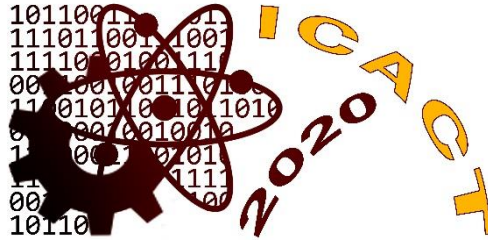# International Conference on Advances in Computing and Technology

Proceedings

28th November 2020

" Conquering Global Challenges through Innovations in Computing, Technology, and Education"

Faculty of Computing and Technology
University of Kelaniya
Péliyagoda, Sri Lanka

UNIVERSITY OF KELANIYA

ICACT 2020

International **C**onference on **A**dvances in **C**omputing and **T**echnology

(**ICACT–2020**) **Proceedings**

" Conquering Global Challenges through Innovations in
Computing, Technology, and Education "

28th November 2020

Chief Editor
Dr. Asanka Pallewatta

Faculty of Computing and Technology
University of Kelaniya
Sri Lanka
2020

The sole responsibility of contents of the papers is vested to the authors.

Indexed in the IJIFACTOR Master List

Organizing Committee of the International Conference on Advances in Computing and Technology (ICACT–2020)

Message from the Vice Chancellor

It is with great pleasure that I write this message for ICACT-2020, the 5th International Conference on Advances in Computing and Technology, organized by our University's newest Faculty – the Faculty of Computing & Technology. Although ICACT-2020 is the fifth in the series, this is the first occasion on which it is to be held online.

Advances in Computing and Technology enable people all over the world to reach out and connect with each other to share their knowledge and experience. We all face a very challenging situation today, due to the COVID-19 pandemic, which has affected all countries and the delivery of virtually all goods and services. Therefore, this is the right time to come up with innovative ideas to successfully meet the challenges posed by the pandemic. Successful integration of technological advances could take us to a brighter future that includes new medications, treatment methods and rehabilitation procedures for COVID-19 infected people. In the event of social restrictions, industries could benefit from technological advances such as robots and IOT to continue their production with minimum human interventions or even do without it. Thus, the theme of this conference - Conquering global challenges through innovations in computing, technology and education - is highly relevant to today's context.

As one of the largest national universities in Sri Lanka, we face many challenges in continuing with the delivery of our programmes of study, because of the wide diversity of courses that we offer, and our large student population. To overcome these challenges, we need to take maximum possible advantage of the advances in computing and technology that are available to us. I am happy to note that some of these technological aspects have been already successfully integrated into our teaching practice, thus enabling the continued conduct of academic activities.

Online conferences present a great platform for the dissemination of knowledge in a pandemic world. Your active participation, and willingness to share your knowledge and experience will be to everyone's benefit. Finally, I would like to thank the organizing committee for taking on the task of organizing a virtual conference under exceptionally difficult circumstance. I would like to take this opportunity to wish all the participants fruitful deliberations during ICACT-2020.

Senior Professor Nilanthi De Silva
MBBS (Colombo), MSc (London), MD (Colombo)
Senior Professor of Parasitology and Vice Chancellor

Message from the Chairman of the Research Council, University of Kelaniya

It is with great pleasure that I issue this message on the occasion of the 5th International Conference on Advances in Computing and Technology 2020 (ICACT 2020) organized by the Faculty of Computing and Technology, University of Kelaniya.

Research and innovation is the mainstay for economic development of a nation and mission of the University Research Council is to promote research excellence among its academic staff to make a significant contribution to the knowledge enhancement and national development. I am very pleased to note that the academics and researchers of the Faculty of Computing and Technology are extremely motivated and involved in high quality multidisciplinary research with the aim of achieving national development goals of Sri Lanka

With this year's theme, "Conquering Global Challenges through Innovations in Computing, Technology, and Education." I'm positive that ICACT-2020 will provide a platform for all the presenters and participants to present novel and latest developments in the fields of Computing and Technology, exchange of knowledge, share opinions from researchers, engineers, scientists, academia and industry and nurture international research collaborations.

Further, it is our privilege to have Dr. Nadia Pantidi from the University of Wellington, New Zealand as the Keynote speaker of the ICACT 2020 and I hope this will be a trigger for our academics to rethink on strategies for technological innovations as solutions to the challenges of the global pandemic of Covid-19.

Therefore, I wish to congratulate the Dean, staff and the organizing committee of the Faculty of Computing and Technology for organizing this international conference with the aim of improving research culture and quality in our University and I wish ICACT-2020 every success.

Senior Professor N.P. Sunil-Chandra
BVSc (Sri Lanka), MPhil (Perad'ya), PhD (Cambridge),FSLCVS, FSLCM (h.c)
Cadre Chair and Senior Professor

Message from the Dean of the Faculty of Computing and Technology

It is an honour to witness the successful completion of the first ever online conference organized by the Faculty of Computing and Technology, University of Kelaniya. We have been organizing this annual conference since 2016. Despite the setback caused by the Covid-19 pandemic, the responses to our call papers were overwhelming. I am sure that this year conference gave us important insight on how to continue our research works under the "new normal" situation created by the Covid-19 outbreak. The Covid-19 pandemic has opened a new window of experience in the digital world for us. Let us preserve this experience and the knowledge gained for future generations.

The theme of this year's conference is "Conquering Global Challenges through Innovations in Computing, Technology and Education". The Faculty of Computing and Technology realized the need for integrated and multi-disciplinary approach to find solutions to global challenges. The academic staff of the faculty from the Computing and Technology domains work together to achieve this objective. We established the National ELearning Resource Center (NELRC) with funding from the National Budget in 2017. The NELRC is functioning as a research center at the University of Kelaniya producing two innovative products: E-Lankapura and NeLCon Studio for eLearning. Further faculty trained its academic staff in deep learning and student-centered learning methods realizing the value of teaching/learning pedagogies and education tools. All these shows the commitment of the Faculty of Computing and Technology to establish an integrated and multi-disciplinary approach to find solutions for the global challenges.

Dr. Nadia Pantidi from the Computational Media Innovation Center (CMIC), at Te Herenga Waka, Victoria University of Wellington, New Zealand enthused the virtual audience by her impressive keynote speech on "Re-imagining technological innovation in the light of Covid–19". I hope that the experience and the knowledge gained through the conference and the keynote speech will positively contribute to the innovations in different fields.

I greatly admire the encouragement and the support provided by the Vice-Chancellor, Chairman/Research Council, All the Deans, Heads of the Departments, Academic and non-Academic members of the University of Kelaniya, Sri Lanka and hope that it will continue throughout the years to come. I congratulate all the presenters for their achievements and highly appreciated the invaluable contributions made by the participants from different parts of the world. I hope that the opportunity offered through ICACT 2020 helped all the participants to build new networks and collaborations as well as to develop and expand their research to achieve the highest possible outcomes. Finally I am sure that the experienced gained through the challenges faced by the highly motivated and dedicated team of young academics of the Faculty of Computing and Technology by converting this year's conference into an online conference will turn the direction of the faculty in the future.

Dr. Gamini Wijayarathna
DrEng (Electro-Communications, Japan)
MEng (Electro-Communications, Japan), BSc (Kelaniya, Sri Lanka)

Keynote Speech – "Re-imagining technological innovation in the light of COVID-19"

The Covid-19 pandemic has prompted urgent rethinking of the ways we live and innovate and reminded us all of how interconnected and interdependent our world is. Now more than ever, humanity is challenged to act on such issues and in so doing, to consider how solutions might materialise in local as well as global contexts. In this talk, she draws from examples of current research to showcase the potential of technologies to support community resilience and, in particular challenges and opportunities for people to create and sustain meaningful connections with each other.

About the Keynote Speaker

Dr. Nadia Pantidi (BA, M.Eng, PhD) is a Lecturer at the Computational Media Innovation Centre (CMIC), at Te Herenga Waka, Victoria University of Wellington, New Zealand. Her research interests are in the areas of Human Computer Interaction (HCI) and User Experience (UX), with a focus on understanding, evaluating and designing for people's real world experiences with using technologies. Her research leverages participatory and experience-centered design approaches aimed at enhancing community resilience and engagement. Before joining CMIC, she was a Lecturer in Human Computer Interaction at University College Cork, Ireland; a co-Investigator with the H2020 project Grassroots Wavelengths (https://grassrootsradio.eu/) and a country representative for the COST Action From Sharing to Caring (http://sharingandcaring.eu/).

Her work is regularly published in high impact international conferences and journals in the field of HCI, such as the Association for Computing Machinery (ACM) Conferences on Human Factors in Computing Systems (CHI), Designing Interactive Systems (DIS), Communities and Technologies (C&T), Computer Supported Co-operative Work (CSCW).

Message from the Conference Chair

It is a great pleasure for me to extend my warmest compliments to everyone who got involved in the ICACT 2020. At this specific juncture, I carry an abundance of warm gratitude to Senior Professor Nilanthi De Silva, the VC of the University of Kelaniya for her positive encouragement all the time. Meanwhile, I also have a high regard for the presence of Senior Professor Sunil Chandra, Chairman of the Research Council, University of Kelaniya. My gratitude also remains with Dr. Nadia Pantidi for her valuable contribution as the keynote speaker. And, I would like to thank Dr. Gamini Wijayarathna, the Dean of the Faculty of Computing and Technology for his tremendous support, guidance, and encouragement from the very first day.

And, I'd like to thank the co-chairs, secretary, the web admin, editorial board, and everyone in the organizing committee, and especially all the distinguished reviewers and session chairs for all of their wonderful commitment towards this conference from the beginning to the end. My heartfelt thanks to all the staff members of Faculty of Computing and Technology, University of Kelaniya for their positive commitment throughout this entire conference. I would like to thank the director of the ICT Center of University of Kelaniya, and his team for all the support providing the hosting facilities, as we had no access to our faculty premises (in Péliyagoda) during the conference due to COVID-19 pandemic.

We are fortunate and glad to host this event for the 5th consecutive time without any interruptions even during this global pandemic. However, organizing this year's conference was indeed challenging since we have hosted this as an online conference for the first time. But, we are very happy to see more than 90 research papers with a very good international participation representing 15 countries including Sri Lanka. And there were papers from almost all the state Universities of Sri Lanka, and also from some private higher educational institutes as well. In the first 4 years, we have published only the abstracts, and from this year we have upgraded the proceedings by publishing short-papers.

Therefore, I see this achievement as a great milestone since we started this international conference in 2016. From here onwards, we would like to make this platform much stronger in building a solid global network through research. We are planning to extend this platform by introducing an international journal in next year calling full papers. I really look forward to seeing a great development with these plans, also with all of your positive contributions.

As the Conference Chair, I am indeed repeatedly grateful to all the enthusiastic participants. We really believe that this conference ICACT 2020 highlighted your research achievement and it helps you to stand as the research frontiers in Computing, Technology and Education. Your effort, courage, and also the patience made a great contribution to host this conference successfully as planned, and you all are proud partners of it.

Dr. Asanka Pallewatta
PhD (Denmark), MEng (Japan), BEng (Japan)
Diploma in Diplomacy (Sri Lanka), Diploma in Fashion Design (Sri Lanka)

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Haar Classifier Based Face Recognition and Tracking in a Video Stream using Real Time Computer Vision with OpenCV

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Abstract—In the past few decades, the interest on computer vision has increased drastically with the development and popularity of machine learning and deep learning concepts. Human face recognition and detection from an image or a video stream source is a popular research topic in the field of biometrics. Face detection and recognition technology have captured a greater attention due to the successful implementation in various applications and real-world consumer related market products. With the development in technology and hardware capabilities, face detection/recognition and emotional recognition has become a popular research area related to computer vision and algorithm-based image analysis. The paper further emphasizes a real-world implementation using a program which is developed using various libraries of Open CV, Matplotlib and Python framework along with video stream using a High Definition input source. A critical analysis is provided on Haar-Classifier which is an algorithm used in OpenCV for face detection and tracking purposes.

Keywords— face detection, Haar-Classifier, OpenCV

I. INTRODUCTION

Machine learning builds under the background of Artificial intelligence that could transform information to knowledge. In the past few years people used to explore more and more data, but it would be useless if it cannot be analysed and find the pattern hidden in it. Machine Learning (ML) techniques has the potential to figure out the underlying pattern in a large/complex dataset which would be extremely difficult to discover by humans. Once the hidden pattern is identified and with knowledge on specific problem, predictions could be provided on events in the future that might be helpful in future decision making. [1]

Computer vision is a rapidly evolving research area devoted to modifying, analysing and in-depth high-level understanding of individual or series of vector and raster images. Computer vision is mainly intended to determine the feed from an external image or video source and use that understanding to manipulate and create a response on a programme or trigger an event.[2] Computer vision technology are used in many different applications in the current world such as on biometrics, surveillance systems, augmented reality, user authentication systems and many more. The main goal of the paper is to emphasize the implementation of face detection and recognition using OpenCV libraries with the aid of a visual stream input from a web camera or any other input source. Once the program is initiated based on the input stream the algorithm will search, detect, and recognize any human face/group of faces based on various facial features on a face of a typical human being.[3]

II. CHALLENGES AND COMPUTER VISION APPLICATION

Computer vision is highly computational oriented, since most computer vision application must be executed in real time, it requires lot of computational and processing power. At minimum level, a single frame should be processed and completed within 35-45 milliseconds. Modern photography is embedded with computer vision by which cameras are capable of automatically detect and focus a person face and automatically trigger the shutter when a person smile. With rapid revolution in the camera technology, modern photography cameras, CCTV cameras and smart phone cameras are embedded with powerful lens, aperture, shutter capacity and low light sensors. These developments have improved the computing power on image processing which ultimately increases the demand on computer vision applications. Optical Character Recognition uses computer vision technology to identify the text and characters from a scanned document and which they can read them aloud using an audio synthesizer. Modern automobile industry uses computer vision to maintain the vehicle in the road lanes which is used with cruise control system, here the driver can allow the vehicle to travel with in a specific lane. Robotics at the manufacturing industry depends on computer vision to map real world objects and its parameters when performing specified tasks accordingly. [4]

III. OPEN CV

OpenCV (Open Source Computer Vision Library) is a computer vision library available on open source platform.[5] This is developed using C language and could be implemented on any kernel platform. Open CV is developed by Intel Corporation. The libraries are mainly developed to be used in real time processing of images. Originally the OpenCV libraries are developed using C which makes it portable to some platforms. OpenCV can be implemented using many different languages such as python, Java etc. With the introduction of OpenCV 2.0 a new C++ interface is embedded with the traditional C interface. With the introduction of new version and new interface, vision functionalities could be implemented in an application with

1

few numbers of code lines and reduces the programming errors such as memory leaks.[6]

IV. LITERATURE REVIEW

A. Face Detection Classifiers in OpenCV

Various algorithms or classifiers are used to perform the face detection in OpenCV. The algorithms/classifiers are used to determine whether the input stream consist of -face (Positive)/Consist of a face or face (Negative)/Does not contain face. OpenCV consist of two pretrained classifiers which could be used in face detection and recognition applications.[7] The two type of classifiers are-

- Haar Classifier
- LBP Classifier or Local Binary Pattern

On 2002 with the paper titled "Multiresolution Grayscale and Rotation Invariant Texture Classification with Local Binary Patterns" Local Binary Pattern (LBPs) was re-introduce and populated.[8] Just like Haar classifier, LBP classifier is trained using several images. Human face consists of micro visual patterns where LCP visual descriptor features used feature vectors, which recognize a human face from a non-face object.[9] Since the current facial detection and recognition application is developed using Open CV Haar Classifier, it further elaborates the algorithm using the Haar feature based cascade classifier.

B. Haar feature based cascade Classifier

Haar name originated from the Haar wavelets which is used by earlier real time face detectors. Haar-feature classifier is based on the Haar wavelets which was first used by Paul Viola and Michael Jones in their paper titled "Rapid Object Detection using a Boosted Cascade of Simple Features". The classifier was mainly used in computer vision applications such as for face detection.[10]

Haar classifier utilizes a machine learning approach for object detection in visual input streams and which can perform image processing at high speeds with higher detection rates. A large amount of positive and negative datasets of images are used to train the classifier. Positive images are datasets of images which the classifier needs to detect. While the Negative images are datasets of various other images of objects which the classifier does not want to detect.[10]

This can be attributed to three main reasons:

Haar classifier uses "Integral Image" concept to quickly compute the features detected by the detector. This concept reduces the image processing time which is important in computer vision related applications.

The Algorithm used in learning is based on "AdaBoost", this selects limited number of most important features from a large data set and provides the most efficient classifier.

Many more classifiers are combined to create a "cascade" to avoid the focus on non-face regions in a video stream/image, where more computation is focus or spent on object like regions or areas.

C. Methodology of the Haar feature based cascade Classifier

1) Haar Classifier features extraction

A large amount of training data as video stream or images are fed to the algorithm. Then the classifier begins to extract the Haar related features from each and every fed image or inputted video stream. After words Haar features are used to primary detect whether a relevant feature is present in the input video feed or the image. Haar features are similar to square shaped windows which are placed on images or run across the video stream to compute a feature. The feature is a single value obtained by subtracting the total pixels under the white area and that under the black area.[11]

2) Integral Images algorithm

The Integral Images algorithm was introduced by Viola Jones. The algorithm uses a "24x24" base rectangle shaped window, which can calculate over 180,000 features. This algorithm uses the values of four corners of the rectangle to calculate the total number of pixels under it.[10]

3) AdaBoost

As elaborated above, even though by 24x24 window more than 180,000 values of features could be resulted, all the features might not be helpful on detecting a human face.(Goyal et al., 2017) To determine the best feature out of the bulk, the Ada boost algorithm would be used. AdaBoost algorithm is used to filter the features which are helpful to increase the accuracy of the classifier. After the filtering process the number of features would gradually drop from 180,000 to 6000.[10]

4) Cascade of Classifiers

Cascade of Classifiers is another way proposed by Viola Jones, that would contribute the algorithm to process faster. Cascade Classifier consist of various stages where at each stage it consists of a strong classifier. A major benefit of the cascade classifier is it eliminates the requirement of applying all the features at once in a window. Separate sub window groups of features are created, and at each stage classifier determines whether sub window detect a face or not. In the absence of a face the sub window is discarded with the respective features of the window. If the classifier is passed by the sub-window, then at the next stage the second stage of features are applied.[10]

V. TECHNOLOGIES UTILIZED

The program is developed using the Python programming language along with Matplotlib 2.0 and OpenCV 3.2.0 dependencies. The program is developed and run using Python 3.6.8 64bit version. Since this version is more stable when executing OpenCV projects. The cascade files of Haar algorithm could be downloaded from OpenCV GitHub page. The video stream is sourced to the program using HP True Vision HD inbuild Web camera.[12]

VI. IMPLEMENTATION

The program is mainly developed using the Haar Classifier function which is capable of analysing and detecting human face or group of faces using the HD video stream input from the laptop web camera. After successfully detecting the face/group of faces, program outputs a green colour square around the face/ group of faces by tracking the position of the face in the video stream.[10] Initially after installing the OpenCV 3.2.0, Python v3.6.8 and Matplotlib 2.0, the required libraries/dependencies should be imported and added to the program module. [13] The list of required imports is as follow- **import numpy as np ,import cv2, import matplotlib.pyplot as plt, %matplotlib inline**

The program should be fed with a video source to analyse and perform the face detection. The following code is used to load the live video stream from the web camera of the laptop to the program-**camera=cv2.VideoCapture(0).** After adding the input source, the Haar Cascade files should be imported. OpenCV contains number of pre trained classifiers for various instances. Some of the classifiers could be used to detect the eyes, face, object etc. OpenCV classifier file is an XML file. The xml files are added to the root of the project directory. The classifier xml file is as follow-**clsfr=cv2.CascadeClassifier('haarcascade_frontalface_default.xml')**

The detection algorithm only works with grayscale colour scheme. The following line of code is added to transform the colour images/video stream to grayscale. **gray=cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)**

To implement the Face detection, in the classifier a module name "detectMultiscale" must be added to the code. When the above module is added the function will return a square with coordinates(x,y,w,h) around the face detected. With the function three important parameters are passed based on the data. The three parameters passed are image or input video source of type CV_8U, "scaleFactor" and "minNeighobors". "ScaleFactor" is passed to determine the amount of reduction or compression in input image or video source under each scale."minNeighbors" parameter is passed to specify the amount of neighbors each and every candidate rectangle should have to retain and depict the face. The quality of the faces detected will be affected with this parameter. The following line of code is added to implement the above functionality-**faces=clsfr.detectMultiScale(gray)**

An infinite loop is added to the code since the input stream is sourced from the web camera which is a video stream. The loop runs over all the coordinates returned and these coordinates are represented using a square in OpenCV. A green square will be drawn around the face if detected with a width of 2CM. The code used to add the loop and green rectangle functionality to the program-**for (x,y,w,h) in faces: cv2.rectangle(img,(x,y),(x+w,y+h),(0,255,0),2)**

With the green square representation, a text called "Face" will be outputted in HERSHEY font type. The following line of code is used to add this functionality to the program.

cv2.putText(img,'FACE',(x,y-10),cv2.FONT_HERSHEY_SIMPLEX,1,(0,255,0),2)

Finally, in order to determine whether face/group of faces has been correctly detected, the original inputted video stream is outputted in colour format. The following line of code is used to add this functionality to the program-**cv2.imshow('LIVE',img)**

VII. RESULT AND DISCUSSION
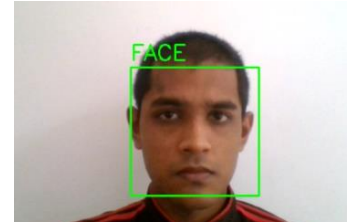
Fig. 1. Output of the program after a successful face detection

The final outcomes of the programme are referred using the Fig 1. These HD video frames are sourced from a web camera. Occasionally face detection algorithm would detect another face within the face detection rectangle, although there is only one face physically existed. In the said cases post image processing is used to derive the coordinates of the exact face using OpenCV Haar Classifier. When system falsely output more than 1 square to a face, distance of centre points of the square is been calculated. If the calculated distance is smaller than the pre-set threshold, Then the final position of the detected face will be determined by calculating the average of these squares. Although the currently implemented method is successful, various bugs and limitations have been identified when testing the face detection algorithm due to the performance limitation in Python language. After evaluating the program based on factors such as Individual face/group of faces detection capability, Detection speed, Efficiency of detecting under various lighting conditions, CPU and resource utilization while the program is running, the face detection algorithm proposed by Viola and Jones is more suitable when implementing real time face recognition/detection.

VIII. CONCLUSION

Face detection/tracking and recognition is important on building commercial and industrial applications. The paper presents an in-depth explanation of Haar Classifier algorithm implemented using OpenCV libraries. Various face recognitions algorithms could be utilized based on various demands and factors affecting to the application. Advantages of implementing face detection using Haar classifier features over other features are high calculation speed. Accuracy and speed are the features which determine the success of a face detection algorithm. To provide a better face detection and recognition, the program will be further enhanced in the future to implement the solution in a practical real-world application using Internet of Things.

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

Shallow Dense Network for Effective Image Classification

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Abstract — **In this study, we demonstrate high image classification performance using a Dense network with only one hidden layer. In this method, we systematically tuned the number of neurons in the hidden layer and trained our model on a benchmark image classification dataset. The shallow model was able to successfully gain state-of-the-art AlexNet level performance. Neural networks with extensively deep architectures typically contain millions of parameters, which are both computationally expensive and time-consuming to train. This study shows that going deeper into neural networks is not always necessary, rather it is more important to focus on the correct number of neurons in each layer.**

Keywords — shallow, dense, neuron, classification

I. INTRODUCTION

In 2012, Krizhevsky et al. introduced AlexNet for image classification [1], which has an overall 660,000 neurons, 61 million parameters, and 600 million connections. It took the authors 6 days to train their network two Nvidia Geforce GTX 580 GPUs in parallel over 90 epochs. Later in 2014, VGG-16 was introduced by Simonyan et al. [2]. It contained collectively 138M parameters. From later on, it has become a go-to trend to go design more and more complex neural network structures incorporating a significantly added number of parameters.

The problem with going deeper is that it requires more sophisticated hardware, such as GPUs, which are quite expensive. Also, training a network for days or weeks without hassle is not always an applicable option. In this study, we tuned the number of neurons along with different activation functions and dropout rates having only one layer and attempted to gain AlexNet level accuracy. We performed experimentation on the Fashion-MNIST benchmark dataset introduced by Xiao et al. [3].

II. OBJETIVES

Our main objective in this research is to find out the optimal neural network architectures that have as few parameters as possible while not compromising the performance. Additionally, this work also exposes the capability of a single hidden layer in a network.

III. METHODOLOGY

The Fashion-MNIST dataset contains 60,000 training and 10,000 testings of 28-by-28 pixel grayscale images for 10 classes [3]. The accuracy performance of AlexNet on the Fashion-MNIST dataset, as reported by Ma et al., is 86.43% [4]. Additionally, Duan et al. applied the VGG-11 network structure on Fashion-MNIST and achieved 91.5% accuracy [5].

The generic model structure is visualized in Fig. 1. It contains three layers - An input layer, one hidden layer, and the output layer. 28x28 pixel images are provided to the network via the input layer. The output layer has 10 neurons for 10 classes. We tuned the number of neurons in the hidden layer based on the number of total pixels in an image. An image has 28x28 (784) pixels. We started training our model with the number of neurons (n) equivalent to 1% on the total pixel, which is 7 neurons only (784x0.01). Then, we gradually increased neurons by taking 78 (10%), 392 (50%), and 784 (100%) neurons. Outputs from the hidden layer were flattened before the output layer.

We generally used a 50% dropout (d) for the hidden layer. However, in two cases, we applied 80% drop out because of their convincing performances to reduce overfitting. Each hidden unit was experimented with without any activation functions and with ReLU activation. In the final layer, we applied softmax activation as the classifier. Moreover, in all cases, we initialized biases with zeros and employed glorot_uniform as the kernel initializer. All the tasks were implemented with Keras Function API.

The total number of trainable parameters were around 54K, 611K, 3M, and 6.1M for corresponding 7, 78, 392, and 784 neurons in the hidden layer. There were no non-trainable parameters. We continued training each model until there was 50 consecutive no improvement in validation loss.

IV. RESULTS AND DISCUSSION

We have summarized our experimental results in Table 1. For 7 neurons, our model achieved 84.51% test accuracy and a test loss of 0.43 with 87.72% Precision and 81.19% Recall without activation function over 100 epochs. In contrast, the accuracy, loss Precision, and Recall were 83.95%, 0.46, 88.14%, and 79.35% over 158 epochs. In case of 78 hidden neurons, the accuracy, loss Precision, and Recall were 84.58%, 0.43, 87.81%, and 81.67% over 72 epochs without activation; and 84.60%, 0.43, 87.72%, and 81.92% over 88 epochs, respectively. Again, the corresponding accuracy, loss Precision, and Recall for 392 neurons were 84.69%, 0.43, 87.55%, and 81.90% over 65 epochs without activation, while 86.20%, 38.86%, 88.46%, and 84.35% over 287 epochs with ReLU activation. Furthermore, for 784 hidden units, the respective accuracy, loss Precision, and Recall were 84.24%, 0.44, 87.06%, and 81.78% over 69 epochs without activation. On the other hand, these results for 784 hidden units with ReLU activation were 86.18%, 0.39, 88.24%, and 84.30% over 214 epochs, correspondingly.

Now, as the highest test accuracy (86.20%) with test lowest loss (0.39) in the previous models was for 392 neurons (with ReLU activation), we trained the models with 392 neurons with 80% dropout for both with and without activation. Point to be noted that the second-best model in terms of test accuracy was also with 392 neurons, however, without activation (84.69%).
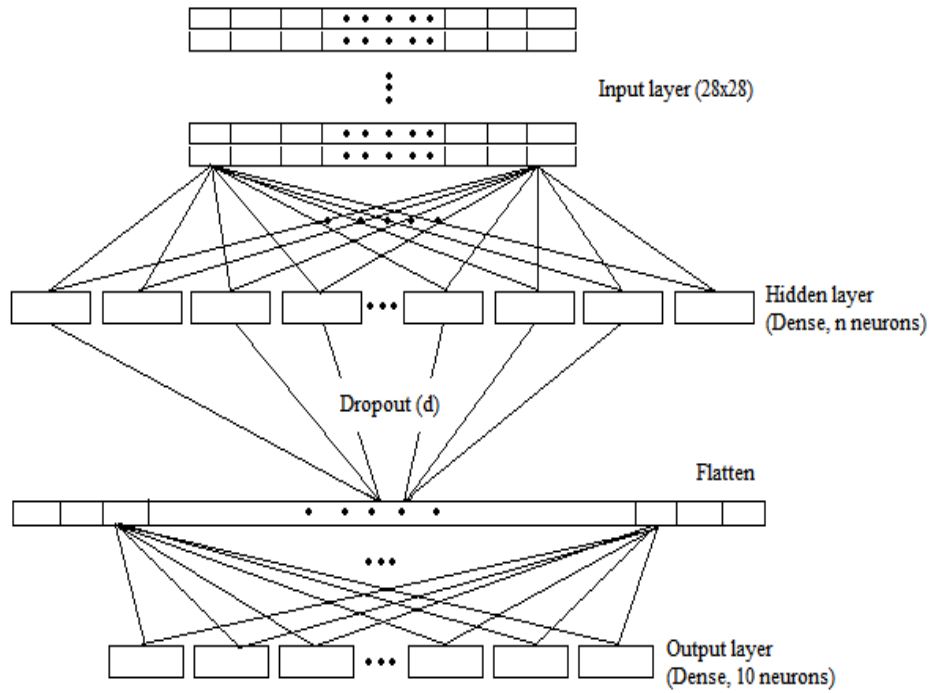
Fig. 1. Generic model structure.

Table 1. Details and evaluation of applied models in comparison to AlexNet (accuracy 86.43%).

# neurons	Activation function	Dropout	# params	# epochs	Test accuracy	Test loss	Precision	Recall
7	None	0.5	54,904	100	0.8451	0.4376	0.8772	0.8119
7	ReLU	0.5	54,904	158	0.8395	0.4626	0.8814	0.7935
78	None	0.5	611,686	72	0.8458	0.4365	0.8781	0.8167
78	ReLU	0.5	611,686	88	0.8460	0.4352	0.8772	0.8192
392	None	0.5	3,074,074	65	0.8469	0.4383	0.8755	0.8190
392	ReLU	0.5	3,074,074	287	0.8620	0.3886	0.8846	0.8435
392	**None**	**0.8**	**3,074,074**	**377**	**0.8636**	**0.3805**	**0.8877**	**0.8455**
392	ReLU	0.8	3,074,074	68	0.8445	0.4390	0.8755	0.8152
784	None	0.5	6,148,138	69	0.8424	0.4443	0.8706	0.8178
784	ReLU	0.5	6,148,138	214	0.8618	0.3884	0.8824	0.8430
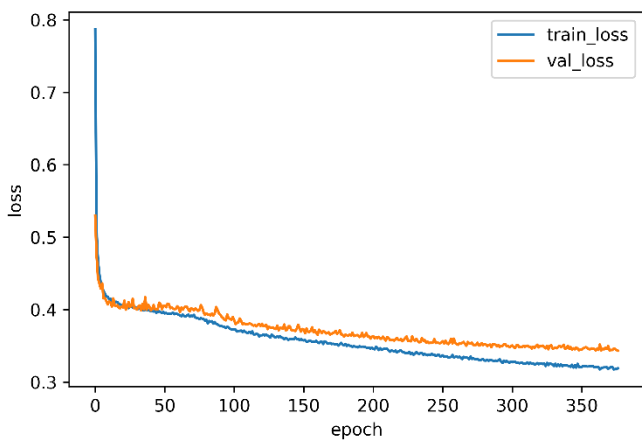
Fig. 2. Training loss versus validation loss for model with 392 neurons and 80% dropout.
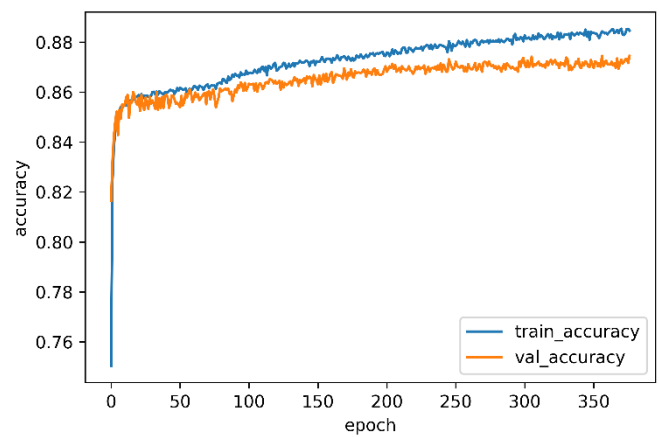
Fig. 2. Training accuracy versus validation accuracy for model and 392 neurons with 80% dropout.

Finally, for 392 hidden neurons with 80% dropout, the accuracy, loss Precision, and Recall were 86.36%, 0.38, 88.77%, and 84.55%, respectively, over 377 epochs, without activation. However, with ReLU activation, the corresponding results were 84.45%, 0.44, 87.55%, and 81.52% over 68 epochs.

Overall, the best performance was for the model consisting of 392 hidden units with an 80% dropout without any activation function. The performance (86.36% test accuracy) was almost the same as the accuracy level of AlexNet (86.43%).

V. CONCLUSION

In this research work, we have demonstrated the powerful capability of the hidden neurons to learn over data. We also investigated the single-hidden layer model competing with very deep AlexNet. Nonetheless, these results should be further investigated intensely with other benchmark datasets. Also, we need to examine if this behavior is also applicable to images with higher dimensions. We also need to construct more similar types of shallow Convolutional models to observe the effects. Considering the proper number of neurons
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with the correct configuration, we hope that this type of shallow model would largely eradicate our necessity for heavyweight models, thus reducing the requirements of expensive hardware.

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Ball Localization and Player Tracking using Real Time Object Detection

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Abstract — **In a fast-moving game like football, real time tracking is a challenging task. Although there are many CNN models for object detection and tracking, real time ball localization and player tracking, in a fast moving sequence such as football is associated with many bottlenecks. Specially in this type of application, the object of interest can be associated with diverse background scenarios at different time instances. For instance, the ball may be in the football pitch freely passing from player to player at one time frame, whereas it can be dribbling by a single player through the pitch in another time instance, or it may be inside the goalpost, or it may even be out of the pitch. Therefore, a single CNN model is not sufficient for the ball localization in this type of sporting event. Hence, in this research, several CNN models are trained and combined to get the best results of ball localization, which includes player tracking using customized deep SORT algorithm.**

Keywords — Ball Localization, Player Tracking, CNN, Deep SORT

I. INTRODUCTION

Football (soccer) is a fast-moving game, which is highly popular in Europe, backed by significant financial investments and a huge fan base. With the modern advancements in video technology, the football clubs, managers, coaches and broadcasters alike have taken steps to merge the technology with the football game to improve the player performance and the return revenues of the game. One of emerging domains of video technology research in football, is the player tracking and ball tracking [1],[2].

When extracting information from a football game video, it is a very important to localize the ball, because most of the information depends on the coordinates of the ball. In this research, the coordinates of the ball with respect to the video frame is identified and a player tracking method is utilized to re-initiate the ball tracking, when it disappears from the observed video frame. For this purpose, YOLO [3] and Deep Sort Algorithm [4] are employed as the backbone architectures, specifically for real time object detection and for player tracking respectively. Furthermore, several models generated using these two architectures are combined using conditional algorithm to generate a more accurate final output, i.e. ball tracking.

II. OBJETIVES

The main objective of the research presented is to design an automated architecture to track and locate, the ball. In addition, the ball localization is improved using player tracking results. We focus only on these two features, as they are the key features of the game and they assist the stakeholders to analyses as well as to summaries the football game efficiently.

III. METHODOLOGY

The key outputs of the research revolve around the ball location. Hence, we have treated ball localization as our main task. To identify the ball in different occasions, several approaches are adopted, namely; Ball Localization when it is freely on the football pitch, Ball Localization when it is in the Goal Post, and Ball Localization when the ball is handled by a player.

Ball Localization when it is freely on the football pitch

This is the main module of our algorithm. When the ball is freely moving on the pitch, the ball is in a light green grass background. We have generated a custom database, with this particular background setting (i.e. when the ball is on a greenish grass backgrounds in Fig. 1) to train the main module.
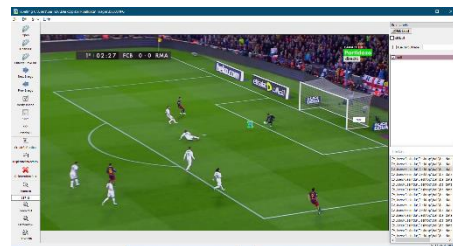
Fig. 1. Annotating asample image in the database

It is noticed that at the 1st step of the training the moving average loss is about 104 while the learning rate is 0.00001. At the 14000 step the moving average loss is at 0.5. Immediately, the training is stopped, to avoid overfitting. The trained model is validated, by observing the performance at different number of steps. Further, step count of 10000 is selected as the optimal step count and the objects with precision level higher than 50% is selected as the ball candidates.

Ball Localization when it is in the Goal Post

A goal, one of the critical events in football is defined as the event when the ball crosses the goal posts. To assist the

identification of this specific scenario, the goalpost is first localized and, then the ball is searched inside the goalpost contour to detect whether it has crossed the goalpost. Unlike the ball, the goalpost has special characteristics, such as the net with checkerboard pattern, and rectangle border of the post. Hence, the goalpost can be easily detected even without considering the color analysis. Therefore, to reduce the computational cost of the analysis, as a preprocessing step, thresholding is used to generate binary image as in Fig. 2. A new dataset is created using the preprocessed binary images, and another CNN model is trained for the goalpost detection task. It should note that the CNN models adopted in this research at each stage have different layered architectures. Yet, they are trained in a similar manner as explained earlier. At the testing stage, images with detection precision level higher than 60% are selected as the goalpost candidates.

The next step is to identify the coordinates of the ball in reference to the localized goalpost. For this purpose, the goalpost location is marked in the original frame, and a new YOLO model is trained to identify whether the ball has gone inside the goalpost, at each time instance. Fig. 3 presents a sample image of the annotated dataset used for goal detection.

Fig. 2. Thresholded, binary image for Localized Goalpost

Fig. 3. Annotated image with the ball inside the goalpost

Player Tracking

The player tracking is used in the proposed system, mainly to analyze the player moments and the behavior around the ball's trajectory. Also, the player movement is used to assist the ball tracking in scenarios where the model presented earlier fails to detect the ball position. When the earlier system fails to detect the ball, the nearest neighboring player to the last location of the ball is discovered. Thereafter, the particular player's track is used as the temporary track of the ballwith the assumption that ball is with this particular player. The architecture of the tracking algorithm is developed using the DEEPSORT algorithm. Since the DEEPSORT uses linear algorithms: Kalman and Hungarian algorithms to track the player path, the non-linear behavior of the player will cause disruption in individual player tracking. In the proposed system, two methods are implemented to address this problem. They are,

1. Track the two teams separately: When players are involved in one-on-one defending proximity of the two players are very narrow. Hence, there is a high probability for individual tracking ID to be falsely changed between the two players when they cross over. This can be reduced by following two detection sets separately for each team based on jersey colour of individual team.

2. Analysis of tracking ID: Due to the random movement of the players and the change of the camera angle, system may mistakenly detect the same player as two different players in neighbouring time instances. To overcome this issue, the characteristics of each track and its ID are

monitored and once similarity level between two adjacent IDs increase, they are linked together using tracking interruption commands.

Using, above fine-tuning methods, the proposed player tracking method is optimized. Further, the player tracking is used to assist the ball tracking when the system fails to detect the ball, as follows.

1. The Euclidian distance of each player to the ball is estimated and stored along with the player tracking ID when the ball disappears from the tracking system.

2. The Euclidian distance of each player to the ball is estimated and stored along with the player tracking ID when the ball re-appears.

3. Select the trajectory of the player with the smallest average Euclidian distance in the above two cases as the best trajectory of the ball during the missing interval.

The overall structure of the proposed algorithm for ball localization and tracking is presented in Fig. 4.
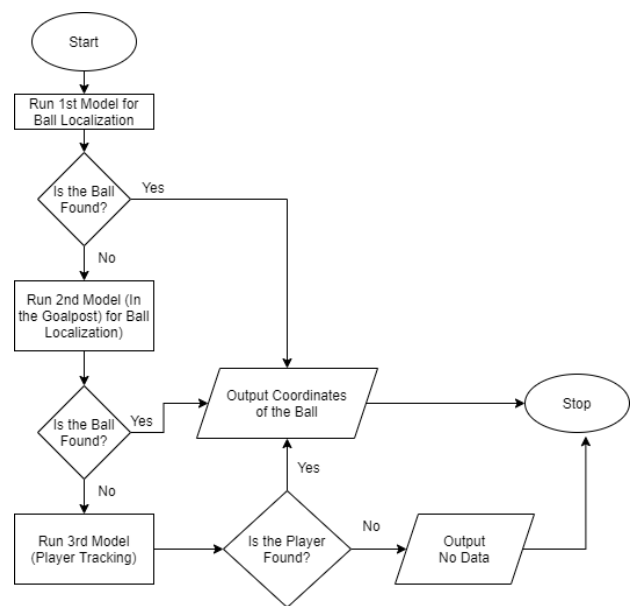
Fig. 4. Proposed Ball Tracking and Localisation Algorithm

IV. RESULTS AND DISCUSSION

As presented in Fig. 5, the developed ball tracking model is able to successfully locate and track the ball with 80% accuracy. Yet, in this model, the tracking becomes challenging when the ball is shadowed by players. The output of the goalpost localization algorithm is presented in Fig 6. In average the model is able to detect the goalpost with 95% accuracy. Fig. 7 presents the goal detection through ball and goalpost location identification. When searching the ball inside the goalpost, the optimal number of step size is selected as 7500 steps while the threshold value is lowered to 0.4 and only the contour which has the highest accuracy is selected as the final trajectory of the ball. Furthermore, the trained model performed with 65% of accuracy. If the system is unable to locate the ball using above 2 algorithms, then the player tracking algorithm is initiated. The tracking of players of each team separately is presented in Fig. 8 along with ball positioning in color yellow. Furthermore, it illustrates a time instance just before the ball localization failed.

Fig. 5. Results of ball Identificaton, when it is on the football pitch
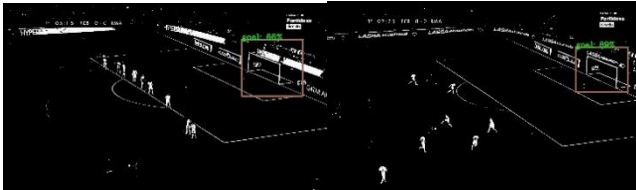
Fig. 6. Results of Goalpost Localization

Fig. 7. Results of ball Identification, inside the goalpost

Fig. 8. Player tracking of team with Red and White Jerseys

Fig. 9. Ball tracking using player movements

Since the ball is closer to the payer 1 in Red team (using information before and after the ball disapearence), the location of the ball is tracked using the player 1's location of the Red team as in Fig 9. Note that in Fig 9 it is hard to get a clear picture of the ball as it is shadowed by the player movements. A summary of the performance of each individual sub-module in our propsed system is tabulated in Table 1.

Table 1. Performance of each sub module in the proposed system.

Model	Accuracy
Ball Localization when it is freely on the football pitch	80%
Goal Post Localization	95%
Ball Localization when it is in the Goal Post	65%
Player Tracking	undefined

V. CONCLUSION

In our research, the ball localization is successfully carried out using several sub modules to overcome the limitation of using one fixed model. Hence, we present an optimized ensemble algorithm for effective and efficient ball tracking. The main module in our proposed design localizes the ball, when it is freely moving on the football pitch with a higher accuracy. If the main module fails to obtain a positive track, the algorithm searches for the prominent nearest object (player or goalpost) in the current frame. If the nearest object is the goalpost, our algorithm searches the ball inside the goalpost. If the nearest object is a player, our algorithm tracks the nearest player to the ball before and after the ball tracking algorithm failed and reinitiate the process with the assumption that ball is shadowed by the player. Therefore, our research addresses the ball localization, when it is not even possible to identify the object of interest through the visual inspection by a human observer.

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Image Detection System for Elephant Directions along with the Forest Border Areas

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Abstract —**Human-Elephant Conflict (HEC) and its mitigation have always been a serious conservation issue in Sri Lanka. It occurs mainly due to the encroachment of forests by humans as part of societal development. Consequently, these human settlements are highly affected by the intrusion of wild elephants as they cause extensive crop-raiding, injuries, and even death in many cases. The major aim of this study is to reduce human-elephant conflict along with the forest border areas. Convolutional Neural Network (CNN) is playing a major role in elephant detection by supporting efficient image classification. The trained CNN-based model achieved the highest accuracy of 92%. Furthermore, the study can be useful for scientists in bio-acoustics for the studying of wildlife recordings.**

Keywords — Human-Elephant Conflict, wild elephants, Convolutional Neural Networks (CNN)

I INTRODUCTION

The Asian elephant is heavily threatened by fragmentation of habitat, loss of habitat, and conflict between the human and elephant. The conflict between humans and elephants is one of the biggest environmental problems today[1]. Owing to human population expansion, the conversion of forest lands into human settlements occurs. This results in the common position being shared by wild animals and humans. Sharing gives rise to the Human-Elephant conflict and catalyzes it [2]. HEC minimization can be accomplished effectively by elephant monitoring. Different methodologies for elephant tracking have been considered in earlier studies, namely, fetching radio collars, electric fencing, usage of video cameras and wireless sensors, etc[3]. The following study proposed a hat system that helps to find the elephants which are nearing the forest border area, thus disseminating warning at the appropriate times and thereby helping in reducing human-animal conflicts in forest areas. The related issues include crop-raiding, injuries, and death to humans caused by elephants, and also the elephants being killed by humans to prevent crop-loss, and land encroachment(Fig. 1)[4].

Fig. 1: House destroyed by elephants

Elephants are normally the largest mammals, which require vast amounts of food, water, and living space. Due to deforestation, elephants have no other choice, therefore they invade human living areas in search of food and water through elephant corridors [5]. To shunt the elephants back to the forest, conventional strategies such as beating drums and bursting firecrackers are less successful. The use of elevated electric fences and walls are neither economical nor effective. Electric fences are dangerous to both elephants and humans. This can be achieved by detecting the presence of elephants and giving prior information about their presence to the respective locals in need by using the advancement of technology. The areas where the unexpected confrontation of humans and elephants occur may be identified by an automated surveillance system and appropriate alerts can be sent for helping the people living near elephant habitat regions [6]. Here used image data sets containing elephants in different poses, sizes, in groups, or as individuals. This detection system helps to find whether the elephants are nearing the forest border area or not, thus disseminating warning at the appropriate times and thereby helping in reducing human-animal conflicts in forest areas[7].

II OBJECTIVES

The major aim of the study is to minimize the human-elephant conflict in the forest border areas and the conservation of elephants from human activities as well as protect humans from elephants.

-Protection of elephants, their habitats, and elephant corridors

Due to the increase in the population, human settlement is extending to forest border areas, causing conflicts between elephants and humans, leading to loss of life and property, also elephants lose their habitats due to human activities. Hence, large scale monitoring is required for real-time detection and warning of elephant intrusion into human settlements. Existing solutions using seismic waves, image processing, etc. are costly solutions for large-scale monitoring. The project aims at low-cost solutions and protection of elephants their habitats and elephant corridors.

-Got a clear idea about the elephant population nearly forest border areas

Elephant monitoring is essential in forest boundary areas for minimizing human-elephant conflict. To calculate the elephant population nearly forest border areas is another important goal of this. Forest authorities should gather these calculations for the annual census. Having accurate and reliable data about elephant population numbers and distribution is needed to form long-term conservation management plans.

-Find out factors that increase human and elephant deaths

The primary focus of HEC mitigation has been limited to preventing elephants from raiding crops. The complexities of HEC do not allow such a simplistic approach in all cases and that is the major failing for most HEC mitigation efforts. Furthermore, the complexities of HEC have not been taken into consideration in most if not all HEC mitigation efforts and HEC research. In the absence of a comprehensive understanding and approach to HEC mitigation, the bulk of the efforts have failed; HEC has not been reduced across the Asian elephant range.

III   METHODOLOGY

Here we use the Convolutional Neural Network to build the model. Object detection relates to both machine learning and image processing which is used to detect the instances of the object. The algorithms for object detection are popularly used in real-time applications. Fig. 2 shows the overall diagram of the methodology.
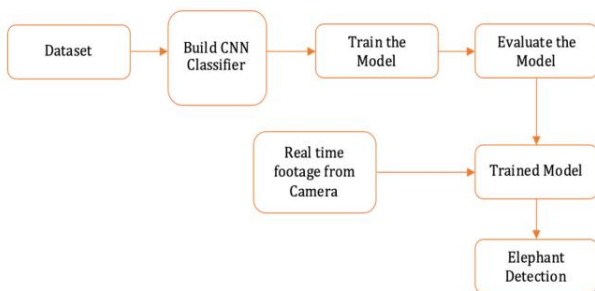
Fig. 2. overall diagram of the methodology

Here we collected different animals namely elephants, deer, bears, buffalo, hens, cats, etc. After gathered data, it is divided into two folders, testing data set and training data set. We divide all images (of size 800×600 pixels) into the same size. To get a high accuracy we use the data augmentation technique. Using python and visual code IDE, we build the CNN model and divide the data set according to the 70:30 rule. (70% for the training data set and 30% for the testing data set).
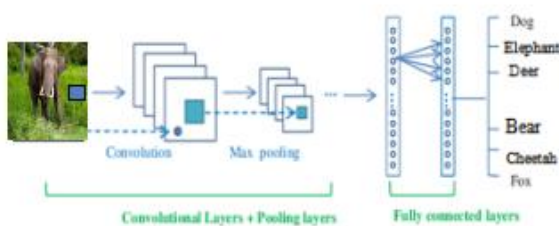
Fig. 3. Layered architecture

Then we developed the CNN model with various layers and training data.   The CNN neurons are organized in a volumetric fashion like height, width, and depth. Illustration fig. 3. shows CNN architecture, it consists of a completely linked layer, convolutional layer, pooling layer. [8] Usually, the traditional layer and pooling layer are alternated, and each filter's depth increases from left to right, while the output size (height and width) decreases.

IV   RESULTS AND DISCUSSION

1. Data analysis

The study used 6500 images with 2000 images of elephants (Table1). In terms of lighting and context, images will vary from one another, so that the model can generalize better. Like this, the data is collected and organized into two separate files as the training data set, and the test data set respectively. We need to resize our images after collecting the data, because some of them may be pretty tall.

Table 1. No of the images collected from different data sets

Name	Number of Animals
Elephant	2000
Deer	800
Bear	1000
Buffalo	1000
Cheetah	850
Fox	100

The advancement of machine vision technologies in combination with artificial intelligence and a camera can be utilized for the automatic accomplishment of image identification. This helps in deep learning, the machine learning built on deep neural networks (DNNs). CNN is a class of deep, feed-forward artificial neural network, which has been proved successful in analyzing images.[9] The convolution operation identifies different features of the input. The idea is to include the detection of elephants; hence it is useful for the forest officials to chase the elephants back to the forest and to help the public to save their property and life.

2.Data set preparation:

We need to collect as many images as possible in the given time frame to train a CNN model to obtain some respectable precision. We gathered pictures of the courses we needed and then developed a CNN model on it. The programming was done using Keras, which is a back-end library of Python using Tensor-flow. We divide the training data into batches after data collection and then optimize the loss function using the CNN algorithm. Fig. 4 shows the sample images of elephants used for training.

Fig. 4. Sample images of elephants used for training (elephants,2020)

As a result of this, we achieved the highest accuracy of 92% (Fig. 5), and we hope to develop this model, by identifying

elephants and other animals using object detection techniques.
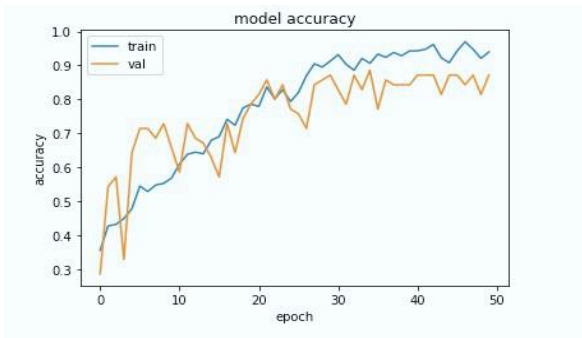
Fig. 5. Accuracy with training and validation

3. Object detection

Different animal images are provided to the testing algorithm after training of data set images using the training algorithm to validate the working of the algorithm. The results show that all animals are correctly detected and that the percentage of accurate results for each animal image is displayed. The data set represents the number of segmented image objects and each result displays the number of pixels matched by the segmented data set images used for the training algorithm.

Fig. 6. Result of the object detection

Typical results are illustrated in the above fig 6 with an elephant image .

VI. CONCLUSION

We have shown how to train an elephant detection system using convolutional neural networks. The study has identified the most critical challenges and necessary improvements of the proposed detection methods and concludes that our findings have the potential to form the basis for a future automated early warning system for elephants. We discuss challenges that need to be solved and summarize the features of a future early warning and monitoring system. The system can also be deployed along with forest border areas or food plantation areas for elephant tracking and monitoring. More importantly, these results demonstrate the importance of certainty in identifying elephants into human living areas and provide early warning about the elephant entry into the human habitat. This technique is useful to identify an approaching individual elephant as well as a group of elephants. Taking into consideration the frequent incidents of human-elephant conflicts in the forest border areas, this work mainly aims at reducing elephant intrusion in the human habitation area nearer to the forest. There are areas where wild elephants cause horrible damages and people and authority become helpless. The proposed idea gives the best solution to such situations by giving an early warning to the authority and people. The approach minimizes the manual work which is not possible all the time because it is difficult to monitor the presence of elephants manually. Our results demonstrate the importance of identifying elephants in human living areas and providing early warning about the elephant entry into the human habitat.

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Flood Impact Level Detection from Multimedia Images using Transfer Learning with CNN Architectures

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Abstract — **Natural as well as man-made disasters are a global threat to all populations. Some of the natural disasters are floods, cyclones, landslides, earthquakes, and droughts. Terrorism and bomb explosions are some of the disasters caused by man. Among the natural disasters, flooding is a significant contributor to loss of human life, economic loss and property damage disturbances. Floods can occur with little notice or forecast. In this paper, we study deep neural networks with a transfer learning mechanism to identify flood impact levels using multimedia images.**

Keywords — deep neural network, transfer learning

I. Introduction

Flooding is a major natural disaster that contributes to disruption of human life, damage to property and the economy of a country. Governments have to pay special attention to manage these emergencies because it can interrupt the development of the country and can affect economic growth. Flooding incidents call for a quick response. Rescue and emergency teams should respond quickly to the locations impacted and get victims to safety in a timely way. Unfortunately, in terms of quick response, rescue teams may be affected by floods also. Automatic identification of flood risk levels helps to promote preparations that will minimize the effects of disasters. Figure 1 shows the global disaster types from 1998 to 2017. Figure 1 highlights that flooding is the most prevalent natural disaster type.
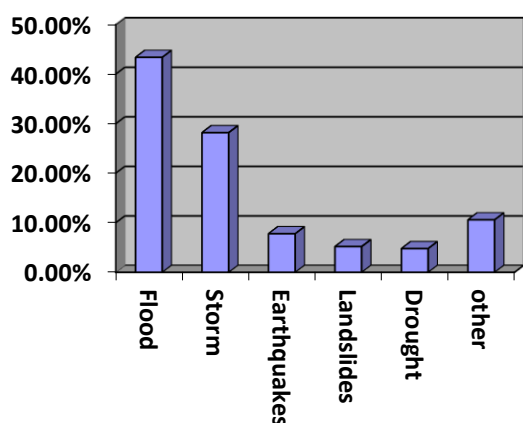
Fig. 1: Percentages of Global occurrences of natural disaster types from 1998-2017

By 2020, the amount of digital data produced will exceed 40 zettabytes for every man on the earth. The majority of these data will be produced by machines as they communicate with each other over the network [1]. With the huge development in information technology day by day, a massive set of data release to the internet daily. These data coming from different fields might contain very important information if we can sort them and understand the hidden relationships in those data. These developments change the activities on multimedia and produce both semi-structured and unstructured data on the internet. Therefore, multimedia data mining has become a very popular research area due to the huge amount of multimedia data on the internet as audio, images, video, graphics, text or sensor data, etc [2].

Big data analysis is an emerging technology that is used to analyze data with huge size which is beyond the ability of commonly used software tools to capture, manage, and process within a tolerable elapsed time[3]. When compared with traditional data sets, big data need instant analysis methods because of their unstructured data. We can get novel opportunities from analyzing big data such as realizing new values[4], to gather detailed knowledge about concealed values, and also acquire knowledge on possible ways to organize and manage multimedia datasets efficiently[5]. Visual data, sensor data, Geographical data, social media data, storing and sharing data, and satellite data are a few types of data that can be used to create a real-time flood emergency management system [6].

This study is based on the following two main research questions;

- What is the deep learning algorithm that can be used to manage flood emergencies?
- How to provide a comparative study to analyze those available approaches?

This paper includes the research objectives, proposed methodology, results, and then discussion and conclusion. In the conclusion section, recommendations for future work are also mentioned.

II. OBJECTIVES

The objectives of this study are to find available deep learning models to identify flood impact levels using images and create a comparative study to identify the most accurate model combination with high performance. The ultimate goal of this study is to support the flood emergency management in the country and contribute to the safe living and economic growth of the country.

III. METHODOLOGY

The following figure shows the proposed methodology of the research study.
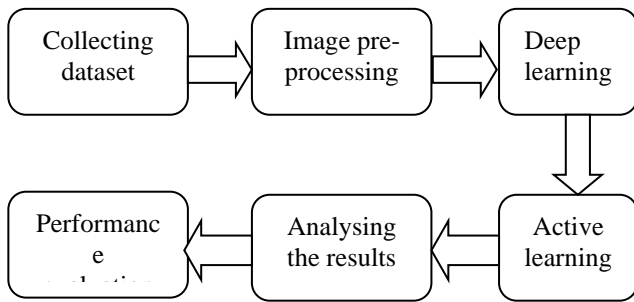
Fig. 2: Proposed methodology

A. Dataset

Dataset is compromised of 1543 social media images and has categorized into three categories. There are 553 "highrisk level" images, 607 "Medium-risk level" images, and 383 as "low-risk" level images. Dataset divides into parts as a training set (1243 images) and a validation set(300 images).

B. Image Pre-processing

Image pre-processing is an application of a wide array of activities ranging from altering images, applying artistic filters, enhancing the comprehensibility of the images, image segmenting, etc. In image pre-processing data augmentation is techniques use to increase the number of image data. Data augmentation is a process of creating new images by performing rotation or reflection of the original image, zooming in and out, and shifting, applying distortion, changing the color palette [7].

C. Deep Learning Models

In the image processing context, many advanced Conventional Neural network architectures have been used to feature extractions.VGG16, VGG19, InceptionV3, Mobilenet, DenseNet 169, DenseNet201, Denset 121 are some of models available to image feature extractions[8]. A Convolutional Neural network is formed with several layers. These layers perform image classification tasks. A CNN architecture generally consists of alternate layers of convolution layer and pooling layer and one or more fully connected layers at the end. For the transfer learning mechanism used in this study, we only choose 3 models, VGG16, VGG19, and MobieNet.

D. Transfer Learning

Transfer learning and domain adaptation refer to the situation where what has been learned in one setting is exploited to improve generalization in another setting. Transfer learning is an optimization that allows rapid progress or improved performance when modeling the second task. Simply, the model trains with a large amount of data and adjusts model weight and bias during training. These learned weights are transferred to solve another task. Another network model that is going to solve this new task starts with these pre-trained weights.

E. Confusion Matrix

The Confusion matrix is used for finding the accuracy and the performances of the model for the classification problem where the output is two or more types of classes.

- True Positive (TP) = Real label and predicted the label of the sample is positive.
- True Negative (TN) = Real label and predicted the label of the sample are negative.
- False Negative (FN) = Real label of the sample is positive, and the predicted label is negative.
- False Positive (FP) = Real label of the sample is negative, and the predicted label is positive.
- Real Positives (RP) = Real positives
- Real Negatives (RN) = Real Negatives
- Predictive Positives (PP) =Predicted Positives
- Predictive Negatives (PN) =Predicted Negatives

F1-score defines true positives are considered as twice important as the other samples.

$$\text{Accuracy} = \frac{TN+TP}{TN+FN+TP+FP} \tag{1}$$

$$\text{Precision} = \frac{TP}{TP+FP} \tag{2}$$

$$\text{Recall} = \frac{TP}{TP+FN} \tag{3}$$

$$\text{F1Score} = \frac{2TP}{P\,2TP+FP+FN0} \tag{4}$$

IV. RESULTS AND DISCUSSION

Table 1: Summary result table

	VGG19	VGG16	MobileNet
Accuracy Epoch=15, batch-size=32	52%	57%	89%
Accuracy Epoch=15, batch-size=10	50%	53%	86%
Speed	Low	medium	high
Loss Epoch=15, batch-size=32	26%	22%	5%
Loss Epoch=15, batch-size=10	23%	15%	5%

After analyzing the results and selected the MobileNet model as the high accuracy feature extraction model. In the evaluation phase, we used the F-measure mechanism to validate the performance of the chosen model. In the analyzing part, it shows the **F-measure value** as **0.62450**. Figure 2 shows the confusion matrix for the model.

Fig. 3: Confusion Matrix for Mobile Net Model

For the flood impact level prediction, we choose images from social media that are not in the dataset and then go through the trained model and got the results. Here are the results of them.

Figure 4: Used images for prediction

Img 1   Img 2   Img 3

Table 2: Prediction results table

	High-Risk	Medium-Risk	Low-Risk	**Prediction level**
Img 1	0.935892	0.036322	0.027786	**High-Risk**
Img 2	0.067895	0.633542	0.298563	**Medium-Risk**
Img 3	0.006743	0.195617	0.79764	**Low-Risk**

V. CONCLUSION

In this study, we have studied the level based flood image classification and flood area segmentation and also provided a flood image dataset. We have proposed an image classification model according to their impact level. Further, it provides a comparative study between VGG16, VGG19, and MobileNet deep learning models. When comparing the results, MobileNet model has resulted in higher accuracy. MobileNet model predicts the impact level with over 89% accuracy. The other conclusion that can stated after analyzing the results is that the accuracies of the models increase when increasing the batch size of the training phase. As this study mostly used image data, we used the CNN algorithm to get high accuracy results. This automated approach minimizes manual work because it is difficult to define the severity of the flood without prior knowledge and it is a time-consuming process. As future work, we suggest to combine different types of multimedia data such as image, audio, and video data and to create a real-time platform for flood prediction.

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The Future of Artificial Intelligence and its Social, Economic and Ethical Consequences

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Abstract—**Recent development in AI has enabled the expansion of its application to multiple domains. From medical treatment, gaming, manufacturing to daily business processes. A huge amount of money has been poured into AI research due to its exciting discoveries. Technology giants like Google, Facebook, Amazon, and Baidu are the driving forces in the field today. But the rapid growth and excitement that the technology offers obscure us from looking at the impact it brings on our society. This short paper gives a brief history of AI and summarizes various social, economic and ethical issues that are impacting our society today. We hope that this work will provide a useful starting point and perhaps reference for newcomers and stakeholders of the field.**

Keywords — Artificial intelligence, chatbot, ethics, AI bias

I. INTRODUCTION

Although Artificial intelligence (AI) came into existence in ancient times, only in 1956 the official name was formally given [1]. Since that time AI research has undergone a period of optimism and disappointment due to the slow progress which was observed. There was a fluctuation in progress made until after 1993. Research began to pick up again after that, and in 1997, IBM's Deep Blue became the first computer to beat a chess champion when it defeated Russian grandmaster Garry Kasparov [2]. This was the beginning of a new era in the AI field. In the last two decades, much has been done in academic research, but AI has been only recently recognized as a paradigm shift. A lot of progress is now being made as the investment has been going into the field. AI researches highly depends on funding since it's a long-term research field and requires an enormous amount of effort and resources.

AI techniques are being used to predicting deforestation before it happens, NASDAQ stock now monitors trades to see if insider trading is going on, NASA use AI methods to schedule payload operation, diagnosis of acute leukaemia, breast, and pancreatic cancer, and also predict patient survival with breast cancer, to car automation, and many other areas [3]. This application area highlights the importance and the benefits that AI technology brings us today. AI or machine intelligence can be devoted as an activity of making machine intelligent. That intelligence can be seen as the quality that enables an entity to function appropriately and with foresight in its environment [4]. But AI research defines AI as the study of intelligent agents, an agent that can perceive its environment and takes an action that maximizes the outcome or goal [5]. Advancements in computing power, theoretical understanding, and a large amount of data have enabled AI techniques to be an essential part of the technological revolution and in helping to solve many complex problems of our daily life. Take an example of recognizing object from images which just seemed like a sci-fi of AI a few years ago but now a simple convolutional neural network sits at the back and does the work [6]. All this may just be the begging of the new era of technological advancement. A huge amount of money has been poured into AI research due to its exciting discoveries and as the days go on it's getting better and better. But perhaps the capabilities that the AI brings obscure us from looking at the consequences that come with it. In this paper, we try to review the current social, economic, and ethical consequences that AI technologies will bring.

II. SOCIAL AND ETHICAL CONSEQUENCES OF AI

Social consequences involve those effects which the technology will directly or indirectly impact our life from an individual perspective, community, and society at large. The integration of AI is now transforming our daily life inevitably [7]. We are using different products powered by AI without even noticing. Google Assistant, Amazon's Alexa, Roomba vacuum cleaner, chatbots, and many other products in our world today are mostly powered by AI technology. The popularity of the technology has been assisted by the increase in computational power and a sheer increase in the amount of data [8]. The excitement about AI and its future impact on health care, our economy, climatic changes, and the education system are promising. Despite AI progress, few ethical issues have been presented. With the technological approach to be human-like, the threats and unpredictable complication cannot be overseen [9].

III. UNEMPLOYMENT

With the automation of processes dominating the AI field. Job displacement is one of the huge consequences that AI will have. In the past decade, human has relied on physical work and investing their time to earn. With the technology still rising and smart intelligent robots have been developed, we may see a future where individuals are being paid just for being citizens which will be important in helping to combat the job-stealing automation [10]. Despite the threat, a look of some automation like autonomous vehicles seems like a good ethic choice as it will help in a significant reduction of the accident if successfully implemented. One study conducted by Frey et al. found that 47% of total US employment is at risk of being replaced by machines over the next two decades [11]. AI-related jobs are now dramatically increasing in demand. According to the annual report AI index report [3], the AI skills requirements in job-listing have continued to grow multiples times from year to year. These statistics indicate the increasing need for AI skills to survive in the job market. But on the bright side, the replacement of machines could finally see humans doing what they like and other non-labour activities like family caring, community activities and found other new ways to help the society [12].

IV. INEQUALITY

Another dramatic effect of AI technology is the widening of the wealth gap. As technology cuts off the human workforce in different companies, this means the revenue will go to fewer people. Hence AI-driven companies will make all the money while fewer people will benefit. Although some people argued

that automation won't be the source of increased unemployment still it can destroy middle-range jobs while increasing those on the low and high-end jobs. This will augment social inequality and amplify the gap between low and higher-end job earnings [13]. The AI startups are now benefiting from the investments as the potential of the technology indicating its potential towards businesses. This brings the initiative for the society and their governments to create policies that will supervisor and ensure equal distribution of wealth among individuals to combat the increasing gap.

V. Humanity

With the rise of AI bot, modern human interaction is also changing. A remarkable AI bot named Eugene Goostman won the Turing challenge for the first time [14]. In this challenge, the bot interacted with a human in a text input format and the user was required to guess whether they were chatting with a machine or human. The bot fooled more than half of the human raters into thinking they have been talking to their fellow human being. Unlike the human nature of being tired and changing moods, these machines are more efficient and have a wide environment and resources for making relationships with humans. The chatbot of today not only can answer a variety of human questions but also can establish an emotional connection with humans [6],[15].

We have already started to see the beneficial use of bots. One good example is the visabot which help a user better understand American immigration laws and apply for the right visa based on persons need. The chatbot helps in smoothing visa processes, save time, and ensure already filled in visa forms[1]. Another example is a Microsoft chatbot which was created to interact with people on social media but ends up adopting the bad side of the conversation as they interact [16]. This serves as an example of the need for guidance on the purpose of the chatbot we are creating. There have been many positive stories about and use of chatbots, but the question remains will they create a society of its own in the already disconnected world of social media or will they help to shape up the behaviour of the humans which to some extent has already degraded.

VI. Artificial Stupidity

With the unpredictable behaviour of humans, learning from them can sometimes be difficult. The data that AI technology is using to train and learn mostly does not cover all the aspect of human behaviour. Intelligence comes from learning, whether you're human or machine. Systems usually have a training phase in which they "learn" to detect the right patterns and act according to their input. Once a system is fully trained, it can then go into the test phase, where it is hit with more examples and we see how it performs. The training phase cannot cover all possible examples that a system may deal with in the real world. These systems can be fooled in ways that humans wouldn't be. For example, random dot patterns can lead a machine to "see" things that aren't there. If we rely on AI to bring us into a new world of labour, security, and efficiency, we need to ensure that the machine performs as planned and that people can't overpower it to use it for their ends.

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https://visabot.co/

VII. AI Bias

For a human to be intelligent they need to learn to do the AI systems. But the imperfect nature and of humans creates a biased environment when it comes to the dataset the models are learning from. One good example could be a criminology prediction system which was observed to be biased against black people [17]. Although the model proved to be accurate still the assessment of the prediction together with the errors produced was not assessed enough. Here comes the question of the purpose and the impact of technology on people's lives. The analysis and handling of the technology need in-depth exploration of the results it produced and not only rely on the accuracy. Handling these systems to a non-expert to rely on can be more detrimental than it looks. Although the systems are building to serve our social progress the bias nature of humanity can still be propagated if not handled carefully. In another research conducted by the Massachusetts Institute of Technology together with Stanford University were the team examined the three facial recognition systems and broke down the accuracy of the result based on gender and race [18]. The researchers noted biases in the results produced and noted that that classification bias came from the dataset used to train the model. So, the researchers in AI argue that the biases in the kind of system we produced can be reduced by diversifying the workforce that is involved in building the systems or even making the researchers aware of the biases that exist in their work.

VIII. Security

Autonomous weapons are now being developed at a rapid pace. Powerful nations are battling each other to become the leading power in autonomous weapons. From automated warfare jets, to robotic soldiers all are already in the ground field. The increased power of destruction that the technology is adding is far beyond measures. Talking about nuclear, aerospace, cybersecurity, and biotechnology these are priority areas for the country's national security. For example, Cybersecurity is becoming even more important now as the fight won't only be on the battleground but the systems we are building ourselves. Big countries like the US, China, and Russia are racing each other towards the global dominance of AI technology. A quote from the Russian president Vladimir Putin said, "AI is the future, not only for Russia but for all humankind," Whoever becomes the leader in this sphere will become the ruler of the world." [19]. Countries like China have even announced its ambition of becoming the leader in AI technology by the year 2030 [20]. This shows the race is on and only time can tell the outcome of the system that is faster and more capable than humans by order of magnitude.

IX. Evil Genes

With many unanswered questions within the AI field today, new questions and unknowns continue to erupt as the technology progresses. The evil within the AI is not what we see in Hollywood movies of machines turning against humans, but rather is the mechanisms that the AI uses to solve the problems which we did not intentionally do that way. An interesting example is provided by Julia Bossmann in her report where an AI system could provide an answer to eliminate all humans as a solution to combat cancer [21]. So as useful as it is the technology still needs to understand the full context of the environment in which we want to find a solution for that.

X. THE ECONOMIC IMPACT OF AI

Like in the early days when electricity was discovered and brings about the industrial revolution, the same is predicted for AI technology to bring another industrial revolution. In an article published by Parkes and Wellman, the four sectors that will see the tremendous effect of AI technology are the Manufacturing industries, Professional services, financial services, and wholesale and retail [22]. Some countries are already starting to take advantage of the opportunities presented by technology today. One of the countries is China which has even set its goal to become the global leader in AI research by 2030 [20].With a massive population of around 1.4 billion in which 730 active internet users, the country sees its potential in collecting data, and the technology becoming more hungry for data. It seems that AI is going to become the new powerhouse for the countries and investment in research will be crucial for the country to break through and beneficial utilization of technology.

According to research conducted by Accenture, one of the leading global technology companies on top twelve global economic leaders revealed that AI technology could double annual economic growth rates in 2035 by changing the nature of the work and creating new relationships between man and machine [23]. This indicates an increase in the absorption of AI in our economies. The technology will continue to offer amplification and transcend of the current capital and labour capacity to propel our economic growth. Although the initial phase will be more on the industrial and manufacturing side, consumers will be the next frontier as a variety of AI products will finally be on the market.

XI. CONCLUSION

With this exponential increase in AI technology, it is time for the people and their governments to embrace technology instead of fearing change. It is also clear that the complication of the challenges that technology presents is also a concern. Governments and other policymakers should collaborate with the researchers to try and steer the technology towards serving humanity as the impact of the technology spans globally. As the computation power advances and more data being generated, researchers together with the community should focus on making both technology and people working more together rather than increasing the gap. Different organizations, associations, and individuals are becoming global examples in collaborating to take action and measure against the challenges that the technology presents. Organizations such as Algorithmic Justice League which highlights the algorithmic bias and let the people raise their concerns and experience to develop best practice and accountability. The petition to the UN urging rapid action on weaponized AI will help global engagement. The AI4All which aims to train a new and more diverse generation of the future AI technologist, thinkers, and leaders [3]. The is a need for global engagement for AI to stimulate and enforce policymakers to take appropriate actions.

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Taal Recognition of North Indian Classical Music: A Data Mining Approach

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Abstract—**Computational musicology is an interdisciplinary area in which computational methods are used to analyze musical structures: notes, chords, rhythms, and patterns thereof. While western classical music is extensively explored, North Indian classical music still remains to be explored computationally. Recognition of their rhythmic structures is important as it serves in a multitude of applications e.g., intelligent music archival, enhanced navigation and retrieval of music, and informed music listening. Rhythm in North Indian classical music revolves around the theme of *Taal* - the cycle of beats of specific syllables and beats. The main aim of the proposed study is to apply data mining for the recognition of *Taal* in North Indian classical music. In this study, acoustic features pertaining to rhythm were extracted using MATLAB MIRToolbox. Support Vector Machine, Naive Bayes, Decision Tree, Random Forest and k-Nearest Neighbor classifiers were applied on extracted features. Among these classifiers, Decision Tree obtained an accuracy of 51.61% and Naïve Bayes obtained an accuracy of 64.16% with cross-validation. The findings of the study are limited by the consideration of a smaller dataset, but the study would make a promising contribution through computationally exploring rhythmic patterns of a great music tradition.**

Keywords—Taal Recognition, Computational Musicology, North Indian Music

I. INTRODUCTION

Music plays a vital role in our day-to-day life especially in today's digital age. With music going digital, there are large and growing collections of music available to users on demand, requiring novel ways for structuring these collections automatically using different dimensions of music. Recognition of rhythmic structures and patterns of North Indian classical music is important hence it has a large audience and significant musicological literature [5].

Rhythm in North Indian classical music revolves around the theme of *Taal* - the cycle of beats of specific syllables and beats. *Taal* is the most basic information for listeners to follow the rhythmic structure of music [6]. A *Taal* has fixed-length cycles, each of which is called an *avart*. An *avart* is divided into equal basic time units called *matra*. The *matras* of a *taal* are grouped into sections, sometimes with unequal time-spans, called the *vibhags*. *Vibhags* are indicated through the hand gestures of a *thali* (clap) and a *khali* (wave). The first *matra* of an *avart* (the downbeat) is referred to as *sam*, marking the end of the previous cycle and the beginning of the next cycle [3].
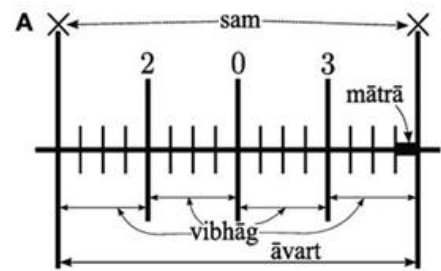
Fig. 1. An avart of a popular tal, showing the matras(all time ticks),

There are over 70 different Hindustani *Taals* defined, but in this study, we mainly focus on only 4 *Taals.* They are *teentaal*, *ektaal*, *jhaptaal*, and *rupak.*

Table 1: Matra, Vibhag, and Matra Grouping of the Four Taals considered in the Study

Taal	Matras	Vibhag	Matra Grouping
Teentaal	16	4	4+4+4+4
Ektaal	12	6	2+2+2+2+2+2
Jhaptaal	10	4	2+3+2+3
Rupak	7	3	3+2+2

Major Research Questions

    a) What are the frequently used data mining algorithms for *Taal* recognition?

    b) What are the most effective acoustic features pertaining to rhythm in *Taal* recognition?

    c) How to develop a data mining-based model for *Taal* recognition with a higher accuracy compared to the existing models?

Rhythmic analysis is the study of how music works andhow it is structured organized and generated in time. It is the study of the most fundamental aspects of music, and tells us not only about the music but about the culture which produces that music, about the importance of universal and culturally specific factors in music, and ultimately about how music may represent our knowledge of the world.

II. OBJECTIVES

North Indian classical music has evolved into a complex but established music system over the years and it is one of the most rhythmically sophisticated in the world. Even though various attempts are made to computationally analyze its rhythmic structure, this sophistication calls further

advanced methods. Hindustani music therefore can be considered as an ideal subject for computational analysis. Accordingly, the main objective of this research was to present a data mining approach for *Taal* recognition of North Indian classical music. The specific objectives were to review the frequently used data mining algorithms for *Taal* recognition, to review the most effective acoustic features pertaining to rhythm in *Taal* recognition, and to develop a data mining model for *Taal* recognition with an improved accuracy over the existing models.

III. METHODOLOGY

A. Tools and Resources

The literature reveals that there are number of audio feature extraction tools that have been used in previous music classification studies. Among them, MIRtoolbox, marsyasand psySound are the most commonly used tools [1,2]. This study employed the Matlab MIRtoolbox version 1.7.2 to extract the rhythmic acoustic features. For the scientific calculation process Jupyter Notebook development environments were used with python language to train and test the classifiers.

A dataset consisting of 151 excerpts (2mins; 44.1 kHz; stereo; .wav) obtained from CompMusic Hindustani test corpus, operated by the Music Technology Group of the Universitat Pompeu Fabra (UPF) in Barcelona, Spain[4] was used in the study. belonging to four popular *Taals*: namely *Tintal, Ektal, Jhaptal, Rupak Tal.* For each *Taal*, there are excerpts in three *Layas* namely Vilambit (slow), Madhya (Medium), Drut (Fast).

B. Feature Extraction (Using Matlab MIRToolbox)

Music acoustic feature extraction is the most important part in this study to influence the rest of the experiments. In order to train the machine classifier by supervised learning, eight rhythmic acoustic features were obtained from MATLAB MIRToolbox by using various dimensional features methods that are already defined by the toolbox.

Table 2: Extracted Features were Used in This Work; STD = Standard Deviation, M = Mean

Features	Used Method(MIRtoolbox)
Tempo M	*mirtempo()*
Fluctuation M	*mirfluctuation()*
Onsetcurve(Envelope)_PeakPos M	*mironsets()*
Onsetcurve(Envelope)_PeakMag M	*mironsets()*
Event density M	*mireventdensity()*
Metrical Centroid M	*mirmetroid()*
Metrical Centroid STD	*mirmetroid()*
Pulse clarity M	*mirpulseclarity()*

C. Rhythmic Analysis (Taal Recognition)

As shown in Figure 2, the initial stage describes the process of audio preprocessing. Under this stage another process was carried out and known as music feature engineering, which includes acoustic feature extraction from music segments using the MIRtoolbox mirexport method. In the next Stage, training and testing data were formed from the major dataset in order to train and test classifiers. Five standard classifiers

were used for experiments which were identified as frequently used classifiers in previous studies which were Support Vector Machine (SVM), k-Nearest Neighbor, Naïve Baise, Decision Tree and Random Forest. Supervised learning is usually done with independent training and testing datasets and therefore the dataset (151 music excerpts) was split as 80% for training and 20% for testing. Then the classifiers were evaluated by its corresponding testing data set and the best classifiers were identified based on the measurements:precision, recall, and f-measure.
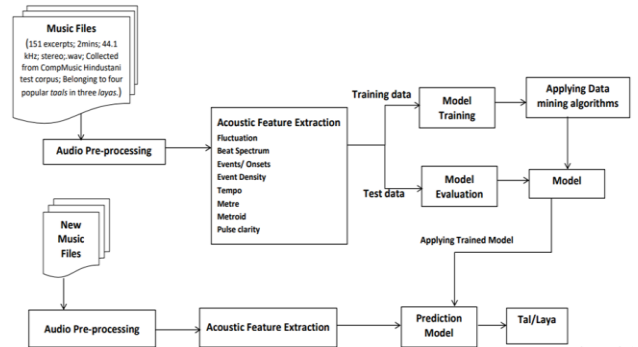
Fig. 2: Overall Taal Recognition Process

IV. RESULTS AND DISCUSSION

The following results were obtained from the classifiers as shown in Table 3.

Table 3: Results of the Taal Recognition (SVM-Support Vector Machine, NB-Naïve Baise, KNN-K-Nearest Neighbour, DT-Decision Tree, RF-Random Forest,

Classification Algorithms	Evaluation Metrics			Accuracy
	Precision	Recall	F1-Score	
SVM	50%	48%	49%	48.38%
NB	43%	48%	43%	48.38%
RF	44%	35%	35%	35.48%
DT	51%	52%	51%	51.61%
KNN	42%	39%	38%	38.70%

Decision Tree (DT) classifier achieved the best results yielding precision, recall, and F-measure values of 51%, 52%, and 51% respectively. Further the results shows that Naïve Bayes (NB) and Support Vector Machine (SVM) classifiers yield the next highest accuracy value which is 48.38% However, comparing the ultimate results of the Taal recognition , DT was identified to be outperforming the other classifiers yielding an accuracy of 51.61%.

The experiment was continued to evaluate the performance of classification using 5-fold cross validation. Apart from the conventional training and testing approach, cross validation randomly partitions the dataset into 5 (5-fold) equal sized subsamples. Thereafter each fold splits the dataset in training and testing with randomly selected data. After the training, the testing is performed using test data. Likewise, the training and testing processes are repeated until every 5-fold serves as the test data. The accuracy is returned for five folds and finally the averages of all 5 accuracies are calculated in each and every iteration. Table 4 shows the performance of classifiers with cross validation. According to

the previous approach DT was identified as the best classifier. However, after the cross validation, NB was returned as the classifier with highest accuracy (64.16%). Therefore, the final prediction model was developed using the NB classification algorithm.

Table 4: Cross validation result of Classifiers ((SVM-Support Vector Machine, NB-Naïve Baise, KNN-KNearest Neighbour, DT-Decision Tree, RF-Random Forest))

	SVM	KNN	NB	DT	RF
1st	58.33%	37.50%	45.83%	41.66%	26.66%
2nd	66.66%	54.16%	70.83%	54.16%	60.80%
3rd	58.33%	41.66%	70.83%	41.66%	48.09%
4th	45.83%	54.16%	62.50%	50.00%	75.78%
5th	70.83%	62.50%	70.83%	50.00%	61.51%
Mean	60.00%	50%	64.16%	47.50%	43.90%
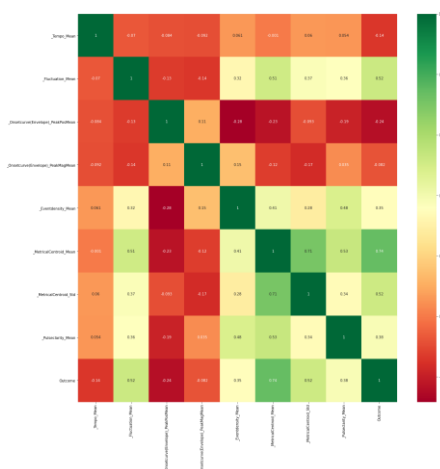
Fig. 3: Correlation Metrics Among all the features

In order to further enhance the accuracy of the prediction model, the study used correlation metrics method and the statistical relationship between the selected 8 features were identified as shown in Figure 3. Accordingly, the top six highly correlated features (Fluctuation, Onset curve (Envelope) PeakPos, Event density, Metrical Centroid, Metrical Centroid STD, Pulse clarity) were considered which led to an enhanced classification performance of60.83% with both SVM and NB classifiers.

V. CONCLUSION

Summing up the results of literature review, computational analysis of rhythm in North Indian Classical music warrants further attention and existing research can be further improved to enhance the classification accuracy. Accordingly, the ultimate goal of this study was to classify and verify the rhythmic structure of music associated with Taal in North Indian Classical Music. An evaluation of five supervised learning classification algorithms was made on a collection of 151 music stimuli which belongs to four popular Hindustani Taals namely,Teentaal, Ektaal, Jhaptaal and Rupak. Among them five classifiers, Decision Tree yielded the highest accuracy. However after cross validation, a higher accuracy could be obtained using NB classifier. The performance of this classifier could be further improved when considered only the six most influential features from among the initial eight features. The resulting improvements in the accuracy levels indicates that we can consider those features for the final prediction model. Even though the findings of the study are limited by the consideration of a smaller dataset, it is believed that the study would make a significant contribution through attempting to computationally explore rhythmic patterns of a great music tradition.

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Machine Learning Approach for Real Time Translation of Sinhala Sign Language into Text

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Abstract — **An effective communication bridge has to be adopted between deaf people and the rest of the society to make deaf and mute people feel involved and respected. This research is aimed at creating a real time Sinhala sign language translator by identifying letter-based signs using image processing and machine learning techniques. It involves creating a digital image database of hand gestures for the 26 static signs. These images are processed, recognized and classified by a Convolutional Neural Network (CNN) based machine learning technique. The proposed solution is able to identify 26 hand gestures by using the CNN network with 91.23% validation and 89.44% training accuracy.**

Keywords — Sinhala sign language, Convolutional Neural Network, Digital image processing, Real time translator

I.   INTRODUCTION

Development of language as a communication medium was a huge achievement in evolution, and there is no human community without it. Humans have a natural tendency for language in two different modalities: vocal-auditory and manual-visual. Speech is the predominant medium for transmission vocal-auditory language and it seems that spoken languages themselves are either also very old or are descended from other languages with a long history. On the other hand, sign languages do not have the same histories as spoken languages because special conditions are required for them to arise and persevere.

Many natural languages have created their own sign language system with different grammar, syntax, and vocabulary where each displays the kinds of structural differences from the country's spoken language that show it to be a language in its own right. Among those, the Sinhala Sign Language is a visual language used by the deaf people in Sri Lanka which currently consists of more than 2000 sign based words. In any sign language, there are signs allocated for particular nouns, verbs and phrases and are frequently used and highly standardized. These are known as established signs.

This research is aimed at creating a real time Sinhala sign language translator based on letter based signs using image processing and machine learning with the intention of producing an effective communication platform for people with auditory and verbal impairments.

At first, a database of hand gestures for 26 categories is created and those digital images were processed, recognized and classified by a CNN. Then, we identify the most suitable architecture and the implementation platform to develop the system to translate the Sinhalese signs into text through recognition of static alphabet based signs.

A device that translates sign language of deaf-mute person to synthesized text and voice for communication is revealed in [6]. In [1], a new way of communication called artificial speaking mouth is introduced. Because there are drawbacks in the haptic-based approach, work on gesture recognition of sign language is often done by using vision-based approaches as they provide a simple and instinctive communication between computer and a human .[2]. The model proposed in [3] is used to recognize hand gestures captured using a webcam where the feature extraction is done efficiently using SIFT computer vision algorithm. Herath [4] presents a real time Sinhala sign language recognition application by using a low cost image processing method by capturing images having a green background. Vision-based approaches have also been studies in further literature [5, 7].

II.   METHODOLOGY

A. The Dataset

In this study, we have only considered 26 letters which have static hand gestures having green as the background color. There are 34 images in one category and the total number of 884 images in the training dataset. Our testing data set consists of 11 images in one category and a total number of 286 images.

B. Preprocessing

In the proposed research, the images are taken under identical parameters such as background color, same side of the hand, etc. The selected images have a width and height of 255 pixels and a scaling factor 1./255 on either side. The proposed CNN model is shown in the below Fig. 1.
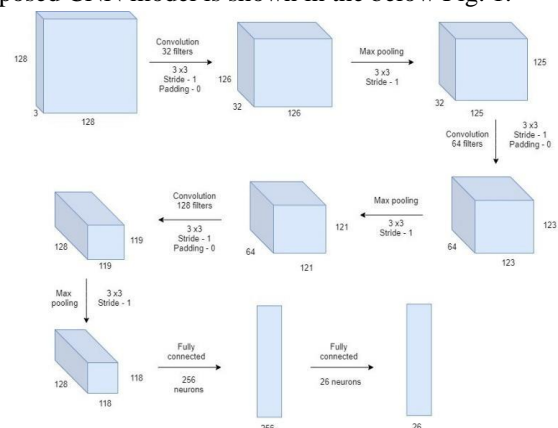
Fig. 1: The CNN architecture

We used a 2D convolutional layer as it provides a better validation accuracy than 3D convolutions. The main task of the convolution stage is to extract high level features such as edges of an input image. After inserting a 128 x 128 image with 3 colors into the convolutional layer, it produces a 126 x 126 3 color image. Starting with a 3x3 filer, we gradually increase the filter sizes while adding more convolutional layers. To classify the dataset, we add an artificial neural network to the convolutional neural network. Basically, a fully connected layer looks at what high level features most strongly correlate to a particular class to produce an output.

We used 256 units which is the number of nodes that should be present in a hidden layer and also leaky relu activation function to achieve non-linearity in the fully connected layer. We have 26 nodes in the output layer because there are 26 categories to reflect the alphabet letters. The Softmax function is used for the activation in the output layer [8]. Subsequently, ooptimizers update the weights to minimize the loss function at each iteration [9].

G. Desktop Application

When the user shows a sign from the right hand to the web camera window in the computer, it processes 200 frames and the final frame will be captured to be used for further tasks. Then, the location of the image is transmitted to the web server where the CNN is deployed. Finally, the relevant letter, which is predicted from the CNN model, is considered as the response. The relevant letter and the cropped image is displayed in the desktop application as in Figure 2.
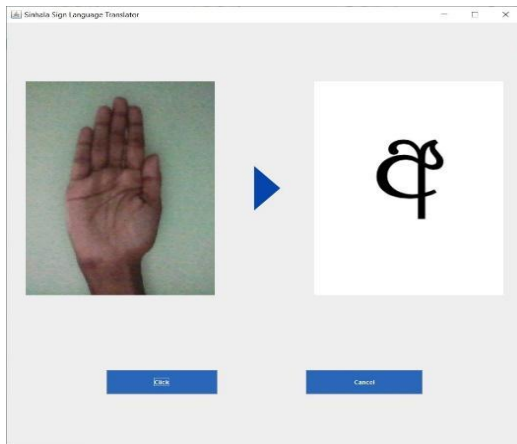
Fig. 2: final output view of the desktop application

III. RESULTS AND DISCUSSION

A) Results of CNN model

Training loss and training accuracy: According to Figure 3 the training accuracy of the proposed CNN model is 89.44%. It is pretty much a good performance when we consider the amount of data in the dataset. The training data fit into the model well as the training loss of the proposed CNN model is 0.2647. As in Figure 4, the loss of training set is gradually decreasing with respect to each epoch.

The validation accuracy of the proposed model is 91.23% while the loss is 0.2651 as depicted in Figures 3 and

4. According to these figures although the graph fluctuates at certain points, the validation accuracy is increased.
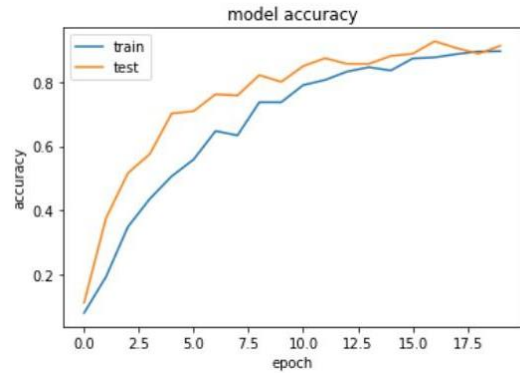
Fig. 3: Accuracy vs epochs of the model
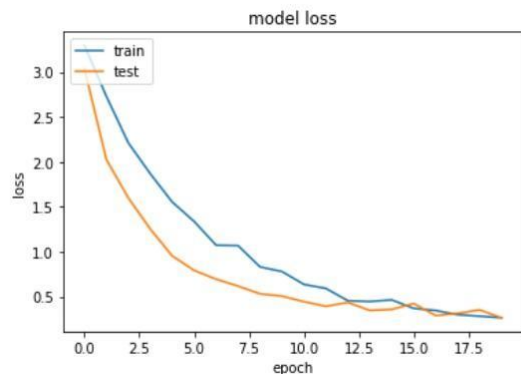
Fig. 4: loss vs epochs of the model loss

IV. CONCLUSION

We proposed a model for a Sinhala sign language translator, which can be embedded in an application to give a real-time experience to the user. It was able to identify 26 hand gestures using a convolutional neural network with 91.23% validation accuracy and 89.44% training accuracy. The application is able to generate the relevant letter by getting an input of a hand gesture within 1.75 seconds of average time. Additionally, it is capable of tracking the hand gestures of Sinhala sign language for letters and printing it in a text field on a user's device.

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Survey on Data Mining Techniques for Visual Impaired Entrepreneurs using Mobile Network

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Abstract — **According to WHO there are around 280 million people who are visually impaired and out of them 246 million are low vision people and 82% are all blind as well as most of them are women. Data mining has already established as a novel field for exploring hidden patterns in the huge datasets. In Sri Lanka according to international agency for the prevention of blindness they identify 1.7% suffer from visual impairment and they are in 40+ age population as well as survey that revealed 1.6% and 15.4% severe visual impairment among study population. It varies from district to district. These people taking help from someone else for their every purposes. It is very difficult and risky when considering about the Covid-19 pandemic situation. Because according to virus it avoid close contact with people and guide to stay at least six feet away from people mainly always advice about the social distance among people using several techniques. In this paper, review some advances made recently in the study of mobile phone datasets. Mainly this paper contributes social networks that can be constructed with such data, the study of personal mobility, geographical partitioning, urban planning, and help towards development as well as security and privacy issues.**

Keywords — Entrepreneurship, Visually impaired, Automated Speech, Data mining

I. INTRODUCTION

Data mining has already established as a novel field for exploring hidden patterns in the huge datasets [4]. In WHO they identify there are around 280 million people who are visually impaired and out of them 246 million are low vision people and 82% are all blind as well as most of them are women. [1] In Sri Lanka according to international agency for the prevention of blindness they identify 1.7% suffer from visual impairment and they are in 40+ age population as well as survey that revealed 1.6% and 15.4% severe visual impairment among study population. It varies from district to district. There are several ways to define blindness. Most of are define it as the inability to see at all at best, to discern light from darkness. And main thing is not all blind people are 100% blind. These people taking help from someone else for their every purposes. It is very difficult and risky when considering about the [3] Covid 19 pandemic situation. Because according to virus it avoid close contact with people and guide to stay at least six feet away from people mainly always advice about the social distance among people using several techniques. When it turn to those people And not a lot is done from the perspective of those with disabilities. In that situation it totally impact for that community and mainly they suffer from that because of their disability. When compare with current situation always hear about the social distance. But when considering it with visual impaired community how they face for that virus without help of someone? How they navigate that issue successfully?

According to current situation researcher try to provide solution for above matter using one of data mining technique which is called as K-means algorithm. K-mean algorithm is a distance based clustering algorithm which partitions data into predetermined number of clusters. It rely on distance metric used to measure similarity between data points. Data points are assigned to nearest cluster. [2] And also it is unsupervised learning algorithm for clustering a set of items into groups. Here is the method which is used for K-mean algorithm set of multi-dimensional items and a number of clusters, k, we are tasked of categorizing the items into groups of similarity. The centres of these groups are called means. Here is algorithm in pseudocode,

Input: Data Set

Number of Clusters(k)

Number of Max Iterations (maxIterations)

Initialize k means at random points

For i = 0 to maxIterations:

Iterate through items Assign an item to its   closest   mean

Update that mean Return means

According to K-mean algorithm researcher hope to done it using mobile networks to identify locations of visual impaired community with the use following steps,

- Partition of objects into k non-empty subsets.
- Identifying the cluster centroids (mean point) of the current partition.
- Assigning each point to a specific cluster.
- Compute the distances from each point and allot points to the cluster where the distance from the centroid is minimum.
- After re-allotting the points, find the centroid of the new cluster formed.

II. METHODOLOGY

A.System Overview

Proposed system was e commerce based online platform for visually impaired entrepreneurs to sell their products using speech recognition. System is the one of the most significant and many useful projects in which proposed system the entrepreneurs should not go for the customers to sell their products and users can get their problems solved through the system. The main aim of this objective based application is to enable the handicapped specially visually impaired persons to access the ecommerce-based platform which are most widely used for online selling of items or

products nowadays. So, proposed system will develop an ecommerce-based application using speech recognition to eliminates or reduces the various practical difficulties that the visually impaired persons come across. In ECSFE using speech recognition for login registration and other rest parts of the system and keyboard provide an extra advantage to visually impaired entrepreneur and allows them to use the application with more flexibility.

In proposed system provides facilities as follows,

- Registration is provided for both customers and employees. Mainly visually impaired persons navigate through system by using the audio technology.
- Complete information of employees with their name, product name, price, phone number, mail (if them have) and address.
- Products are categorized according to different sections. (ex-foods, clothes).
- Users can post comments and complaints.
- Users can request products from employees according to their choice.
- Users can request transport if they want (provide online location of employees).
- Employees Have facility to communicate with bank consultant regarding payment issues.
- Flexibility in the system according changing environment.
- Controlling redundancy in posting the same data multiple times.
- Provide orders with the constraint time.
- Notification will send to the employees when they have orders, messages, comments and other.
- Training feature available for new entrepreneurs to learn how to become self-entrepreneur.

III. THEROTICAL BACKGROUND

K-means clustering algorithm mainly define as a unsupervised learning method which consist with iterative process. With use of that data mainly grouped into k number of predefine sub- groups and also it makes data points into inter clusters. According to algorithm it need following outputs,

- K number of subgroups or clusters
- Sample or training set$\{x1,x2,x3…,xn\}$

Mainly algorithm built in hierarchical manner and also top and down built using binary splits and refinement of all nodes at the end. When there are missing values in columns k-means interprets them as missing at random. This can be done using two methods such as ,

- Elbow method
- Purpose method

According to above K-mean algorithm researcher hope to be done it using mobile networks. Mainly visual Impaired persons identify using their mobile networks with use of that identify their location and provide help them to prevent. Here are the methods which can be used for that,

- Partition of objects into k non-empty subsets
- Identifying the cluster centroids (mean point) of the current partition.
- Assigning each point to a specific cluster
- Compute the distances from each point and allot points to the cluster where the distance from the centroid is minimum.
- After re-allotting the points, find the centroid of the new cluster formed.
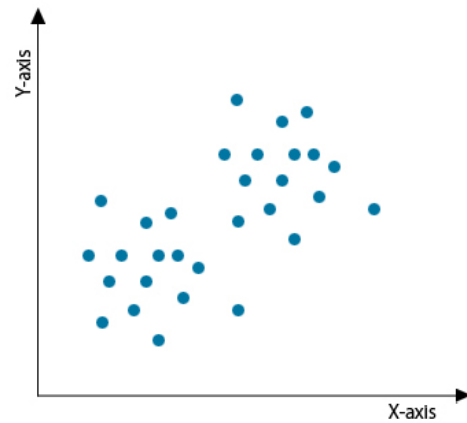
Fig. 1

A. Mobile networks

In enation, a dataset of people making phone calls to each other is represented by a network where nodes are people and links are drawn between two nodes who call each other. In the first publications related to telecommunications datasets, the datasets were rather used as an example for demonstration of the potential applications of an algorithm or model rather than for a purpose of analysis. However, it quickly appeared that the so-called mobile call graphs (MCG) were structurally different from other complex networks, such as the web and internet, and deserved a particular attention, review here the different contributions on network analysis. Will address the construction of a social network from CDR data, which is not a trivial exercise, simple statistical properties of such networks and models that manage to reproduce them, more complex organizing principles, and community structure, and finally we will discuss the relevance of the analysis of mobile phone networks.
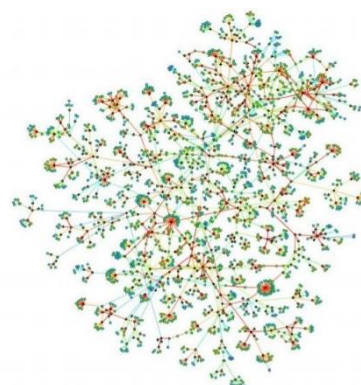
Fig. 6 System Process Module

IV. RESULTS AND DISCUSSION

Used questioner to identify what are the factors more effective for my Entrepreneurship development for visual impaired entrepreneurs' problem. Have made a questionnaire distributed to 20 responds and collect the views and get the average calculation of the parameters. According to that take all the literature reviews and questionnaire have gathered what is the weight of that factors and how those factors influence to my case and in the above table it describes the final output of sample survey. It consists with 8 questions and percentage weight of each output. 90.5% responds response for first question. It is the main turning point for develop the system.

Table 2. Questionnaire Evaluation

Factor	Questionnaire weight	Answers weight	Final weight
Does disability is disturbance for doing entrepreneurship?	Yes	77.8%	
	No	11.1%	
	It depends on the attitude	10%	77.8%
How is acceptance from the market?	Good	66.7%	
	Bad	33.3%	66.7%
Do you have good relationship with customers when communicate with them?	Yes	66.7%	
	No	33.7%	66.7%
Can solve those problems using technology?	Yes	66.7%	
	No	11.1%	
	Other	22.2%	66.7%
What is the preferred way for visually impaired entrepreneurs to use this system?	Screen reader	66.7%	
	Brail system	11.1%	66.7%
	Touch screen	10%	
	Other		
Have face difficulties with screen reader?	Yes	75%	

	No	12.5%	85%
	Language difficulties	85%	
Is proposed system useful for visually impaired entrepreneurs to sell their products?	Yes	90.5%	90.5%

V. CONCLUSION

The researcher has highlighted what are the existing system, failures in existing situation and how is the new system, how the system works, who are the main users, services and how they can deal with the proposed system. And this paper gives an overview of the system architecture and implementation of the E-commerce system of visual impaired entrepreneur system as android and web based. Entrepreneur is the valuable resource in the organization they mainly inspire successful social development through of those entrepreneurs visually impaired resource is special and important to provide great service and product to customers. To meet the new challenges and requirements of the market, the business owners need to think and make better decisions. This study has limitations online accessibility evaluation tools and expert evaluation may report diverse web accessibility errors.

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Text Mining Approaches for Social Media Censoring: A Systematic Literature Review

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Abstract — **Social media has recently become one of the most popular communication media used by people all over the world. Their feedback, reviews, and criticism towards products, services, people, or organizations can be easily expressed as posts and comments within the social media platforms e.g., Facebook and Twitter. This mapping study focuses on Social Media Censoring using the text mining techniques which is based on the existing research done in the past eight years. At the starting level of the research, the selected strings which are relevant were applied in major seven digital repositories. Direct search and snowballing on those publications were conducted to scale back the limitation of accessing specific databases. The selected 13 studies have various aspects such as publication year and source, objective, research type, type of methodology used for social media censorship; and those were concerned in this mapping study. From these studies the major area of knowledge regarding social media censorship was gained. The censorship takes place in social media when information, speech, public communication, public posts through images or texts are considered as objectionable, sensitive, or inconvenient for individuals, organizations, or the government. For the purpose of censorship of social media, there are several kinds of text mining techniques available and applied in the real world such as clustering, categorization, and decision tree categorization. The knowledge gained from those studies as an outcome supports building a mechanism that helps to reduce the spread of irrelevant information in social media with the use of text mining techniques.**

Keywords — Social Media, Censorship, Text Mining

I.   INRODUCTION

Social media has become the most common way of communication as most of the people in today's world use them in their routine life to keep connected to each other [1]. These social media were introduced at the beginning of the 21st century. In 2002 Friendster was started, MySpace and LinkedIn in 2003, Facebook in 2004, Twitter in 2006 and many others during and thereafter [2]. While this rapid increment of communication sources enhanced easy communication and connection, it also led easier dissemination of false news and information. This situation poses a serious risk to the truthfulness of all media publishing [2]. Censorship is known as omitting the harmful or objectionable information spreading through the media as suppression of speech and public communications. There are mainly four types of censorship; withholding information, destroying information, altering or using selective information, and self-censorship [3].

Nowadays the information shared through the internet is stored in digital repositories. And those repositories contain a large amount of data flows. As per the findings "Text Mining" is an interesting process for the information extraction and to explore knowledge from textual data sources that are located in the digital repositories [4]. According to the researchers, 80% of available texts on the web are unstructured and the remaining 20% is structured [1]. To read those unstructured data there are several kinds of text mining approaches available such as summarization, classification, clustering [4].

Numerous situations across the world highlight the importance of censoring information within social media. Therefore, the traditional methods of censoring are difficult to be executed, warranting automated ways such as the use of text mining techniques.

The research questions attempted to be answered through this mapping study are given below; when and where the related studies regarding social media censorship are published? What are the aspects that have been focused on in the selected study areas? What kinds of research have been done so far? What are the benefits of social media censorship? What are the technologies and methods used in this research area? What are the limitations in existing research?. Presenting answers for the above questions, this mapping study helps the future researchers who are focusing on social media censoring with the aid of text mining techniques while a detailed view on the related research conducted so far in this field of study.

II.   OBJECTIVES

The main objective of this mapping study was to investigate the text mining techniques adopted worldwide for social media censoring/ content moderation. In order to achieve the above objective the following specific objectives were set Reviewing the history of social media censorship and its present situation across the world, reviewing different text mining approaches used in social media censorship, providing insights on the future of social media censorship, identifying the barriers and challenges in applying text mining for social media censoring, providing a set of

guidelines/recommendations for successful implementation of text mining based approaches for social media censoring, and developing a preliminary model for sentiment prediction with the use of social media data.

III. METHODOLOGY
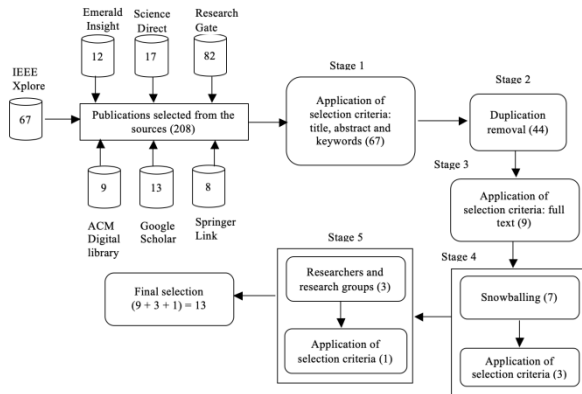
Figure 7: Overall selection process

From the digital repositories, publications during the period from 2011 to 2018 were considered. In the initial search 208 publications were retrieved as a result. The total retrieved results included 67 from IEEE Xplore, 8 from Springer Link, 82 from Research gate, 17 from Science Direct, 13 from Google Scholar, 12 from Emerald Insight, and 9 from ACM Digital Library. Then the criteria of the selection process were continued on the selected publications to identify and extract the most specific related studies. Figure 1 show the major five steps used in selecting the final set of studies.

In the first stage 141 publications were eliminated returning 67 studies. Approximately 67.8% of the studies were eliminated from the selected whole. In the second stage23 duplications were eliminated from the selected 67 publications which were existing in more than one database.

Accordingly, 44 studies were considered under the third stage of the selection process. In this stage full text of the study was considered and incomplete or irrelevant studies were removed. Under this process 35 studies were eliminated considering some specific inclusion criteria (IC) and exclusion criteria (EC). 11 publications were eliminated by EC2 (The paper is published just as an abstract); 11 publications were eliminated by EC5 (The paper is not a primary study. It is either editorial or summary); and finally 13 publications were eliminated because of not satisfying IC1 (The paper describes the text mining techniques for social media censorship).

In the fourth stage of the selection process, the selection criteria focused on outside of the selected sources. The approach helped to overcome the limitations of accessing only specific databases. All the references of the selected 9 publications were analyzed and as a result 7 additional publications were discovered by the method of snowballing. Then the selection criteria were performed throughout these selected 7 studies. Under that 4 publications were selected, which are most relevant to the study. Altogether there were 13 publications selected until then and they were taken into the final fifth stage. From this step 3, publications were

identified by direct searching which are mentioned by research of the selected 13 studies. A total of 13 publications were retrieved as a result of this complex selection process.

IV. RESULTS AND DISCUSSION

The findings of this mapping study were summarized in a tabular form having the fields: Study, Aspects, Text Mining Approaches, Solutions and the Limitations/Future Works. This summary table was used as the source of extracting information to answer each research question. Some sample entries of the summary table are given in Table1 representing some of the key studies. Figure 2 elaborates on the distribution of selected papers over the year of publication. Only the papers published from 2011 to 2017 were taken into consideration in order to get an updated view of the study area. Figure 2 further shows the distribution of the selected papers over the digital repository each was obtained from.
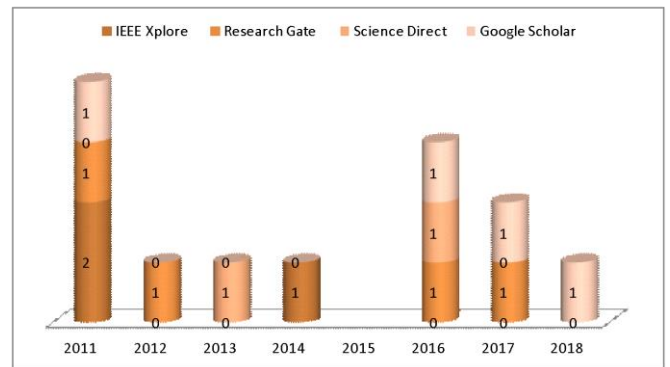
Figure 8: Distribution of the selected studies according to the datasets over the years

The findings revealed the use of some text mining techniques that are applied in censoring purposes such as Information Extraction, Categorization, Clustering, Topic Tracking, Summarization and Association Rule Extraction [1], [5]. Moreover, various limitations associated with the above studies were identified while identifying future research directions to facilitate social media censoring with text mining techniques in order to provide better solutions. Following are among the findings.
1. The limitation associated with the selection of areas for censorship experiments.
2. Limitations associated with the social media selected due to the restrictions within the country.
3. While text data is extensively being used currently in isolation, image, audio, and video data can be successfully integrated in the future.

Table 3: Partial Summary Table

Study	Aspects	Text Mining Approaches	Solutions	Limitations/ Future Works
[1]	N/A	IE Categorization Clustering Topic Tracking Summarization Question Answering Association Detection	Need of text mining based DSS for government agencies. Various text mining applications developed in e-government. Proposed an integrated framework used by government organizations' to develop text mining based DSS.	Extend the technical architecture for Text-Mining based DSS for e-governance as Multi-lingual Text Mining based Decision support system (MLTMbDSS)
[3]	Facebook and Twitter	NLP Text Clustering Categorization Association Rule Extraction	Categorization of text mining as; text clustering, text categorization, association rule extraction and trend analysis were according to applications.	Examining the text mining techniques on Arabic textual data from Facebook and Twitter, & sentiment analysis of Arabic text.
[6]	Twitter	Topic Extraction Clustering	Found the vast bulk of censored tweets contained political content, often critical of the Turkish government. Also the research establishes that Twitter radically under-reports censored tweets in Turkey, raising the possibility of similar trends hold for censored tweets from other countries. And has discussed the relative ease of working around Twitter's censorship mechanisms.	The research conducted within the Twitter data collected targeting only Turkey with some Twitter rate limitations and some restrictions from other groups those who expect to crawl their content.
[7]	Social Media	N/A	The censorship of expression that exists on social media in China shows major setbacks in regard to the key elements of a public sphere	Focused only on the concept of the public sphere but also can analyze social media and their impact on freedom of expression on democracy and ideology as well.

(N/A – Not Available)

4. Text data from social media posts and comments can be supplemented by articles from newspapers and direct interviews as a means of enhancing the prediction accuracy.

V. CONCLUSION

The main aim of this mapping study was to provide a comprehensive idea on social media censorship with the use of text mining techniques which overcome the barriers and limitations in conventional manual mechanisms. The study revealed the use of various text mining approaches that can be successfully adopted in social media censoring. Further, the limitations and barriers associated with the existing works were also identified while providing insights on prospective research directions which enhance the existing mechanisms of text mining techniques. While sentiment analysis, hate speech detection, and fake news identification are among the frequent text mining tasks performed on social media data, the development of a prediction model and comparison among different machine learning algorithms including Logistic Regression, Support Vector Machine, and Random Forest are looked forward in the study with related

to one of the above tasks. It is believed that the findings of the present mapping study would contribute and support various attempts across the world for assuring a reliable social media experience

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Comparing Deep Neural Network Models for Handwriting Recognition

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Abstract — **Handwriting recognition is a technique used to interpret intelligible handwritten input and convert them into digital text using Machine Learning tools. This research paper provides a comparison of the application of CRNN and RNN for handwriting recognition, using a dataset containing about 400,000 handwritten names. Our experiments demonstrate that the CRNN model produces the highest accuracy compared to RNN model.**

Keywords — Handwriting recognition, CRNN, RNN

I.   INTRODUCTION

Handwriting Recognition is an interesting and demanding research based in Artificial Intelligence, computer vision and pattern recognition [6]. A computer performing handwriting recognition is defined as a system capable of acquiring and detecting characters or words in a paper documents, images and others converting them into machine encoded form. In order to perform these tasks, machine learning algorithm has to be implemented for more advanced intelligent Handwriting recognition. It has contributed immensely to the advancement of automation process in many fields and made improvement to the interface between man and machine in numerous applications. During the past years, main focus was on the implementation of new techniques and methods to reduce the processing time while ensuring higher recognition accuracy.

II.   OBJECTIVES

In an attempt to find an accurate machine learning model for Handwriting Recognition, the main objective of this research work is to compare the accuracy of a hybrid Convolutional Recurrent Neural Network (CRNN) model against the Recurrent Neural Network (RNN) model.

III.   METHODOLOGY

Model A: CRNN

The CRNN model which is a hybrid model is created using the tensor flow and Keras library of python. The model consists of different layers. Layer 1 where the input is fed and is reshaped into (256,64,1) by the reshape layer. Layer 2,3 and 4 are Convolutional Layer. Layer 2 creates 32 feature maps as output using 32 different filters. Layer 3 is another Convolutional layer having 64 feature maps while Layer 4 uses 128 features map. For the 3 layers of CNN, MaxPooling is used to reducing the spatial size of the image i.e. (2,2), (2,2) and (2,1) respectively, uses a filter of size (3,3) and uses ReLU as the activation function. Layer 5 is RESHAPE Layer of size (64, 1024) and Layer 6 is the DENSE layer using ReLU for the activation. Layer 7 and 8 is the RNN where LSTM will output 256 parameters. Layer 9 is the DENSE layout. Layer 10 is where the neurons are activated using

SOFTMAX as the activation function. Layer 11 is the last layer that outputs the results.
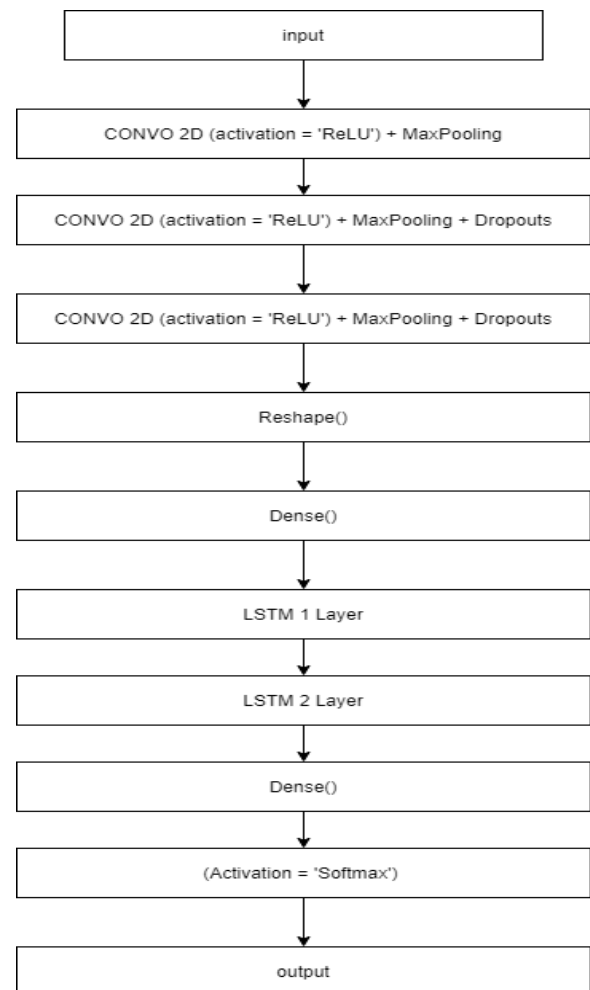
Fig. 1: shows the structure of the first model.

Model B: RNN

The second model is an RNN that is recurrent neural network, and it consists of 6 layers only. Layer 1 is where the input is processed and are shaped as (256, 64). Layer 2 and 3 are LSTM Layer where both will output 256 parameters. Layer 4 is DENSE layer that will feeds outputs from the previous layer to all its neurons. Layer 5 uses SOFTMAX for the activation. Layer 6 is the final layer that will produce the outputs.
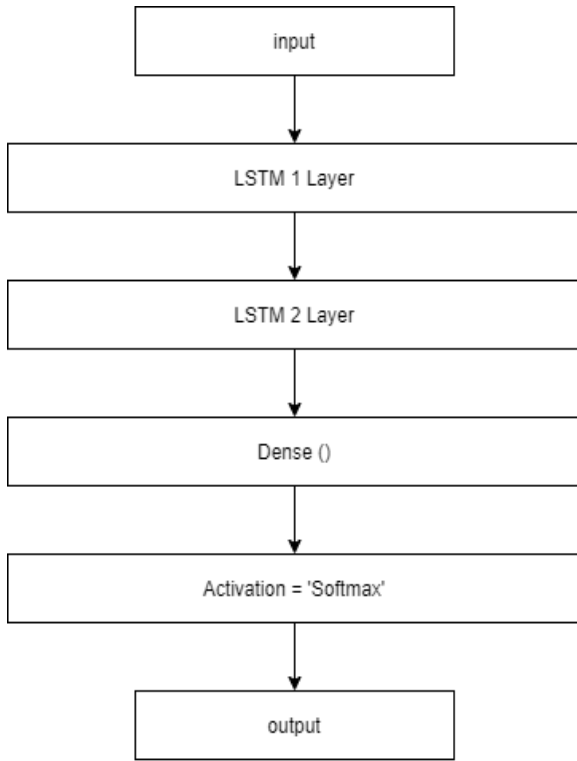
Fig. 2: shows the structure of the second model.

IV. RESULTS AND DISCUSSION

All the accuracy of the models (Deep CNN, CNN and CMAM, TPP-PHOCNet and AFDM) found in previous research papers was taken into considerations. The two model that I have created, tested and validated are included in the table with their accuracy.

For the model A and B, the accuracy was calculated by having an array of alphabets. CTC loss function is applied. The Machine learning model identifies the handwritten text in the image and predicts each character using the array. The percentage of number of correct character predicted is also calculated. The characters are concatenated and it is compared with the identity of the image. An algorithm is applied that is number of correct word * 100 and it is divisible by the total number of the validation size. Hence the total accuracy is achieved.

The accuracy for all model ranges from 32.89 % to 94.31 %. Model A: CRNN has an accuracy of 75.27 % and Model B: RNN has an accuracy of 32.89 %. Note that for the other models, they were trained using different datasets. Two of them are IAM and RIMES. We have train the 2 model using the same dataset.

Table 1: The accuracy of the 7 different model

	Accuracy Obtained
Deep CNN [1]	80.0
CNN [2]	87.1
CMAM [3]	74.45
TPP-PHOCNet[10]	94.31
AFDM[10]	92.94
Model A: CRNN	75.27
Model B: RNN	32.89

V. CONCLUSION & LIMITATIONS

This research paper provided a comparison of the application of CRNN and RNN for handwriting recognition. Based on the results obtained, it can be concluded that TPP-PHOCNet has the highest accuracy of 94.31 % compared to other models. The difference of accuracy for all the models varied because it depends on the number of dataset trained, tested and on different PC with different specifications. Hence it can be concluded that TPP-PHOCNet model is the best model compared to the two models (Model A: CRNN and Model B: RNN) that we have created.

Due to limited resources, only 30000 values were trained, and 3000 values were tested for both the model of CRNN and RNN. With better resources such more RAM and GPU, more values will be trained and tested for better accuracy and the training time also would have been faster.

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Optimal Relay Node Placement to Improve the Expected Life Time in Wireless Sensor Network Design

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Abstract — **Wireless sensor network has become one of the main emerging technologies used to enhance the performance and the scalability of real-time monitoring design and IOT today. The functionality of wireless sensor networks differs from one application to another application. The expected lifetime also differs according to the application. Sensor nodes operate under extreme power constraints. So, minimizing the power consumption of each node by placing relay nodes in optimum locations is important to expand the lifetime of the whole network. Because the death of a single node may lead to the failure of the whole network. However, a two-tiered network architecture is used to reduce the power consumption in the network. To simulate the proposed algorithm and to evaluate its performance comparing an available algorithm we use the COOJA simulator. Then the network lifetime is measured and observed.**

Keywords — WSN, Node Placement, lifetime optimization

I. INTRODUCTION

Wireless sensor networks (WSN) are used to measure physical phenomenon changes. Applications like health care monitoring, industrial supervision, military applications are supported by WSN. WSN consist of several sensor nodes that are deployed in a target geographical area according to the instructions of specialists. A sensor node that has the capacity to monitor the physical changes communicates with other nodes in the network. Sensed data is collected by the Sink node using multi-hop or single-hop communication.

Sensor nodes (SN) operate on small batteries and have limited power. The lifetime of the network is determined by the time taken for the failure of the first sensor node due to lack of battery power. More energy is taken up for the communication process within the network. If one of the nodes fails, then the whole network will be failed. The factors affecting the performance of WSN are the efficiency of the network, cost, coverage, power consumption, packet drop rate, delay, and the network lifetime.

Special nodes called Relay nodes (RN) which have more power and higher transmission range are used to connect all sensors and establish a connection to pass all sensed data to the sink. The connectivity between the sink and sensor may be direct or it may be through relays.

There are two types of WSN namely, single-tiered or two-tiered. In a single-tiered network, both sensors and relays can pass data to other nodes. While in a two-tiered network, sensor nodes are not responsible for forwarding the packets sensed by other sensor nodes. when the devices have the same hardware capabilities such as memory, battery, processor, and features in communication devices then that is called A homogenous network. Heterogeneous networks are when the devices have different hardware capabilities [1].

In [2] Nitesh and Jana proposed an algorithm for the connectivity problem by placing a minimum number of relay nodes and minimizing the overall communication cost as the constraint. The arbitrarily deployed sensor nodes were generated by an algorithm based on a spiral sequence.

According to Sapre and Mini [3], The proposed algorithm is to ensure that all the SNs have connectivity to the sink node using the minimum number of RNs.

The research carried out is presented as an optimization problem. To enhance the lifetime of the network the RNs are placed in optimum places. In this network, an environment with already deployed SNs in an open area having a line of sight is considered.

II. OBJECTIVES

The goal of this research is to formulate a mathematical model to show the optimal placement of RNs and to design the network in order to increase the expected network lifetime.

III. METHODOLOGY

Let's assume that all nodes in the network are homogeneous and sensor nodes are already deployed. Relay nodes are layered according to the proposed algorithm. Here we are considering a two-tiered network because if the sensor node will transmit the data collected from other SNs, then the battery life of the SN will be dissipated so quickly. So, here sensor nodes can only communicate with relay nodes to pass the sensed data but do not pass the sensed data of other nodes. Relay nodes can communicate with both sensor nodes and relay nodes.

Here we assume, there are n number of SNs and m number of RNs. The value of m, i.e. the no of RNs, is given by the

algorithm. Let's say Di is the Euclidean distance from the sink to the sensor node Si
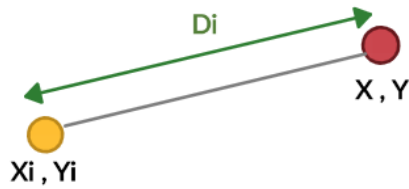
Fig 1.- Euclidean distance between SN and Sink

$$Di = \sqrt{((X - Xi)^2 + (Y - Yi)^2)} \qquad (1)$$

Here Xi, Yi are the X and Y coordinates values of SN and X, Y are the coordinates of the Sink node.

A SN can communicate with a RN only if the relay is in the range of the SN. If the range of the RN is r and the range of the SN is R, then to establish the connectivity between two nodes,

$$\| Di - r \| \leq R \qquad (2)$$
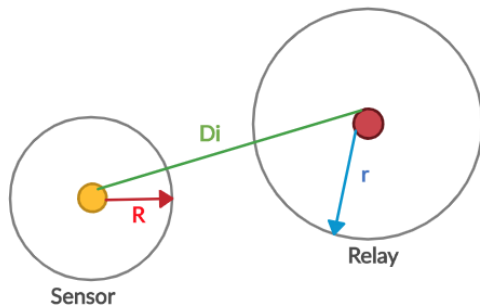
Fig 2.- Communication distance between SN and RN

In our proposed algorithm we measure Euclidean distance between each sensor node and sink. Sensors which having Euclidean distance less than the range of the sink node are covered directly. The sensor node which has the longest distance from the sink node is selected and check around the transmitting radius of the sensor, for the placement location of the relay node which covers the maximum number of relays. To find that position we scan all the possible positions of the relay nodes at a distance of R, which is the range of SN from the selected sensor node which has the highest Euclidean distance from the sink node. After scanning all 360° a relay is placed at the position where the relay can cover a maximum number of sensors. But if there is more than one probable position that covers the maximum number of SNs then we take the Euclidean distance also into consideration. From those probable positions where it covers the maximum number of RNs, we place the RN in the place where the Euclidean distance from the sink to the RN that we are going to deploy is minimized. The SNs which are get covered from the deployed relay node are not required to be taken into consideration. So, we eliminate them. Then all remaining sensors are considered and repeat the same procedure until all SN establish the connectivity path to the sink.

Algorithm		
Input	:	Positions of sensor nodes, Geographical area, Sensor range.
Output	:	Positions of relay nodes
Step 1	:	The sink is placed at 0,0 position.
Step 2	:	Sensors are placed in a given geographical area.
Step 3	:	Marked the ranges of sensor nodes.
Step 4	:	calculate the Euclidean distance from the sink to each and every sensor node.
Step 5	:	Separate the sensors within the range of the sink node which has direct connectivity to the sink.
Step 5	:	starting from the sensor node with the highest Euclidean distance from the sink node find a position around that sensor at a distance equal to its range among all possible positions which can cover maximum no. of neighbor sensors.
Step 6	:	If there are more probable positions that cover the maximum no. of relay nodes, then select the position which has the minimum distance to the sink node.
Step 7	:	eliminate the selected sensor node and its covered neighbors leaving the relay node at the placed position
Step 8	:	repeat steps 5,6 and 7 until all sensor nodes are covered and the connectivity is established.
Step 9	:	Find the optimum position to place relay nodes considering the selected relay node positions.
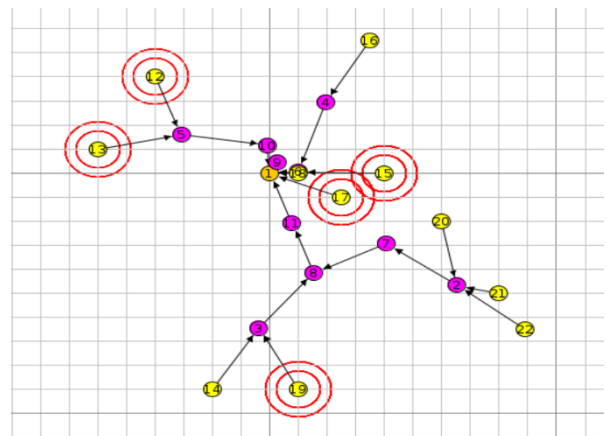
Fig 3.- Topology of the proposed algorithm

IV.   RESULTS AND DISCUSSION

According to given sensor locations first, the number of RNs needed to establish the connectivity in the network and their locations were obtained using our proposed algorithm. Then, various data sets for different sensor locations were set.

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And relevant to those sensor locations the required number of relay nodes and their locations were obtained.
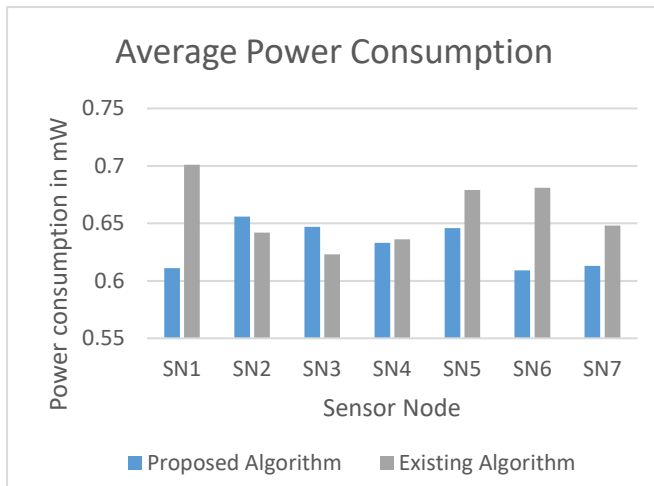
Fig 4.-Average power consumption comparison between sensor nodes of proposed and existing algorithms.

The power consumption of the sensor nodes is varying with the placement of the relay nodes. We took two scenarios where the SN locations are the same, but the relay nodes are placed using an existing algorithm and using the proposed algorithm. After simulating the sensor network using the Cooja simulator it could be observed that as a whole, sensor nodes in the network where the RNs are placed using the proposed algorithm consume less power than the SNs in the network where RNs are placed using the existing algorithm. Fig.4 represents a comparison between the power consumption of the SNs in both scenarios. According to fig. 4, it can be seen that some SNs in the proposed algorithm consume more power compared to the existing one. It is because of the difference in RN locations. The power used to transmit data from a SN to a RN varies according to the placement of RNs. The performance of the proposed network can be affected by; the power consumption due to the distance from the SN to the RN when SN transmits the data and when more RNs connect to the SN according to the proposed algorithm. Therefore, the network can show a lower performance

However, our aim is not to reduce the power consumption or to increase the performance of each and every SN. But it is to improve the expected lifetime of the whole network. The lifetime of the network is determined by the time taken for the failure of the first sensor node due to lack of battery power. So, according to fig 4, the probability of the failure of sensor node 1 (SN1) where the RNs are placed using the existing algorithm is high as its power consumption is very high when comparing with other sensors. So, the lifetime of the network in the existing network is less compared to the proposed network. Though some sensor nodes consume more power in the proposed algorithm the possibility of failure of the first sensor node is less when compared to the existing one. So, the lifetime of the proposed network is higher than the existing one.

The average power consumption of all the SNs in the network where the RNs are placed using the proposed algorithm is graphed after the simulation using the COOJA simulator. And it is shown in fig. 5
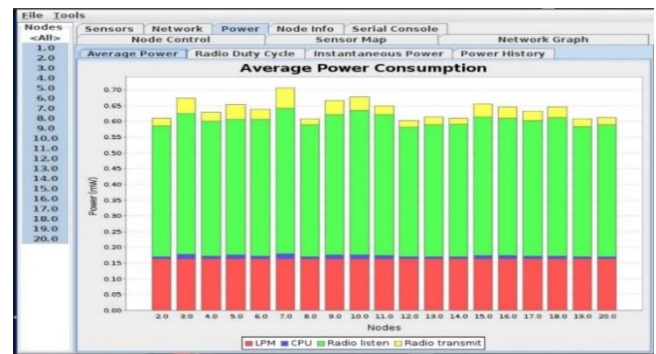
Fig 5.-Average power consumption comparison of the sensor nodes in the proposed algorithm

V. CONCLUSION

In this paper, we have presented an algorithm to enhance the lifetime of the overall network. The relay node placement was done by minimizing the communication cost and overcoming the connectivity problem. Therefore, the locations we obtained through this algorithm can be considered as the optimal locations for the placement of relays in the WSN. We took a comparison with an existing algorithm and the obtained results were analyzed to show that our proposed algorithm contributes to prolonging the lifetime. Through this research, we have proved that the algorithm we proposed takes prominent places in the successful deployment of relay nodes.

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Road Traffic and Congestion Management System for Intersections Based on VANET

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Abstract—**Road safety is regarded as the most severe problem in the world right now. With the increase of road accidents considerable research has been done in recent years regarding road safety. Vehicular Ad Hoc Networks (VANET) is used as the platform with infrastructure for the development of new systems to enhance the safety and comfort. With the new trends like self-driving cars, colour light systems are not effective. Therefore junction traffic control is of paramount importance. In this study, the traditional colour light system is replaced using VANET. VEINS framework has been used to simulate the traffic environment in a 4-way junction. OMNET++ is used to control the traffic in the simulated junction. Simulation results show that Vehicle to Vehicle communication (V2V) reduces road traffics and accidents. Also for a low congested junction, a prioritization algorithm using speed is implemented. This is much better than the previous approach for a low congested junction. Lane detection is also implemented using Machine Learning, to avoid the misbehavior of drivers and the violation of rules. This method results in ensuring safety of the drivers and passengers.**

Keywords— VANET, colour light, Lane detection

I. Introduction

According to WHO report (2018) Sri Lanka is ranked 96 in the world in road traffic accidents related deaths with 16.37 deaths per 100,000 of population. Also in Sri Lanka most of the accidents occur around intersections. The potential of an intersection assistant which supports the driver in such conditions, would be enormous. The concept of Vehicular Ad-hoc Networks (VANET) which has opened new possibilities to avail the use of road safety applications, recently came into limelight [1].

Vehicular ad-hoc networks are responsible for the communication between moving vehicles and its surrounding. It enables communication among vehicles and roadside infrastructures. It makes transportation systems more intelligent. Since the movement of vehicles is restricted by roads, traffic regulations, we can deploy fixed infrastructure at critical locations to make intelligent decisions based on the vehicle movements.

II. Objectives

The main objective of this project is to automate the road traffic handling mainly near a junction. This will result in reducing the road accidents and in turn will ensure the safety of the civilians.

III. Methodology

The software employed in this research are SUMO and OMNET++. Also Veins; a vehicular network simulation framework is used on top of OMNET++ to visualize the simulations. SUMO is used to simulate the junction while Veins is used to simulate the traffic while OMNET++ is used to code using C++

In the proposed system each vehicle is recognized using a unique identification number (ID), which can be the license plate number or a custom made ID. Wireless communication devices onboard enable vehicles to communicate with each other, vehicle to vehicle (V2V), or roadside infrastructures (RSU), vehicle to infrastructure (V2I) by sending and receiving messages, using their unique ID. The system proposed utilizes a predefined queuing area where the vehicle waits for the reply from the RSU which is the centralized controller [2]. All Vehicles are programmed to stop or slow down when they enter the queuing area.

In the proposed system a packet is transmitted by the RSU to the nearby vehicles and a reply packet is transmitted by the vehicle requesting to leave the intersection after entering the queuing area. The RSU design will consist of processing power as well as intelligence to make decisions. Hence, once the reply packet is received at the RSU, it analyzes and compares all the received data from all vehicles near the junction. Next, the vehicles are prioritized using a predefined priority mechanism. The response packets are transmitted to the prioritized vehicle allowing to leave the junction. Once left the junction the vehicle should retransmit an acknowledgement message back to RSU and in response RSU clear all the data related to the vehicle ID which left the junction. [4]

In the proposed system the vehicle prioritization is handled two ways; First In, First Out (FIFO) or category of the vehicle type. In FIFO, the speed based protestation algorithm is adopted. In the Speed Prioritization the estimated time to reach the junction is calculated, using the information received from the vehicle. Then vehicles are ordered according to the expected time to reach the intersection. A permission to pass notification is sent to the vehicle with the fastest arrival, while the others are informed to slow down, with a pre-calculated speed-rate, in such a way that they too

can leave the junction in an ordered manner without completely stopping the vehicle

$$\text{Expected Time} = \text{mean velocity}/\text{distance} \qquad (1)$$

In the vehicle priority based method, emergency vehicles such as ambulances, police cars, are given the priority to pass the junctions without slowing down, while informing the other vehicles to slow down with appropriate speed-rates. These speed-rates are calculated at the RSU with the help of the information packets received from the vehicle itself at regular intervals.

Further a lane detection is simulated using python to detect the lane [3] for each vehicle to pass through. The vehicle will use the lane information as well, when applying brakes to slow down or accelerating to speed up near a junction.

IV.   RESULTS AND DISCUSSION

Fig.1, shows a simulation instance at SUMO, for the proposed system. In the designed environment a beacon message is generated from the RSU and transmitted to all vehicles at every 2s intervals. In Fig.1. The beacon is shown in white dot and the vehicle is shown in blue dot. Beacon is

sent when a vehicle enters the core area or the range of the RSU. After receiving the beacon, the vehicle transmits the REQUEST message to the RSU. The command prompt in Fig1 shows that the RSU received REQUESTs as data. After sending the REQUEST, the vehicle receives a command to go as PERMIT or one of the other commands to wait. Next, the vehicles start to leave the intersection using the lanes they are currently in.If a lane change is necessary the RSU sent a RESPONSE, asking the vehicle to move to another lane. Fig.2 shows the output of the lane detection algorithm.

Fig. 2. Output of Lane Detection
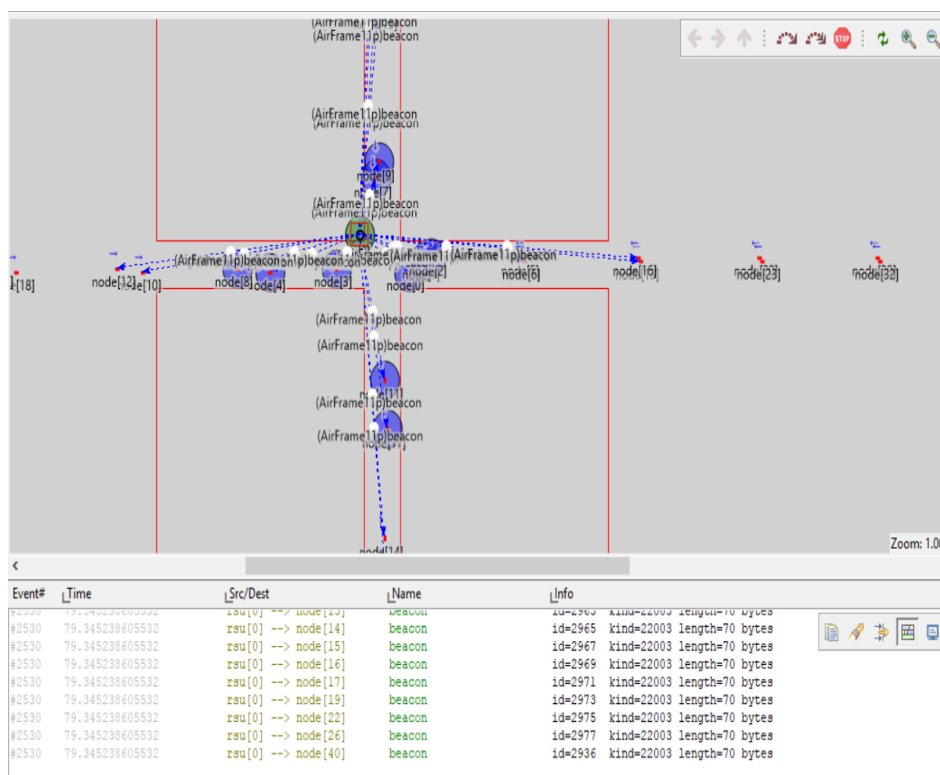
Fig. 1. Simulation of the Process

V.   DISCUSSION

The VANET architecture defines the communication mechanism between vehicles and roadside units. It does not specifically present any vehicle traffic handling or decision taking system [6]. Current VANET based transportation systems include automated driving with safety protocols such as breaking, lane changes, speed regulations etc. [6]. Although there exists few complex intersection management architectures [7], the proposed is a simple, low powered

traffic control system based on vehicle speed analysis, facilitated through roadside infrastructures.

For a highly congested junction, color light can be simply replaced by a VANET based control system to achieve better performance. Using the proposed system, it is possible to implement a traffic handling mechanism, where a lane with higher congestion is cleared first by the RSU. This can be achieved by creating different lists at RSU called permitted list, pending list, and priority list, and assigning incoming

vehicles into the most suitable list after analyzing the messages received from the vehicles. Also in an ordinary congested junction using the comparison algorithm that we have developed, significant traffic control can be achieved. We are able to achieve this improvement by estimating their distance to travel, and prioritizing the vehicles with lesser estimated time to arrive at the junction. With the introduction of lane detection the vehicle can estimate the traffic ahead in the lane it travels. Also, it can be further used by the vehicle navigation system to detect bad driving such as sudden lane changes or drink driving. The inbuilt communication units can share this information with neighboring vehicles using VANET architecture.

VI.   CONCLUSION

VANET is a very useful networking architecture in Road Safety and Traffic Management. It is used in the presented application to communicate between V2V and V2I transmission. Our aim was to manage the traffic within an intersection to reduce the traffic congestion and to reduce the road accidents near an intersection. According to simulations, the proposed algorithm successfully manages the communication between vehicles and RSU to achieve a good traffic management. Using this technology we could make roads safer and faster to travel.

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

Encryption and Key Management Mechanisms in WLANs

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Abstract — **Wireless technologies have been evolving rapidly for a considerably long time. As these wireless networks communicate through radio transmissions, they are vulnerable to attacks. Thus, to minimize these attacks a number of key management algorithms are introduced under 802.11 standards. In this paper, the authors will be discussing the cryptographic algorithms used in the cases of wireless networks.**

Keywords — WEP, WPA, Wireless networks, encryption, decryption, authentication

I. Introduction

With massive increase in the usage of technology, networks have become a very important and an underlying technology for all the technological development. Networks have been developed from the primitive wired networks which communicate through cables to wireless networks which communicate through radio waves.

The main principle that governs wireless networks is mobility. Communication in wireless networks happens between a transmitter and a receiver by using radio signals as the medium of transmission [3].

The benefits of WLANs are the mobility, scalability, flexibility, cost, ease of installation, reliability and reduced installation time.

The IEEE standard for wireless networks is 802.11. There are a number of IEEE standards introduced for wireless networks. These standards differ by their range, frequency, data rates and some characteristics. The currently used IEEE wireless network standards are mentioned in the Table 1 below.

Table 1. Wireless Network standards according to IEEE

Standard	Data Rate	Frequency	Range	
			Indoor	Outdoor
802.11a	5 GHz	54 Mbps	100 ft.	400 ft.
802.11b	2.4 GHz	11 Mbps	100 ft.	450 ft.
802.11g	2.4 GHz	54 Mbps	125 ft.	450 ft.
802.11n	2.4 GHz / 5 GHz	600 Mbps	225 ft.	825 ft.
802.11ac	5 GHz	1 Gbps	90ft	1000 ft

As the name implies, wireless technology requires no wires for the devices to be connected to the networks, thus, making this technology more convenient and easier to use. With all these efficient features of WLANs comes the need for a secure network, as the networks are wireless, they are more vulnerable to attacks. Thus, a proper set of security precautionary measures are required for a secure communication between devices connected through wireless networks.

Various cryptographic algorithms are used in order to secure the communication in WLANs. A cryptographic algorithm is a mathematical function used to encrypt or decrypt a message communicated within a network. The main component of a cryptographic algorithm is the key used for communication. The key should always be a secret.

There are different types of cryptosystems. Namely: Symmetric encryption, Asymmetric encryption, Physical encryption and Quantum encryption.

The types of ciphers are Substitution cipher, Transposition cipher, Steganographic cipher, Stream cipher and Block cipher.

A good cryptographic algorithm should not display patterns, should maintain One-way-ness and the algorithms should not be very complex but should be secure. This security means that the best attack on the weakest part of the cryptosystem should take a long enough time, usually expressed in terms of basic operations on a PC, in 2^n, where n is the security level. This unit is used to refer to the time that breaking a theoretically perfect symmetric cipher would need: with a key size of 128 bits, testing all the possible 2^{128} keys takes 2^{128} operations, where one operation is one tentative of decryption.

This review paper discusses about the set of security measure taken by WLANs in order to provide a secure communication without any tampering or attacks targeted towards the devices connected. The security measures are specifically the key management methods and the encryption and decryption methods of the communication happening through WLANs.

II. Wired Equivalent Privacy (WEP)

WEP has been the main security provision [1] as well one of the most common security protocols [2] introduced for 802.11 standard (Wi-Fi). As the name implies WEP was introduced to provide privacy equivalent to that of wired networks [1].

The goals of introducing the WEP protocol were as follows: Avoid eavesdropping, protect the privacy of information, prevent manipulation of data and detect tampering of data.

WEP operation is a three-step procedure. The three steps are authentication, encryption and decryption. The following section provides a detailed explanation about the three steps.

A. WEP Authentication

The authentication process prevents any unauthorized access to the Wireless network. Authentication is maintained using the pre-shared WEP key. The authentication process is explained in figure 1.
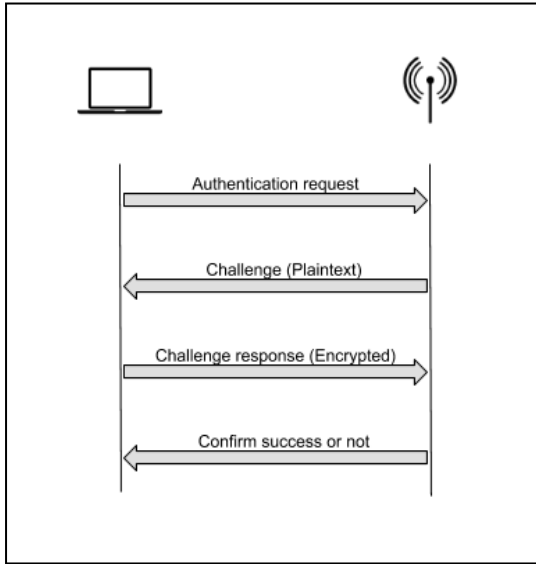
Fig. 1. WEP authentication mechanism

Step 01 - The client sends an authentication request to the access point to get connected to Wireless network.

Step 02 - Once the AP receives the request the AP sends a plaintext challenge to the client who sent the request.

Step 03 - The client encrypts the challenge by using the pre shared WEP key and sends the encrypted challenge response to the AP. The AP then decrypts the Challenge response using the Pre-Shared WEP key and matches it with the original plaintext challenge sent.

Step 04 - Once the matching is done, the AP sends a confirmation message, mentioning if it was successful or not.

This is the 04-way handshake of the WEP authentication process between the client and the Access point.

B. WEP Encryption

WEP uses Rivest Cipher 4 (RC4) algorithm for the encryption process. RC4 is a widely used stream cipher algorithm in software applications. Figure 2 illustrates the block diagram of the WEP encryption process.

The RC4 algorithm consists of two main operations

1. Pseudo Random Number Generation (PRNG)

2. Creating a key stream

Step 01 - The sender of the message does an integrity check to the plaintext to be sent and obtains an Integrity Check Value (ICV).

Step 02 - An Initialization Vector (IV) concatenated with the pre shared WEP key is sent into the RC4 algorithm. (IV = 24 bits and WEP key = 40 bits) RC4 creates a Pseudo Random number using the PRNG operation. This PGNR is used to generate the key stream.

Step 03 - The generated key stream is XOR ed with the plain text and the ICV.

Step 04 - The output of the XOR function provides the cipher text. This ciphertext / encrypted message is sent to the receiver together with the IV.
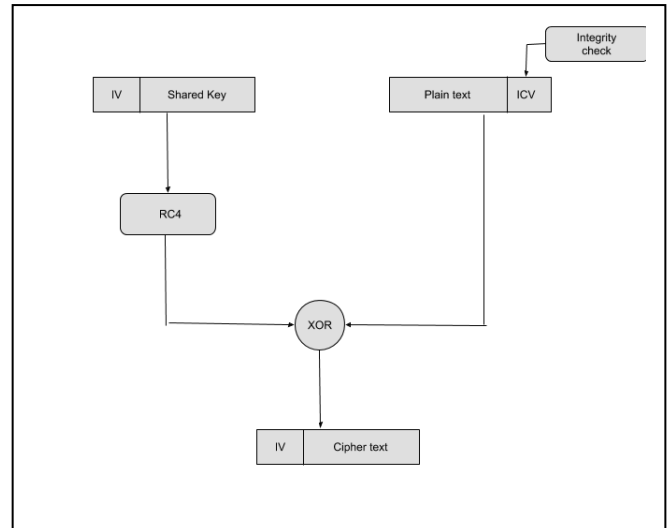
Fig. 2. WEP encryption mechanism

C. WEP Decryption

The decryption process is the same process as the encryption process, just reversed. Figure 3 illustrates the WEP decryption process.

Step 01 - The initialization vector is obtained from the header of the packer received from the sender.

Step 02 - The IV is concatenated with the PSK of WEP and sent through the RC4 algorithm function.

Step 03 - The key stream output of the RC4 algorithm is XOR ed with the ciphertext sent by the sender.

Step 04 - The output of XOR is the plaintext.

Step 05 - Further this plaintext is sent through an integrity check and the value received is matched with the original ICV.

Step 06 - If the values are matched the receiver receives the message [2] [7].
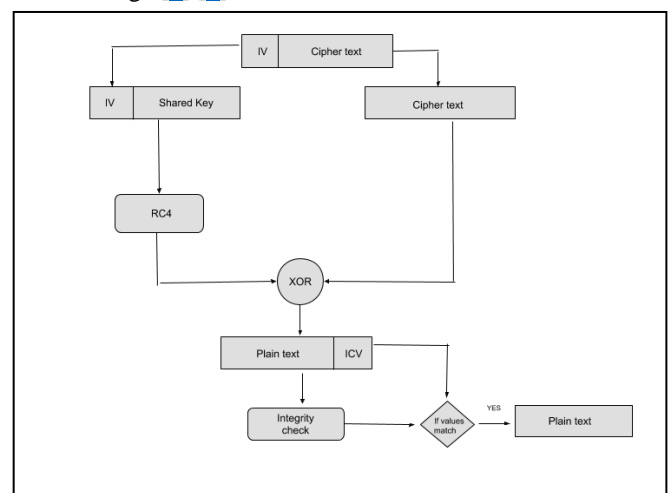
Fig. 3. WEP decryption mechanism

III. WI-FI PROTECTED ACCESS (WPA)

WPA is a solution to the limitations of WEP that was discussed in the section above. WPA has 2 operation modes. The operation modes are as follows: [2][7]

a. Personal mode - This mode has no authentication server and the secret key is shared between the client and the access point. It is also known as WPA-PSK [7].

b. Enterprise mode - This mode uses an authentication server that has security controls to avoid unauthorized access [7].

Similar to WEP, WPA also contains 03 steps as follows: authentication, encryption and decryption [4].

A. WPA Authentication

WPA uses 802.1x and EAP for authentication of users.
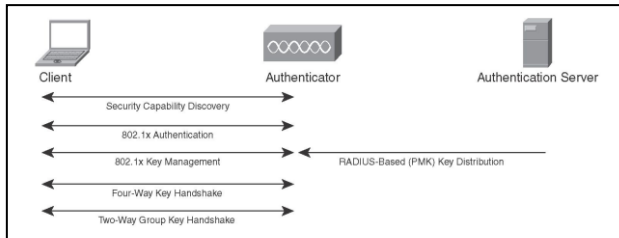
Fig 4 - WPA enterprise mode authentication

B. WPA Encryption

The weaknesses of WEP are avoided by using Temporal Key Integrity Protocol (TKIP) as the encryption algorithm. [6] The use of TKIP assures that data will remain protected. In WPA, the key is changed for every frame and change is communicated between the AP and the client [5] [2].

Unlike in WEP, the key is automatically distributed and there are dynamic session keys.

The encryption process consists of the following parameters: Initialization Vector, Data encryption key, Source Address, Destination Address, Priority field value, Data integrity key.
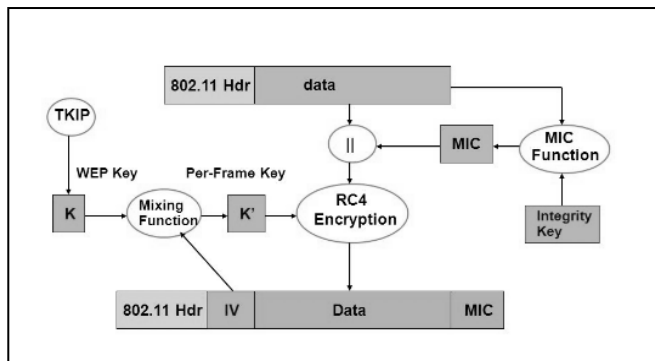
Fig 5 - WPA encryption mechanism [8]

WPA should: allow only authorized users to access the network and protects data, should be interoperable in all IEEE wireless standards and use dynamic session keys [7].

An alternative to TKIP (which was introduced as a temporary protocol in IEEE 802.11) a protocol has been introduced with higher security features. This protocol is Counter Mode Cipher Block Chaining Message Authentication Code Protocol (Counter Mode CBC-MAC Protocol - CCMP) [9]. CCMP is the latest and the standard protocol used to maintain both integrity and data confidentiality in WPA – II. It provides data confidentiality, authentication and access control. This is because CCMP is a block cipher of a key size of 128 bits [9].

IV. CONCLUSION

In this paper, the author has discussed the encryption and authentication mechanisms used in the key management of wireless networks. These discussed topics of this area are some of the common protocols used. This review paper will be useful for future researches planning to conduct research or build new algorithms related to the wireless networks' domain.

In conclusion, WEP can be identified as a depreciated protocol due to the usage of short keys and using WPA-II is the best solution for security of a WLAN due to the large key size of at least 128 bits.

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Computer Vision, Deep Learning and IoT Based Enhanced Early Warning System for the Safety of Rail Transportation

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Abstract — **There is a growing demand for the improvement of the safety of transportation, particularly in the light of escalating frequency of collisions, where casualties and the associated costs are high. This is more so considering the frequent collisions of wild elephants on rail tracks in Sri Lanka. A warning system, if developed based on the concepts of Computer Vision, Deep Learning and IoT(Internet of Things) with a bleeding edge technology, would yield a solution for the improvement of the safety of different transportation modes with the entire process depending on data collection and sharing in real-time in order to achieve the required functionalities. In this study using LoRa(Long Range) advanced technology that best fits the requirements with its' simple but highly stable and effective architecture for communication between IoT units, a camera module having PoE(Power over ethernet) and night vision feature for capturing live footage in daytime as well as in night time and using the IoE(Internet of Everything) concept, the overall process successfully shares real-time data thereby providing an efficient outcome. Computer vision base works well with IoT and object detection through visualization and analysis of digital content, where it is 'videos' in the said context. Python was used as the primary implementation platform and C for the purpose of implementing the IoT functions. PyCharm and Arduino was used as the implementation environments which significantly support the core of implementation platforms selected. The 'dnn'(Deep Neural Networks) module of OpenCV highly supports the Python platform and is used for the purpose of object detection with a deep learning backbone. The dnn module is used over darknet considering the valuable benefits provided by it and mainly its' fast performance capacity. Related formulas are used for measuring the speed of the vehicle, distances, time slots, etc., and the deep learning algorithm is customized to support the scope of the object detection process. By analyzing the collected/shared data the risk levels and warning signal emittance can be derived accordingly. The deep learning approach used has vastly facilitated in gaining an outstanding scalability by multi-object and multiscale detection like humans, elephants, vehicles, etc., ensuring the improvement of prevention of many possible collisions. Though the system was successfully tested for rail transportation, the algorithm could be successfully used in any other transportation mode as well as to detect more object classes with the scalability of the deep learning algorithm.**

Keywords — IoT, IoE, Deep Learning, bleeding edge technology, LoRa, PoE, OpenCV, dnn, Darknet

I. INTRODUCTION

Train accidents have become a major issue in the context of South Asia, due to lack of safety measures/systems that help to mitigate accidents successfully. The massive number of fatal road accidents that happen around the world has become a considerable issue causing dreadful harm to humans, animals as well as public/private property. The braking capability and the braking distance of these large vehicles are often a factor for road accidents. Many of the readily available systems use complex architectures and resources ending up with a costly solution. Some of them lacks the scalability and interoperability when it comes to safety solutions.
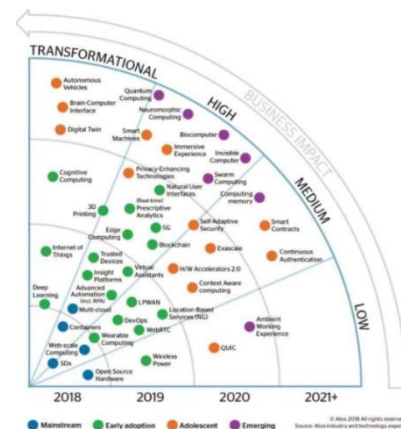
Fig. 1. Updating Technologies [7]

II. OBJECTIVES

The objective of the system is to improve the safety of transportation systems, particularly rail transport, by reducing collision with wild elephants and other related consequences. The focus is given to adopting modern technological trends for building a simple yet effective early warning system, where it can be used to address many safety related scenarios in transportation worldwide. Achieving a high scalability was a priority, so that the system is not limited to a single scenario. The use of new technological trends to cost effectively build a warning system to address an impactful problem in the modern society.

Therefore, the primary goal of the study is to build an efficient and an innovative warning system with bleeding edge technologies, which contribute to modern advanced technological trends including data science and accelerated Machine Learning approach with IoE concept, leading to a highly expandable and cost-effective systematic solution, for

the ultimate purpose of enhancing the safety of transportation worldwide.

III. METHODOLOGY

The entire process of the system can be broken down into 4 main steps; object/barrier detection and recognition, speed and distance calculation, derive risk levels, display warnings. The camera unit will be responsible for capturing live video feed for the detection purpose while LoRa is used for communication between the units for data sharing.

The developed system consists of three IoT units for performing individual tasks and data collection purposes and the data is shared in real-time among the separate units. These three units will be installed at three separate locations; Unit 02 at accident prone locations which will primarily detect objects in real-time, Unit 01 at a considerable distance from Unit 02 for the purpose of on-coming vehicle detection and Unit 03 at the dashboard of the vehicle to display warning signals. The system uses a deep learning approach for object detection and recognition in real-time and the power of the chosen algorithm vastly helps to expand the functionality of the system. Moreover, the system is built considering the braking distances and capability for the efficiency and reliability of the system, where it can be used as an effective solution for reducing fatal road accidents other than railway transportation and is a cost-effective solution compared to other safety features like auto-pilot, Forward-collision warning (FCW), etc with the underlying simple architecture.

Unit 01 will keep checking for approaching vehicles and once a vehicle is detected, the system will calculate the speed of the vehicle and the signal is sent to Unit 02, where object detection starts on the live video feed from the camera and the Unit keeps checking for detections until a given time is reached. The risk level is derived depending on the distance between the approaching vehicle and unit 02 and the warnings are sent and displayed in Unit 03 based on the derived risk level and movements of the object.

Table 1. Risk levels and color gradings

Risk Level	Indicative Color Grading
Low	**Green**
Medium	**Yellow**
High	**Red**

LoRa technology is selected for communication of the system for it being a low-cost technology with a wide-area network protocol working on low-power. It offers a long coverage range of op to 10km and secure data transmission for M2M (Machine-to-Machine) and IoT applications.

Table 2. Comparison of Communication technologies [1]

	Maximum Speed	Range	Cost	Power consumption	Drawback
Bluetooth	Up to 2Mbps	20m (line of sight)	Free	Average	Not suitable for applications that need a high communication data rate.
Wi-Fi	Up to 450Mbps (depends on the standards)	< 50m	Somewhat high	High	Only works at where it is setup and has a limited range.
ZigBee	250kbps	< 100m	Average	Somewhat low	Suffers low data speed, short range and high maintenance cost.
GSM	Depends on the network (> 40kbps)	Up to 35km (depends on the network)	High	High	High energy consumption
RFID	-	< 10m	Low	Low	Radio waves can be affected by metals and liquids.
LoRa	32Kbps	Up to 10km	Low	Low	Low bandwidth and limitations on the used frequencies can affect message delivery.

YOLOv3 algorithm based on deep learning was selected for the implementation of object detection for it works almost in real-time. Its' high confidence scores and FPS rates outperforms many other deep learning algorithms, and it is highly customizable and scalable due its' multi-scale detection, strong feature extraction network and multilabel classification. It has the capability of detecting 80 object classes by default and can can also be used for detecting any other object class(s) by training the network with simple modifications.

Table 3. Comparison between the reviewed algorithms (as per the approximate results on COCO dataset)

	Confidence Rate	FPS	Accuracy	mAP	Inference Time (ms)
YOLOv3 320x320	High	45	Somewhat high	51.5	22
Tiny YOLOv3	Low	220	Low	33.1	-
R-FCN	High	6	Somewhat high	51.9	85
SSD321	High	22	Somewhat high	45.4	61

OpenCV 'dnn' module was used as the backbone for running the algorithm and it provides easier configuration for

YOLO models to run on CPU. 'Darknet' which is the default backbone of YOLOv3 highly performs with a CUDA supported GPU, but its' implementation on a CPU lacks performance as well as accuracy. Darknet works best with C programming language over python, whereas OpenCV supports both C and Python with many supporting functions for object detection.

A trial was carried out to a railway scenario and several formulas were used for implementation purposes. The safety distance for which a train will be dragged by applying emergency brake, was calculated for the worst case scenario by applying conservation of energy theorem, the work done by *Frictional Forces(E)* at braking must equal the *Kinetic Energy($E_{kinetic}$)* dissipated (where maximum braking capacity is applied):

The energy present in an object in motion is given by the following equation [2]:

(m = mass of the object in kilograms, v = the velocity of the object in meters per second (m/s), $E_{kinetic}$ is the kinetic energy in joules (J))

$$E_{kinetic} = \frac{(mv^2)}{2d} \qquad (1)$$

(F_f = the force of friction in newtons (N), d = the stopping distance in meters (m), E = the energy produced by the brakes in Joules)

$$E = F_f \times d \qquad (2)$$

Applying conservation of energy (speed in ms^{-1} = 22.2, safety distance = 350m);

$$E_{kinetic} = E;$$

$$\frac{(mv^2)}{2} = F_f \times d;$$

$$F_f = \frac{(mv^2)}{2d} \qquad (3)$$

$$d_{safe} = \frac{v^2}{22.2} \times 350 \qquad (4)$$

For the trial scenario, the speed was taken as 22.2ms^{-1}, where it is the maximum speed of a train in Sri Lanka and the maximum drag distance of a train which comes in the maximum speed is 350m. Same formulas can be used by changing the values according to the scenario and the vehicle type.

IV. RESULTS AND DISCUSSION

The system was tested for the worst-case scenario of a train arriving at the maximum speed, and the results were taken to conform the required functionalities of the developed system. Fig. 2. shows an overview of the system with the IoT units.
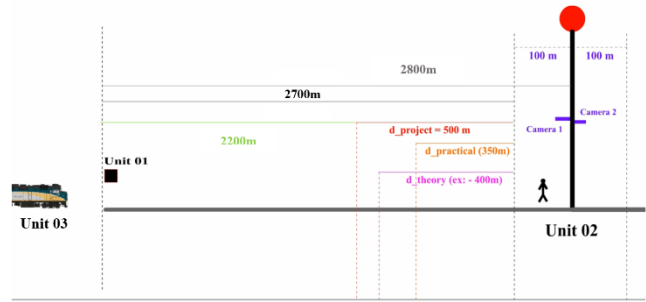
Fig. 2. System Overview

Table 4. Test results for a train

Description	Input	Expected Results	Actual Results
Check if the calculations are made on vehicle detection	Two distance readings taken for a given time	Speed and safety distance are printed to the serial monitor	As expected
Check if the train detection signal and calculated values are sent to unit 02	Train detection signal	Train detection message and values are printed to the python console	As expected
Check if multi-class detection is successful	Bounding boxes, class id	Humans are identified as 'person', animals identified as with relevant animals class name, vehicles identified with relevant vehicle class name	As expected
Check if multi-scale detection is successful	Objects with varying size scales	Bounding boxes are correctly derived for varying scales	As expected
Check if the time slots are properly derived and the risk levels are derived according to the time slots	Total time, elapsed time, number of risk levels(3)	Three time slots are derived according to the total time taken for the train to reach and the risk level is displayed according to the time slot in which the object(s) is detected.	As expected
Check if the warnings are sent to unit 03(vehicle) whenever a detection happens	Detection, risk level	Warnings are printed to the PyCharm console whenever a detection is done	As expected
Check if the respective light blinks according to the warning received and whenever a detection happens	Warning signal through pySerial	Green light blinks when the warning message is 'L'. Orange light blinks when the warning message is 'M' Red light blinks when the warning message is 'H' Lights blink on object detection	As expected

Following figures depict the test results.
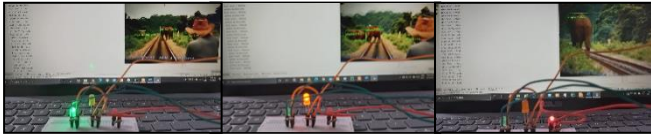
Fig. 3. Object classes are properly identified and Green LED, Yellow LED and Red LED are blinked respectively, when detections happen within 'low', 'medium' and 'high' risk levels

Moreover, the system was accepted by Sri Lanka Railways in order to mitigate the current issues in railway transportation of Sri Lanka.

V. CONCLUSION

With the unaccountable number of vehicle accidents that happen regularly, many countries tend to go for solutions like auto-pilot vehicles, Forward-collision warning (FCW), vehicles with advanced security features, etc. However, these alternatives can most of the times be costly. Rather than going for a new vehicle with advanced safety technologies, it would always be a valuable alternative to go for a unit that can be easily installed.

As the system is developed and tested for railways using advanced computer technologies including computer vision, deep learning and IoT to achieve the core objectives of the study, and as the system is being accepted by Sri Lanka Railways, it conforms that the system serves the problem domain as well as the field of computer technologies for the ultimate goal of improving the safety of transportation systems. However, the system has the advantage of being more enhanced with integration of several trendiest modern technologies, to gain more connectivity of devices and people through collaborative AI approaches, supporting to move from a cutting edge to bleeding edge system with accelerated machine learning together with IoE concept used among the IoT units. Use of vast computer technology fields like data science gives the advantage of coming up with a more extensible and scalable cost-effective product, while fine tuning the deep learning algorithm to detect more object classes to be used in more relevant scenarios. Therefore, the focus is to further explore on other major transportation related issues and take the developed system to next level, where it can be launched as a single unit with an appropriate camera module to be integrated and the algorithm to be developed to do custom detections, and finally to be installed in major transportation mediums (trucks and buses) worldwide, as a cost-effective handy product, that will efficiently integrate with current high-end technological trends and blend with demanding IT fields like data science, AI, accelerated ML, etc.

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Reference Model for Large Scale Intranet of Things Middleware

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Abstract — **Internet of Things (IoT) have been adopted by industries and enterprises in order to utilize the maximum of the facilities it supports. However, security is the biggest challenge in IoT implementation and deployment due to it residing in public internet. With the aim of addressing this issue, this research work focuses on developing a middleware that could be decoupled with the public internet and leverage big data for large scale enterprises and could be entirely hosted at on-premise intranet. For this purpose, a middle ware model is proposed, and a prototype was developed based on the proposed model and was tested for performance with identified evaluation. The proposed middleware model shall address the security concern of enterprises which uses Internet of Things in their cooperate network.**

Keywords —Enterprise IoT, Apache Middleware Offerings, IoT Hardware

I. INTRODUCTION

One of the most trending topics in the field of information technology which has emerged in the recent past is the Internet of Things (IoT). Although the application of IoT in various fields has drawn the attention of many stakeholders, some of the drawbacks and inefficient products used for these application purposes have brought up dissatisfaction too. Since the phrase itself suggests, the IoT is tightly coupled with Internet, by means of hardware such as sensors, devices and servers, middleware such as service buses and message ingesters and software such as enterprise application which are needed to be connected together [1]. Hence, they need to be exposed to the public internet too.

Main problem of IoT deployments and implementations residing on public internet is security. Although it is definitely going to be advantageous, especially for enterprises, most enterprises do not like to expose their IoT deployments to the public internet. The main concern here is the unauthorized access. One best solution to this issue is to deploy it with in their intranet.

The most important component in the IoT architecture is the middleware[2]. In the current IoT architecture, the middle-ware service is provided by cloud vendors such as Microsoft Azure, Amazon Web Service, IBM Bluemix etc. [3]. All these middle-ware offerings are hosted in a public cloud in a multitenancy manner. These cloud vendors normally provide Internet of Things deployments on public internet as it is the nature by the name "Internet of things". Also, the enterprise level IoT implementations are done on public internet, as the middleware which can process big data and which is reliable and fast in processing telemetries and messages are only available in the public internet. Even though Microsoft provide Azure Stack, which enables enterprises to host the Azure cloud services on-premise of their local corporate network, the azure stack requires a very high-end hardware. On the other hand, Microsoft Azure provides Azure IoT Edge computing, which is basically an

Edge computing instance supported by Microservice architecture that could be used in the proposed architecture as it does not totally decouple the IoT deployment from public internet [4]. If the IoT middleware is made to work with intranet connection or corporate network, it would easily address the concern on security and can be easily adopted by enterprises which concern much about security.

II. OBJECTIVES

This research focuses on how a middleware can be decoupled with the public internet and can leverage big data for large scale enterprises by developing a IoT middleware architecture which can entirely be hosted at on-premise in the network latency, which means, the intranet, as data does not need to pass through data centers hosted in different regions. The main objective is to build an edge computing architecture that would be highly scalable for enterprises by reusing the existing software. Hence, it will definitely improve the efficiency of the real-time decision making. The outcome is a middle-ware service that runs on linux platform as most of the IoT hardware support Linux[5].

III. METHODOLOGY

The proposed reference architecture is specially designed for large scale use like enterprises which focus much about the security concern. Apache NiFi is chosen for Data Ingestion and Device Management. For streaming the message and analytics, Kafka or Spark Cluster is chosen. For the storage purpose, HBase is used. Based on the proposed reference model, a prototype was developed, such that it incorporates the expected features using the existing software and components in Apache.

A. Proposed Middleware Model
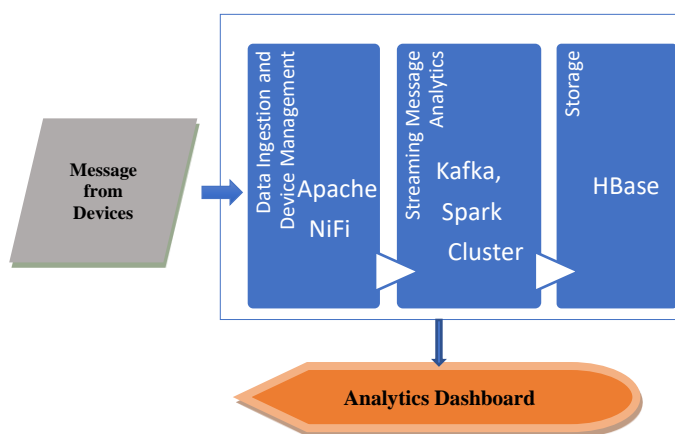
Fig. 1. Reference Model of the Proposed Middleware for Large Scale Intranet of Things

B. Prototype Implementation

a. Data Ingestion and Device Management

Data ingestion, which means receiving data from sensors is the starting point in the architecture. From the beginning onwards, the devices are managed and the next most important is the development of Digital Twins of the devices as it is easier to control all the devices from the software itself rather than physically setting the devices on or off or other properties. When it comes to current IoT offerings from famous vendors, each of them uses such tools like IoTHub (viz. in Microsoft Azure for example, via cloud offering). Since it is built as the on-premise architecture based on Linux, Apache NiFi was chosen. Apache NiFi does not have a dependency on a specific data format, and it has the capability to consume and publish MQTT[1] protocol as well. Since Apache NiFi offers the ability to create custom components, the device twins can be built as custom components [6]. On the other hand, NiFi has a robust authentication support as it uses TLS certificates by default for user authentication which has been configured for Kerberos[2] or LDAP[3] as well.

b. Streaming Message Analytics

Once the messages are ingested to the system, then it is stored. But since the architecture has been built for large scale domains, the number of messages would introduce bigdata to the system. Thus, there should be a way to opt-out which message to store. Apache Kafka is the ideal candidate for the previously mentioned purpose. The reason for choosing Kafka was that it could be used for real time streaming and data-pipeline applications. Kafka provides facility to partition the data into different topics which can be indexed and be read by the consumers. This can be also pipelined to either Apache Spark cluster for near-real-time analytics or can be batch processed.

c. Storage

Once the messages are processed, they are either stored or ignored. This architecture provides a way to store the messages as well using HBase which is schema-less, built for horizontally scalable wide tables and ideal for storing both semi-structured data and structured data.

C. Prototype Evaluation

The prototype developed based on the middleware model was tested for performance with the following metrics and the results were noted accordingly.

a. Number of devices connected concurrently: To evaluate the number of devices connected concurrently, a number of emulated devices with a unique ID were connected to Apache NiFi endpoint and the results was noted.

b. Number of Messages processed concurrently: To evaluate the number of messages processed concurrently, telemetry messages in a given format produced from each device connected to Apache NiFi endpoint was sent through the streaming message analytics service and results on the number of concurrently processed messages was noted.

c. Number of Records saved Concurrently: The telemetry messages thus sent to the streaming message analytics service was checked for whether it is saved to the HBase 3storage and the number of similar messages saved concurrently to the storage was evaluated to find the number of records saved concurrently.

d. Number of Messages Processed in a time window: With the aim of evaluating the performance fo the prototype, number of messages processed in a time window was calculated by identifying the number of messages processed in a given time (60s-time window).

e. Number of Messages successfully saved in a time window: The number of messages saved in the HBase storage was evaluated to find the number of messages saved to it in a given time (60s-time window).

IV. RESULTS AND DISCUSSION

The prototype developed based on the proposed reference model was evaluated for expected functionalities. Since the prototype was developed with the aim of implementation at large scale intranet of things environment, the developed prototype was tested for performance based on the identified metrics.

At the first glance, the middleware's performance was tested for the number of devices being connected concurrently with three servers of different specifications and the results shows that all the emulated devices which were connected were running concurrently on all the servers with different specifications like 2GB RAM and 4 Core CPU, 4GB RAM and 8 Core CPU and 8GB RAM and 8 Core CPU.

Fig.2 , Fig.3 and Fig.4 shows the analyzed results of the four performance evaluation metrices as tested with a server of specifications 2 GB RAM and 4 Core CPU , 4GB RAM and 8 Core CPU and 8GB RAM and 8 Core CPU respectively with 100, 1000, 100000 etc. number of messages as the input which is given in the "x" axis of each graph.
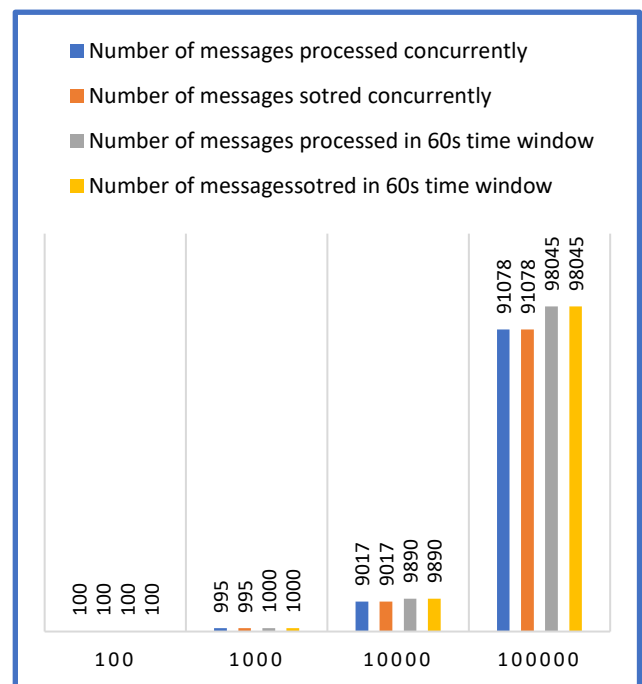
Fig. 2. Performance Evaluation of the Middleware Developed with Server of Specification - 2GB RAM and 4 Core CPU
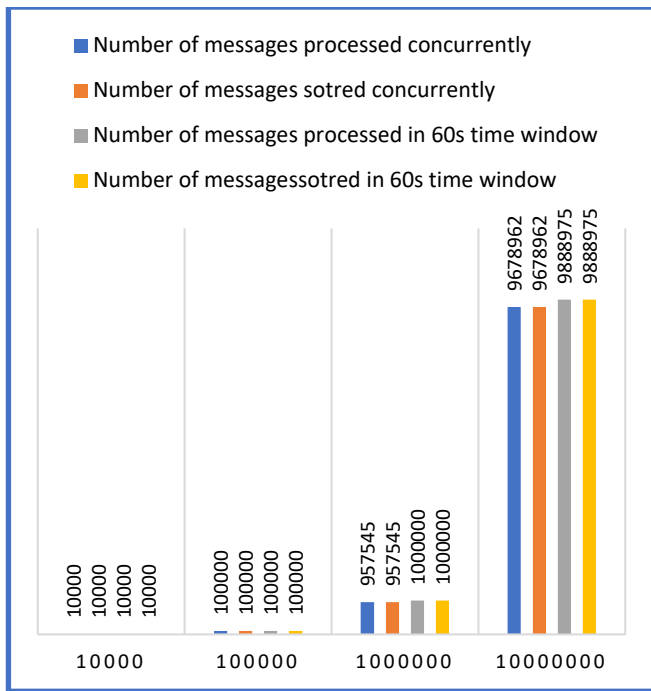
Fig. 3. Performance Evaluation of the Middleware Developed with Server of Specification - 4GB RAM and 8 Core CPU
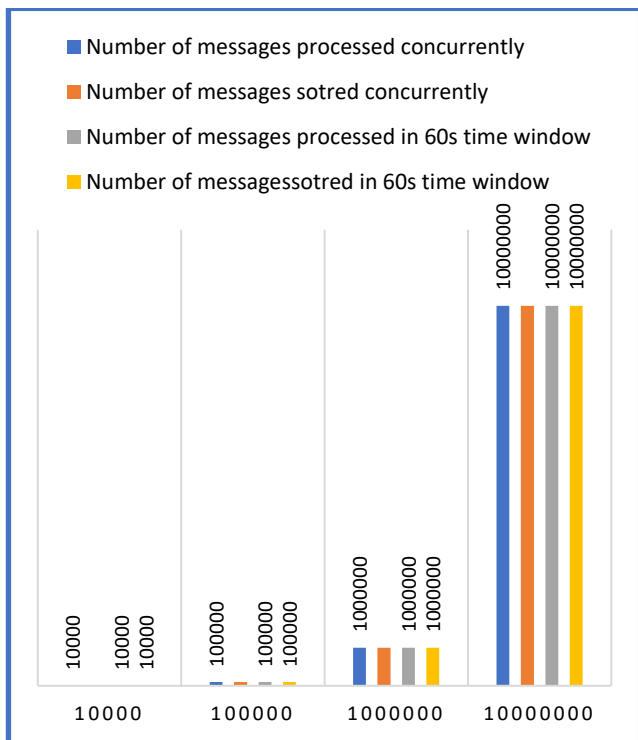
Fig. 4 Performance Evaluation of the Middleware Developed with Server of Specification - 8GB RAM and 8 Core CPU

Based on the results of the perofrmance evaluation, it is obvious that when the specificaton of the server is higher, the expected results for each metric is better compared to the one ith low specifications. Hence, it could be suggested that one way to improve the performance on enterprise babis to process large vloume of messages is to improve the hardware epcifications as needed. Figure 5 shows the graphical reprentation of the comparision of messages processed in a time window by different servers with different hardware specifications. It highlights the fact of improved performance with improved hardware specification.
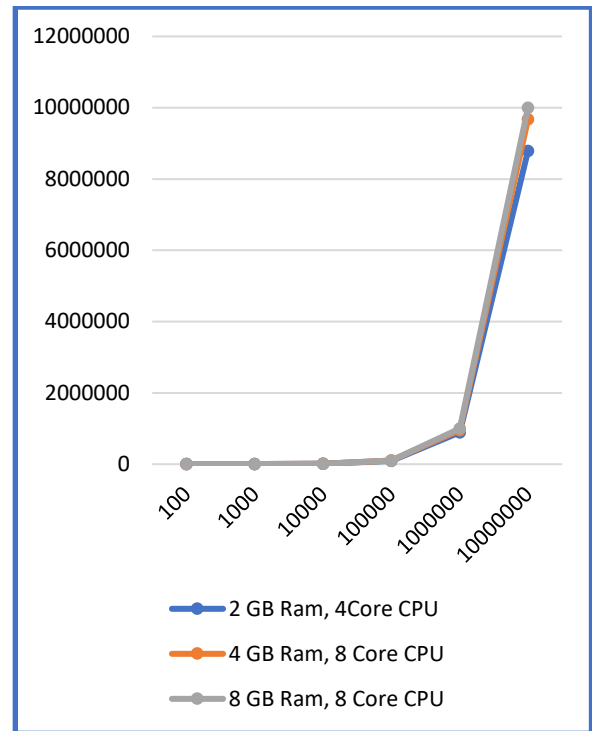
Fig. 5. Graphical Reprensentation of the number of messages proceesd in a time window (60s) by tdifferent servers

V.   Conclusion

This research was mainly intended on building an edge computing architecture with the proposed reference model that is highly scalable for enterprises that uses huge amount of data which is said to be "Big Data". The main idea was to reuse existing software for the research instead of reinventing a wheel as it saves time and avoid errors. Hence, Apache was chosen as it provides several middleware offerings that can run on Linux with minimal configuration. The main reason for selecting a middleware service that can run on Linux is that most of the IoT hardware have Linux support at the first place.

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Reliable Cell Selection and Performance Analysis in 5G

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Abstract — **The requirement for wireless communication devices and fifth generation (5G) cellular network access is rapidly going up. Overlapped cell areas are consisted in 5G cellular networks and it grants dynamic coverage with respect to time. Moreover, 5G users can be covered by number of cells. As the result of that, reliable cell selection is needed in 5G and it is critical decision for 5G users. In this research, two schemes are proposed as the solution. The signal strength is considered as the first scheme while channel availability factor is considered as the second scheme. The result of simulation model is evaluated by considering the fairness index and the blocking probability. For efficient cell selection, scheme 2 is much fairer than scheme 1 because by using scheme 2, channel availability is balanced through cells and radio access technologies (RATs). It can be summarized that the proposed schemes are reliable cell selection schemes which can be used to develop the overall system performance.**

Keywords- cell selection, channels availability, signal strength

I. INTRODUCTION

The 5G wireless technology is the most current rendering of cellular technology crafted to increase the efficacious delivery and responsiveness of wireless network services. The advanced 5G technology is not just the next interpretation of mobile communications, evolving from 1G to 2G, 3G, 4G and now 5G. The 5G mobile cellular communications system provides a far higher level of performance than the previous generations of mobile communications systems. It serves data rate higher than 20Gbps. The initial phase of 5G non-standalone deployments focuses on enhanced mobile broadband (eMBB), which provides greater data-bandwidth complemented by moderate latency improvements on 5G. Within enhanced mobile broadband there are three distinct attributes 5G will need to deliver including higher capacity, enhanced connectivity and higher user mobility. The current generation uses Worldwide Wireless Web (WWWW) which is a well-situated combination of broadband and unified IP. Frequency band for this technology ranges from 3GHz-300GHz. Additionally, 5G is prided for its innovative feature of ultra-reliable communication; this has been forecast to be an intrinsic communication pillar which provides services categorized as anywhere and anytime, aimed at the end user in URC [2]. The efficiency and ultimate quality of the services issued to end users will be asserted by the reliability and availability of the network. These are the key benefits that communication service providers expect from 5G. Anytime anywhere communication is a major requirement for critical applications (industrial automation, automotive, eHealth) in 5G networks. Networks such as 5G are designed with the intention to assist in a vast range of services and applications in demand.

Additionally, 5G is prided for its innovative feature of ultra-reliable communication; this has been forecast to be an intrinsic communication pillar which provides services categorized as anywhere and anytime, aimed at the end user in URC [3]. The efficiency and ultimate quality of the services issued to end users will be asserted by the reliability and availability of the network. These are the key benefits that communication service providers expect from 5G. Anytime anywhere communication is a major requirement for critical applications (industrial automation, automotive, eHealth) in 5G networks [4]. Networks such as 5G are designed with the intention to assist in a vast range of services and applications in demand. Due to this reason, 5G network users and devices can be covered by multiple cells as illustrated in Figure 1. Therefore, efficient cell selection is needed in 5G. This could be done especially by taking full advantage of network capability to facilitate extreme performance that includes supporting of hugely inter-tethered devices in 5G. The main challenge in 5G devices is that scalable and efficient connectivity for a massive number of devices sending very short packets, is not done adequately. In such scenarios, 5G devices are expected to select the most appropriate cell based on the channel availability information of each cell. Therefore, a solution is needed to pave way for efficient cell selection in order to take the optimal decisions with the help of efficient connectivity.
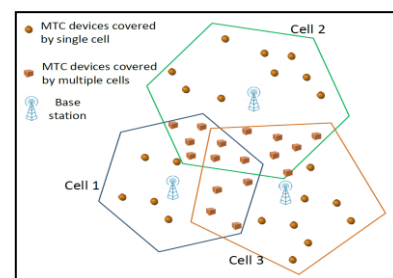
Fig 1: Overlapped cell areas.

Numerous studies and research projects are carried out to develop 5G mobile network technology efficiently. A development of 5G mobile network technology and its architecture are presented in [5]. The study in [5] is concentrated on all foregoing eras of mobile technology, developmental aspect of 5G technology and basic architecture behind this mobile technology. Moreover, the various components including GPRS, EDGE,3G, WLAN, LTE involved in the architecture making it very fast, secure and famous among the customers in all over the world. As the result of that 5G technology is granting specified services with WWWW functionalities in the lowest cost ever, by keeping the users in the top of the priority. The research work performed in [6] focusses on cellular architecture and key technologies for 5G wireless communication networks. According to the work in [6], the performance requirements of 5G wireless communication systems have been specified in terms of capacity, spectral efficiency, energy efficiency, data rate, and cell average throughput. Moreover, the 5G cellular architecture has been proposed with separated indoor and outdoor applications by

using distributed antenna system and massive MIMO technology which are consisting of multiple antennas at both the transmitter and receiver. Some short-range communication technologies, such as WiFi, femtocell, and mm-wave communication technologies, be promising candidates to provide high-quality and high-data-rate services to indoor users while at the same time reducing the pressure on outdoor base stations. Additionally, the paper discussed some potential technologies that can be deployed in 5G systems to satisfy the expected performance requirements, such as cognitive radio networks (CRNs) and spatial modulation. Ultra-reliable communication in 5G wireless systems (URC) is presented in [7]. URC is the one of the novel features in 5G which is not exist in today's wireless systems. URC is accorded to provision of some piers of communication services near 99.999% every time. The paper presents a systematic view on URC in 5G wireless systems. It introduces the key concept of reliable service composition, and instance service is designed to assimilate to accommodate the requirement to the level of functional reliability. Furthermore, the problem of URC is analyzed.

Another study in [8] presents a research work on achieving ultra-reliable communication in 5G networks in a dependability perspective considering the space domain. In this investigation, URC which is a part of 5G communication is considered as a critical technology pillar for offering anywhere and anytime uses to end users. The paper highlights the concept of URC from the dependability perspective also in the space domain and defines the cell availability and system availability. Additionally, the availability and the probability of granting a guaranteed level of accessibility in a network are considered as both/either cell-wise and/or system-wise. An automation of 5G network slicing with machine learning is discussed in [9]. Due to appearance of illegitimately vast number of new connected devices and new types of services, the 5G communication networks are getting complex. Moreover, the requisites of creating virtual network slices are appropriate to provide optimal services for different users and applications are posing challenges to the efficient management of network resources, processing information about a huge volume of traffic, staying robust against all potential security threats, and adaptive adjustment of network functionality for time-varying workload.

The above work mostly considered the optimization algorithms or cell association with little attention to RATs. In spite of this, in the proposed algorithm, both signal strength and channel availability factors and balancing of the devices among cell and RATs are thought out. Thus, the outline of the way of solving the problem in this research is to implement an algorithm for devices which are in an overlapping area, considering two schemes, namely, signal strength, and the combination of channel availability and the signal strength.

II. OBJETIVES

The objective of the proposed research is empowering the algorithm for cell selection based on the availability and reliability performance in 5G communication.

III. METHODOLOGY

In the both schemes, the mobile network consists of two cells two RATs as illustrated in the figure 2, with two of them overlapping, while 40 devices are distributing among cells.
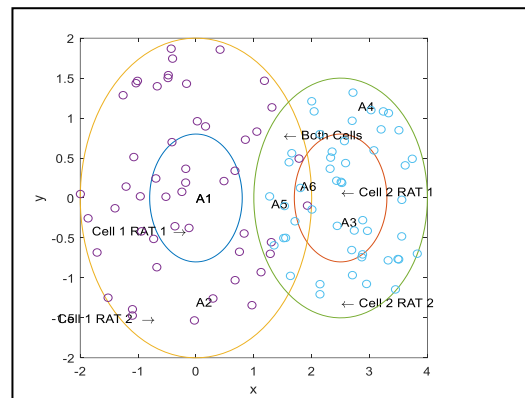
Figure 2: Network Scenario for the simulation

An analysis of many algorithm models created for cell selection is furnished as the solution. Through the elimination of multiple issues in those models, this research proposes an approach for cell selection in heterogeneous 5G comprising of two schemes for different cells. Firstly, as the first scheme, a mobile network of two cells overlapping an area was considered while numerous devices are distributed among the 5G cells. Afterwards, the cell coverage area was determined. From that result, it is possible to compute whether the devices are in cell 1 or cell 2 or an overlapped area. The devices which are in the overlapped area are examined after that. With the help of X and Y coordinates the distance from the base stations for every device could be calculated. Next, the simulation model is used to compare the distance between every device. Secondly, this research paper proposed the second scheme. From the result of the scheme 1 cell coverage area, it could be computed if the devices are in cell 1 or cell 2 or an overlapped area. The devices which are in the overlapped area are dealt with thereafter. Scheme 2 is mainly focused on the channel's availability of each and every cell. Therefore, first, the proposed simulation assigns the channels limit for each cell. Then it is determined whether these cells exceed their channels limit or not. If they do not achieve the channels limit, then the devices can easily select a cell. If the cells achieve their channels limit, then the simulation model checks the distance. The simulation model was implemented according to the above-mentioned schemes by using MATLAB.

IV. RESULTS AND DISCUSSION

The simulation results for two schemes are illustrated in this section. The scheme 1 is based on the signal strength. For that purpose, the proposed simulation model considers the distance from the base stations and the locations of the devices. After simulating the above mobile network, the average number of devices for each RAT and the blocking probability were generated as follows:

Average of associated number of nodes in C2R2 : 8.079
Average of associated number of nodes in C2R1 : 3.576
Average of associated number of nodes in C1R2 : 1.248
Average of associated number of nodes in C1R1 : 0.903

Blocked probability is : 0.141

The scheme two is based on the combination of the channel availability and the signal strength. The average number of devices for each cells were as follows in the scheme 2.

Average of associated number of nodes in C2R2 : 9.270
Average of associated number of nodes in C2R1 : 2.262
Average of associated number of nodes in C1R2 : 9.320
Average of associated number of nodes in C1R1 : 1.892
Blocked Probability is : 0.198

The main purpose of scheme 1 and scheme 2 is to model a reliable cell selection model for 5G mobile networks. The evaluation of the performance of scheme 1 and scheme 2 is generated by considering the fairness index and the blocking probability.

Firstly, Fairness measures are utilized in network engineering to find out if users or applications receive a fair share of the system [10]. To calculate the fairness index, Jains Fairness Index is applied. The figure depicts the fairness index of the mobile network based on two schemes as X axis and the ratio of nodes between cell 1 and cell 2 in Y axis. The fairness index in six different scenarios was found out by changing the number of devices in each cell. In Figure 3, the fairness indices of two schemes are compared with the ratio of nodes between cell 1 and cell 2.
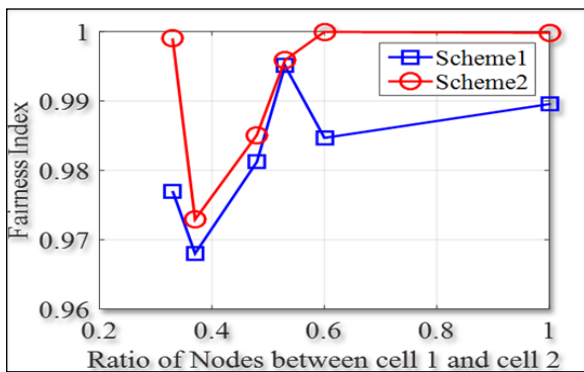
Fig. 3. *Fairness Index of Scheme 1 and Scheme 2.*

When the fairness indices are compared, it is obvious that scheme 2 is fairer than scheme 1 because scheme 2 is always close to 1. This means that its fairness is higher than the fairness of scheme 1. In scheme 2, the simulation model is used mainly by considering the channels availability. By using scheme 2, a channel which is less loaded will be used leading to more balanced channel utilization. As a result of that, scheme 2 always tries to balance the devices in each cell. Therefore, it is proven that for cell selection, scheme 2 is better than scheme 1.

Secondly, the impact of Duty Cycles on the Blocking Probability (BP) was calculated. The BP varies with the duty cycles. A duty cycle or power cycle is the fraction of a period in which a signal or system is active. A period is the time it takes for a signal to complete an on-and-off cycle. On-Off cycles play a major role in 5G devices as there are battery powered devices consist. They stay often in the off mode and, they need to perform cell association again when they in the on mode. Therefore, duty cycles can be considered as an important performance parameter. The duty cycle of this

simulation model can be calculated by using following formula.

$$Duty\ cycle = \frac{ON\ period}{Total\ period} = \frac{1/mu\_11}{\left(1/mu\_11 + 1/mu\_12\right)}$$

where:
• 1/mu11=the mean value of on time period
• 1/mu12= the mean value of off time period

The duty cycle changes when mean off period is constant as shown for both schemes in Figure 4. Mean on time period changes from lower to higher and checks the blocking probability. We can see from the image that the probability of blocking rises when the on-time period grows. The number of devices stays active when the on-time period increases. Therefore, new device requesters have to wait until the devices get off. Hence, the blocking probability increases while the on-time period of devices increases in both schemes.
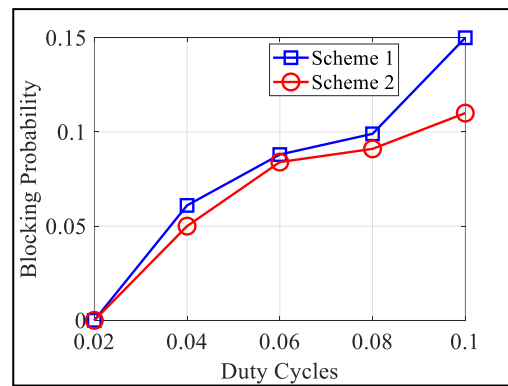
Figure 4: The Graph of Mean Duty Cycle on the BP- Mean Off Time Period Constant.

Thirdly the blocking probability is compared with number of channels by considering both schemes 1 and 2 which is illustrated in figure 5. It can be clearly depicted that the probability of blocking dramatically drops initially when the number of channels grows in both schemes. When there is a limited number of channels, the devices have limited chances to access channels. Therefore, it is proven that when there is a high number of channels, the blocking probability gets low, because there is higher chance to device to access a channel when there are less occupied channels.
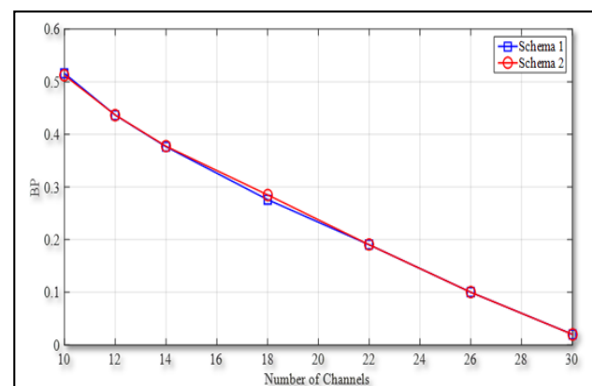
Figure 5: The Graph of Number of Channels on the Blocking Probability

V. Conclusion

In this research, the main objective of this study as the constructing of the algorithm for cell selection based on the availability and reliability performance in 5G scenarios, is expressed. The cell selection is executed with the help of two schemes. Scheme 1 is based on the signal strength with the help of the distance of each device and the second scheme consisting of channels availability and the distance.

The accuracy of the model is assessed by simulations. The obtained simulation results are used to evaluate the performance of the simulation model. The numerical results show that the fairness index is high in scheme 2 than the scheme 1. Therefore, the results prove that based on channels availability and the distance, cell selection can be performed.

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Unique Dining Experience with the Use of Emerging Technologies

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Abstract — **Food selection from a menu at a restaurant is one of the main difficulties faced by the customers due to lack of information on available food items, dietary restrictions arising due to personal factors, problems related to the menu and situational issues. This paper discusses an innovative solution to address these issues and a personalized food recommendation system on Amazon Web Services (AWS) using Deep Learning technology is proposed. 3D Modelling technology has been utilized to enhance this solution further while Blockchain technology is recommended as a future enhancement to facilitate the end-to-end traceability of food item ingredients.**

Keywords: Restaurants, Service innovation, Deep learning

I. INTRODUCTION

The growing trend in eating out of home has created the need for restaurants to offer comprehensive services in order to develop customer satisfaction and remain competitive in the rapidly growing food service industry [1]. The diners' desire for an attractive dining experience has created the need for restaurants to continually improve their offerings when serving customers. It was noted that this can be achieved through service innovation which has a positive impact on customer satisfaction and return patronage, thereby allowing restaurants expand their market share [3].

This study focuses on employing emerging technologies to allow restaurants offer unique services while catering to each diner's specific requirements. The implementation of a personalized food item recommendation system along with an informative digital menu system will be discussed. Although certain restaurants offer tablet based digital menus to diners, it is noted that such applications do not cater towards adding ease to the food decision making process by providing recommendations and supplementary information regarding food items.

II. OBJECTIVES

The main goal of this study to make use of emerging technologies to offer innovative services at restaurants, thereby assisting diners with the tiresome task of food decision making while making it possible to place orders and make payments via a single solution. Restaurants can ensure that they offer a unique and comfortable dining experience to customers.

III. METHODOLOGY

This research followed the mixed methodology when gathering data to identify issues faced by diners. A questionnaire was distributed using snowball sampling method to collect data from customers who had experience dining out. 54 responses from customers belonging to all age groups were used to find out their problems. Then, interviews were conducted with restaurant staff to identify their suggestions and to explore their experiences when serving diners. The data gathered was analyzed and visualized using Microsoft Excel spreadsheet software.

IV. DISCUSSION

The factors identified for personalization are Customer age, Gender, Occupation, Involvement in sports, Dietary restrictions (i.e. Food allergies and intolerances), Personal diets followed (i.e. High protein diet), Calorific limits (i.e. Limit of 500 calories per meal), Spending range (i.e. LKR 1500 to 3000) and other conditions (i.e. Diabetes/High blood pressure). Deep learning, 3D modelling and Blockchain technologies were identified as suitable technologies to find a solution to issues faced by diners and restaurant staff.

Several recipes (Algorithms) offered by the AWS Personalize service were experimented to identify the optimal recipe to implement the recommendation functionality. A dataset group consisting of User, Interactions and Items datasets were uploaded to the AWS S3 storage service which was accessed to develop the Deep Learning model.

Based on the accuracy metrics obtained for the models developed, the AutoML recipe (Refer Fig.1) was chosen as the optimal recipe to proceed with as it produced the highest accuracy of 82%. Then a custom model and campaign were created. Once completed, the GetRecommendations API call from Personalize runtime was used to obtain real-time recommendations by passing the User ID.

Solution version metrics			
Normalized discounted cumulative gain	Precision	Mean reciprocal rank	Coverage
At 5 0.7710	At 5 0.4872	At 25 0.8954	0.9688
At 10 0.8209	At 10 0.2809		
At 25 0.8394	At 25 0.1200		

Fig. 1. Solution metrics for the AutoML recipe

Food item recommendations generated for individual diners based on the above stated factors were presented as illustrated in Fig.2.

Lack of detailed information regarding individual food items was overcome by designing the digital menu as shown in Fig.3. Similarly, detailed information comprising of item availability, ingredient details, nutritional value, preparation time and methods, serving size and previous reviews were provided about all food items so that diners can make well informed decisions.

Fig.4 represents the interface through which diners can view food items as a rotatable 3D model. The rotatable nature allows food items to be viewed through all angles in order to better understand what can be expected by ordering a

particular food item from the menu. This helps diners overcome confusion and dissapointment especially in the case of food items with foreign or unfamiliar names.
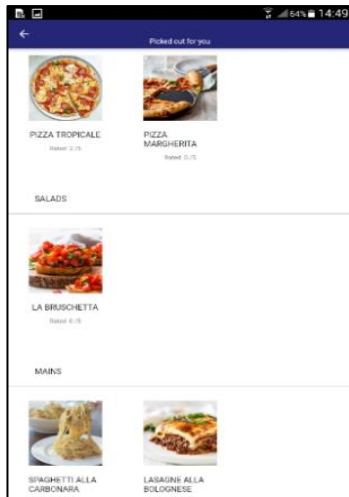
Fig. 2. Personalised food item recomemendations generated
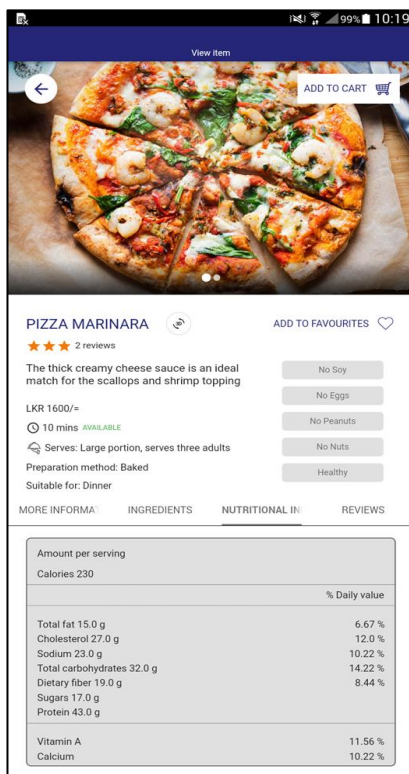
Fig. 3. Detailed information regarding each food item

Blockchain technology can be recommended to implement a feature to facilitate end-to-end traceability of ingredients from the 'farm to the fork'. It is a fairly new technology defined as a public ledger containing all executed transactions that are stored on a distributed database in the form of encrypted blocks [2]. Information such as the crop cultivation conditions, use of fertilizer, processing and distributing conditions can be recorded using Blockchain supply chain systems. Sensors and Internet-of-things (IoT) implementations will be required to track levels of pesticide and fertilizer usage in crops. RFID tags, Quick Response (QR) codes or barcodes used to label each produce, allows the end-user to gather traceability data by scanning this code. This will

be particularly valuable in ensuring authenticity of Organic and Halal certified [4] food items.
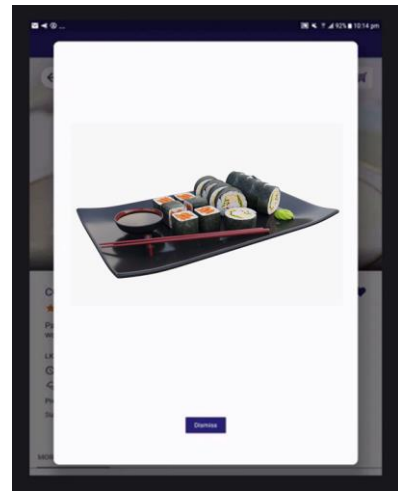
Fig. 4. Food item viewed as a 3D model

Lastly, the prototype with the above technologies has received significant positive feedback from IT experts in terms of the evaluation criteria. It was unanimously agreed that the prototype helps to overcome the difficulties in food decision making. User experience, system design, performance, completeness and choice of technologies have been rated highly as shown in Fig. 5. However, the security aspect of the application has been acknowledged as an area that can be improved further.
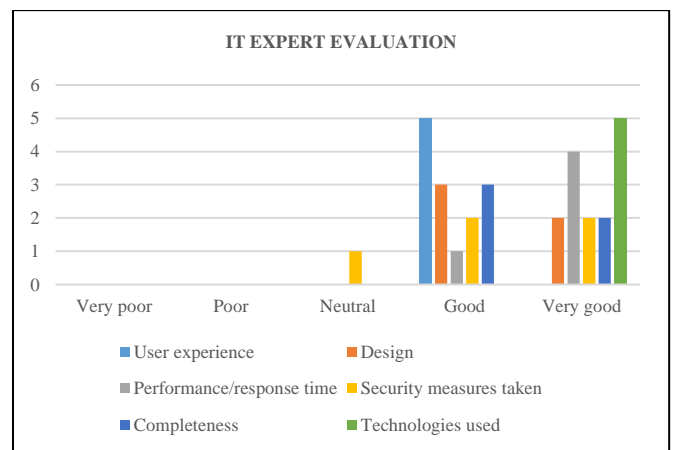
Fig. 5. Overview of IT expert evaluation

V. CONCLUSION

This study provides valuable insights regarding implementations that can bring about ease and satisfaction to diners while directing the food service industry towards offering unique dining experiences to their customers.

Future research efforts on this topic can be focused on providing transparency on artificial food additives and flavors added. This can be made possible by setting up IoT implementations which monitor specifics during the preparation of food items at restaurants. However, such implementations are very costly, and therefore a thorough cost-benefit analysis will be required in advance to assess its feasibility.

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Multi-Objective Nature-Inspired Algorithms for Sensor Node Localization in Wireless Sensor Networks

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Abstract —**Localization of sensor nodes in WSN in many different scenarios is becoming an important issue due to widespread application. Localization process is necessary to report the origin of events, routing and to answer questions on the network coverage, assist group querying of sensors. Small and inexpensive tools with low energy consumption and limited processing resources are increasingly being used in various scenarios of application including search, rescue, disaster relief, target tracking, biomedical health monitoring and number of tasks in day to day life. In general, localization schemes are classified into two broad categories range-based and range-free. However, it is difficult to classify hybrid solutions as range-based or range-free. We make this classification simple in this paper, where range-based schemes and range-free schemes are divided into two categories, complete schemes and hybrid schemes. In this study are taken in consideration the simulation of the approaches of Hybrid algorithm. Based on simulations, we understood the influence of dimensioning, so the localization efficiency will increase from 1D to 3D because at 3D the reference nodes will interact in more directions, but because of the complexity of the network, the convergence time will also increase. Node localization is one of the fundamental problems of the wireless sensor network. This paper reviews different approaches of node localization discovery in wireless sensor networks. Also presented is the summary of the schemes suggested by various scholars for localization improvement in wireless sensor networks. Moreover, compare the existing localization algorithms and analyze the future research directions for the localization algorithms in WSNs.**

Keywords — localization, Node, range-based, range-free

I. Introduction

The automatic location detection of sensors, namely localization is an important issue for WSN applications, especially in cases, when the sensors are deployed randomly, or when they move about after deployment. One explanation is that in order to be relevant, the position of a sensor must be known for its results. The location itself is often the only data to be sensed in most situations. For many location-aware network communication protocols such as packet routing and sensing coverage, position information is essential [2].

Using the same transmission medium as wireless local area networks (WLANs) to communicate properly with nodes in a local area network. But, this and the other protocols cannot be directly applied to WSNs. The major difference is that, unlike devices participating in local area networks, sensors are equipped with a very small source of energy, which drains out very fast. Therefore need arises to design new protocols for MAC (Media Access Control) [1] that are energy aware. Obviously, as the latter has limited resources, there is some gap between a normal WLAN and a WSN(Wireless Sensor Networks).

WSN localization is an important, key enabling technology that attracts considerable interest in research. With the constrained resources of network sensors, as well as their high failure rate, many challenges exist in the automatic determination of the sensor's location. Different application requirements such as: scalability, energy efficiency, cost, accuracy, responsiveness and privacy affect sensor localization systems research and development [3].

Many different application scenarios can be built on the basis of nodes with sensing and actuation capabilities. The major application scenarios include; Proceedings of the 2009 13th International Conference on Computer Supported Cooperative Work in Design disaster relief applications [4], environment control, intelligent buildings [5], facility management, preventive maintenance of machines, medicine and health care.

II. Objetives

Algorithms inspired by a new nature are used to test their effectiveness in solving problems. Therefor the main objective of this research is to be as follows,

• To develop a multi object nature inspired algorithm use to localize sensor nodes in wireless sensor network.

• Find the most suitable nature inspired algorithm for wireless sensor network localization and define more accuracy, scalability algorithm and Overcome existing problem in defined algorithms.

III. Methodology

The TBL (Trilateration-based Localization) & MBL (Multilateration-Based Localization) techniques are among the most common and used methods of localization based on trilateration and multilateration [6]. This chapter discusses different aspects of the performance of the TBL algorithm through the application of single and multi-target PSO (Particle Swarm Optimization) variants. Number of localized nodes, trade-offs between multiple objectives, the number of transmitted messages, the time needed to localize as many nodes as possible and power consumption are studied.

Multiple output levels can be used by wireless transceivers [7]. Three separate PSO models have been developed to observe the effect of multi-output power levels. The first two are single and multi-target, binary PSOs, designed to vary the power output only between three distinct stages. The other one is continuous multi-objective version with multiple objectives which shows the extreme case in which the power output is infinite. The continuous version shows that the full optimization can actually be achieved, while modern transceivers cannot do so. Then comprehensive power consumption measurements are carried out during nodes in transmission mode using discrete or continuous power levels.

Discrete Levels has been believed to have three different power levels and then the length of the wave can be determined on the basis of the required output power. The permitted levels were computed in (1) and (2) where R is the range in meters, Po is the sender power, Pr is the sensitivity of the receiver, Fm is the faded margin in dB, f is the frequency of the signal in MHz and n is the exponent of the loss. Po and Pr measured in dBm.

$$R = 10x \quad (1)$$

$$x = (P0 - Fm - Pr + 30 * n - 32.44 - (10 * n * \log [10]f))/(10 * n) \quad (2)$$

In Continuous Levels ZigBee transceiver is capable maximum range of 132 meters and the minimum 60 meters is assumed in this process. In this method, transmission range varies continuously, as in (3) and (4), instead of previously in power range. As in previous discreet methods, energy consumption is measured using [8]. In the end (4) power consumption Po is converted from dBm to mW.

$$P0 = (10 * n * \log 10\, R) + (10 * n * \log 10\, f) - (30 * n) + Fm + Pr + 32.44 \quad (3)$$

$$\hat{P}_0 = 10^{\left(\frac{P_0}{10}\right)} \quad (4)$$

The proposed approach includes using a single and multi-objective PSO for each wireless sensor node to select a suitable, discrete or continuous output power level. PSO was used to optimize different targets, including the position time, the messages transmitted while localizing and power consumed, for various combinations. The method would only optimize the transmitter mode to reduce the average power output level used by all nodes to make the procedures as protocol independent as possible as well as allow the methods to be used for any protocol of localizing.

The power usage is estimated from the adjusted transmission range of each node in the proposed implementation. In order to help solve localization problems the transmission ranges are modified with the SOPSO (Single-objective Particle Swarm Optimization) and MOPSO (Multi-objective Particle Swarm Optimization) algorithms.

To configure the different discreet power ranges or the continuous range of transfer of each sensor node intelligently, the SOPSO and MOPSO algorithms are used. Therefore, an N-dimensional representation is used to represent each sensor used in the field. In addition, objective functions for messages sent, time needed for localization, power consumption and localized node numbers (A.K.A. locizability) are determined.

As discussed above, the issue in this study is the number of messages sent, the total energy consumption, localization time and localizability. In order to achieve those goals a PSO approach was introduced to manage Multi-objective Problems, with the intention of seeking a balance between conflicting targets and offering a range of optimal solutions, instead of just one objective solution in which the main objective is to maximize the number of localized nodes without unnecessary power or more time to localize the nodes.

The pseudo code of the two MOPSO Versions implemented is shown in Fig 1.

```
1:  procedure MOPSO(nodesList)Saac
2:          initialize swarm;
3:          initialize leaders archive;
4:          measure crowding distances;
5:          for i ← 0 → numberIterations do
6:                  for j ← 0 → numberP articles do
7:                          procedure calculateNewVelocities
8:                                  choose random leader as global best;
9:                                  update velocities;
10:                         end procedure
11:                         calculate new positions;
12:                         run MOPSO mutation;
13:                         evaluate the solution;
14:                         update particle memory;
15:                         update leaders archive;
16:                         measure crowding distances;
17:                 end for
18:         end for
19: end procedure
```

Fig 1 - MOPSO Algorithm

IV. RESULTS AND DISCUSSION

The tool used in this research based on Java SE 7. The network topology has been saved in a file (topology file) via the tool, to allow the examination of the same localization scenario, using different power levels or methods. The file contains the X and Y coordinates of each node in addition to the type of the node, if it's a normal or anchor node.

The simulation process flow chart is shown in Figure 2 Notice that, in step 2, in addition to the X and Y anchor coordinates, the Java code used reads the location of the node in the saved topology file. A random file of 240 nodes, 40 of which anchor nodes, is spread around an area of 1000 x 1000 meters for this research. One PSO versions proposed is used in Step 3. Step 4 and Step 5 are part of the fitness function in the analysis of particle solutions through the flooding and TBL localization process.
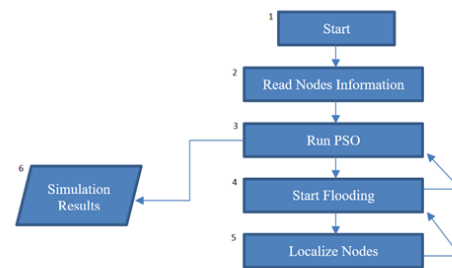
Fig 2 - Simulation Flow Chart ; with statically selected power ranges as Minimum, Medium, Maximum.

As shown in Table 1, the first run was for all 240 nodes only using minimal power ranges, allowing each of the nodes to transmit up to 63.28 meters over the distance. The localization procedure has consumed 20, 55 mW. This reflects 41 messages from the 40 anchors, and the only identified node from the anchors has been over 480 units. The second time used only medium range transmission, which allowed the transmission up to 91.47 meters of each node at a distance. Following flooding, the 40 anchor nodes and localized nodes were used to identify 96 nodes over a period of 1,200 units by results of 136 messages consuming 171.21 mW. Both 200 nodes were localized in the last run where the maximum power range for all nodes during 960 units of time was used. When using the maximum range of power each node could

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

transmit up to a distance of 132.22 meters, the localizing procedure consumed 758.95 mW of electricity.

Table 1 - Baseline results using multiple discrete output power levels.

	Run₁	Run₂	Run₃
Power Ranges	Minimum	Medium	Maximum
Transmission Ranges	63.28	91.47	132.22
Time	480	1200	960
Energy Consumption	20.55	171.21	758.95
Localized Nodes	41	136	240

BMOPSO was used to overcome the poor quality of BSOPSO's solutions by reducing localization time and energy consumption and increasing the number of localized nodes. The BMOPSO parameter values are shown in Table 2.

Parameter	value
# Particles	100
# Iterations	200
Min Tran Range	64
Max Tran Range	132
Mutation Percentage	15%
Mutation Value	Min Tran Range
C1 and C2	1.49445
Inertia Weight (ω)	0.1

Table 2 - BMOPSO Parameters' values

This method has managed to find a balance between all the competing objectives and to provide solutions which exceed the BSOPSO (Binary Single-objective Particle Swarm Optimization) approach, which shows the results from 50 tests. In some cases the two previous methods were better implemented at all stages, which was to localize all the nodes in the shortest possible time with less energy than all other solutions previously used in the methods.

In the 50 experiments, 77 solutions were found, but not optimal. Of these, the baseline was 28 above power consumption and the same time and number of localized nodes

were retained. The overall energy consumption rated between 4% and 21% below the baseline. The best approach is to achieve a 29 percent energy consumption improvement by the BMOPSO (Binary Multi-objective Particle Swarm Optimization) process, but to localize only 145 nodes.

V. CONCLUSION

By simultaneously optimizing the different objective functions, the general performance of the TBL algorithm has been calculated and improved. The results show clearly that SOPSO and MOPSO are used effectively to optimize the TBL algorithm with regard to energy consumption, which can be improved by up to 32% on the Transmit mode of transceivers. In addition, PSO has been found, as shown in the study, that it is less stable to use single global output power in location of the nodes than to use multiple levels and that using the maximum possible output level is not a cost-efficient solution to localization stability, In particular, PSO was found to overcome this problem without advertising the TBL work. However, in addition to many other techniques, our analysis can be mapped to actual test beds using component based localization.

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Performance Comparison of IoT Based Metering System with Different Blockchain Platforms

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Abstract — **Blockchain technologies are rapidly adopted worldwide. Internet of Things and blockchain adaptation can give better performance and security for users. Blockchain technologies still there is a strong lack of framework that tests and contrasts various schemes. This framework can be used to evaluate the potential of blockchains and making it easier for developers to find bottlenecks and therefore improve their applications. This paper includes performance analysis of a two blockchain platforms. Consider Ethereum and Hyperledger Fabric to estimate the performance and limitation of these platforms. For this evaluation chose use case as an electricity billing scenario. Measure the platform's performance and quality. For that use Hyperledger caliper performance benckmark tool. It compares various systems and makes it possible to better understand the different application options by measurement analysis in terms of throughput, latency, protection and fault tolerance. Finally evaluate and pick the right billing scenario blockchain framework.**

Keywords — blockchain, internet of things, ethereum

I. Introduction

Significant progress of blockchain both in variations and quantities has been seen in the past few years. Although well-established blockchain systems have now been implemented to address the demands of these new technologies, there is still a want for more autonomous and hands on success testing of these blockchain technology. For experts to identify margins and decide which platform to accept for their own applications, this knowledge will be essential [3]. The focus here is a performance analysis of a few blockchain platforms for electricity use cases. Throughput and latency are among the key technological difficulties and limitations which have not been commonly studied.

Distributor-consumer transactions are far from automation and Current utility payment systems and delivery systems lack accountability. In most implementations, current usage rates cannot be tracked, because most metering schemes still rely on manual meter readings. This metering method often costs a great deal of time and money [1]. A program is required in which all users meet the same rates of usage, all consumers have trust in the system and personal data privacy is secured. Consumption patterns should be calculated and used to address technical challenges before any future challenge is critical. Blockchain and IoT may be used as a workaround [2]. Applying smart contracts based on blockchain offers a chance to increase the speed, scale and safety of energy applications. This advancement provides the best blockchain network for the electricity billing system.

The reason of using blockchain in the energy sector is gaining a more and more huge interest. Decision-makers and utility businesses in the energy sector have asserted that blockchains can potentially offer solutions to energy industry challenges [4]. Blockchain technologies have the potential to enhance energy and process efficiency, accelerate IoT platform development and digital applications and innovate the P2P energy trading and decentralized generation. Moreover, blockchain technologies have the potential to improve current energy companies and utilities practices considerably by improving internal processes, customer services and costs.

Blockchain technologies can be added to a several of use cases associated to the operations and business practices of energy firms.

It provide, billing mechanism, sales and marketing, trading and markets, automation, smart grid applications and data transfer, security and identity management, sharing of resources, competition and transparency to energy sector rather than current mechanism.

II. Objetives

This work maingly focus on evaluate performance of ethereum and hyperledger fabric blockchain platforms for electricity billing scenario. In addition,

- To build different blockchain platforms for smart metering scenarios.
- To measure performance choosen blockchain platforms.
- To choose the best blockchain platform for electricity metering systems.
- To improve the scalability of the electricity industry by using the best platform, Increase customer experience, and increase blockchain understanding.
- Provide trust by blockchain agreement (consensus) for the entire electric network.

III. Methodology

Figure 1 describe overall flow diagram of the expected system for performance evaluation. Analyze and calculate the real electricity usage data to performance evaluation for ethereum and hyperledger fabric platforms. First get meter reading using current sensor and send that data to the hosted server. Then create blockchain implementation with smart contracts for both ethereum and hyperledger fabric blockchain platforms that can enable pay users electricity usage. Next configure hyperledger caliper for both platforms and measure the performance with real electricity usage data.

Finally compare two platform and find best platform for billing scenario.

Methodology has main three processes.

1. Hardware setup

A Current sensor has been selected by the project to monitor and store improvements to the user interface of the power meter. This current sensor (HW-670) is the instrument that detects and transforms current through the measured path to the comfortable, current-related output voltage. When a current travel through a wire or a circuit, a voltage saving occurs.
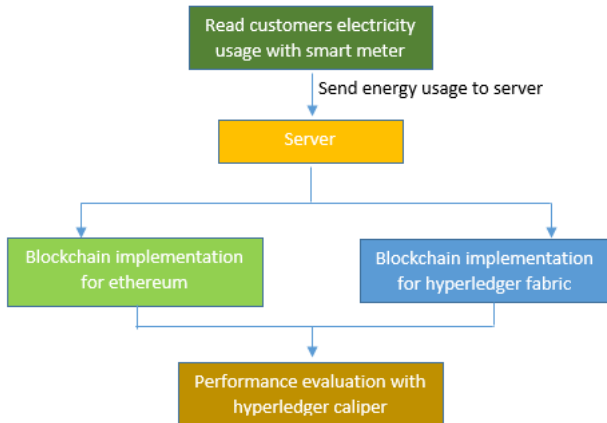
Fig. 2. Overall flow diagram

2. Blockchain implementation

The virtual machine Ethereum (EVM) is a virtual network for the execution of intelligent contracts. The benefit of using an EVM is that no infrastructure is required and that the entire blockchain network can be set up in similar settings. EVM is the JAVASCRIPT VM environment for any Ethereum node which provides a complete validation for any mission carried out in EVM with https:/remix.ethereum.org. Then the nodes conduct logical contracts. Developed smart contract algorithm is shown in below.

```
mapping (address => uint256) balance
Init: address
constructor (Tokens, new customer):
        Customer = new customer
        balance[Customer] = Supplier

Event Transfer(Sender, amount, Receiver);
Function pay(Sender, Amount):
if balance[Sender] ¿ Amount then then
        balance[Sender] += Amount
        balance[Customer] -= Amount
        return
        else
        return FALSE
end if
Function (getBalance(Sender):
return balance[Sender]
```

3. Performance evaluation

hyperledger caliper - Benchmarking tool for blockchains used to estimate the performance of individual blockchain applications is the hyperledger caliper supplied by the Hyperledger project. The key aim of Caliper is to help developer's find the best blockchain platform, measure resource consumptions and quantify network costs. The parameters endorsed are performance rate, transaction phase, latency and consumption of resources (CPUs, memory).

Metrics - Following has been described what are the metrics utilized in the analysis and gathering of the data.

Transaction Latency measures from the point a transaction is given in to the point the result is available throughout the network. Does include the propagation time and the consensus processing time.

Transaction Throughput checks the number of lawful transactions committed in the Blockchain network. The rate estimation takes place in all nodes as transactions per second (TPS).

Sending Rate is the real sending rate on the Target TPS of the Hyperledger Caliper. The exact number set in the configuration file will be attempted by Caliper.

Successful transaction indicates the number of transactions committed to the ledger. The causes include a number of network glitches, time-outs, caliper glitches and the lack of a packet, to name a few.

CPU displays the CPU power used for the containers for research. Measured in Caliper in the form of CPUs (MAX) and CPUs (AVG).

IV. RESULTS AND DISCUSSION

Hardware setup: Read users electricity reading using HW-670 current sensor. And send that reading to hosted server. For that used 000webhost server and following figure 2 shows electricity reading results database.

Performance evaluation: Both ethereum smart contacts and hyperledger fabric chain codes are validated. Then measured performance ethereum platform with smart contracts and Hyperledger fabric with chain code. Figure 3, 4 respectively show both platforms caliper reports.

Fig. 3. Meter reading database

Fig. 3. Caliper report for ethereum

Fig. 4. Caliper report for Hyperledger Fabric

Comparison of ethereum and hyperledger fabric implementations: Table 1 described performance metrics evaluations for both blockchain platforms. It shows best performance in hyperledger fabric blockchain platform.

Table 3 Performance Comparison

	Ethereum	Hyperledger Fabric
Blockchain type	Public Permission-less	Permissioned
Throughput	6	96.7
Consensus Mechanism	Proof of work	PBFT
Blockchain generation time	15 seconds	0.26 seconds
Programming	Solidity	Chaincode

Blockchain's dominance in the electricity and bill payment fields is not only apparent but inevitable. In the energy market, the blockchain and its implementation case is still under progress and not without shortcomings. There are also areas that needed to be upgraded and excavated. The methods suggested include contextual analysis for the application of ethereum and hyperledger fabrics. Users can see the Hyperledger Fabric is lightweight and adjustable.
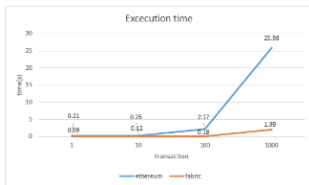
Fig. 5. Execution time with transaction
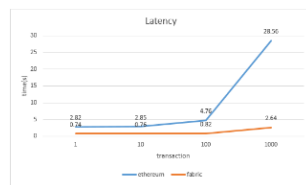
Fig. 6. Latency with transaction
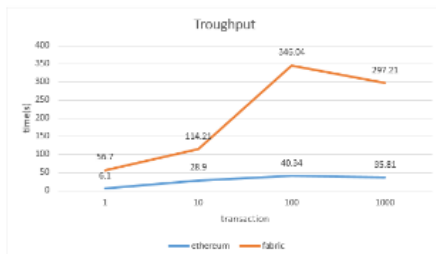
Fig. 7. Throughput with transaction

Respectively figure 5, 6, 7 show how to change execution time, latency, throughput according to amount of transactions. Execution time and latency were increased according to amount of transactions ethereum rather than hyperledger fabric. Throughput was increased according to amount of transaction increase hyperledger fabric rather than ethereum. Analysis of this performance comparison hyperledger fabric blockchain platform is most suitable for electricity billing scenario.

V. CONCLUSION

This research focuses on the performance analysis of electricity billing systems. This can extend for various blockchain platforms. Then test blockchain efficiency for selected platforms using Hyperledger Caliper tool. After this, determine the most appropriate electricity billing platform for the blockchain. Hope to check transaction sending rate, batch size, and output, usage of the CPU/memory and latency. Hyperledger Caliper presented details on the output of the proposed model with the benchmarking tool, which can serve as a basis for future discussion. Latency, Processing and memory bottlenecks were found. This study not only builds a leap forward in rigorous reliability measures, but also outlines the ways in which the Caliper instrument should only be used for energy billing. Further hope that success with other blockchain systems will also be assessed. The aim is to in future test potential solutions for the bottlenecks using various consensus algorithms, different endorsers, various databases and more powerful hardware. And this can also refer to multiple implementation scenarios.

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Vehicles and Pedestrians Detection by Using Deep Transfer Learning

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Abstract — **This paper presents a comparison of two customized models for object detection which are generalized by fine tuning the pre-trained models. The already trained models used are Faster RCNN with Inception V2 and Single Shot Detector with MobileNet V2. The images are obtained by using the PoE-supported IP camera and raspberry pi. As a result, the mean average precision (mAP) values of Faster RCNN with Inception V2 and Single Shot Detector with MobileNet V2 based on transfer learning technique are 0.556 and 0.267. So, Faster RCNN with Inception V2 customized model gives better detection result.**

Keywords — object detection, transfer learning, fine tuning

I. INTRODUCTION

Object detection is an important and challenging task in computer vision. It includes the tasks such as recognizing and classifying every object in an image and localizing each one by drawing the appropriate bounding box around it. Along with the rise of facial detection, autonomous vehicles, smart video surveillance and various people counting applications, fast and accurate object detection systems are rising in demand.

Recently, deep learning has substantially advanced the object detection field. By using deep learning, features and contents of various objects from digital images can be automatically determined. But deep learning requires a very large amount of dataset. By using transfer learning, the problem of insufficient training data can be solved. The training data and test data are not required to be identically distributed in transfer learning. In addition, the model in target domain does not need to train from scratch. In this way, the demand of training data and training time in the target domain can be significantly reduced. Figure 1 shows the transfer learning process.
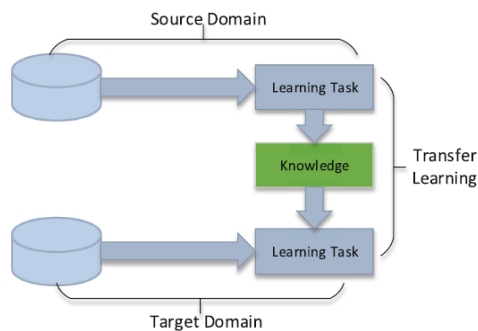
Fig. 1. Transfer Learning based learning process [1]

Chuanqi Tan et al. [1] presented a survey on Network-based, Instances-based, Mapping-based and Adversarial-based deep transfer learning categories. Nobuyoshi Yabuki et al. [2] utilized the transfer learning technique based on Single Shot Detector with VGG-16 model to detect the objects in construction sites and disaster areas. Zhen Zeng et al. [3] presented transfer learning based license plate recognition

system by using pre-trained Xception model. Ajeet Ram Pathak et al. [4] presented about the deep learning applications for object detection including with frameworks and services, benchmarked datasets, state-of-the-art approaches, etc. Xinrui Zou [5] presented the comparison of traditional machine learning techniques and deep learning techniques.

The research question for this paper is: Which of the existing models is the best for this application in the field of object detection? Two models for object detection based on fine-tuning the pre-trained models are compared to answer this question.

II. OBJETIVES

The main objective of this research is how to apply the existing deep learning models for an application rather than creating a new one. It gives us an effective result without requiring high computational resource.

III. METHODOLOGY

The object detection models are created by using transfer learning technique based on pre-trained models. Tensorflow object detection API is used to identify and detect objects in images. As shown in figure 2, steps are as follows:
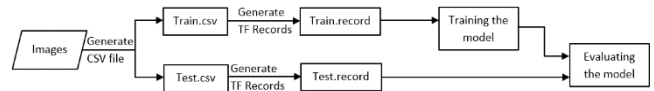
Fig. 2. Basic Flow Diagram

A. Gathering and Labeling of Data

A simple and good tool called labelImg is used to label these images. As shown in the figure 3, creating a rectangle box on the target objects is the process of labeling the images. Six labels are created. These labels consist of five vehicles and pedestrian.

Fig. 3. Labeling images by using LabelImg tool

B. Creating TFRecords files

Tfrecord files for both train and test images are needed to generate after labeling all the images and saving their corresponding XML files. Firstly, the .csv files from the XML

files are created. And then, tfrecord files are created from these .csv files according to the labels such as bicycle, bus, car, motorcycle, person and truck.

C. Training and Evaluating the model

At first, a label map file which maps an id to class name is created. The training process uses transfer learning technique which uses an already trained model to train on custom data. Faster RCNN with Inception V2 and Single Shot Detector with MobileNet V2 models are fine tuned based on the latest checkpoint that has been pre-trained on the COCO dataset. Finally, the inference graphs are generated based on the saved summary files with the highest step number after the models are successfully trained. In this way, these inference graphs can be used by applications that want to run these customized models.

IV. RESULTS AND DISCUSSION

Training dataset contains 881 images and testing dataset contains 378 images. The training processes are done over five thousands iterations. To evaluate the accuracy of these models, COCO evaluation metric is used. A mean Average Precision (mAP) evaluation metric is used when evaluating object detector performance. This value shows that how accurate the detection is over the images. Table 1 presents the mAP for each of the customized models.

Table 1. Mean Average Precision of Different Customized Models

Customized Model	mAP
Faster RCNN with Inception V2	0.556
Single Shot Detector MobileNet V2	0.267

Table shows that Faster RCNN with Inception V2 customized model is more precise than Single Shot Detector with MobileNet V2 customized model in detecting objects for this application. A few of the results produced by these models are shown in figure 4 and figure 5.
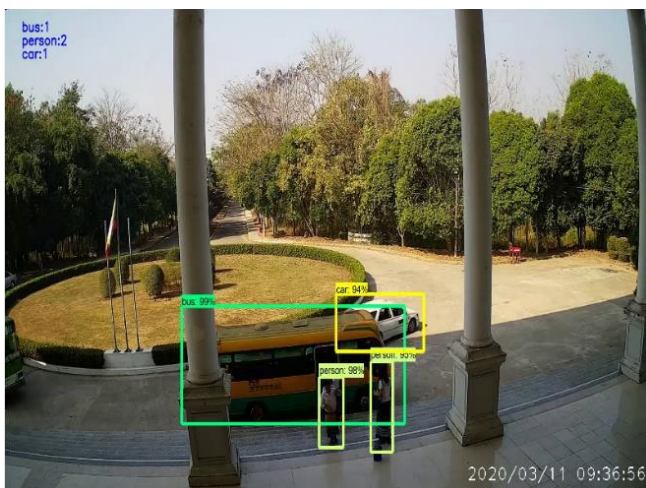
Fig. 4. Detection Result of Faster RCNN with Inception V2 customized model
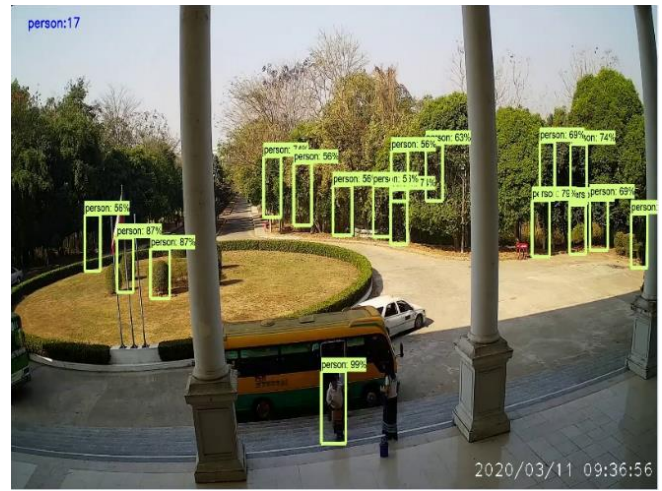
Fig. 5. Detection Result of Single Shot Detector with MobileNet V2 customized model

V. CONCLUSION

The deep transfer learning technique is implemented by using already trained models such as Faster RCNN with Inception V2 and Single Shot Detector with MobileNet V2 models. The application is implemented by using PC with Intel i5 processor. The results suggest that fine tuning the Faster RCNN with Inception V2 model gives better results than fine tuning the Single Shot Detector with MobileNet V2 model according to the mAP.

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

COVID-19 Outbreak Forecast Model using FbProphet

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Abstract — **The novel Corona virus, COVID-19 is a threat to the whole world at present. It has impacted economies, and the livelihood of countries and the people in them. Despite health precaution measures implemented around the globe the spread of this virus is still on the rise. This study aims to predict the number of confirmed individuals and deaths by the corona virus. The research is mainly focused on predicting time-series data using FbProphet forecasting model. The result helps the health institutions and the public on the understanding of the impacts and influence of the corona virus in their life and the importance to control its spread.**

Keywords — COVID-19, Corona, FbProphet

I. INTRODUCTION

The recent threat to global health is the outbreak of the novel Coronavirus. The global pandemic Coronavirus disease 2019 (COVID-19), was reported in December 2019, in Wuhan, Hubei Province in China. Since then the disease has been spreading throughout the globe driving the whole world under risk. From December 2019 to till September 30th 2020, the virus has affected around 213 countries or territories [1] with nearly 33, 844, 926 confirmed cases identified and more than 1, 012, 677 deaths all around the world have been reported [2]. The number of individuals being tested positive for COVID-19 is laddering up which has put medical doctors into a struggle to immediate invention of a vaccine that would control the spread of virus. The governments, World Health Organization along with the medical experts all around the world are on the run to minimize the spread of the virus by adopting several surveillance methods, PCR tests, tracking the individuals who have been tested positive and their movements, thereby sending for quarantine and self- isolation for a certain period of time or by predicting the impacts that would be caused by the virus.

This research studies time-series forecasting of the number of corona virus individuals who will be tested positive as well as the number of deaths that would occur due to the spread of the disease all around the globe, which would help the medical experts as well as the public to understand the severity and impacts that would be caused by the virus.

The methodology in section 3 clearly describes the method employed for the research work. It is mainly of four steps as: data collection, data visualization, building the forecasting model and making the predictions. The results and discussion in section 4 presents the results from the study conducted. The results are given as a comparison between the actual and predicted values of confirmed and death cases on a selected date.

II. OBJECTIVES

The proposed study on forecasting the COVID-19 outbreak aims to predict the number of confirmed cases and fatalities that would occur in the next 365 days by the spread of the Corona virus using FbProphet model. The study also aims to make the public aware of the consequences of not following the health safety measures.

III. METHODOLOGY

The methodology adopted forecasts the outbreak of COVID-19 globally based on two aspects: global confirmed cases and global death cases for the next 365 days starting from 2020-08-24. FbProphet model is used for forecasting, which is a time series prediction algorithm.

The flow diagram in Fig. 1. illustrates the proposed methodology. The process consists of four significant phases such as:

i. Data Collection
ii. Data Visualization
iii. Build the Forecasting Model
iv. Make Predictions
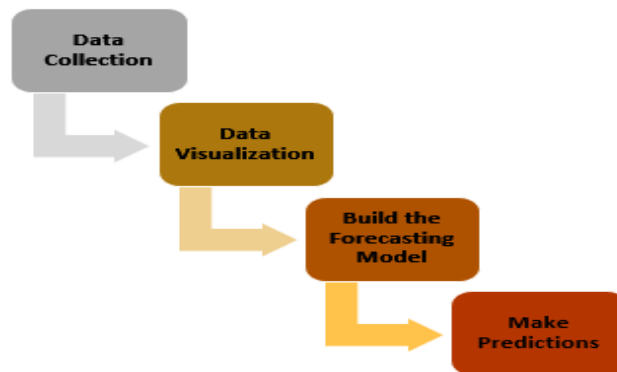
Fig. 1. The flow diagram of the proposed methodolgy

i. Data Collection

The most recent COVID-19 outbreak epidemical data on a daily basis are collected from the data repository operated by Johns Hopkins University center for Systems Science and Engineering (JHU CSSE) [3]. The total of globally confirmed and death COVID-19 cases from 2020-01-22 to 2020-08-24 were collected.

ii. Data Visualization

To have a clear understanding on the dataset used, it has been transformed into a visual context. The graphical representations are generated to identify the current trends for the total confirmed and death cases of COVID-19, globally. The dataset consists a total of 192 countries around the world. A total number of 23,457,652 people have been infected by the virus and nearly 808,892 people have died because of the virus during the timeline considered.

As shown in Fig. 2. the topmost infected country by COVID-19 is US with the overall of 24.31%. Similarly, the pie chart visualized, illustrates the countries in order with the corresponding percentages of the confirmed cases they have. Meanwhile, Fig. 3. shows the visualized pie chart based on the global death cases reported because of the virus from January to August 2020. Based on the analysis the highest number of deaths are reported in United States (US) with the

percentage of 21.86%. Brazil takes the second place with 14.19%. Mexico (7.48%), India (7.11%) and United Kingdom (5.12%) are the counties next in line taking up the top most 5 countries with increased fatality rates from the global pandemic.
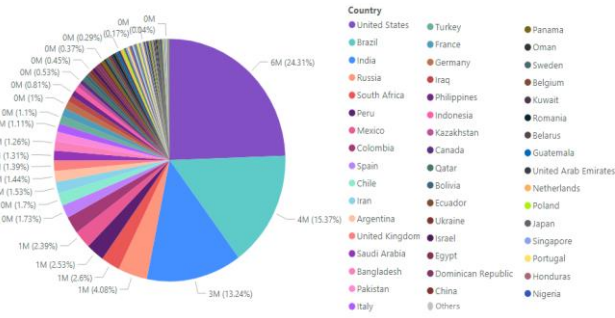
Fig. 2. The total number of COVID-19 confirmed cases with respective countries
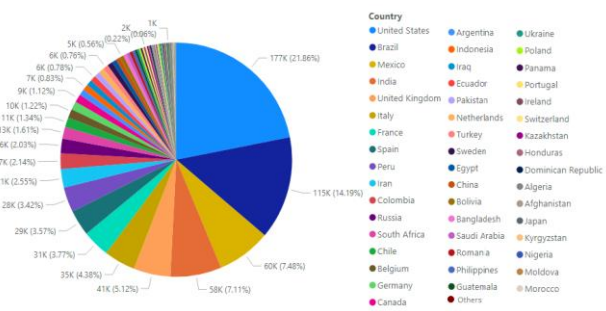
Fig. 3. The total number of COVID-19 death cases with respective countries

Further, the visulaizations confirm that the number of infections along with death are increasing globally. And from one country to another, the degree of infection varies in count. Therfore, it is understood that there is an exceptionally increasing demand for forecasting the trends and the growth pattern of this pandemic globally.

iii. Build the Forecasting Model

Based on the dataset the future impacts of COVID-19 will be forecasted considering the total confirmed and death cases from January to August worldwide. Among the prevailing algorithms that are used for data mining prediction and analysis, the adopted methodology uses FbProphet; a forecasting model developed by data scientists of Facebook for an enhanced time series prediction and unseasonal situation.

Sklearn model API is followed by FbProphet and an instance of Prophet Class is created where its fit and predict methods are called. The ds (datestamp) and y are the two dataframe columns of input to Prophet. Then the Prophet object is instantiated to fit the model. As a result of model fitting, the model will be able to learn the data and it can later be generalized to similar kind of data.

Table 1. Confirmed cases (ds,y)   Table 2. Death cases (ds,y)

Table 1. and Table 2. respectively show the COVID-19 confirmed and death dataset for the duration from 2020-01-22 to 2020-08-24. The two columns ds and y specify the date and the values considered, in a numeric form. In simple, it is a type of data conversion to a format preferred by Prophet.

iv. Make Predictions

To make predictions, a dataframe need to be created with the future dates. In context of FbProphet these are identified as periods. The periods are parameters indicating how many days to create. In the methodology adopted, the forecasting consists of 365 days as the period. Table. 3 shows some of the selected forecast dates (ds) after 2020-08-24.

Table 3. The selected forecast dates (ds)

Index	ds
188	2020-09-02 00:00:00
189	2020-09-03 00:00:00
190	2020-09-04 00:00:00
191	2020-09-05 00:00:00
192	2020-09-06 00:00:00
193	2020-09-07 00:00:00
194	2020-09-08 00:00:00

Table 4. shows the prediction of COVID-19 for the dates selected from the forecasting model. Here for each future row, a predicted value is assigned. It is given by the name yhat and is calculated based on yhat_lower and yhat_upper. The exact prediction is shown as yhat and yhat_lower, yhat_upper represents the minimum prediction and maximum prediction respectively.

Table 4. Predictions for confirmed cases

Index	ds	yhat	yhat_lower	yhat_upper
188	2020-09-02 00:00:00	1.05068e+07	2.45479e+06	1.83765e+07
189	2020-09-03 00:00:00	9.89288e+06	2.43156e+06	1.76665e+07
190	2020-09-04 00:00:00	1.02092e+07	2.82213e+06	1.77639e+07
191	2020-09-05 00:00:00	1.0618e+07	2.50816e+06	1.86283e+07
192	2020-09-06 00:00:00	1.06996e+07	2.37792e+06	1.86511e+07
193	2020-09-07 00:00:00	1.05705e+07	1.96485e+06	1.89826e+07
194	2020-09-08 00:00:00	1.07965e+07	2.64086e+06	1.85042e+07

As stated above, the forecasting model is built to predict for 365 days and these are some of the selected sample dates to demonstrate the predictions. Similarly, the predictions for death on dates selected are shown in Table 5. below. According to both predictions the number of confirmed cases along with the fatalities are increasing exponentially.

The plotting indicated in Fig. 4. and Fig. 5. illustrate the relationship between the original values and predicted for both confirmed and death cases all over the world. The actual values are shown in black dotted lines while the predicted values are shown in blue solid like lines.

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

Table 5. Predictions for death cases

Index	ds	yhat	yhat_lower	yhat_upper
188	2020-09-02 00:00:00	453279	160006	739040
189	2020-09-03 00:00:00	428459	153452	718179
190	2020-09-04 00:00:00	438882	149182	731260
191	2020-09-05 00:00:00	457788	166662	734695
192	2020-09-06 00:00:00	465110	164528	739444
193	2020-09-07 00:00:00	457107	155454	740350
194	2020-09-08 00:00:00	464766	175482	742936
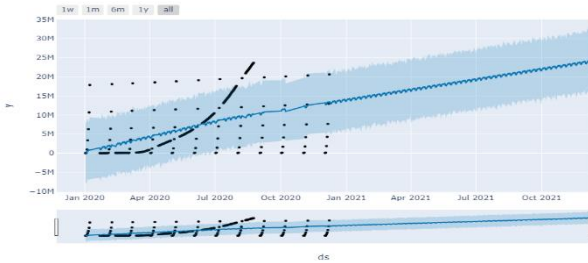
Fig. 4. The actual and predicted values for confirmed cases
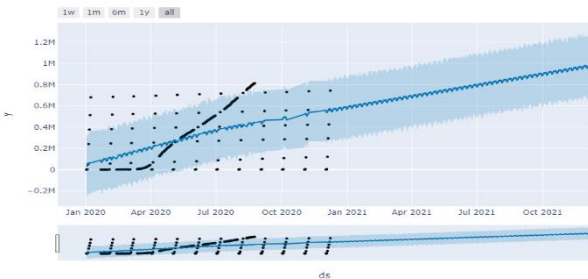
Fig. 5. The actual and predicted values for death cases

IV. RESULTS AND DISCUSSION

Confirmed and death cases from COVID-19 are the time series that are constructed from the data collected. The experiments for forecasting the trends of COVID-19 are carried out based on a selected date (2020-10-02). While taking the confirmed cases, 32.30% is accomplished on the predicted values for 2020-10-02. And on the same date 46.31% is accomplished on the predicted values for death cases. Table 6. and Table 7. respectively show the COVID-19 confirmed prediction status and death prediction status on the date chosen.

Table 6. COVID-19 confirmed prediction status on 2020-10-02

ds	yhat	yhat_lower	yhat_upper
2020-10-02 00:00:00	1.10365e+07	3.31913e+06	1.91345e+07

Table 7. COVID-19 death prediction status on 2020-10-02

ds	yhat	yhat_lower	yhat_upper
2020-10-02 00:00:00	471064	192522	772306

The actual value with predicted value comparison is done based on WHO's Coronavirus Disease Dashboard as given in Fig. 6. R-Squared and Mean Squared Error metrics were used to compare the predicted values to the actual values, which values to 0.6532 and 2.342.

Fig. 6. WHO COVID-19 dashboard on 2020-10-02

V. CONCLUSION

In this work a forecasting model for COVID-19 has been proposed to predict the confirmed and death cases of COVID-19. The obtained data is visualized as pie charts to show the countries along with the number of cases reported; confirmed and death. The time series prediction is done for the upcoming 365 days from 2020-08-24. From the percentages achieved on the predicted values, it is observed that the future works must focus on increasing the predict percentage so that the predictions become much closer to the actual values for the forthcoming days. Since data mining algorithms require a larger amount of data for model generalizations and information extraction, time series data for COVID-19 is limited. Thus, this sort of constraint is experienced while using the model to predict 365 days. As a suggestion, an effort can be given to develop a hybrid quality model for better forecasting by combining the model implemented during the research, with the other existing time series forecasting models.

The usage of FbProphet model to evaluate and predict COVID-19 pandemic is a significant challenge. As stated above, with a larger data set the actual advantage of using this model can be achieved. More importantly, the model can be used to target the peak values of the pandemic which can assist the public health strategy of flattening the curve in controlling the COVID-19.

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An Ontology-based Knowledge Sharing Portal for Subfertility in Humans

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Abstract — **Subfertility is called failure to conceive after unprotected and regular sexual intercourse for 12 months. Subfertility depends on male and female factors. Males need to check first and after that females need to check for subfertility factors. Decision making is critical in the treatment method of subfertility. So, ontology modeling will help in decision making to diagnose causes and treatment methods easily. It is designed and developed to support doctors, medical students, and researchers. The ontology model is designed by using the Delphi method. Data collected with the discussion of one doctor and four medical students. The ontology model is evaluated and validated by tools OOPS! Evaluation editor, DL query & SPARQL Query, and ontology experts. Future work is planned to develop a decision support system for the subfertility of the female.**

Keywords — subfertility, fertility treatment, ontology

I. INTRODUCTION

Management of subfertility needs a common definition of subfertility and infertility. Subfertility is a failure to conceive after regular and unprotected intercourse for 12 months. In basic, the Age of the female depends on fertility but not on the male's age. Doctors check for the causes of subfertility and treat them. If the patient didn't conceive anymore then they have infertility. The female factor is a vast area than the malefactor. So, Males need to check for the causes very first, and after that only females need to check [1].

Subfertility in humans is a large area and critical in the gynecological field, doctors couldn't take actual decisions without past histories, treatments, tests, and also medical students facing a lot of doubts when learning the subfertility area. So, this domain was selected to develop a knowledge-sharing model for the domain experts. Ontologies are one of the powerful mechanisms used for the representation of knowledge and decision making in the semantic web [2]. Domain knowledge is depicted using ontology which is machine interpretable. It can be used for establishing a common conceptualization to facilitate store, share, retrieve, decision making, and representing knowledge. The ontology model has classes, individuals, and relationships between them. Relationships are depicted using object properties and data properties. Restrictions are used to increase the accuracy of depicting relationships [3].

Quality of ontology closely depends on its validity which will prevent the application from using inconsistent, incorrect, redundant information, enhancing the quality of information. Thus, validation and evaluation of ontology is a key factor. But there was no exact methodology to evaluate this ontology. It depends on the purpose, aspect of which ontology trying to validate [4].

Human's subfertility ontology developed using Protégé Ontology Editor 5.5. . Web Ontology Language (OWL) is used to implement all concepts and relationships in the subfertility domain. Evaluation of the developed ontology is evaluated using the FACT++ reasoned of Protégé ontology editor 5.5. By using the reasoned, DL queries used to check the correctness of the ontology also SPARQL query is used for evaluation using Jena API. The ontology model validates by ontology experts and the domain validated by domain experts [5].

Research questions are considered as the research gaps for the selected topic or the analysis of the selected topic. Many research questions need to be analyzed on the topic of "An Ontology-based Knowledge Sharing Portal for Subfertility in Humans". The following research questions lead to this research.

- **RQ1:** What is the current status of knowledge dissemination in the context of subfertility?
- **RQ2:** How ontology modeling can be used to the decision-making related to subfertility and in future works?
- **RQ3:** How the evaluation process of the designed ontology model can be carried out?

This paper is about the presentation of an ontology model for decision making in the treatment method of the human subfertility domain.

II. OBJECTIVES

The main objective of this research is to design an ontology model for the treatment method of human subfertility and evaluation & validation of developed ontology. This research aims to contribute to treatment method in the human's subfertility in hospitals by developing an ontology-driven solution that organizes, describes, and helps to decision making clearly in the domain and medical students also can get knowledge by developing an ontology-driven solution that describes all the diagnosing causes and treatment method from top to the base level. This would help the researchers to reuse the ontology and for future works.

III. METHODOLOGY

Some methods were used to design ontology modelings such as Grüninger and Fox's methodology [6] and the Delphi method [7] in the literature review. We have selected the Delphi method to get more accuracy and agility. Fig. 1 describes the methodology of developing an ontology model of human subfertility.

In the scratch, data collected by the discussion between one doctor, four medical students, a researcher, and also from the books [8] which are provided by them. Other than that, we checked all the data collections from the below experts were correct or not using trustable sources received from the experts. All the details were categorized under appropriate classes, and individuals were integrated. All the categorized and integrated details were given to doctors and medical

students. Domain experts evaluated those details after that revised again in an iterative manner and rectified all the corrections.
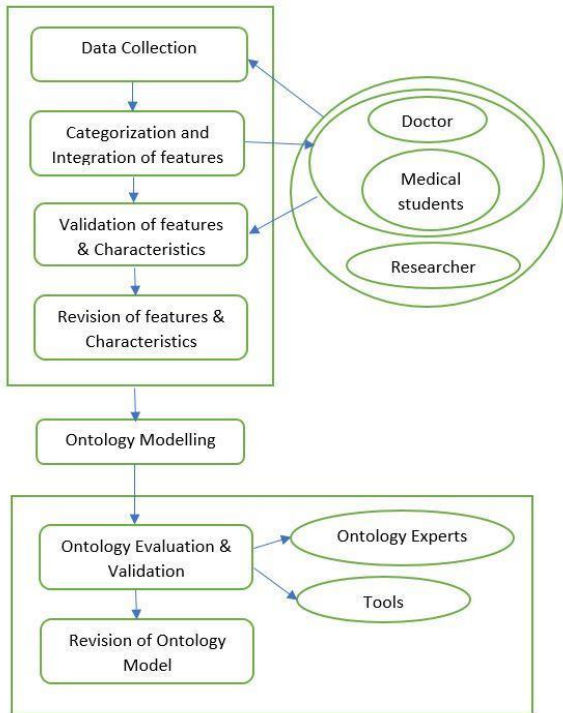
Fig 1. Methodology for Ontology Modelling

By using the ontology modeling knowledge, Ontology is designed using Protégé Ontology Editor 5.5. After that, the Ontology model is evaluated by OOPS! Evaluation Editor. All the pitfalls were identified and also rectified by the researcher, FaCT++ reasoned is used for reasoning and DL Query used to check the correctness of the ontology modeling and relationships. SPARQL Queries also used to check the ontology model. Finally, two ontology experts validated the ontology model, and corrections were rectified.

IV. RESULTS AND DISCUSSION

Human's subfertility treatment method ontology models developed ontology using Protégé Ontology editor 5.5. Developed Ontology's part of the Ontograf shown in Fig 2.

The evaluation and validation have been done separately. FaCT++ reasoner is used to validate the correctness and quality of developed ontology. OOPS! The ontology editor used to find the critical, important, minor pitfalls and all the critical errors were rectified. Figure 3 shows the OOPS! Evaluation results of developed ontology.

Ontology is validated by DL Query using the FaCT++ reasoner. Some of the DL queries and the answers are shown in Table 1 by the collection of competency questions created by the researcher.
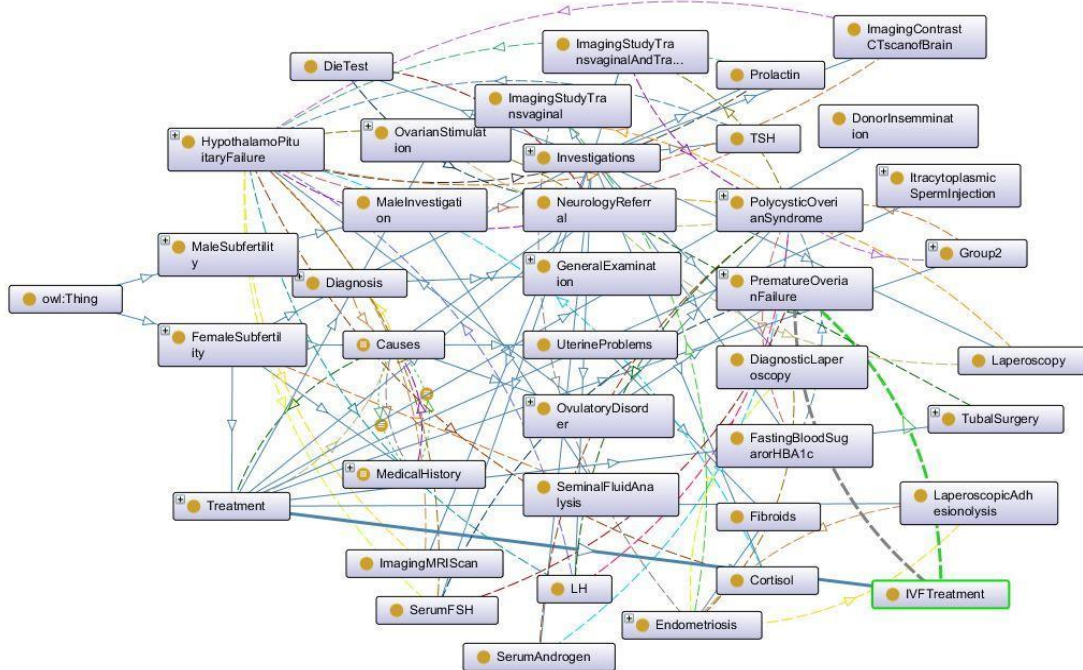
Fig 2. Part of the ontology's ontograf

Evaluation results

It is obvious that not all the pitfalls are equally important; their impact in the ontology will depend on multiple factors. For this reason, each pitfall has an importance level attached indicating how important it is. We have identified three levels:

- **Critical** 🔴 : It is crucial to correct the pitfall. Otherwise, it could affect the ontology consistency, reasoning, applicability, etc.
- **Important** 🟠 : Though not critical for ontology function, it is important to correct this type of pitfall.
- **Minor** 🟡 : It is not really a problem, but by correcting it we will make the ontology nicer.

[Expand All] | [Collapse All]

Results for P04: Creating unconnected ontology elements.	1 case | Minor 🟡
Results for P07: Merging different concepts in the same class.	4 cases | Minor 🟡
Results for P08: Missing annotations.	126 cases | Minor 🟡
Results for P10: Missing disjointness.	ontology* | Important 🟠
Results for P11: Missing domain or range in properties.	1 case | Important 🟠
Results for P13: Inverse relationships not explicitly declared.	1 case | Minor 🟡
Results for P21: Using a miscellaneous class.	1 case | Minor 🟡
Results for P22: Using different naming conventions in the ontology.	ontology* | Minor 🟡
Results for P41: No license declared.	ontology* | Important 🟠

Fig 3. OOPS! Evaluation Results.

TABLE I. Dl Queries and Answers

Competency Questions	DL Query	Answers
What are the treatment method for Tubal Disorder Cause?	TubalSurgery and hasSurgeries only TubalSurgery	Labaroscopic_Tubal_Surgery Surgery_for_hydrosalpinges Tubal_catheterisation_or_cann ulation Tubal_microsurgery
What are the medical history that helps to find Tubal Disorder?	TubalDisorder and is select some MedicalHistory	Scar_Tissue Pelvic_Inflammatory_Disease History_of_Gonorhea_or_Chla ymydia

V. CONCLUSION

Female subfertility is a vast area than male subfertility so males need to check first. That is the norm in the medical field. If they don't have any causes then doctors can move to female subfertility. Doctors and medical students have many confusions about decision making. So, this ontology modeling will help in decision making in diagnosing causes and treatment methods.

Human's Subfertility domain ontology designing is a tedious task. The female subfertility domain is more tedious than male subfertility designing. This research is about the decision-making of the partners who have a problem and go further diagnosis and treatment using this ontology model.

Human subfertility ontology can help in the gynecological department and also researchers can use this ontology model for their further research. In the future, we are going to develop a decision support system that helps to make decisions in their field to doctors and medical students easily.

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Fetal Head Detection in 2D Ultrasound Images using Deep Learning

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Abstract — **Automatic fetus head's boundary detection in the ultrasound image is a very challenging task due to the formation of intensity profile of the image. Ultrasound images are mostly affected by speckle noise and does not show a smooth intensity variation. A computer-based assistance system for the calculation of gestational age of the fetus is useful for the practitioners. Gestational age is a key quantity for an analysis about the baby's healthy growth which is calculated from the fetus head circumference. In this study, a deep learning-based solution is proposed where the layers and the parameters are adjusted in the U-Net architecture to maximize accuracy of the localization of the head region. There after the extracted contour is used to fit an ellipse and measure the age. The algorithm is trained with 899 images and validated with 100 images. Testing results on 335 images reveals promising with almost 100% localization accuracy and 88.96% specification. Detection of small size fetus is affected by the very closest similar intensity pattern. It will be addressed in the future**

Keywords — Gestational age, Deep learning, Fetus head, Ultrasound image

I. INTRODUCTION

Medical imaging modality such as X-ray, MRI, CT, and Ultrasound are playing a critical role in the assessment of several internal organs of a human body. In this regards US imaging is largely adopted in the medical field since it is non-invasive, low cost, and ability for real time scan. Ultrasound image is affected by several factors such as instrument noise, environment noise, background tissues, other organs, and breathing motion. Still, it is preferred for the scanning during prenatal stage.

Assessment on the fetus growth during the prenatal stage is necessary to determine the abnormalities in the development. Gestational age (GA) is one of the biometric measurement used for this assessment. For the calculation of GA, the ellipse parameter extracted from the ellipse that is constructed with the help of the fetus's head circumference (HC) which is extracted from the Ultrasound scan image. The manual examination on the Ultrasound image for the HC is a very tedious task and needs skilled persons. Therefore, an automated system for the GA calculation is useful, which can able to reduce the errors and tiredness during the examination of Ultrasound images.

The process of automatic calculation of GA has several stages where the HC is localized through the segmentation or machine learning or deep learning. Then an ellipse is fitted with the help of contour of the HC. The accuracy of GA depends on the precise segmentation of HC. Image processing based algorithms such as threshold based approaches [1, 2, 4], feature based localization methods such as Haar like features [1, 6], Hough transform [2, 5, 6] are not preferable if the image quality is largely affected by noise. Also, if there are variations in the continuous intensity pattern it will not produce good results. Therefore, researchers wish to make use of learning based methodologies for the HC segmentation in Ultrasound image. Machine learning approaches are good if a large number of samples are available for the training and need more time for learning. Recently Deep learning method such as a convolutional neural network (CNN) [7, 8, 9, 12, 13, 14] becoming popular in semantic segmentation. Among the available network model, U-net [9, 10, 11] is the most preferable for feature extraction and classification in medical images.

In this research study, the U-net is employed for the segmentation of the HC in the Ultrasound image. It is examined the influence of number of layers in U-net and the image size to precisely localize the HC.

II. OBJETIVES

Main objective of this study is to develop a simple deep learning architecture to localize the head region of the fetus in ultrasound image with high accuracy and fit an ellipse around the segmented head region to measure the circumference and gestational age.

III. METHODOLOGY

The U-Net architecture has proven to be excellent for medical image analysis. Thus in this work, CNN with U-Net is utilized for the HC detection. The number of layers is five and each layer has two convolutions and one max pooling. The convolution features of down_sampling layers are concatenated with the same level of the up_sampling convolution layer to improve the detection accuracy. Figure 1 shows the framework of the U-Net.
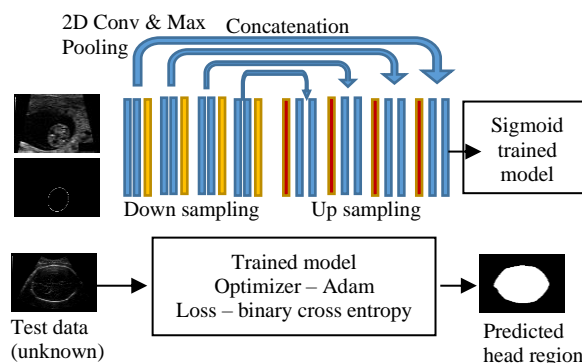
Fig 1: Implemented U-Net for the HC detection.

IV. RESULTS AND DISCUSSION

The proposed framework is trained using 899 Ultrasound images and validated with 100 images. For the testing, 335 Ultrasound images are used in this study. All the data are download from publicly available database. The python program is executed in normal CPU computer (1.8 GHz, 8 GB

RAM, 64 bit OS) and the epochs are set to 10. The total time taken for execution is around 30 min.

Qualitative results: The proposed framework successfully identifies the fetal head region from the un-annotated ultrasound images. Figure 2 shows the visual evidence for the head region localization by the U-Net architecture.

Original US image	Predicted region	Region contour and ellipse
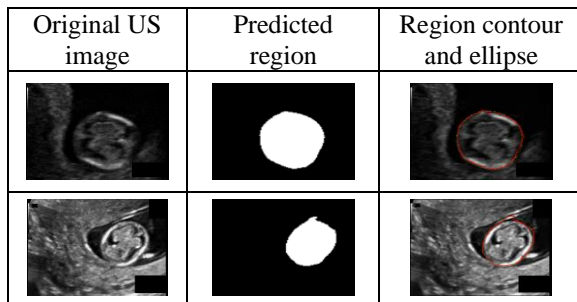
Fig. 2: Visual examples of the predicted HC region in unknown data. Left – original image, Center – predicted region, right – the contour and ellipse are drawn on the image. Red line – contour, green – ellipse. It is viewed clear in large scale image**.**

Quantitative results: For the quantitative analysis, every predicted region is visually inspected and counted as a correct prediction (TP) if the fitted ellipse goes along with the Head boundary region. If the predicted region is larger than or smaller than the true head region is counted as true negative. It is tested on 335 un-annotated ultrasound images. Therefore,

$$TP = 298$$
$$TN = 7$$
$$Sensitivity = TP/(TP + TN) = 88.96\%$$

The proposed U-net architecture has a sensitivity of 88.96%. On the other hand, the predicted region almost covers the fetal head region. The only thing is over detection and under detection. It will be further improved by adding post refinement process on the predicted region. True negative cases are shown in Figure 3.
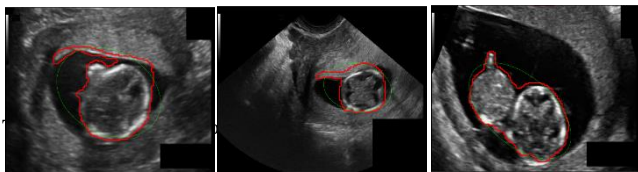
Fig. 3: Example for true negative cases.

The literature reveals that the HC localization in ultrasound images is a challenging task due to the shape and intensity variation of the fetus. Threshold based methods are good if the border information is very clear and no other tissues show the bright intensity. But Ultrasound image is affected by several factors such as instrument noise, environment noise and background tissues. So it would not able to accommodate the intensity variations of the head region. Feature based localization methods has the same issue as in the threshold based methods.

The proposed deep learning based U-net architecture gave a promising result of the localization of the head region with five layers and modified parameters.

V. CONCLUSION

In this study, a deep learning approach with modified U-Net architecture is proposed for fetal head segmentation in ultrasound images. It successfully segments the head region with 88.96% of sensitivity. Further, the true negative cases almost cover the actual region. There will be a further study for the improvement of accuracy. Here the preliminary results are reported. The initial results are promising which implies that it can be improved further in future studies.

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Standardized Fourth Central Moment Based Three Step Algorithm for Fetal Movements Identification

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Abstract — **Fetal movement monitoring, one of the simplest methods of accessing fetal health lacks extensive studies beyond ultrasound or MRI scans, which are mainly conducted in a clinical setting. This study presents an algorithm which could identify fetal movement count using accelerometric data to measure the fetal well-being. The three-step algorithm includes a preprocessing step using kurtosis, Non-Negative Matrix Factorization followed by spectral clustering. It can be observed that this algorithm has the capability to differentiate fetal kicks from other artefacts with 96.55% accuracy.**

Keywords — Fetal movement, kurtosis, NMF, Spectral Clustering

I. INTRODUCTION

There is a limited number of methods practiced in gynecology to assess fetal health. One of the most common practices is to perform ultrasound scans. However, the long-term effects of ultrasound exposure have not yet been evaluated through generations. Hence it should be used with caution [1]. Another practice is to conduct a MRI scan. Both of these can only be conducted in a clinical setting and several restrictions are present [2]. Therefore, these types of scans are conducted scarcely throughout the pregnancy. Hence there is a huge vacant space for self-monitoring and practical systems to access the fetal well-being.

Fetal kick count is a standard procedure recommended by professionals to keep track of well-being of the fetus [3]. There are several recorded instances where a reduced number of fetal movements has been a prior indication of stillbirths and other adverse effects [4]. A standard practice is for the pregnant mothers to count the fetal movements themselves and notify their obstetrician of any change in pattern. Even though this practice has been done for a long time it is not the most reliable method available [5]. Studies have shown that the sensitivity of each mother in identifying fetal movement differ from each other. Also, trying to manually monitor the fetal movement pattern can cause psychological distress in mothers. For these reasons, it is mandatory to have a rudimentary approach to access these fetal kicks without any human intervention.

In current literature, there have been several attempts to recognize these fetal kicks using most elementary machine learning techniques [6][7]. In several types of research, they have extracted accelerometric signals corresponding to fetal kicks as felt by the surface of the pregnant mother's abdomen and implemented different algorithms such as threshold-based methods and time-frequency domain analysis. However, some algorithms failed to yield a satisfactory accuracy, while some algorithms proposed were too complex for standard commercial use. [8][9].

II. OBJECTIVES

In this research our intention is to produce a model where machine learning techniques like non negative matrix factorization and spectral clustering are applied to accelerometric signals which are extracted from mothers abdomen in an non-invasive manner. From that we aim to generate an optimum algorithm in order to generate a highly accurate and effective fetal movement detection method which will be helpful for pregnant mothers as well as doctors to ensure the well-being of the fetus.

III. METHODOLOGY

In this paper, we utilized the data set Fetal Movement Detection Dataset Recorded Using MPU9250 Tri-Axial Accelerometer [10]. This dataset includes observations from 13 pregnant mothers. The data was collected using the sensor MPU9250. It consists of raw time-domain data from a triaxial accelerometer and a triaxial gyroscope. Also, the instances a fetal movement occurred and the instances where other artefacts such as mother's laugh occurred were noted.

The gyroscope measures the rotational motion in three principal axes where the accelerometer measures the incident acceleration or the vibration along each axis.
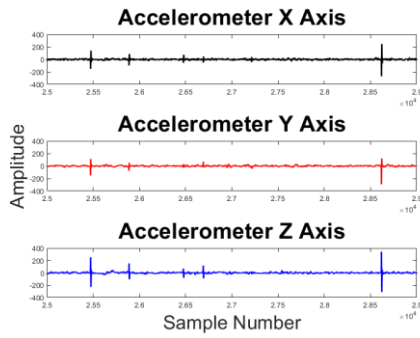
Fig. 1. Accelerometer data along three axes
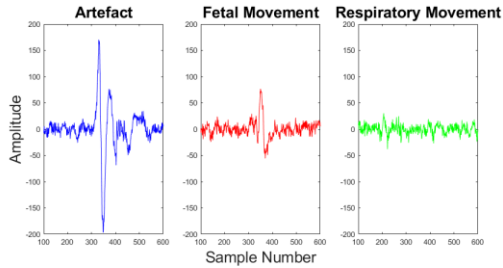
Fig. 2. Realization of artefact, fetal movement, and respiratory movement

Fig. 3. Cluster signatures obtained after the two-step method

Fig. 4. Kurtosis values obtained for each realization

Since the type of movement, we are attempting to classify is a fetal vibrations incident on the mother's abdomen it was decided to use the data from the accelerometer to develop the algorithm. The acceleration along three principal axes for few realizations are shown in Fig. 1.

It can be observed in the figure that the impact of fetal movement on Z-Axis is significantly more notable than the effect on other axes. Hence it was decided to use the data along the Z-Axis to conduct analysis. As it can be observed in Fig. 1, The signal is highly random with fetal kicks, mother's breathing movements and other artefacts from the mother's bodily movements. Due to these reasons, our primary focus was to develop an algorithm to classify the signal segments into three classes. They are fetal movements, other artefacts and mothers respiratory movements. For this initially, the raw signal was split into small realizations assuming the data given in the dataset to be the ground truth about the occurrence of fetal movements and other artefacts. A single realization of each class is shown in Fig.2.

When analyzing each realization initially the Short-Time Fourier Transform was applied. Then Non-negative Matrix Factorization was used to reduce the dimensionality of the data. This is done to reduce the computational power used. In general, a non-negative matrix can be represented as a multiplication of two low rank non negative matrices by utilizing Non-negative Matrix Factorization [11]. The matrix decomposition of Non-negative Matrix Factorization is shown in "Equation 1".

$M \approx AS$; where $M, A, S > 0$ (1)

M M : Input Spectrogram A A : Bases Matrix

S S : Abundance matrix

The resulting bases matrix A was assumed to have signatures specific to each class. Hence the bases matrix was used as the input for the spectral clustering algorithms which was formulated in-house [12]. The results obtained by this are shown in Fig.3.

The cluster signatures of each class after applying spectral clustering can be observed in Fig. 3. It can be observed that while the cluster signatures of artefacts are isolated from other cluster signatures, the cluster signatures of fetal movements and mothers' respiratory movements are overlapping each other. This is not a favorable result. Therefore, it was decided to include a preprocessing step to eliminate mothers' respiratory movement realizations. For this further analysis of mothers' respiratory movement signals were conducted.

When further analysis on mothers' respiratory realizations were made, it was observed that it has a close resemblance to White Gaussian noise. One of the simplest analysis methods to identify White Gaussian noise is to compare the value of the Standardized Fourth Central Moment, which is also referred to as the kurtosis. Hence a simple kurtosis calculation was carried out on all realizations and the results obtained are shown in Fig.4.

As it can be seen in the Fig.4 the kurtosis values of mothers' respiratory movement realizations are vacillating around 3 where kurtosis value of fetal movements and other artefacts have different values. Therefore, a simple kurtosis calculation was conducted as a preprocessing step where a threshold was set to remove mothers' respiratory movement realizations. Then the remaining realizations which contain predominant variations were analyzed following the same procedure mentioned above. And the resulting cluster distribution is shown in Fig.5.

It can be observed in Fig.5 that the previous overlapping is not present. Hence fetal movement realizations and other artefacts can be classified with higher accuracy.
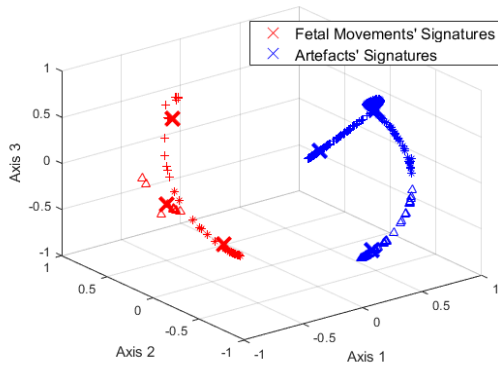
Fig. 5. Example of a presentation of data in a pie chart

Finally, remaining realizations were used to test the algorithm. When testing the Euclidean distance from a signature point to the test signal point is measured and grouped into a relevant group with minimum distance.

IV. RESULTS AND DISCUSSION

Two algorithms were implemented on the data set to classify fetal movements. Initially, a two-step method was implemented where a Non-negative Matrix Factorizations was conducted and the resulting Bases matrix was fed into a spectral clustering algorithm. But as seen in Fig. 3 there is an overlap between mothers' respiratory movement realizations and fetal movement realizations. This can result in increasing the false positives. In our application, an increase in false positives pose a huge threat to fetal health. When a false positive occurs the algorithm will identify that a fetal movement has occurred where in reality no fetal movement has occurred. This can lead to the mother to believe that the fetus is moving where it is not. This in turn will result in the inability to consult an obstetrician promptly. However, true negatives can lead to superfluous consultations, which are undesirable but do not cause much harm to the fetus.

As a solution for the issues a three-step method including a preprocessing step to remove mothers respiratory movement realizations was implemented. The resulting confusion matrix can be observed in Table 1. As it can be observed in the confusion matrix the preprocessing step was able to identify 89.41% of mothers' respiratory movement realizations and the remaining algorithm was able to identify 96.55% fetal movements accurately. Also, the algorithm has identified 9.41% of mothers' respiratory movements and 11.11% of other artefacts as fetal movements.

V. CONCLUSION

Table 1. Confusion matrix for the three-step method

	True Category		
	Fetal Movement	Respiratory Movements	Other Artefacts
Fetal Movement	96.55%	9.41%	11.11%
Respiratory Movements	0.00%	89.41%	0.00%
Other Artefacts	3.45%	1.18%	88.89%

In this research two methods to analyze accelerometric fetal movement data detection were compared. It was observed that while the two-step method performed poorly by adding a simple preprocessing step the accuracy of the algorithm was improved comparatively. Therefore, it can be concluded that fetal movement can be identified by applying the above mentioned three-step algorithm to accelerometric data. However, further studies are required to analyze the behavior of fetal movement in larger populations.

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A Mobile Base Application for Cataract and Conjunctivitis Detection

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Abstract — **With time the life patterns of humans have evolved at a rapid space. Today, it has come to a point where people are opting to put their health status behind other priorities in life. A contemporary example is the spreading of the COVID-19 virus. One of the other significant health issues faced by the present-day community is illnesses related to the eyes. However, unlike other health issues, most of the eye diseases can be cured with proper attention. Cataract and Conjunctivitis are identified as two of the main eye diseases faced by a mass amount of people around the world. If left untreated, these diseases can even lead to blindness. As a matter of fact, Cataract has been reported as the first cause of blindness by the world health organization. Typically, the detection of these diseases is done by an ophthalmologist with the use of a special medical equipment. Thus, the channeling of an ophthalmologist has become a mandatory requirement for the detection of these diseases. In addition, the availability of medical equipment and medical officers is deficient in rural areas. Thus, as a solution for the above-mentioned issues, it was decided to propose a mobile-based application, Eye Plus, for the detection of Cataract and Conjunctivitis diseases. Using Eye Plus, one would be able to test his/her eyes at a convenient time in any place for a zero cost. In addition, it provides additional information related to Cataract and Conjunctivitis diseases. Another special feature of the application is the ability to operate it without the help of another party. At present, the application achieved a success rate of 83.3% for a collection of 150 images.**

Keywords — Cataract, Conjunctivitis, Image Processing, CNN, Keras, TensorFlow

I. INTRODUCTION

Due to the rapid increment in technology, most modern society people suffer from eye illnesses. Nevertheless, patients are reluctant to wait in the queues in hospitals because of their busy schedules. To minimize eye illnesses, we introduce a mobile application where users can check their eye illnesses on their own at home. This application is mainly focusing on two illnesses, namely Conjunctivitis and Cataract which tries to identify those illnesses by using Image Processing and Deep Learning techniques. Currently, Sri Lanka can find a few localized web and mobile applications to detect eye illnesses. Most of the existing applications (such as Eye test, Eye Exercises-Eye Care Plus, and Macular Test) mainly focus on improving the user's medical and scientific skills. They mainly focus on detecting color blindness, eye exercises, Shortsightedness, and Nearsightedness. For Shortsightedness and Nearsightedness patients are required to read Jaeger charts placed in measured distance away from them. In smartphone solutions, the user cannot maintain that distance. Thus, it is hard to get an accurate result from a mobile application for such diseases.

II. OBJECTIVES

The main objective of the research is to introduce a mobile based application to detect Cataract and Conjunctivitis diseases of a person. Accordingly, the sub-objectives of the research as follows:

1. To allow a user to test for Cataract and Conjunctivitis illnesses:
   - At a convenient time for him/her.
   - From home or any preferred place without having to go to the eye-clinic or hospital.
   - Without having to pay additional charges such as channeling and doctor fees.
2. To provide additional information related to Cataract and Conjunctivitis diseases.
3. To provide a user with the ability to operate the application without the help of another party.

III. METHODOLOGY

Image processing and deep learning methods are used for the detection of eye illnesses. Deep learning is a branch of machine learning, and deep learning methods can generate results better than human experts. Convolutional Neural Networks and Deep Neural Networks are some of the main deep learning methods used in various fields like medical imaging and search engines [6]. Google's TensorFlow is one of the main libraries that can be used to build deep learning models. This system builds the TensorFlow model by using Keras library. Keras consists of an interface for use cases. Google's TensorFlow provides good performance using Keras high-level APIs and fast debugging. This process is used for classification, understanding, and prediction. The methodology that was used to obtain the desired output can be broken down into the three stages as follows:

A. Image preprocessing and segmentation.

This concept is used to remove the noise from images. The mobile application captures the user's eye images and uploads that image to the server. In order to detect and crop eyes, Haar-Cascade files were used. At first, the server-side needs to remove the noise of the image. A clear eye retina images need for data extraction [1]. Noise is a random variation of the image intensity and noise visible as part of the grains in the image. The image can be affected due to light or thermal energy of the heat. This heat can occur with image sensors. In this research, eye image capturing is done by a mobile camera.

Input can be an image or sequence of images, and output may be a set of parameters associated with the image. Contrast is one of the main features of image processing. It improves the clarity of objects by enhancing the brightness between the foregrounds and backgrounds. This process accommodates the corresponding brightness and darkness of objects, and it improves object visibility and clarity. The image processing technique's main function is to increase the image quality to make differences in the outcome of the image. Due to high image size fluctuation, all the images

require to be downsized to a size of width 50 pixels and height 50 pixels. Fig.1 shows the condition of the image before and after pre-processing.
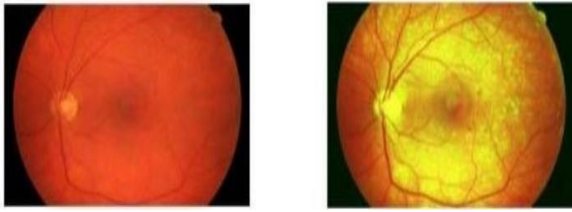
Fig. 1. Image before pre-processing and after pre-procesing

B. Feature Extraction and Classification.

A Convolutional neural network (CNN) is a sub-part of Neural networking, which can introduce as very useful in image recognition and the classification. This application uses a pre-trained models to detect Cataract and Conjunctivitis with Cataract, Conjunctivitis, and normal eye image sets. The trained models include class objects to read images as input [4].

The feature extraction process needs to be cross-checked by using another method called G-filter. The G-filter method is used to overcome the reflection and uneven illumination interference [5]. The model reads the image dataset as input, and subsequent layers of convolutional neural networks process that. The batch technique is used to train the neural networks that standardize the input images batch layer-wise. This process decreases the count of numbering training epochs required to train the network. 2D Convolutional layer implements a convolution kernel that involves with input layer and produces output tensors. Max-pooling process down-samples input image to minimize image dimensions. This process allows making predictions about the features which are contained in the sub-reigns. Pooled map and flattened obtained in the featured map. The matrix of the pooled feature map is transformed into a single column using flattening. Further, for processing, fed to the neural network. Dense layer use for adding a fully connected layer to the neural network. Fig. 2 shows CNN model architecture of the system.
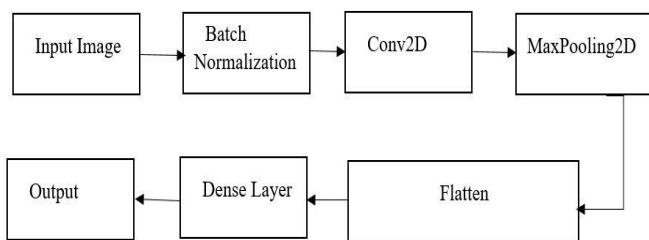
Fig. 2. CNN Model

The model is supposed to detect the class of the input image. The system creates a model or a binary classifier to make predictions. The testing image data set is not the same as the training model dataset. The training model may contain the unimportant features. This situation can make an over fitting issue. To avoid this issue, we need to keep a portion of the dataset separately from the training procedure. After the training phase is completed, the model can make predictions for new images. Fig. 3 describes flow diagram of the model.
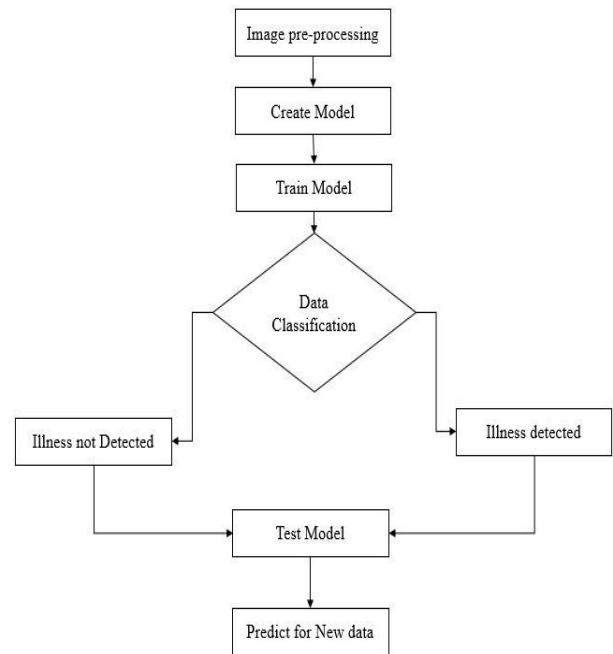
Fig. 3. Model Flow Diagram

C. Finalize output

For the output, finalization considers image extraction output, and the questionnaire answers output. The mobile application provides questionnaire interfaces to users. These questionnaires are based on the physical symptoms of Cataract and Conjunctivitis. Tearing, burliness, and light vision are some of the Cataract's physical symptoms. These symptoms cannot catch by images. An accurate final output always requires both image extracted data and physically gathered data. Eye burning, tearing, itching, and paining are some of the physical symptoms of Conjunctivitis. The eye specialists are involved in organizing support questionnaires. According to the server signal after the data classification analysis, the mobile application provides a user's questionnaire interface. The questionnaire interfaces contain questions about main symptoms like itching, tearing, and eye painting—each of these questions assigned a weight value. By analyzing the user's answers and according to the weights of the questions, finalize the output. The final output depends on these questionnaire output and image feature extraction output. After the image analyzing process completes, the server sends the output signal to the mobile application. The mobile application analyzes both results and finalizes the eye condition.

Additionally, the application provides eye specialist doctor details, some home remedies as well as eye specialist details base on the eye illness. Moreover, it displays relevant nearby hospitals. Fig. 4 shows the overall system diagram including application-side functions and server-side functions.

IV. RESULTS AND DISCUSSION

Measuring the light source option helps the client get a quality image with recommended light energy using a smartphone light sensor. If the mobile phone's light energy is lower than the recommended range (1000lu), it does not capture the image.
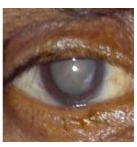
The distance calibration function guides the user to set the required distance between him/her and the application and thereby preserve the quality of the captured image. When the user zooms the camera, it changes the distance between two eyes. Once the distance requirement is satisfied, the user can capture the image. The system can identify Camera-Flash-Effect, Conjunctivitis, and Cataract with a higher accuracy. About 150 images were used to test the proposed application. Those samples consisted of regular images, Cataract affected images, and conjunctive affected images. Eye Plus achieved a success rate of 83.33% for those images. Table 1 depicts some sample images entered into the system and the corresponding outputs of those.

V. CONCLUSION

This paper presents the development of the eye illness detecting application, an ideal solution for eye illness patients. Researchers proposed an android and IOS mobile applications where it identifies the most prominent eye illnesses using image processing and machine learning techniques. The mobile application provides the users with various benefits over existing applications that are available in the market. Those who use this application can identify the eye illnesses within a short time with mobile device aid. The final output of the application, including home precautions that he/she can take to reduce the illness up to some extent, can finally consult a doctor to cure it completely.

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Fig. 4. Model Flow Diagram

Table 1. Unit testing results for data extraction and classification

Image	Actual Situation	Conjunctivitis Positive or Negative	Cataract Positive or Negative	Correct Output
	Normal Eye	Negative	Negative	Yes
	Detect Conjunctivitis	Conjunctivitis detected	Positive	Yes
	Detect Cataract	Cataract Detected	Positive	Yes

Automated Detection of Diabetic Retinopathy in Retinal Images using Neural Network

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Abstract — **Diabetic Retinopathy is one of the most dangerous eye diseases that is influenced by working-age people in Sri Lanka that are caused by long term diabetics. It is changed the retinal blood vessels and that leading to vision loss. Ophthalmologist identifies the DR using manual observation of retinal images. It takes lots of time and given inaccurate results frequently. Doctors do lots of errors when detecting Diabetic Retinopathy. To reduce problems that occur in manual checking here introduced the automated computer-based system. This approach is used for the diagnosis of Diabetic Retinopathy using eye fundus images automatically. Contrast Limited Adaptive Histogram Equalization (CLAHE), morphological process, and filtering techniques are used to extract the blood vessel. Convolutional Neural Network is a classifier that is used to detect the right category of the DR. The accuracy of the DR detection system is observed as 93.36% and 90.1% respectively according to CNN architecture.**

Keywords—Diabetic Retinopathy, CLAHE, Morphological

I. INTRODUCTION

Diabetic retinopathy or eye-diabetes is due to diabetes that occurs mostly in the retina eye. In many developed countries, diabetic eye conditions are one of the most leading symptoms of a complete blink[1]. The detection of retinal pathologies has become much easier by using automated retinal image analyses, while other methods such as eye visual disturbances take time and patients have to suffer for a while. Diabetic retinopathy occurs when hyper glucose damages the small vessels that supply the retina with nutrients and oxygen[2][3].

The purpose of this paper is to detect diabetic retinopathy (DR) automatically, using features derived from various algorithms for processing the retinal image such as the circumference of the optical disc, specific to the lesion (microaneurysms, exudates), image level[4]. These features are now being used within an ensemble machine learning system that includes various learning algorithms such as the Neural Network and Convolutional Neural Network[5][6].The idea about research [7] is only provided different image classification techniques and not provided a specific algorithm as proposed paper.

Extracting features through anatomical algorithms of part recognition and lesion detection can be used for the classification of images. A group of classifiers then uses this method to identify whether or not a picture has diabetic retinopathy. The most significant characteristics are the diabetic retinopathy exudates that provide early stages of information. The biggest reason for exudates is protein and lipid leakage into the retina by blood vessels that have been damaged[8]. A machine-learning technique based on the ensemble is used to confirm the location of diabetic retinopathy in a picture.

II. OBJECTIVES

The main objective of this study is to select the best retinal image classification algorithm and guaranteed that any method from both clinical and research experience is appropriate. Automated systems for image analysis typically require large quantities of computational power. In the sense of a diagnostic point of view, any possible classification strategy must be feasible. As sub-objectives, we are decided to develop a mobile application that patient can check their diabetic retinopathy revel without doctors.

III. METHODOLOGY

In the Preprocessing part, for the presence and noisy areas, we generate binary disguises. Different images of the retinal create retinal characteristics difficult to extract and differentiate exudates from other contrasts and brightness in images. The improvement technique is first applied so that the outcome is more useful than the original image for further analysis. Equalization of histograms, which consistently and significantly manipulates histograms. To reduce the processing time of the procedure, Kaggle images [9]were resized to 540 x 340 pixels. However, several strategies for enhancing images are based on structural operations in the local neighborhoods of pixel values. Low quality, such as interfering with analysis.

(a)   (b)
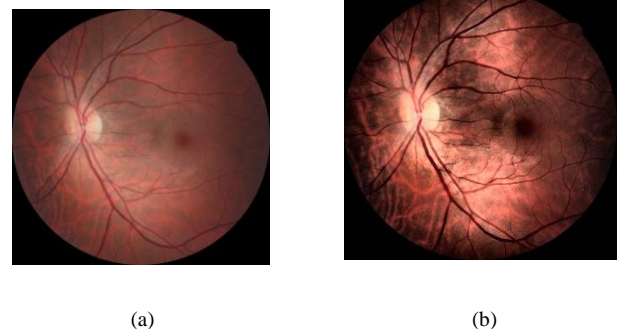
Fig 1: (a) Original Image (b) Enhanced Image
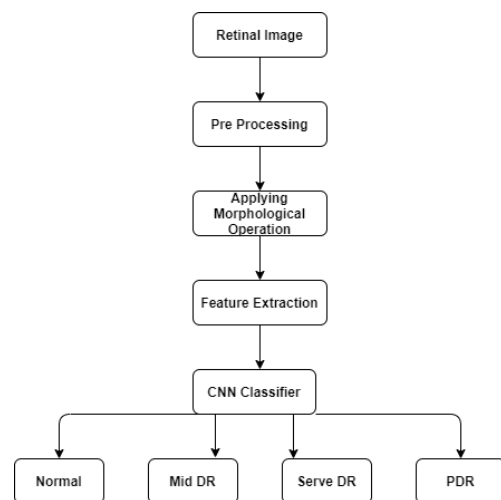
Fig 2: Proposed System

In automated detection of anomalies, pre-processing these images can ensure the appropriate amount of competence. The first step is the Preprocessing part and then captured the features of retinal images using normalization. Most of the retinal images have low image contrast and using the pre-processing part and Morphological operation extract more features in the blood vessels. CLAHE histogram is used to enhance the image. Then using enhances images with different CNN architecture to classify the DR into four stages. Using VGG 16, AlexNet, and Inception V3 as a classifier to get the precious result.

IV. RESULTS AND DISCUSSION

In Kaggle Dataset we used 3256 categorize retinal images and enhanced the image stages vices and training the neural network using an enhanced image to get the accurate result. Getting the accuracy according to various CNN architecture and used the best precious architecture as a classifier in the automated system.

The performance of the proposed system is assessed based on four measures: True positive (TP) shows that the data is suffering from the disease and the test result was also positive, false positive (FP) shows that the data is not suffering from the disease and was diagnosed as positive, true negative (TN) indicates that the patient is not suffering from the disease and False negative (FN) was diagnosed as negative and indicates the disease suffering, but diagnosed as negative[10][3]. TP is the fraction of the pixels that are properly classified as pixels of the light lesion. This measure is also called sensitivity. The following calculations are made.

$$Sensitivity = \frac{TP}{TP + FN} \times 100 \qquad (1)$$

Specificity is defined as the percentage of normal images classified by the system Accuracy in percentage is the measure of

$$Specificity = \frac{TN}{TN + FP} \times 100 \qquad (2)$$

Accuracy is the percentage of correctly classified normal and abnormal images

$$Accuracy = \frac{TP+TN}{(TP + FN+TN+FP)} \times 100 \qquad (3)$$

Table 1. Comparison of the DR results with Different CNN Architecture

CNN Architecture	Sensitivity	Specificity	Accuracy
Inception V3	82.8%	82.4%	85.6%
AlexNet	84.2%	83.1%	83.7%
VGG 16	90.1%	91.78%	93.36%
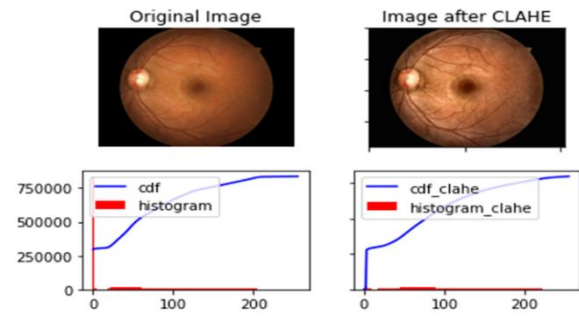
Fig 2: Histogram Graph

According to the results, VGG 16 architecture is more sensitive than other architecture and it is provided better accuracy rather than other architecture. So, we used VGG 16 architecture for automated diagnosis of Diabetic Retinopathy. A computer-based system is provided better accuracy results rather than others. Already published methods do not give much accuracy to our new method.

V. CONCLUSION

This study presents the automated system that is used to detect the Diabetic Retinopathy. In this work, we have introduced the new feature extraction and classify approach that is used in the computer-based system to identify the severity of retinal images. Early detection of the DR is a vital thing because it voided the blindness and can timely treat that system have 90.1% sensitivity and 93.6% accuracy. The proposed method is provided more sensitivity and accuracy rather than other methods and architecture. This method provided better feature extraction rather than other and accurately grading according to image stages. In the future, we will try to classify using a large image database and real-time dataset.

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SHMS – Smart Health Monitoring System: A Study of Computerized Patient Management System with Remote Monitoring Functionality in Sri Lanka

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Abstract—Computerization in the health care industry has lead to the reduction of mortality rates globally. Though digital health and computerization is a growing phenomenon in the global context, in Sri Lanka still in the early stages. Thus, the primary objective of this study is to study how computerization can improve the efficiency of patient management in Sri Lankan hospitals and improve the chances of survivability of patients in critical conditions. The study ventures into explaining how the effective remote and continuous monitoring of patients and automated medication where applicable enables quicker recovery than conventional treatment methods simultaneously improving patient safety including the newly arising aspects of patient safety due to the health information technology. Furthermore, the impact of a comprehensive medical history of a patient being available to the medical staff in the emergency setting towards the successful recovery of the patient is evaluated. The study makes use of data obtained from research articles and books to understand the scope of computerization that is taking place in the health care industry globally. Studies that have been conducted with regards to technologies have been analyzed to understand the optimal data storage mechanisms for health records and the applicable technologies in the context of a Sri Lankan hospital. The results of this study will be beneficial at developing practical solutions for the computerization of the Sri Lankan health care system and the approach that should be betaken towards the general public.

Keywords—*Remote Monitoring, IOT, Patient Management, Health, e-health*

I. INTRODUCTION

Continuous Patient Monitoring(CPM) plays a vital part in delivering the best treatment to patients. It is very important when it comes to maintaining stable post-treatment health conditions of patients. In Sri Lankan hospitals, patient monitoring happens completely manually in the form of periodical examination by the medical staff. It would require a health worker for every couple of patients if continuous monitoring needs to be done manually, which is not feasible for a hospital with limited staff. Another downside of this is the delayed response time when a patient's health condition deteriorates and becomes unstable. The majority of Sri Lankan hospitals also lack computerized systems for managing patients. The medical history of a patient is not readily available to the staff. When responding to a health emergency, the availability of the medical history of that patient could be greatly helpful when planning treatments for the patient. Accordingly, the need for a Computerized Patient Management System(CPMS) with Remote Health Monitoring (RHM) is identified. The objectives of the systems are as follows (1) monitor multiple patients simultaneously at a given time, (2) Monitor patients remotely, (3) maintain profiles for patients that contain the personal details, medical records and vital records, (4) maintain profiles of doctors.

The scope of the proposed solution spans through a web application and an IoT based RHM device. The software is a web application that allows the system to be used by multiple hospitals with the data being stored in the cloud for a higher degree of accessibility.

II. LITERATURE REVIEW

The advent of Information Technology is being utilized in the health care sector globally as Health Information Technology (HIT). SHMS – Smart Health Monitoring System is a product that is built with HIT putting together a patient management system and a remote monitoring system of patients for the hospitals of Sri Lanka. The concept behind this originated with the increased utilization of information technology in the global healthcare industry which seems to be lacking in Sri Lanka. In the developed world many hospitals are computerized with systems that are used to manage patients and their medical records. The hospitals utilize various forms of remote monitoring technologies for monitoring the patients and in some cases remotely providing the medications for certain illnesses with the use of electronic remote medication equipment. SHMS utilizes a device developed using IoT technologies for this purpose with a web application that acts as the interface.

Utilization of Health Information Technology comes in the form of Clinical Decision Support Systems, Electronic Physician's Orders, E-Prescribing, Electronic Medication Administration Records, Patient Data Management Systems, Electronic Medical Records, Remote Monitoring and Remote and automated Medication Administration Systems[1]. There are numerous studies conducted in the field of RHM and there are shreds of evidence on its contributes towards the improvement of the outcomes of the treatments for patients with chronic conditions such as heart failure, stroke, asthma and hypertension[1].

According to an RPM research conducted, in Japan for the management of diseases such as pulmonary heart disease and congestive heart failure discovered that RPM has reduced hospitalization of heart patients by 29% and the reduction of deaths by heart failure by 20%[2]. Under the same research, studied on the resource consumption by patients with regards to the healthcare was simulated through clinical scenarios prepared with hypothetical patients to compare the resource consumption between a patient undergoing remote monitoring and a patient undergoing regular monitoring. Two groups of patients have taken part in the study. The group that underwent remote monitoring was named RM+ (Remote Monitoring) and the group that underwent regular monitoring was named RM-. The findings of the study show that the group RM+ consumed significantly fewer resources than the group RM-[2]. The resource consumption was monitored mainly with regards to unplanned hospital visits, emergency room visits, home visits, and telephone-based communication with

medical staff[2]. The highest impact of cost reduction associated with the utilization of remote monitoring according to the above study is for chronic obstructive pulmonary disease and congestive heart failure due to the reduced complications[2].

Another aspect of ICT in health care is Patient Data Management(PDM). This may include PDM systems retrieving data from electronic medical equipment such as RPM devices and bedside medical equipment, which are then structured, stored, represented to health workers[3]. The same study discovered that these systems result in the increase of time spent on patients directly by the medical staff[1]. The study has obtained substantial evidence with regards to the improvement of the accuracy of medical records resulting in the use of Electronic Medical Records in Patient Data Management Systems which contributes to the improvement of patient safety[1]. A study conducted by Beena [4] on the effects of computerized patient records on patients identified the availability of medical data, consistency of data, and reduction of costs as benefits. The study suggests that when a medication is prescribed, a patient management system could cross-check the treatment with the medical history of the patient and alert the staff on probable side effects and complications should there be any[4] in addition to facilitating the medical staff to manually check the medical history of a patient. This with the added functionality of shared medical data across multiple institutions that uses the system would enable efficient and safe patient care[5][4]. The study has identified cost reductions that could result in the implementation of computerized patient management due to the minimization of inefficient paper-based documentation processes. Further cost improvements could result in the elimination of costly pre-tests which are conducted when there is a lack of understanding about the medical history of a patient[4]. In addition to the health-related safety improvements, the study suggests ways to improve safety within the electronic patient management system to safeguard patient data and privacy. Usage of strong user authentication measures coupled with bio-metrics and audit trails to identify the users that abuse the system, or intruders who have gained access to the system due to compromised login credentials of a user and maintaining backups are suggested[4]. Moreover, with modern technology, PDM systems can be integrated with Clinical Decision Support Systems for enhanced decision making as well.

A separate study conducted on the benefits and drawbacks of electronic health record systems has ventured into clinical outcomes, organizational outcomes, and social outcomes. Accordingly, quality of care is identified as a major outcome of electronic patient record systems in a clinical setting. Quality of care consists of three major dimensions: patient safety, effectiveness, and efficiency[5]. The study has found out that an electronic health record system with clinical decision support tools have increased the adherence to evidence-based clinical guidelines by the health workers. Researchers have observed that computerized reminders have resulted in improvements to the percentage of the usage of influenza and pneumococcal vaccination from 0% to 35% and 50% for hospitalized patients[5]. The use of influenza vaccines has increased from 47% to 65% for all patients and the use of pneumococcal vaccines has increased from 19% to 41%[5]. These studies support the theory that electronic health record systems improve adherence to clinical guidelines.

Private or Public hospitals			
Private Only	Public Only	Mostly Public	Mostly Private
4%	0.2%	50%	45.8%

Another research was conducted[6] on the development of a framework with open source technologies to be used for the development of clinical dashboards that are inter-operable between hospitals. The study has found out that most of the clinical dashboards used in the healthcare sector at present are custom built for a particular hospital and lack interoperability, therefore limiting the share-ability of medical data[6]. The research has identified several challenges regarding the implementation of electronic health record(EHR) systems. The most significant are the challenges associated with data that are fed from medical equipment to EHR. Fragmented vendor standards have been identified as a key barrier for the integration of data from a diverse set of devices to a common platform[6].

A. *Benefits of Computerized Patient Management Systems (CPMS)*

A CPMS with patient profiles which contain patient details, their medical records, remote monitoring functionality with the use of electronic patient monitoring equipment that feeds vital data to the patient management system which then stored in each patient's profile, would result in following benefits :

- Improved and consistent attention towards patients.
- A higher level of preparedness for patients due to the availability of medical and vital history.
- Enhanced emergency response due to the improved preparedness.
- Reduced cost of operations at the hospital.
- Reduced cost of treatments as a result of the elimination of pre-tests due to the availability of medical history.
- Reduced cost at the facilitation of health care.
- Improved adherence to clinical guidelines that result in a higher quality of care.
- Efficient use of staff resources with the use of dashboards for mass patient monitoring.

III. METHODOLOGY

The effect of computerization on safeguarding the lives of patients is studied in the research to propose a solution in Sri Lanka utilizing Health Information Technology (HIT) to improve health care. The study focuses mainly on CPMS and RHM under HIT.

Researches that have been conducted on various implementations of HIT internationally are reviewed for the purpose of investigating the extent of applications. The study has identified the technologies that are feasible for the application of HIT in Sri Lanka.

A survey was conducted with the use of Google forms for identifying the facilities offered by Sri Lankan hospitals and their extent of computerization. The following results were obtained.

IV. RESULTS & DISCUSSION

Table 1: Frequency of hospital visits

Frequency of hospital visits			
<5 times a year	> 5 times a year	1 times per month	>1 times per month
70.8%	20.8%	0.1%	8.3%

Table 2: Hospital visitation public vs private

Table 3: Usage of CPMS in the visited hospitals

Encountering CPMS			
Manual only	Mostly file based	Mostly CPMS	All CPMS
12.5%	41.7%	37.5%	8.3%

Table 4: Feedback on whether the CPMS system supports patient profiles and medical history

Availability of patient profiles and medical history in the above CPMS			
Yes	No	Only admins operate the system	Access only available for staff
21.7%	69.6%	4.3%	4.4%

Table 5: Availability of Remote Health Monitoring in the visited hospitals

Availability of RHM	
Yes	No
22.7%	77.3%

Table 6: Feedback on whether the hospital allows obtaining past medical records

Ability to obtain past medical records	
Yes	No
37.5%	62.5%

Table 7: Feedback on whether the patient has undergone Remote Health Monitoring

Whether undergone RHM or not	
Yes	No
87.5%	12.5%

Table 8: Patients' perception of RHM and whether it contributes to better survivability or not

Perception on whether RHM increases the chances of survivability		
Yes	No	May be
62.5%	0%	37.5%

Table 9: Perception of the importance of accessibility to medical history and patient profiles

Whether the access to patient profiles and medical history across hospitals is important or not		
Yes	No	May be
75%	0%	25%

According to the results of the survey, the majority of the hospitals in Sri Lanka do not have a CPMS with integrated RHM functionality that gives the patient access to their profile details and medical history. Furthermore, there is no universal platform available that could facilitate the creation,

maintenance, and accessibility to the medical history of a patient across hospitals. The results of the survey indicate that patients have a positive perception of the benefits of a CPMS with RHM.

V. SHMS

When introducing a new system in an environment of a developing nation, it is important to focus on the availability of funds, resources, and the overall feasibility of the system. If the system needs technologies that are not available at the time, there is a higher probability of the project being unsuccessful. SHMS is developed with technologies that are readily available for the ease of implementation of the system in Sri Lanka. SHMS is consisted of the following components.

1. Web Application

When introducing a new system in an environment of a developing nation, it is important to focus on the availability of funds, resources, and the overall feasibility of the system. If the system needs technologies that are not available at the time, there is a higher probability of the project being unsuccessful. SHMS is developed with technologies that are readily available for the ease of implementation of the system in Sri Lanka. SHMS consists of the following components :

- Administrator
  ◦ Creates, Updates, Deletes patient and doctor profiles
  ◦ Assigns doctors to patients
- Doctor
  ◦ Creates and Updates medical records
  ◦ Views vital data, patient details, and location
- Patient
  ◦ Views patient details, medical and vital history

The web application has been developed with JavaScript technologies. JavaScript-based frameworks are quite popular for web development and server-side scripting and are heavily being used in the Sri Lankan IT industry. This has made it an abundant resource when it comes to the availability of developers. The utilization of existing and available technologies may contribute to future maintainability.

NodeJS has been used for the REST API and VueJS has been used for the front end. VueJS is based on Angular but is community developed and has a higher degree of efficiency and performance. It's relatively simple yet has the complete functionality expected from a web development framework.
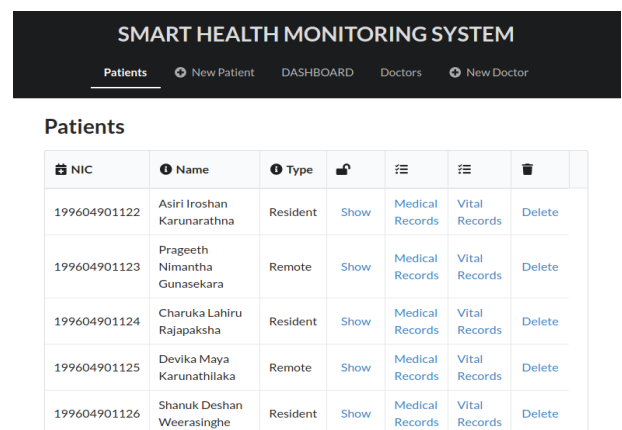
Fig 4: SHMS dashboard

2. Cloud Database (NoSQL)

- Stores profile details of users.
- Stores medical records
- Stores vital records

MongoDB has been used as a database system. The reason for using a NoSQL database was the horizontal scalability. NoSQL databases are ideal for storing a stream of data dumped by the RHM systems. NoSQL databases follow a shared-nothing architecture[7] which eliminates a single point of failure and bottlenecks.

3. REST API

- CRUD operations between web application and database

4. IoT based RHM device

- Measures pulse rate
- Measures body temperature
- Obtains latitude and longitude values of the location
- Emergency mode status (button pressed or not)
- Periodically sends the above data to the cloud database

A. *System Architecture*
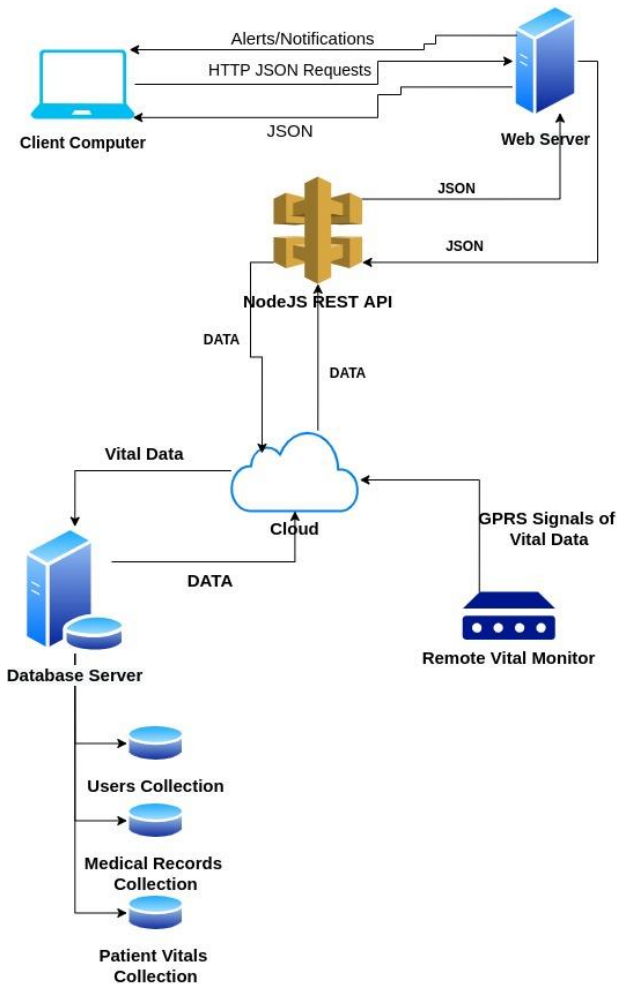
Fig. 5: System architecture

VI. CONCLUSION

The paper presents a CPMS with RHM functionality which utilizes a Web Application and an IoT device. The context of the system is a hospital and the system works as a platform that is accessible across multiple institutions. The application has the flexibility to be integrated with any RHM device that is capable of transmitting data to the cloud due to the separation between the front end and the back end. The application requires a panel of admins from each medical institution for managing. Patients can view their profile details, medical records, and vital history while doctors are responsible for the creation of medical records and observing vital data. The RHM device provides warning and critical alerts based on the vital parameters obtained. The system can be improved by implementing the logic of offering warning levels on the web application instead of on the device and adding different modes such as sleeping, exercising, walking that would adjust the parameter ranges considered for issuing warnings for better accuracy.

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Forecasting of Supply Chain Management for Non-Communicable Diseases

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Abstract — **This paper investigates the usefulness of forecasting modelling to Non-Communicable diseases (NCDs) in supply chain management, which includes the appropriate methods to collect and analyse the important data. An alternative method has been proposed to forecast both vertical and horizontal supply chain relationships in healthcare using machine learning and numerical forecasting models. In future, this proposed method shall be considered to further developments on NCD requirements using at least 30 years' historical data to obtain more specific and reliable information that require to predict the supply and demands.**

Keywords — *supply chain management, Non-Communicable Diseases (NCDs), forecasting, healthcare, numerical models, machine learning*

I. INTRODUCTION

The supply chain is an infrastructure that is required to provide products or services to the customers. Healthcare supply chain management is considered to provide medical supplies, resources, services to patients and healthcare providers. The healthcare items and information on medical products and services typically go through a variety of different parties including; suppliers, insurance firms, hospitals, distributors, buying associations, and a range of regulatory agencies [1].

The healthcare supply chain begins at the manufacturer of the medical products, i.e. prescriptions drugs, gloves, masks, surgery instruments, and sent to a distribution centre. The distribution centres are responsible for supplying all the necessary items to the healthcare organisations to deliver to providers and patients. Hence, there is a high demand for medical products from almost all healthcare organisations. Thus, they purchase medical products in bulk from the suppliers to increase their profits and to ensure the providers and patients do not lack the essential medical supplies.

The healthcare suppliers shall overcome many challenges to deliver their products and services to their providers and patients. Apart from many other challenges, provider satisfaction is considered to be the most challenging task. To achieve the best provider and patient satisfaction, the supplier shall boost its services and performances by cost reduction and improving the quality of products. There are few other concerns which the provider needs to be addressed to boost their performance, such as overnight shipping, hidden costs, storage facilities, physician preference and many more [2]. However, the complexity of the healthcare supply chain increased every day due to the economic pressure, trade disagreements, and environmental changes, which may cause a highly significant risk to both medical organisations and patients [3].

Due to the health care cost and lost economic productivity, Non-Communicable Diseases (NCDs) face a huge economic effect. The world economic forum stated that between 2011 and 2030, the world will suffer a cumulative output loss of around $30 trillion due to NCDs [4]. Moreover, NCDs dominate this 21st century, globally; by its public health challenges and high mortality rate. Cardiovascular disease, chronic respiratory disease, cancer, and diabetes are the major NCDs which cause a higher death rate worldwide [5]. Among these NCDs, one-half of the global deaths are attributed by cardiovascular disease, and 80% of deaths are due to cardiovascular disease happening in low and middle-wage countries [6]. Tobacco and alcohol consumption, improper diet, insufficient physical activity, environmental pollution and increased metabolic risk factors including blood pressure, blood glucose level and obesity may lead to NCDs [5]. It is well-recognised that a healthy lifestyle is essential to the proper maintenance and functioning of the human body. According to the World Health Organization (WHO) 2018 report [7], half of the globally accepted guidelines for cardiovascular disease, which are widely used, are less than a quarter for low-income countries. The WHO further elaborated that only one third (35%) of countries had all necessary NCD medicines and technologies. Thus, it shows an appropriate supply chain management system is important to handle the demand of the healthcare sector to manage the needs of the medical products to treat the patients with NCD.

Recently, the outbreak of the novel COVID-19 shows the vulnerabilities of the supply chain of medical resources where the manufacturers are not able to meet the buyer's needs on time and the required quantity. In the healthcare sector, the forecasting of supply chain relies on both consumer and distributor, rather than on an individual basis. Thus, forecasting offers the visibility of the supply and demand to help the organisation to improve its performance in optimising the inventory level, operations, and to lessen the inventory cost.

The layout of this paper is organised as follows: Section II introduces the main objectives of this study. Section III presents the related works of forecasting model integration in healthcare applications, and the provision of primary healthcare facilities based on demand in managing and

treating the NCDs. Section IV describes the proposed methodology of supply chain management for NCDs data. Finally, Section V concludes the paper and delivers possible future directions that may require to improve the proposed methodology.

II. OBJECTIVES

The objectives of this study are to define the usefulness of the supply chain management system as well as the forecasting models to support NCDs prediction and contrast successful ways of collecting and analysing the supply and demand data. Hence, the aim is to provide a general idea of using the forecasting models in NCDs data analysis to boost healthcare supply chain management. This study proposes different types of methods for data collection, analysis, and prediction to forecast risky medical events, which may be useful in the healthcare supply chain that involves retailers, distributors, producers and suppliers.

III. RELATED WORKS

As the world population grows, healthcare services have increased. This results in more prone to disruption in the supply chain management in the healthcare sector, such as the shortages of medicines and the necessary equipment to diagnose patients. Most researchers focused on the individual analysis of the supply chain management across the organisation (horizontal information sharing), but not, with the organisation's suppliers or vice versa. For example, Sharma et al. [8] addressed the implications of the Internet of Things (IoT) for monitoring the pharmaceutical stocks in the warehouse and its movement. Hence, this will increase the interoperability of the stocks in the warehouse. Most researchers tend to focus on individual analysis on either its supply or demand. Xu et al. [9] addressed the forecasting model of demand for a medical device with the aid of online big data in China, which is Baidu Index. However, the lack of information sharing capability might result in less accuracy of the forecasting model. It has been proven that the information-sharing capability between customer and supplier gives a positive result [10]. Nevertheless, this study will only focus on the combination of both supply and demand forecasting models to increase the accuracy of forecastings of supply chain management for NCDs.

Furthermore, Bui et al. [11] summarised different forecasting models that have been used in the healthcare industry, exclusively on cardiovascular diseases, and using time series data to predict future trends. Thus, there are still more supply chain problems that need to be addressed for these specific diseases such as chronic respiratory diseases, cardiovascular diseases, diabetes, and cancers.

Enhancing the availability of primary healthcare services based on the needs and demand will help to control and treat the NCD patients. Especially, using measuring devices such as thermometer, stethoscope, sphygmomanometers, measurement tape, weighing machine, peak flow meter, and glucometers. However, test strips, i.e. blood glucose test strips, urine protein test strips, urine ketones test strips, troponin test strips, urine microalbuminuria test strips, are also highly demandable medical products in the primary healthcare services. In addition, assay kits including blood cholesterol assay, lipid profile, serum creatinine assay and other devices including nebuliser, pulse oximeter, electrocardiograph, defibrillator and spacers for inhalers are some equipment listed under primary healthcare services [12].

IV. PROPOSED METHODOLOGY

The discovery of information from the NCD dataset is a useful tool for extracting the most important information. This collected information can then be filtered to eliminate redundant information and provide the required predictions using the appropriate forecasting models. Incorporation of the collected NCD data analysis with a forecasting model provides a mechanism for the supply chain management to achieve a useful understanding of the results in the healthcare system. The proposed supply chain management system to NCDs data is shown in Fig 1.
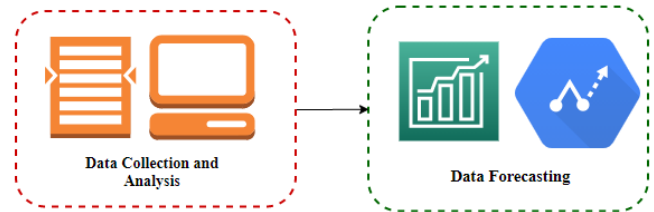
Fig. 1. Proposed supply chain management methodology for NCDs data

A. Data collection and analysis

Data collection in the healthcare field is mainly used to analyse important information and provide insights to support in medical decision makings, especially in analysing the clinical data, pharmaceutical, patient's information, and medical cost. Thus, forecasting will be the most appropriate solution to predict the supply as per the demand of the healthcare field. Most importantly, the WHO has provided up-to-date statistical data that is more relevant to different types of diseases, specifically for NCDs. As of the WHO 2018 report [7], it can be confirmed that the demand for medical supplies is increasing each year rapidly. Therefore, the suppliers shall be able to predict the requirements such as medical product transporting and storing, before ahead. However, providers and patients (customers) should be concerned about many essential factors such as manufacturing quality, durability, and the cost, before demanding products from the supplier.

The collected supply and demand data shall be further analysed to choose the most relevant information. Data engineering may be a useful method to find the trends of the dataset and develop many types of algorithms to make the raw data as useful informatics. Most possibly, the data cleaning process and statistical evaluations can build pipelines to transform the data into the forecasting models to discover their patterns and knowledge to create machine language algorithms to make requisite early predictions.

B. Data forecasting

Forecasting requires historical data for mathematical modelling to work in order to project future outcomes or trends. Hence, forecasting modelling is essential to improve the supply according to the demand. Thus, it may enhance profits and reduce inventory cost. The numerical models such as Naïve method (NM), Cumulative mean (CM), Moving Average (MA), Exponential smoothing (ES), Auto-Regressive Integrated Moving Average (ARIMA), and Linear Regression (LR) can be considered as the best solution to address the healthcare supply chain to estimate the budgets and plans as of the demand from the providers and patients (customers).

Moreover, machine learning is another method that is commonly used to forecast the supply chain in healthcare. The key advantage of machine learning is its ability to handle big data without human interference [13]. Thus, it can provide

an unprecedented consumer with insights into demand. Xu Shuojiang et al. [9] approached Support Vector Machine (SVM) machine learning method to forecast the demand of medical devices with the aid of online big data, whilst Chae S. et al. [14] applied both numerical and machine learning methods; LSTM and Deep Neural Network (DNN) to get an early advantage to anticipate infectious diseases based on the short-term forecast.

As aforementioned, the forecasted results can be utilised to predict the amount of demand (patient) for that particular type of disease in the near future. Hence, with that information, the organisation management can place an order on time, resulting in the reduced delay time of machine to arrive, queue time in the healthcare facilities and reduce overburden of the physicians, in case of the surplus amount of patients coming in.

V. CONCLUSIONS AND FUTURE DIRECTIONS

Healthcare supply chain relationships have paid particular attention to work more closely with partners, including customers, vendors, and different logistics vendors to achieve collaboration and alignment across supply chain relationships, i.e. vertical relationships and horizontal relationships. Most of the healthcare supply chains are lacking in information sharing between the healthcare organization and the suppliers. In future, the provision of healthcare requires a complicated undertakings and trade between quality and cost. Thus, it is essential to create a transparent and a closer connection between supplier and customer, whilst keeping a strong bond between the other organisations, i.e. supplier to another supplier, disturber to another distributor, to work together to improve their priorities and activities to achieve long-term goals, objectives and target strategies by integrating the forecast modelling.

The proposed NCDs data forecasting model confirms that it is essential to gather the most reliable data and analyse them using suitable tools before transporting them to a forecasting model. It has been noted that the machine learning models yield better results in forecasting the NCDs data into various categories. Also, there are several studies which conducted forecasting via deep learning methods and obtained promising results. In addition, the combination of traditional forecasting methods and deep learning models, i.e. Recurrent Neural Network (RNN) or Long-Short Term Memory (LSTM) may be beneficial to the healthcare supply chain management to obtain more accurate forecasting results from NCDs data.

Moreover, computer-based applications can be developed to broadly extend the proposed method to forecast the risk level of all types of NCD patients. This can be done further by emphasising the relevant vitals and their interpretation to provide expert consultations.

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A Text Mining Approach to Analyze Trends in the IT Industry Job Market through Text Extraction from Images

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Abstract —**Mining the details given in job vacancies, helps to understand trends in the job market. In online job vacancy repositories, details of vacancies are stored as images and text information embedded on them. The text on the images is extracted by using a text extraction process, first they need to be preprocessed and cleansed. After that, the preprocessed text is used in the process of text mining. Term Frequency-Inverse Document Frequency mining technique was used to discover keywords in the textual data while the Apriori algorithm was used to find the associations between job titles. As job titles and required qualifications for jobs are rapidly changing in the Information Technology industry, it is worth to understand current trends in the job market when applying for a job.**

Keywords — text mining, job trends, TF-IDF, Apriori

I. INTRODUCTION

Identifying the trends in the job market will be helpful for job seekers to match their qualifications, technical skills, and knowledge with job opportunities. Then job seekers will be able to upgrade their qualifications for jobs and technological skills required for jobs depending on the industry demands. Not only that, but also educators can update curriculum compliance with the current trends in the relevant job market. Identifying and following job trends takes special importance for the Information Technology (IT) profession as it is a rapidly changing industry. Therefore, it is important if there is a way those job seekers can identify what are the dynamics in the job market. Job holders, job seekers, and youth want to know which job prospects and career path look favorable [1-3].

At present, job advertisements are mainly published electronically online. In online job vacancy repositories, vacancies are stored as images and text information embedded in them. Image text is the text information embedded or written on an image. Text mining is a process to extract interesting and significant patterns to explore knowledge from textual data sources [4].

II. OBJECTIVES

This study aims to mine trends in the IT industry job market through text extraction from images that contain details of vacancies. This study will assist to minimize dissimilarities between skills demand and skills supply in the IT industry.

III. METHODOLOGY

The process of the proposed system is illustrated in Fig. 1, As the first stage, the texts are extracted from images. After that texts are preprocessed. The pre-processed textual data is used for text mining, to discover the trends in the job market.
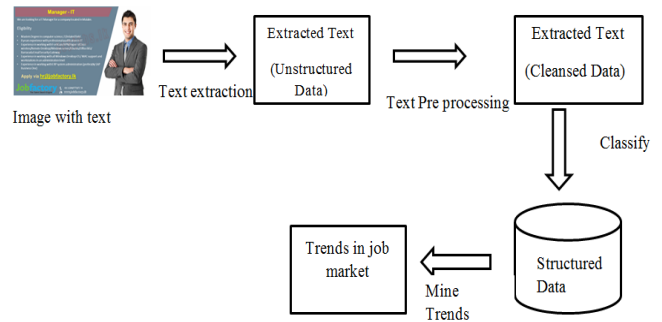
Fig. 1. Text extraction and mining process

According to the system introduced in this study, a data set with five hundred job vacancy images was used. The texts embedded in them were extracted by following Optical Character Recognition Algorithm (OCR). As the textual data embedded in images varied in length and structure, the extracted texts were considered as unstructured. They are not having a defined structure, these unstructured data are needed to pre-process to remove white spaces, special characters, and stop words [5-6]. Text preprocessing was done by following steps as given in Fig. 2; they are Tokenization, Stop word removal, and Stemming.
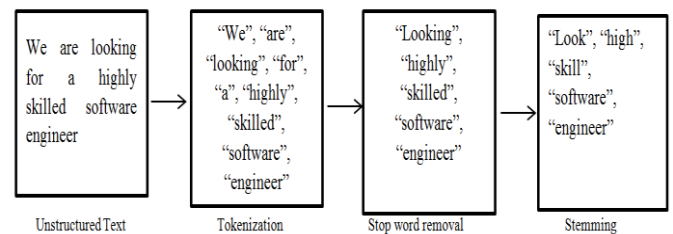
Fig. 2. Text pre-processing process

Tokenization is the process of separating a single sentence into words. This technique is used to explore the words in a sentence. Stop words do not contribute to the content or context of the textual document [6]. Also, stop words can be indicated as words that commonly repeating such as prepositions and conjunctions, therefore stop words need to be removed. Stemming is used to conflating variant forms of a word into a common representation [6]. During the process of stemming, prefixes and suffixes are removed from the word. Stemming is carried out to find the root or the base of the word. This root is known as the "lemma" in Natural Language Processing (NLP). After pre-processing and cleansing data, data is stored in the database and use for text mining purposes [7-9].

In this study, to mine trends in the IT industry job market two data mining descriptive functions were used. They are

mining of frequent patterns and Mining Associations [10-14]. To program the algorithm Python language was used.

Mining of frequent patterns was used to identify what are the most mentioned words in unstructured text data. This does not indicate only the frequency of how many times particular terms was appeared, but also consider its importance. In "Equation 1", W is a statistical measure which uses to refer to the weight that uses to evaluate the importance of a particular word in a document. "Equation 1" describes how weight is calculated in the Term Frequency-Inverse Document Frequency (TF-IDF) technique. The importance increase when a word appears in a document more frequently [15-17].

TF-IDF is a numerical statistic that shows the relevance of keywords to some specific documents [4]. Term Frequency (TF) measures how many times a term is present in a document.TF is the occurrence of any term in a document is divided by the total terms present in that document [4]. Inverse Document Frequency (IDF) assigns a lower weight to frequent words and assigns a greater weight for the words that are infrequent [4]. TF-IDF can be calculated by multiplying term frequency (TF) and inverse document frequency (IDF) [4].

$$W_{i,j} = tf_{i,j} \times \log\left(\frac{N}{df_i}\right)$$

$tf_{i,j}$ = Number of occurrences of i in j
df_i = Number of documents containing i
N = Total number of documents (1)

Association Rule Mining (ARM) is another text mining technique used to discover relationships among a large set of variables in a data set [18-21]. In this study, ARM was used to derive the associations with job titles. Mining associations help to identify what are the related job titles in the IT industry. It is used to identify frequent if-then associations. An association rule consists of two components. The antecedent (if) is the first component. Consequent (then) is the second component. The antecedent is the item found within the data. Consequent is the item found in combination with the antecedent [1] [22-24].

Apriori algorithm was used in this study, to mine the relationship between job titles, or what are the job titles that associate with each other. Apriori algorithm consists of three parts as support, confidence, and lift. Support is the default popularity of an item. It is calculated as given in "Equation 2"; for item B support

$$\text{Support (B)} = \frac{\text{Job titles contain (B)}}{\text{Total job titles}} \quad (2)$$

Confidence is the likelihood that job title B is also mentioned if job title A is mentioned. Confidence is calculated as given in "Equation 3"

$$\text{Confidence (A} \rightarrow \text{B)} = \frac{\text{Job titles contain both (A and B)}}{\text{Job titles contain (A)}} \quad (3)$$

Lift is the increment in the ratio of job title B with A .Lift is calculated as given in "Equation 4"

$$\quad (4)$$

$$\text{Lift (A} \rightarrow \text{B)} = \frac{(\text{Confidence (A} \rightarrow \text{B)})}{(\text{Support (B)})}$$

IV. RESULTS AND DISCUSSION

To identify the current dynamics in the job market, this study has proposed two approaches. TF-IDF algorithm was used to determine what the keywords in the data set were. The trained dataset consists of job titles which were extracted from five hundred job vacancies. The data set was collected using an online site which advertises IT industry job vacancies in Sri Lanka. Based on the trained dataset, Fig. 3, and Fig. 4, show the keywords extracted by processing the TF-IDF algorithm. The keywords shown in Fig. 3, are the keywords extracted in the technology attribute. The trending technologies that were mostly displayed in the advertisements are shown in Fig. 3. Whereas, Fig. 4, shows the keywords extracted from the job title attribute in the data set, which means Fig. 4, shows the most trending job title which extracted from the given dataset.

```
===Keywords===
htmls 0.467
ajax 0.434
xml 0.411
sound 0.379
script 0.338
css 0.262
java 0.241
knowledge 0.199

In [178]:
```

Fig. 3. The output of the TF-IDF technique – keywords in technologies

```
===Designations===
engineer : 0.11
developer : 0.07
senior : 0.06
software : 0.06
it : 0.03
manager : 0.03
specialist : 0.02

In [40]:
```

Fig. 4. The output of the TF-IDF technique – keywords in job title

To mine the associations between job titles, the Apriori algorithm was used. Fig. 5, shows antecedent, support, antecedent support, and consequent support values that exist between job titles. Support value used as an indicator to show how frequently the associated job titles appear together, in the dataset. An antecedent is an item that considers first, when creating an association rule. Consequent is the job title that found in combination with the antecedent. In Fig. 5, the first row represents the support value as 0.83, which means 83% occurrences are there which contain both "system administrator" and "business analyst" job titles out of the total dataset.

Fig. 6, shows the support, confidence, and lift values between job titles. This is useful to understand what the associated jobs in the IT field are. The support value of an association rule is defined as the percentage of records that contain both job titles, to the total number of records in the dataset. The lift value represents whether the association is positive or negative, also it shows the strength of the relationship which exists between the two job titles. If the lift value is greater than one, it indicates a positive relationship.

If the lift value is less than one, it indicates a negative relationship, and if the lift value equals one, the job titles are independent and there exists no relationship between them [25]. Based on Fig. 6, it is clear that, the lift value that exists between all job titles shown here has a positive relationship. Confidence indicates the reliability of the derived association rule. Confidence shows the job titles which appear in an associate way in the used dataset.

antecedents	consequents	antecedent support	consequent support
(System administrator)	(Business Analyst)	0.083333	0.083333
(Business Analyst)	(System administrator)	0.083333	0.083333
(Product Manager)	(Financial Planning Analyst)	0.083333	0.083333
(Financial Planning Analyst)	(Product Manager)	0.083333	0.083333
(Lead Network Engineer)	(Senior Engineer)	0.083333	0.083333
(Senior Engineer)	(Lead Network Engineer)	0.083333	0.083333
(Senior technical specialist)	(Solutions support engineer)	0.083333	0.083333
(Solutions support engineer)	(Senior technical specialist)	0.083333	0.083333
(PHP software engineer)	(Web developer)	0.083333	0.125000
(Software engineer)	(Web developer)	0.083333	0.125000
(Web developer)	(PHP software engineer)	0.125000	0.083333
(Web developer)	(Software engineer)	0.125000	0.083333
(Senior software engineer)	(Web developer)	0.125000	0.125000
(Web developer)	(Senior software engineer)	0.125000	0.125000

Fig. 5. The output of the Apriori algorithm- association between job titles and their support value

antecedents	consequents	support	confidence	lift
(System administrator)	(Business Analyst)	0.083333	1.000000	12.000000
(Business Analyst)	(System administrator)	0.083333	1.000000	12.000000
(Product Manager)	(Financial Planning Analyst)	0.083333	1.000000	12.000000
(Financial Planning Analyst)	(Product Manager)	0.083333	1.000000	12.000000
(Lead Network Engineer)	(Senior Engineer)	0.083333	1.000000	12.000000
(Senior Engineer)	(Lead Network Engineer)	0.083333	1.000000	12.000000
(Senior technical specialist)	(Solutions support engineer)	0.083333	1.000000	12.000000
(Solutions support engineer)	(Senior technical specialist)	0.083333	1.000000	12.000000
(PHP software engineer)	(Web developer)	0.083333	1.000000	8.000000
(Software engineer)	(Web developer)	0.083333	1.000000	8.000000
(Web developer)	(PHP software engineer)	0.083333	0.666667	8.000000
(Web developer)	(Software engineer)	0.083333	0.666667	8.000000
(Senior software engineer)	(Web developer)	0.083333	0.666667	5.333333
(Web developer)	(Senior software engineer)	0.083333	0.666667	5.333333

Fig. 6. The output of the Apriori algorithm-association between job titles and their confidence

V. CONCLUSION

This study was conducted to mine the trends in the IT industry job market. The data were collected from online job vacancy repositories. First, texts were extracted from images and subjected to the preprocessing process. After that, the cleansed data were used to mine knowledge by using two text mining technologies, which are the TF-IDF technique and the Apriori algorithm. By using the TF-IDF techniques it was clear that what the key job titles were. With the help of Apriori algorithm the associations exist between job titles. This study was based to discover what were the key job titles in the IT industry and what are the associations between them, for further, this study can continue to mine what are the qualifications, experiences and technical knowledge associate with each job titles.

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Stock Market Price Forecasting using ARIMA vs ANN: A Case Study from CSE

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Abstract — **Main purpose of this study is to forecast stock price using Artificial Neural Network (ANN) and traditional time series approach such as ARIMA and identify most suitable approach for stock price prediction. Time series forecasting is regarded as the most successful criterion among several factors involved in the decision-making process to pick a correct prediction model. Improving predictability has become crucial for decision-makers and managers, especially time series forecasts, in various fields of science. Using K-mean clustering and Principle Component Analysis, dataset is clustered based upon a central point selection and the Euclidian distance measurement. According to clustering results identify the most contribution sector for the CSE and most contributing Company in selected sector within time period of 2008 to 2017. In particular, ARIMA has shown its success in accuracy and precision in predicting the next time-series lags. As part of the literature, very few studies have focused on Colombo Stock Exchange (CSE) to find new predictive approaches for the forecasting of high volatility stock price indexes. This article explores best sectors and company to invest according to previous contributions and whether and how the newly developed deep learning algorithms for the projection of time series data, such as the Back Propagation Neural Network, are greater than traditional algorithms. The results show that Deep learning algorithms like BPNN outperform traditionally based algorithms like the model ARIMA. For ARIMA and ANN, MAPE values are 0.4672206 and 0.1783333 respectively. MAE values are 29.6975 and 4.708423 respectively results for ARIMA and ANN. The MAE and MAPE values relative to ARIMA and BPNN, which suggests BPNN 's superiority to ARIMA and we suggest ANN model best for forecast stock prices**

Keywords — Artificial Neural Network, Auto Regression Integrated Moving Average, Colombo Stock Exchange

I. INTRODUCTION

Financial markets are the location of exchange of financial assets, such as securities, shares, moneys and goods. Some people are driven to trade because they expect their investment to make a return. The best and cheapest way to create a strong future for the country is to invest in stocks. Shares are financial assets that show a company's ownership (Simon, 2012). At every time when the market does their daily trading, millions of investors and trade firms, both locally and internationally, are directly interested. A stock market is a place where aggregation both buyers and sellers in a single platform for offering shares to the general public to raise their capital needed for restructuring, an expansion for new operations. The decisions of investors in the financial markets and the unpredictable existence of stocks make them very difficult and challenging to forecast.

(Ratnayaka et al., 2015) introduce ARIMA-ANN based hybrid approach for stock price prediction in CSE. In this research we focused to identify most contributing sector and company to the CSE that differ from the above research. And the MAPE and MAE of ARIMA and ANN model is relatively less compared to above research. There was very few studies to forecast stock price fluctuations on CSE. (Samarawickrama et al., 2017) selected few companies randomly and using Recurrent Neural Network types such as Simple Recurrent Neural Network (SRNN), Gated Recurrent Unit (GRU) and Long Short-Term Memory (LSTM) architectures and Feedforward Neural Networks they predict the stock price. Results shows feedforward networks produced highest forecasted accuracy.

In time series predicting, ARIMA is commonly used. Certain methodologies under high volatility are not entirely suited. Linear models, such as linear regression, ARIMA, SARIMA, SARIMAX have the advantage of being very fast, but not precisely so. If a market reaction has a price level and begins to rise rapidly, the linear model does not quickly respond or predict the end of the trend. Likewise, if the price rise to a sudden fall called bubble, a linear model does not do well in this case. This article aims primarily to examine the best forecast model with lower forecast errors and higher performance of forecasting. Machine learning methods have introduced new approaches to problem prediction with deep, layering hierarchy based on the relationships between variables and more precisely deep learning algorithms.

Following research questions are addressed during this research. The way we can predict the stock price in some various sectors like banking sector, construction, plantation, etc. And which sector and company suitable for invest and best model for predict stock values.

The accuracy and consistency of traditional forecasting methods are important research questions compared to deep learning algorithms. To the best of our knowledge, there is no strong empirical evidence that the data production of the economic and financial time series has been predicted using BPNN to fit traditional econometric methods such as ARIMA.

II. OBJECTIVES

Goals and objectives of this research are;

- Use the section vice indices to predict like banking sector, plantation, construction etc.
- Identify best sector and company to invest.
- Finding a suitable approach to predict the long term and short-term price prediction.

III. METHODOLOGY

The main goal of this research is to apply a suitable approach to stock market prediction based on the Artificial Neural Network (ANN) and ARIMA. ARIMA and ANN methodologies are first defined in the methodology. We then find the model for the prediction of the stock price in CSE using different test precisions.

A. Autoregressive Integrated Moving Average Model (ARIMA)

ARIMA is a linear approach that is supposed to be linear in the future value of a variable for which past observations were supposed. The method consists of three main steps: parameter specification, calculation and prediction. Akaike information criterion (AIC), Schwarz criterion (SBIC) and Hannan-Quinn information criterion (HQIC) methods mainly used to select the best model (Hiransha et al., 2018).

The methodology is going under following steps.

Fig. 1 .proposed methodology

B. The Artificial Neural Network (ANN) approach

In here we use 100 epochs to train the model. For hidden layers ReLu is the activation function and output layer use sigmoid as an activation function. We change number of neurons are between 10 to 100 and select the optimal number of neurons for each layer. The Back Propagation Neural Network manages the relation between the input variables very powerfully also that can hold and learn from long sequence of observations.

C. Data Set

In this text, we plan to use a modified pricing of the twenty CSE sectors. Price details of S&P SL20 companies between 2008-01-01 and 2017-03-31 Are downloaded.

D. Data preparation

Data set was preprocessed to check for missing values and to identify outliers. In each set of financial time series, there are a number of openings, high, low, close, changed ASPI and volume adjustments. The authors have chosen an ASPI variable as the only function in financial times for ARIMA and BPNN model training (Selvamuthu et al., 2019). The Economic and Financial Time Data Series has been split into two sub-sets: training and testing, with 80% of the data used in training and the 20% used to test models.

E. K-Mean Clustering

The dataset is clustered with a technique named k-mean based upon a central point selection and the Euclidian distance measurement. In K- mean clustering we have to decide what are the number of clusters that we choose for clustering. For that we use Elbow method. In here 20 features are cluster in to given clusters. We use K-Mean clustering and PCA to select the most trending sector among the 20 sectors and most trending company from the selected sector.

F. Model Accuracy Testing

We use mean absolute percentage error (MAPE), mean absolute error (MSE) for accuracy testing.

$$\varepsilon_{MAPE} = \frac{1}{M}\sum_{j=1}^{M}\frac{|X_A - X_P|}{X_A} \qquad (1)$$

$$\varepsilon_{MAE} = \frac{1}{M}\sum_{j=1}^{M}|X_A - X_P| \qquad (2)$$

In here actual value and predicted value represent X_A And X_P respectively in time t.

Table 1. MAPE Value and Accuracy

MAPE Value	Level of Accuracy
MAPE<10%	Very accurate
10%<MAPE<20%	Accurate
20%<MAPE<50%	Medium
51%<MAPE	Less accurate

IV. RESULTS AND DISCUSSION

First doing data preprocessing part by dropping unnecessary columns of data, checking for missing values, data cleaning and remove strings in columns and find the outliers. To use a time series data model data set should be stationary. We use differencing techniques to remove trend and seasonality. To check for stationarity, we use Augmented Dickey-Fuller Test, Plotting Rolling Statistics, and ACF and PACF plots.

```
Results of Dickey-Fuller Test:
The time series is stationary at the p = 0.05 level.
Test Statistic                  -1.703348e+01
p-value                          8.293205e-30
# Lags Used                      4.000000e+00
Number of Observations Used      2.215000e+03
Critical Value (1%)             -3.433306e+00
Critical Value (5%)             -2.862846e+00
Critical Value (10%)            -2.567465e+00
dtype: float64
```

Fig. 2. Dicky Fuller Test results

In here, test statistic > critical value, which means data set is non-stationary. So we can use this data into time series forecasting. Differencing results shows that there is no trend or seasonality in the given data set. And also PACF and ACF plot shows that is no tend, seasonality or missing values.

Results of identified optimal number of principal components for sector wise shows showed that 5 out of 20 sectors give considerable amounts of contribution of some features to cover the entire data set during the PCA (Principal Component Analysis) phase.
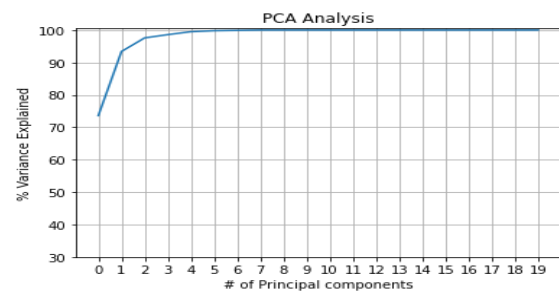
Fig. 3. PCA analysis of features

In here we can see the variance is gradually increase in PC-0 to PC-4. After that there is no considerable change. Thus, we can conclude entire data are covered by 5 components out of 20.

Table 2. Average contribution to clusters

Sector	Average contribute to clusters
Banks and finance	3.16402233
Diversified	2.51563666
Hotels and travels	2.50811733
IT	2.20941733
Motors	2. 66154333

Results shows that "Banks and finance", "Diversified", "Hotels and travels", "IT", "Motors" sectors are highly contribute to the principal components. "Banks and finance" sectors are mostly contributing to the clusters. Thus, we suggest investors to invest in "Banks and finance" sector. Likewise using above method, we analysis most contributing company to Bank sector and results shows Sampath Bank is mostly contributing. Show we suggest Sampath bank to invest. As a next step, select most best ARIMA model with Lowest AIC and HQIC values of 71180 and 71202 comes under p =4 d=1 q=3. Thus, to predict stock market price we use this ARIMA model. Then We predict the ASPI value using BPNN model.

TABLE 3. The models Accuracy for coming week

	Forecasting Models	MAPE	MAE
ASPI	ARIMA	0.4672206	29.6975
	BPNN	0.1783333	4.708423

Results for coming week for ASPI value shows that less MAE and MAPE value have to BPNN model. ANN is extremely exact (less than 10%) with lowest MAPE error levels, based on error analysis data. In addition, MAPE results for precision tests show that BPNN exceeds ARIMA.
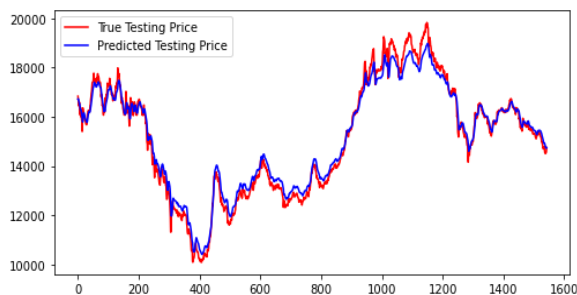
Fig. 4. True and testing plot for ASPI using BPNN

This graph shows true testing price in red color and predicted testing price in blue line using BPNN. Most of the predicted values are nearly close to true testing value than ARIMA.

V. CONCLUSION

By using K-mean and PCA we discover the most contributing sector to the ASPI and among that sector again we select the best company that most averagely contribute to clusters. Among 20 sectors "Bank and Finance Sector" contribute 3.16402233 to the clusters and Beyond the companies in Bank sector "Samapath Bank" contribute 2.397040 for clusters. Thus, we suggest investors to invest in Sampath Bank in Banking sector.

This paper contrasts ARIMA's and BPNN 's accuracy as symbolic techniques when estimating data from time series. The implementation and application of these two strategies on a number of financing data showed that the BPNN is superior than ARIMA. In particular, the MAE value by 4.708423 compared to ARIMA by the BPNN-based algorithm. We propose the advantages of the use of deep learning algorithms and techniques for predict economic and financial data rather than ARIMA.

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ICT Adoption in the Agriculture Sector:
A Case Study in Sri Lanka

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Abstract — **Information and Communication Technology (ICT) has become an indispensable tool in a number of sectors including the agricultural sector. It embodies all the digital technologies used to capture, store, process, and exchange information. Traditionally, agriculture has been the backbone of the Sri Lankan economy and in the transition towards food self-sufficiency in Sri Lanka, ICT integration in the agricultural sector would be imperative. Accordingly, the main objective of the present study was to develop a model for ICT integration in agriculture taking into account the Sri Lankan agricultural sector. The study was supplemented by a systematic review of literature which attempted to identify the different domains of research related to ICT in agriculture, existing frameworks for ICT adoption in agriculture around the world, and the global initiatives for ICT integration in the agricultural sector. As a case study, the study considered the Permanent Crop Clinic Program (PCCP) which is a plant pest and disease diagnostic and recommendation service implemented through farmer group structure called the Crop Clinics (CCs). CCs serve as an extension tool contributing to promote sustainable agriculture and also provides a unique educational experience for farmers through making recommendations based on the diagnosis of live samples. A questionnaire survey was conducted employing different stakeholder groups including officers from relevant government authorities, instructors, and farmers. The study further aimed to provide recommendations on where and how ICT can be better integrated into the above program in order to successfully realize the programme objectives.**

Keywords: ICT integration, Agriculture, Permanent Crop Clinic Programme

I. INTRODUCTION

Information and Communication Technologies (ICTs) are mostly used for the widespread transfer and sharing of information. Today ICT is developing rapidly all over the world. Sustainable agriculture focuses on producing long-term crops and livestock while having minimal effects on the environment [2]. In achieving sustainable development in the agricultural sector, ICT integration in agriculture is viewed as imperative [1].

Despite the immense potential of Sri Lanka to become agriculturally sustainable, there is a lack of established mechanisms for properly integrating ICT in the agriculture sector. The recent COVID-19 pandemic situation also has reiterated the importance of food self-sufficiency for world wide [3]. People tended to fulfill their own needs especially the food through their own cultivations. Through integrating ICT in agriculture it can be made easier for the people who are willing to acquire knowledge about new farming methods, trending agricultural tools etc. Recent advancements in technology which are ranging from micro devices to macro networks, have completely transformed modern global agriculture in a productive way. This transformation calls for

investigations on the existing level of ICT adoption in agriculture and the future prospects.

Permanent Crop Clinic Program (PCCP) is also a new approach, which is introduced by the agriculture department to help farmers to provide beer advice on pest management to farmers when their crops are ill [4]. The farmers bring samples of their diseased plants for plant doctors called Agriculture Instructors to diagnose and prescribe safe, affordable and locally available pest management solutions. From this framework it will provide ICT knowledge related to enhance the agriculture productivity and information flow way for the farmers about the crop choosing, growing and selling of farming industry based on the PCCP objectives by surveying the agriculture officers and the farmers who connect with the PCCP.

II. OBJECTIVES

The major objective of this research is to introduce an operational framework for Sri Lanka for better integrating ICT in the Permanent Crop Clinic Program. That will to diagnose or to identify the causes for certain behavior of some farmers, agency staff, or other development actors. . The study aims to provide recommendations on where and how ICT can be better integrated in the above program thereby supporting the realization of the PCCP objectives. And some other specific objectives are as follows.

1) Specific Objectives
- To identify the different domains of research related to ICT in Agriculture.
- To review the existing models, frameworks, theories for ICT adoption in Agriculture.
- To review the global initiatives for ICT integration in the agricultural sector.
- To identify the major barriers, limitations, challenges in ICT integration in the Sri Lankan agricultural sector.
- To provide insights on the future of ICT in Agriculture.
- To develop an ICT adoption model for Sri Lanka for efficient and effective implementation of the Permanent Crop Clinic Program.

III. METHODOLOGY

Having discovered this research gap, the study has initiated a collaborative project to provide a solution for the prevailing farmer issues and also to increase the ICT literacy

of the people of the agricultural departments of every region. As such inputs for the proposed solution will be coming from various research expertise from the past research studies from different countries. Since this research addresses a problem "The ICT Adoption in Agriculture Sector " which is rather under-investigated in Sri Lanka, this study takes an explorative approach.
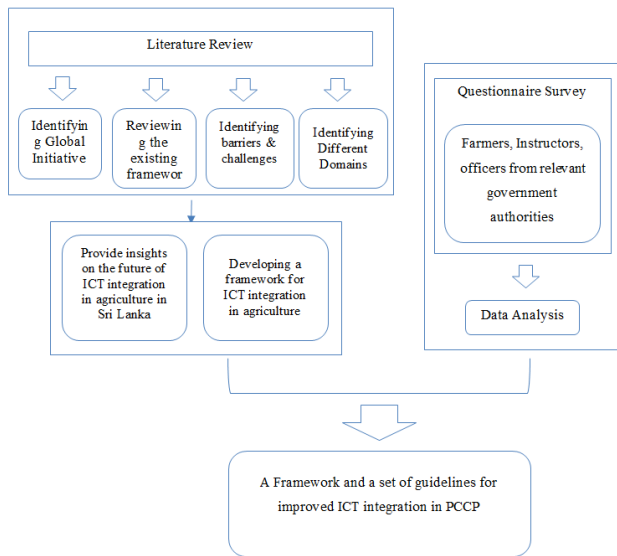
Fig. 1. Proposed Methodology

According to the proposed methodology, study includes reviewing the existing frameworks, identifying barriers and challenges and Identifying Different Domains. Considering those categories, the study aims to provide insights on the future of ICT integration in agriculture in Sri Lanka from that going to develop a framework for ICT integration in agriculture.

This study was proceeding with the aid of data collection techniques such as interviews, surveys and analysis of existing systems from farmers, instructors, officers from relevant government authorities. From reviewing the past studies and analyzing the data, the last aim is to introduce a framework and set of guidelines for improved ICT integration in PCCP.

The questionnaire was designed by considering two main areas which are Individual factors represent farmers and Organizational factors representing the agriculture departments and the agricultural officers. Considering that, two surveys have been carried out involving 30 individual farmers via interviews and questionnaires. Separate interviews have also been carried out with agriculture officers at the Department of Agriculture to identify what information is being gathered, analyzed and how these are currently being used. This was mainly conducted to identify issues faced by the farmers at different stages of the farming cycle and also identify the status of the ICT knowledge of the farmers and the agriculture officers. Questionnaires were distributed as a manual survey tool due to the fact that farmers don't have enough facilities related to the technology. During the surveys, analyzed the depth of Information and Communication Technology (ICT) usage among farmers to

understand what type of recommendation can be made to overcome the current drawback situation using ICT.

According to this research study, by reviewing the past related studies, interviewing the people who are related to the agricultural field especially in PCCP, collecting data from related people, research study has recognized the major barriers and limitations that can be faced when integrating ICT in the agricultural sector. The following are some of the facts for integrating, implementation and effective use of ICT in the agricultural sector.

1. Inadequate computers and supporting technological infrastructure

2. Few trained human resources with computer use and research information management skills within the agricultural officers.

3. Limited laboratories to conduct agriculture research experiments related to ICT integrating in agriculture.

4. Poor ICT strategies and inefficiency of the current government structures, arrangement and management in the agricultural sector in Sri Lanka.

5. Not enough platforms to inform the new innovation that have been done from the researches, government and the private sectors related to the agricultural field to enhance the productivity of the agricultural field and from that develop the sustainability of the agricultural sector.

6. Lack of appropriate ICT policies and standards for monitoring, evaluating and assessing the ICT integrations in agriculture.

IV. RESULTS AND DISCUSSION

When we consider the past research studies related to ICT in integrating agriculture, there are a number of technology development, application development and model development researches in all around the world. Among them, the following figures show the summary of the past research studies related to ICT integration in agriculture.

According to the pie chart most of the research has been done to introduce new innovative technologies integrating to the agricultural sector. Because of the recent COVID-19 pandemic most of the people have tended to produce their foods by their own and they have allured the use of products from their own countries. So the latest research related to ICT integrating in agriculture done about how smart technologies can be effectively used to link agriculture producers with markets to manage harvesting periods, reduce postharvest losses and wastage and ensure better market price for the farming community. For that they have considered the drone, sensor technologies, new innovative ICT tools and the latest applications. Most of the research studies are aimed to procure the effective solutions for the farmers and also the agriculture officers to improve the technical education and skills of the farming community, increase the availability and speed of internet connection in rural areas and lack of awareness of available also limit smart technology usage by farmers.
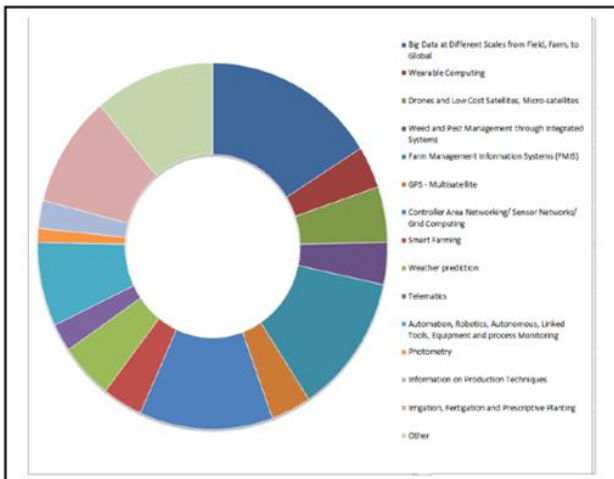
Fig. 2. Summary pie chart of past research studies

There are so many findings that are available at different stakeholders of the agriculture domain in different formats. When considering the frameworks that related to the knowledge management of ICT in the agricultural sector, most of them have been created to solve the current barriers of ICT literacy that have in the farming domain around the world as well as Sri Lanka.

V.   CONCLUSION

Farmers and people who are related to the farming domain need accurate and reliable information at the right time to maintain their farming activities. Lack of information visibility for the crop choosing, growing and selling caused to decadence of the farming industry. Then it may affect the economic growth of the country and the whole human life-style. Thus, it is more important to provide the right information to make decisions precisely at the right time for

the relevant communities. By review of related research, a huge number of researches based on developing new systems, ICT tools and the survey based researches to introduce new models, frameworks have been identified. But there is no any considerable development for distribute this knowledge among the agriculture sector and has not any particular platform including those innovations. For that purpose, we can integrate Information and Communication Technology for the agriculture sector. Thus, one of the main needs for the agriculture sector is to establish an information flow model connecting all stakeholders and related most suitable tools.

There are a number of same researches continually doing by the researchers, because of haven't any standard database including only all the research that have been done related to the ICT integrating in agriculture. To limit that weakness, as a future work this research study suggests publishing and maintaining a database for the agricultural journals, and online books about the agriculture related for help for the people who are interested in the agricultural sector as a knowledge sharing platform

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Sharing Economy Business in the Tourist Accommodation Sector: A Systematic Literature Review

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Abstract — **Tourism industry is the third largest export earner in the Sri Lanka economy. Accommodation is one of the major sectors of the tourism industry which needs to be thoroughly investigated to exploit the related benefits that are yet to be reaped through the successful integration of ICT. Sharing economy can be defined as an economic system in which assets or services are shared among individuals and/or organizations either free or for a fee, usually through the use of the Internet. As an example, the crowdsourcing platforms related to the travel and tourism industry used to get a high tourist attraction. To identify the current status and research gap of the above domain world-wide, a systematic literature review was carried out through the several key search terms being sharing economy, business models, e-commerce, revenue models and hospitality industry. Five electronic databases were searched to seek out relevant studies in the domain with-in the last 5 years (2014-2019) time period. Initially, 157 studies were considered and finally 15 studies were selected for detailed analysis. The findings revealed that there are several researches have been done on the tourism industry of Sri Lanka in the areas like tourism products, travel and tourism, policy making, key challenges in tourism, politics, securitization and etc. However, the results review the researches on the accommodation sector of the tourism industry sector are very least and yet to be grasped by the majority of rural community in Sri Lanka although the rural population accounts for nearly four times as urban population. The study makes a significant contribution by providing a systematic and up-to-date literature review on the selected domain.**

Keywords — **Crowdsourcing, Literature Introduction, Sharing economy, Tourism industry**

I. INTRODUCTION

Economical strategies of a country or any organization provides many opportunities for society to fulfill their desired achievements. The Sharing Economy is a young concept proposed recently with the emerging of internet technology. This consumes huge facilities rather than the Conventional Economic Models [1]. As well there are 4 major subjects related with Sharing Economy concept which are named as supplier, customer, platform and government [2]. The temporary ownership of the under-utilized asset is conveyed to the customer from the supplier through the online service platform [3]. There are very popular sharing economy service platforms available world-wide named as Uber, PickMe, Airbnb, Spinlister, Turbo and etc [4].

Sri Lanka has a foreign customer base, because of our country's location and other resources such as sea, mountains, meditation programs, tourism places and the most important fact is the cost of living of our country. According to the "Annual Report 2018" published by the Central Bank of Sri Lanka, tourist arrivals recorded a substantial growth of 10.3% in 2018, compared to 3.2% growth recorded in 2017 [5]. Therefore, the authors of the study investigated the Sri Lankan tourism domain especially in the accommodation sector to exploit the hidden opportunities and contribute to the community.

In this paper, the authors are presenting an extensive literature on sharing economy concepts and its related areas which are more relevant with the study. As the final outcome, the authors have selected the related publications through the standard selection process to get support for further study on the selected research area.

II. OBJECTIVES

Taken together, the objective of the overall study is to investigate the sharing economy business models with a view of adopt them in the accommodation sharing business in the rural areas of Sri Lanka. For that, the paper provides a systematic literature review on the sharing economy concept adopted world-wide.

By based on the previous studies, publications of government institutes and online resources, the mapping study provides a comprehensive review on sharing economy business services available in world-wide.

III. METHODOLOGY

The major objective of the mapping study is to obtain a thorough understand about the previous studies on sharing economy businesses spread world-wide. These previously done studies are selected through the systematic and standard procedure. As well, the mapping study is conducted by complying with the three main phases as provided by Kitchenham and Charters [6].

Planning: In the planning phase, we were involved with the five electronic databases named as IEEE Xplore, SpringerLink, Emerald Insight, ResearchGate and Science Direct and other online resources as web sites, published reports on Sri Lankan government institutes to get relevant studies for further analysis.

Conducting: In the conducting phase, searching on selected databases with related search terms, selecting relevant studies, review those studies and mapping of the relevant studies activities were carried out.

Reporting: In the final phase, aims to document all the necessary results prioritizing the retrieved studies and circulating them and answering the relevant research questions which were defined in the planning phase.

The below figures show inclusion and exclusion criteria respectively of the study selection process.

Table 1: Inclusion criteria of the study

No	Inclusion Criteria (IC)
IC1	The sharing economy business models

Table 2: Exclusion criterions of the study

NO	Exclusion Criteria (EC)
EC 1	The Papers which are written in another language than English.
EC 2	The Papers published only an Abstracts.
EC 3	The paper is a previous version of the study already selected (Duplications).
EC 4	The papers by considering full text format.

According to the mentioned criteria, the final fifteen studies were selected. Below figure shows about the study selection process clearly.

During this study, publications from 2014 to 2019 were assessed. Because, the tourism industry is up-to-date area in day by day and therefore we selected recent six years. In the initial stage, 157 publications were retrieved. Out of them, 36 publications were shortlisted from IEEE Xplore, 30 from Springer, 36 from Research Gate, 34 from Emerald Insight and 21 from Science Direct. Out of the selected 157 studies, 143 studies were selected based on the EC1 and EC3. Approximately 8.91% of studies were eliminated from the selected whole. Within 143 studies the authors have selected 72 studies by further looking for duplications (EC3) and the published only abstracts (EC2).

So, the removed studies were accounted as 49.6%. Then, the 13 full-text papers were selected by eliminating 59 retrieved papers from the previous stages. In this stage we removed 8 duplications and other 51 eliminated because of not satisfying IC1 up to a considerable level. At the last stage, 6 additional publications were discovered with the aid of snowballing. Then the selection criteria were performed throughout these selected 6 studies. Under that, 2 publications were selected, by removing the duplications and 15 publications selected as a result of the complex selection process.

In the study selection method, the authors aimed to find the relevant studies which are helpful to enhance the participation or entrepreneurship of sharing-based businesses. Because of the entire research study intended to provide the business model and guidelines for enhancement of rural-based participation for sharing-based accommodation businesses related to the tourism industry which are reaped through the Successful ICT integration.

IV. RESULTS AND DISCUSSION

In the section, discusses the answers to the research questions obtained through conducting the systematic literature review. We used the ID of the paper as a reference to answer the research questions.
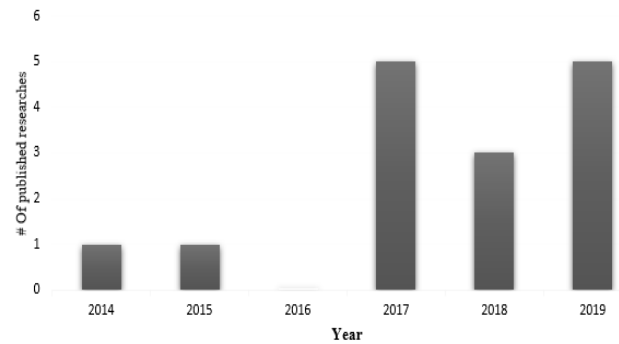
Figure 1: Distribution of the Selected Studies

As mentioned previously in the Figure 1, there are 15 studies have been selected within years from 2014 to 2019.

The authors have categorized the selected studies in to the four major areas for further analysis. Because, it is easy to extract the information from these papers by considering the below mentioned four areas. They are,

- Category1: Basic Concepts of Sharing Economy.
- Category2: Sharing Economy focused to develop new model, framework or platform.
- Category3: Sharing Economy related with the specific areas.
- Category4: Tourism or Hospitality industry with sharing economy.

The selected studies from the literature review expanded in to different areas by providing various solutions for sharing-based businesses spread through world-widely. There are several researchers proposed the conceptual models, business models, frameworks and guidelines as solutions to leverage sharing economy concepts in different domains. As well, there are researchers whose studies are aimed to understand underlying concepts of the sharing economy with the aid of empirical studies and diverse methodologies.

V. CONCLUSION

This paper contributes to the area of the sharing economy business models related to the accommodation sector of the tourism industry. The study considers the important facts like the publication year, keywords, methodology and research type when selecting final studies. Most of researches propose solutions rather than evaluations for problematic scenarios exists with the sharing economy. These solutions are expanded by proposing different conceptual frameworks and integrated business models, recommendations and so on. The articles help to obtain a deep understanding about sharing economy and has certain reference value for theoretical research and practical development in this field. Also, there are research studies which provide an assessment of sharing services and thereby provide some looseness as disadvantages.

Table 3: Bibliography References of the Selected Studies

ID	Bibliographic references
#1	H. Zhang, M. Li and H. Huang, "The Influence and the Development Path of the Sharing Economy on the Economy of China from An Empirical Study," *2018 5th International Conference on Industrial Economics System and Industrial Security Engineering (IEIS),* pp. 1-7, 3-6 Aug 2018.
#2	I. Symeonidis, J. Schroers, M. A. Mustafa and G. Biczók, "Towards Systematic Specification of Non-Functional Requirements for Sharing Economy Systems," *2019 15th International Conference on Distributed Computing in Sensor Systems (DCOSS),* pp. 423-429, 29-31 May 2019.
#3	J. Löbbers, M. v. Hoffen and J. Becker, "Business Development in the Sharing Economy: A Business Model Generation Framework," *2017 IEEE 19th Conference on Business Informatics (CBI),* 24-27 July 2017.
#4	P. Gazzola, Behind the Sharing Economy: Innovation and Dynamic Capability, vol. 6, Springer, 2017, pp. 75-94.
#5	D. Siuskaite, V. Pilinkiene and D. Zvirdauskas, "The Conceptualization of the Sharing Economy as a Business Model," June 2019.
#6	S. Flie, W. Johnston and C. Sichtmann, Fundamentals of Business-to-Business Marketing, Springer, 2015, pp. 171-226.
#7	g. görög, "The Definitions of Sharing Economy: A Systematic Literature Review," June 2018.
#8	K. Frenken and J. Schor, "Putting the sharing economy into perspective," *Environmental Innovation and Societal Transitions,* 23 Jan 2017.
#9	R. Gatautis, E. Vaiciukynaite and E. Vitkauskaitė, "Comparative Study of Sharing Economy Business Models in Accommodation Sector," in *31st Bled eConference: Digital Transformation – From Connecting Things to Transforming Our Lives*, 2017.
#10	C. F. Breidbach and R. J. Brodie, "Engagement platforms in the sharing economy: Conceptual foundations and research directions," *Journal of Service Theory and Practice,* 10 July 2017.
#11	Ministry of Tourism Development and Christian Religious Affairs, "Sri Lanka Tourism Development Plan (2017-2020)", 2017.
#12	S. Hofmann, Ø. Sæbø, A. M. Braccinib and S. Za, "The public sector's roles in the sharing economy and the implications for," vol. 36, 4 Oct 2019.
#13	T. ChristinaZhang, H. Gu and M. F. Jahromi, Computers in Human Behavior-What makes the sharing economy successful? An empirical examination of competitive customer value propositions, vol. 95, ScienceDirect, 2019, pp. 275-283.
#14	M.Ritter and H.Schanz, "The sharing economy: A comprehensive business model framework," *Journal of Cleaner Production,* vol. 213, pp. 320-331, Dec 2018.
#15	L. Zekanovic-Korona and J. Grzunov, "Evaluation of shared digital economy adoption: Case of Airbnb," *2014 37th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO),* 26-30 May 2014.

By consideration of characteristics and dimensions of sharing economy, some researchers produced sharing economy business models which are more related with the research interest. In some research, they held qualitative surveys to collect information from the different stakeholder groups to create and assess to their results. Also, one of the ultimate goals of the entire research study is to enhancement of rural-based participation and entrepreneurship related with the tourism related sharing businesses in accommodation. So, the authors of the study believe that with the aid of ICT integration the participation with the tourism domain can be leveraged. Therefore, in this literature review is used by the authors to gather the domain knowledge and overall idea about the sharing economy businesses adopted in world-wide. Thereby intend to discover the most related studies associated with the research area**.**

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Kansei Engineering Approaches for Web Interface Designing: A Systematic Literature Review

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Abstract — **Visual appeal or the emotional perception of vision is a subjective factor that varies from one person to another. This is very important to businesses in making a better impression on customers' minds about the products they make. This goes the same when considering web site designs as the product space and to measure and translate the individual emotional feelings into design parameters, the effectiveness of the Kansei Engineering (KE) concept has been used in several countries. However, the significance of this method is still not widespread in the area of improving website designing and there is a huge gap that the researchers have to cover in experimenting with different areas that this concept can be applied and also in sharing the knowledge. In order to narrow down this gap, to identify current status, and to motivate scholars who are interested in the domain, systematic literature was conducted initially evaluating 124 studies conducted from 2000 until 2020 and then selecting 14 studies out of that for the final analysis. The study was conducted successfully resulting in analysis of a very consistent and significant set of studies in the domain which will be helpful for the future attempts done by students and scholars. Further, this study contributes as an indicator for the potential scholars on how to conduct a literature analysis.**

Keywords — Interface Designing, Kansei Engineering, Systematic Literature Review, (within one line)

I.   INTRODUCTION

Interface designing in websites is done massively nowadays as novel and effective digital technologies are emerging day by day. Even though designers are equipped with knowledge and experiences in web designing, sometimes they fail to win the users' attention about the designs they make. According to relevant research findings, users' emotional feelings about those interfaces can be figured out as one of the reasons behind this situation since they are all humans who make decisions based on their feelings and psychological emotions most of the time[1]. Therefore, it is essential to consider the human nature and their emotional expressions in designing a web interface before leaping into implementations. Otherwise, the users will be discouraged to use the relevant websites and this may cause the owners a huge crisis in generating user attention and thus income. Kansei Engineering is a booming approach that supports to capture these psychological feelings or preferences and then transfer them to make correct design engineering. The mapping study shows that many researches have been conducted through this methodology yet it is rare to see it in web interface designing. However, it seems that during the last decade this topic has been cited by a considerable amount of individuals about optimized web interface designing in e-commerce/ e-business, e-learning, institutions as well as SME business domains with Kansei Engineering, but comparatively a very little number of reviews among them were found. Therefore, this study is supposed to be conducted in order to narrow down this gap.

II.   OBJECTIVES

While trying to narrow down the gap of having a lack in literature assessments in the domain, this study determines to achieve the following objectives.

- To show which production fields this concept can be applied to
- Understand to what extent the concept has been adapted in businesses around the world
- To identify/show research attempts that have been successful and have provided with effective outcomes
- To highlight the studies that have clearly brought out the KE methodology, its tools and steps in following it accurately

III.   METHODOLOGY

In order to get a clear understanding about the reviewing criteria from the readers' side, Fig. 1 can be simply presented as follows.
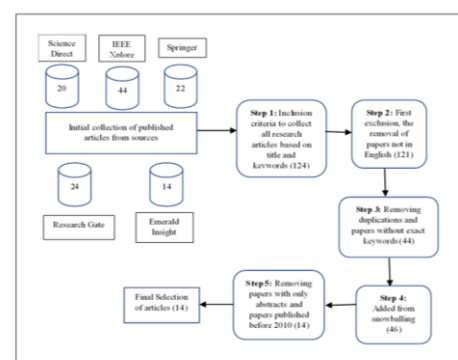
Fig. 1. Process flow in selecting articles

In this research, reviewing method can be elaborated in five main steps and they can be detailed down along these lines.

1.   Tracking a set of review questions

It is crucial to refer only very relevant articles in the selected research area and the purpose of this is to have a clear view about the current status of the research domain and ultimately make a novel solution to reduce the gap that resides in implementing such researches. The below questions were considered in selecting reference articles.

- Who are the targeted parties for the research?

- Are there any researches done using Kansei Engineering to support optimized designing of web interfaces?

- Which researches clearly show the outcomes in using Kansei Engineering concepts?

- Do these researches show how to follow Kansei Engineering approach correctly in web interface designing?

2. Selecting from research sources

Following research sites provided a number of researches that published mostly about the web designing area using Kansei Engineering Approach. Therefore, most relevant research articles were collected from each searching source.

- IEEE Xplore (https://ieeexplore.ieee.org/)
- Springer (https://link.springer.com/)
- Research Gate (https://www.researchgate.net/)
- Science Direct (https://www.sciencedirect.com/)
- Emerald Insight (https://www.emerald.com/)

3. Focus on most related keywords

Highly used keywords identified in the domain are "Kansei Engineering", "Website Designing", "Interface Designing" and "Affective engineering". However, at the first search, even the slightly matching research articles were examined in order to gather a very clear understanding about the domain and current status of this research area.

4. Inclusion and exclusion process

Inclusion and exclusion criteria followed for this research is given in below in Table 1 and Table 2.

Table 1. Inclusion Criteria

No.	Inclusion Criteria (IC)
IC1	All research articles related to KE and interface design based on title
IC2	All researches with keywords, "Kansei Engineering", "Web Designing", "Interface Designing", "Affective engineering"

Table 2. Exclusion Criteria

No.	Exclusion Criteria (EC)
EC1	Studies not in English
EC2	Studies which doesn't have needed keywords
EC3	Duplications
EC4	Studies with only an abstract
EC5	Researches published before 2000

5. Data extraction and synthesis

According to the afore stated inclusion and exclusion criteria, the initial collection of research articles consisted of 124 papers which were published on science conferences, books and also in journals were filtered and sorted to get the final 14 studies which are most relevant to the study scope. Considering how Kansei Engineering is used in website designing, usage of its tools, how effective and impactful this concept is and also based on research results, these studies were selected. A bibliography of these papers will be given in the results section below in Table 4.

Table 3. The overall selection process

Stage No.	Inclusion or Exclusion Criteria	Initial No. of Studies	Final No. of Studies	Reduction (as a percentage)
01	IC1, IC2 and EC1	124	121	2.4
02	EC2	121	84	30.5
03	Duplication Removal	84	44	47.6
04	Addition from Snowballing	44	46	-
05	EC4 and EC5	46	14	69.5

IV. RESULTS AND DISCUSSION

Given below is the set of finalized research articles for the analysis and review of literature. The collection includes researches on areas of institutional, e- commerce, mobile interface designing and also e- learning[2] When considering the research questions and objectives mentioned previously, to learn and identify the KE tools and techniques, a very noteworthy study set was found and one of them was done by Schutte et al. in 2004[3]. Also, the paper done by Mandosa and Ashu Marasinghe[4] shows that the gender difference can affect the measurements of emotional perceptions and almost every study here, clearly focuses on bringing out the KE methodology. Further to see the distribution of these studies over the past decade, a graphical representation is given in Fig. 2.

Table 4. Bibliography

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#4	F. Guo, Y. Cao, M. Wang, Y. Ding and L. W. Liu, "An Interface Design Method for E-commerce Sites'," 2013.
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#6	"Designing a University web site by Considering Users' Emotion and Using Kansei Engineering," in *International Conference of Cognitive Science (ICCS), Institute for Cognitive Science studies, Iran*, 2015.
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#9	F. Redzuan, A. M. Lokman and S. Abdullah, "Kansei Design Model for Engagement in Online Learning: A Proposed Model," in *ICIEIS 2011*, 2011.
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#12	J. M. G. Mendoza and A. Marasinghe, "Kansei Color Concepts in Interface Design for Mexican and Japanese E-commerce Websites," in *2013 International Conference on Biometrics and Kansei Engineering*, 2013.
#13	A. Hadiana, "Kansei Analysis of Interface's Elements for Mobile Commerce Application," in *2016 Fourth International Conference on Information and Communication Technologies (ICoICT)*, 2016.
#14	M. Hamzi and A. Hajmoosaei, "WEB INTERFACE DESIGN FOR ACADEMIC INSTITUTIONS," in *IEEE Conference on e-Learning, e-Management and e-Services (IC3e)*, 2014.
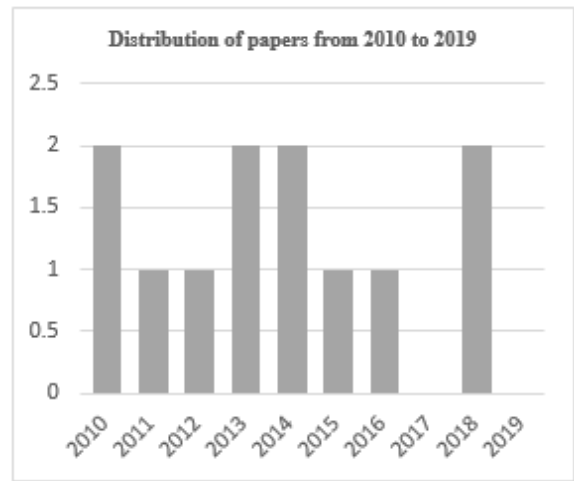
Fig. 2. Distribution of selected studies over the years

V. CONCLUSION

The ultimate goal of this study is to highlight most important and significant past studies that show KE methodology, usage of its tools and techniques in improved web designing during the last decade. Most of the studies have shown that the researchers have used Kansei checklists, questionnaire surveys and there SD scaling and Likert scaling in rating emotional perceptions of selected participants were used. Also for the analysis of the collected data, SPSS and PCA tools were used mostly. Moreover, this study contributes to the research domain by providing a coherent set of related articles and a review in its literature that the future scholars can use for their studies and this article can be considered as an illustrator of how we can do a systematic review in literature in any case. Further to extend this study in the future, it is possible to focus on investigating other affecting features for the visual aesthetics of humans and also different other product domains that this concept could be applied.

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Micro-segmentation Method for Claim handling Process in Health Insurance Claims Data

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Abstract—**The micro-segmentation process helps businesses to improve their customer relationship management process. The whole data set is divided into micro-segments by micro-segmentation. The customers are easily categorized in detail using this segmentation method. The segmentation of the behaviors is based on the user behaviors of the entire data set. We implemented a novel method for micro-segmentation. In this methodology, we used demographic segmentation and the behavior segmentation process. Insurance firms should process their claims process effectively to assess the actions of the policyholder, to claim trends, to request chargers, and other details precisely. In this study, the micro-segmentation approach proposed for managing claims in health insurance firms, which was focused on demographic and behavioral segmentation of clients of the firms, would help to determine the ten policyholders who have higher claiming charges, frequencies based on the policyholder's gender, age and disease status. Using this information, health insurance companies can provide special attention to those policyholders and make strategic decisions to handle their medical claims.**

Keywords — **Micro-segmentation, Demographic segmentation, Behavior Segmentation**

I. Introduction

Customer segmentation is the breakdown of the large database of total number of customers into subparts. Members of the subparts have similar characteristics and those features are dissimilar to other members of other subparts[1]. Today, the use of micro-segmentation for companies helps more than standard segmentation of the consumer. Micro-segmentation is more advanced in segmenting customers into several segments[2]. Micro-segmentation can be used in information technology, corporations, and marketing. Companies may use the results of their micro-segment to understand the needs of their consumers and deliver new goods and efficient services to each of their target customers. In the corporate world, insurance is a vital field. For each resource in every business field, this is very relevant. The insurance industry now provides most individuals and businesses with their services. Insurance providers offer various insurance types including life, property and injuries, health care and unemployment, etc. Claimants are covered by health insurance, health costs, and properties. The insurance company's primary concept is that the insurance company shall guarantee the refund of any loss/costs associated with unknown incidents. In this unknown situation, the insured party paid the insurance company with a smaller payment. Claims can significantly affect a health insurance company's earnings. For this reason, the efficient management of claims in the health insurance industry is important. Segmentation of actions may be used for this purpose. Segmentation of behavior, when interacted with an insurance provider, splits the consumer knowledge in a micro-segment into the particular behaviors[3]. Client claims, overall costs for each client, and the number of times they communicate with the organization concerning insurance policy, a form of policy that they required, etc. can be defined predominantly by the use of behavioral segmentation. By understanding the insurer's claims pattern, important decisions can be made and it is very helpful in the effective and reliable handling of the claim management process. And behavioral segmentation outcomes can also be used for the implementation of new deals, new policies and regulations, insurer charging packages, and more[4].

The main aim of this research is to identify the challenges of integrating micro-segmentation in the insurance business. Customers are divided into several different categories by a more sophisticated method of segmentation. Health insurance providers may use findings from the micro-section to understand the needs of individual customers and offer new products and quality services for each of their target customers. Insurance firms will accurately identify their target policyholders at the end of this study. Therefore insurance companies can also easily make strategic decisions about their future objectives.

II. Objectives

To manage claim data efficiently in the health-care company, the main objective of this survey was the detailed micro-segmentation method using demographic and behavioral segmentation. Claim management today is a vital aspect of the insurance industry. Through lowering excessive claims, an insurance company will increase its income. A detailed approach to micro-segmentation can be used for this. Using behavioral segmentation strategies, the policyholders can classify loyal policyholders, who have the highest overall claims, and so on in various ways. The outcomes of this approach to micro-segmenting can be used for efficient customer relations and insurance firms can provide their customers with such benefits. The insurers will also take a crucial decision on the high claims and frequency of policyholders. The principal objective of the investigation is to forecast micro-segmentation client practices and to incorporate these findings into the operations of health insurance companies. To archive, this primary goal should need to identify the reasons for use of micro-segmentation, to evaluate the reasons for the use of demographics and behavior segmentation for the micro-segmentation process, to identify the problems associated with the introduction of the micro-segmentation process in the insurance sector. And also need to implement the new approach based on micro-segmentation that supports healthcare insurance claim handling.

III. Methodology

Fig.1 shows the research method that applies to this study. Under the data pre-processing step, we first check the null values from the dataset. A null value indicates the

knowledge deficiency or unknown value. It is also, critical to identify the outliers in the dataset. Next, we remove all null values and outliers. This step can be called as data cleaning step.

After this pre-processing, we have a cleaned data set. Next, we apply Exploratory Data Analysis (EDA) to the cleaned dataset. Exploratory data analysis is the predictive analytics methodology that includes a lot of approaches. EDA support for many processers. Some of these processers are increase analysis of the performance, the conceptual model is disclosed, highlight major factors, discover outliers, and provides, best possible variable configurations.
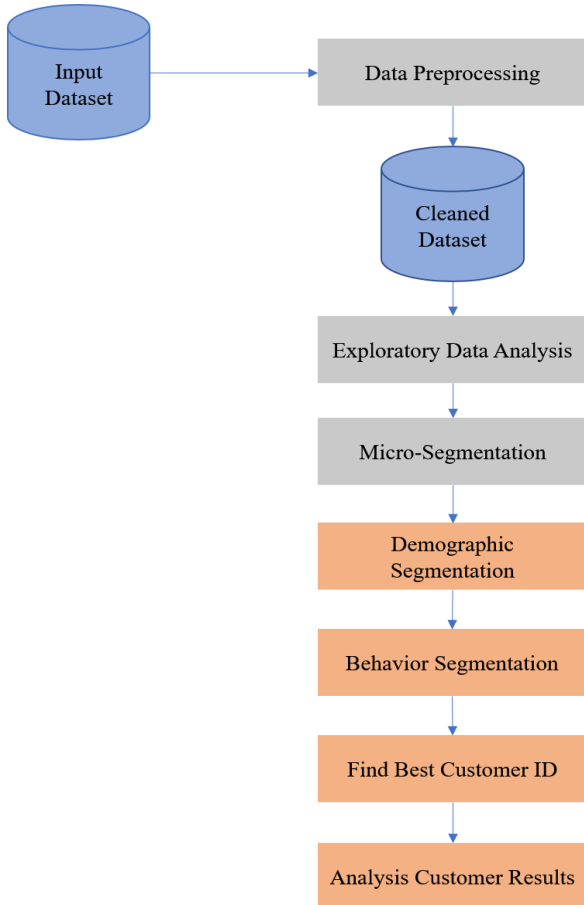
Fig. 1. Methodology

Micro-segmentation is a more advanced form of segmentation that divides the customers into many non-overlapping segments. Businesses can use micro-segment results to understand the needs of their targeted customers and provide offers, new products, and effective services for each of their target customers.

Demographic segmentation is dividing the whole dataset into sub-groups according to age, gender, religion, etc. In this research, we consider three segmentation types. They segment the dataset based on the policyholder's gender, age, and diseases. Age is one of the major and important factors from the factors that are used to segment the data set demographically. Customer characteristics such as level of education, and behavior are very similar for people in the same age group. Therefore, the age-based portion of the dataset makes accurate segmentation results extremely helpful. Gender is another important factor in the demographic segmentation of the dataset. The gender factor is mainly divided into two types, male and female. Customer

characteristics for these two types are dissimilar in many attributes for each other. Gender types are important for the claim process, particularly in the insurance industry. There are various reasons for claiming insurance which affects people in different circumstances. The likelihood of a smoker lodging a claim is greater that for those who do not smoker, for example. The gender of these individuals is important in this case. Also, diseases of the policyholders are critical for the claim handling process in the health insurance sector. Because the claiming patterns and charges are mainly dependent on the type of the diseases that each policyholder may have.

Behavior segmentation is segmenting the consumer dataset into micro-segment according to the behaviors of the consumers. This segmentation method is useful in many areas. Researchers can find ways to apply this behavior segmentation process for further development of the organizations. For the insurance industry, policyholders have their characteristics, especially in the claiming process. This research used the behavior segmentation process for the segment of the health insurance claim dataset. Under this, here we consider the claiming frequencies, claiming chargers, and various other factors regarding each policyholder in the insurance company.

IV. RESULTS AND DISCUSSION

Most businesses used demographic segmentation to determine the special resources in the target segment in the specific sector rather than targeting an overall industry. Demographic segmentation is dividing the whole client dataset into sub-groups according to the age, gender, religion, size of the family, etc.
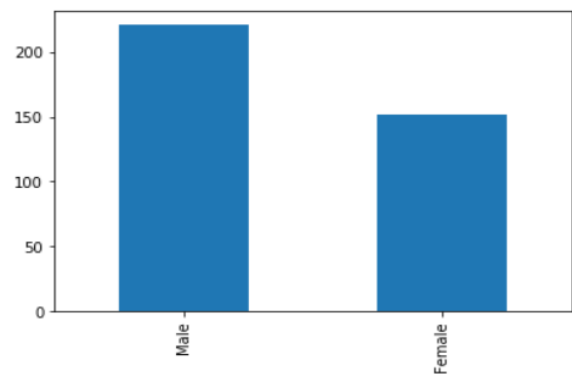
Fig. 2. Segment the dataset based on the gender

Here, segments of the dataset based on the gender of the policyholders. The above Fig.2 shows that, the count of the male policyholders is greater than the count of the female policyholders. Next considering only the male dataset, we applied the demographic segmentation based on the age range of policyholders.

According to Fig.3, the number of policyholders who are in the 36-45 range is greater than other policyholders in other ranges. 46-55 age range has the minimum count of the male policyholders.

Then visualize the count of the policyholder's base on the diseases which are in the age range (36-45).

Fig. 3. Male dataset based on the age ranges

Fig. 4. Distribution of the diseases based on the 36-45 age range

The above Fig.4 represents the distribution of count of policyholder's diseases. According to this figure, we can say the count of the policyholders who have diseases of the digestive system is similar to the count of the policyholders who have urology.

Then find the top ten customer IDs with several claims from the male policyholders who have diseases of the digestive system in the selected age range (36-45).

Below Fig.5 shows, the top ten customers and the number of claims for each customer ID, and that figure visualize the three policyholders have eight claims and two policyholders have five claims. And also, four policyholders have four claims and three claims that come from one policyholder in the selected dataset.

Finally, these ten customers' details visualized using treemap. Fig.6 displays that treemap and that shows the number of items and mean charges for each customer ID.

V. CONCLUSION

The information related to the policyholders is more beneficial for the insurance firm. Applying demographic and behavioral segmentation for that information may obtain the precise results and help to determine the policyholders who have higher claiming charges, frequencies based on the policyholder's gender, age, and disease status. Using this information, health insurance firms can provide special attention to those policyholders and make strategic decisions to handle their claiming patterns. As future work, we would like to carry out experimentation for real-world workload traces and improve the machine learning algorithm for automating the claim handling process in the health insurance sector.

Fig. 5. Top ten customers based on the number of claims
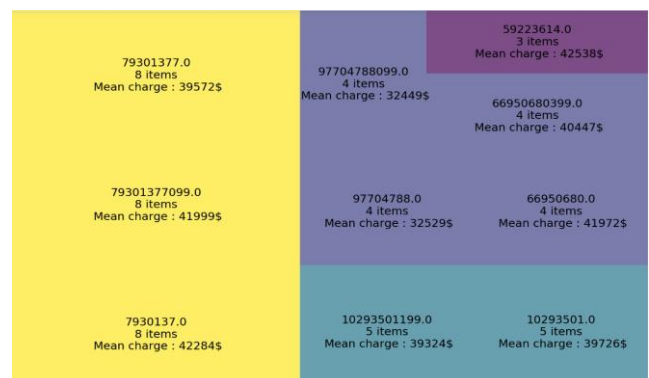
Fig. 6. Treemap for Top ten customers

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The Rise of Blockchain Technology in Sri Lankan Food Supply Chain

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Abstract — **This study focus on rise of blockchain technology in Sri Lankan Food Supply Chain (FSC) to increase traceability of assets. Blockchain is an evolving digital technology that allows remote untrusted parties to have secure transactions. It has grooving attention with FSC industry. Today's FSC need for and innovative traceability approach that serves as an important quality control mechanism ensuring sufficient protection in it phases. We create a blockchain model in the FSC. It can be applied across any supply chain. The proposed model provides a decentralized solution and no need for a trusted centralized authority, improving high integrity, reliability and security efficiency and protection all over production and distribution processes. All transactions are registered and maintained in the unchangeable database of the blockchain with access to a shared file network. The acceptance of blockchain in the supply chain and logistics in Sri Lanka is slow right now because of potential issues and the lack of proven models. There are so many hurdles and difficulties that impede its broader success among FSC. Technical dimensions, curriculum, legislation and legislative mechanisms are included in these challenges.**

Keywords — **Blockchain, Supply Chain, Logistic**

I. INTRODUCTION

Blockchain is cconsidered one of the most innovative innovations available. Blockchain first showed up in 2008 when published "Bitcoin: A Peer-to-Peer Electronic Cash System". The scheme suggested was based on cryptographic proof rather than dependency, allowing any two parties to perform transactions without the need of a trustworthy third party. The plan solved the issue of double spending. This is the first application of Blockchain, Created by Satoshi Nakamoto[2]. There are many critical features that Blockchain provides. Such as Decentralized, Traceability, Consensus mechanism, Immutability, Smart contract[5] . Blockchain application contain distributed architecture. That mean of distributed architecture is the program does not rely on any centralized authority but uses a peer-to-peer application server network operated by the owners of decentralized interests. Today Blockchain is applications further than finance, as in government, health, science, arts and culture[1].

Blockchain are already generating advantages on supply chains around the world. Real-time visibility can be considered an important benefit to supply chain management[4]. Furthermore, all transactions can be observable, and consequently. The data is organized into blocks which form a chain. All the transaction of Blockchain operate in a peer-to-peer network, in a decentralized way. Smart contracts inside distributed ledger are responsible for the validate and store transaction data, and it is not needed to have a central person that validates the transactions[3]. While the challenges involved in implementing a transparent supply chain are huge, the benefits of applying Blockchain to the food supply chain far outweigh the disadvantages (initial capital investment cost and maintenance). The advantages of an active Blockchain can be narrowly defined as a financial advantage, the benefits of the authorities and the benefits of the food companies. For simplicity's sake, however, the benefits can be classified as enhancing consumer loyalty, improving food crisis management, improving dairy supply chain management, expertise and technical innovation, and contributing to sustainable agriculture. There is an emerging rich network of devices and sensors that build an ecosystem rich in data for efficient monitoring and analysis of properties, which was unlikely in supply chains several years ago. This evolution has now allowed us to use this technology to create a Blockchain network that provides as mentioned in this research a lot of possible benefits.

II. OBJETIVES

According to this, emphasis on how Blockchain affects the food supply chain. To have this done, Possible applications and implementation of Blockchain are discussed in the supply chain to help businesses understand how to achieve their business goals. Furthermore, a logistics management program based on Blockchain is applied to evaluate the viability of applying Blockchain in the food supply chain. Accordingly, the major objective of this research is to fill current research gaps, new approaches to integrate Blockchain and IoT technology within food supply chain, and food quality management in the Sri Lankan food supply chain system.

- *Provide Trust for the entire supply chain network through Blockchain agreement(consensus)*
- *Improve the privacy of the supply chain system by facilitating access control over who will have access to the information in the block.*
- *Reduce costs by ignoring additional payment for third-party persons.*
- *Make consumers happier than traditional food supply chain system in terms of transparency of the product and price.*

Enterprise globalization expanded the difficulty of the supply chain processors. Now it is a main component to improve and integrate the information system. The difficulty of taking decisions needs real-time data sharing. When information moved in a linear form in conventional supply chains and inefficiencies in one stage influenced the following cascade stages, Digital supply networks are now capable of building interconnected networks capable of overcoming the action-reaction cycle with real-time data and facilitating cooperation. The figure 1 shows the move from the traditional supply chain to the digital supply network
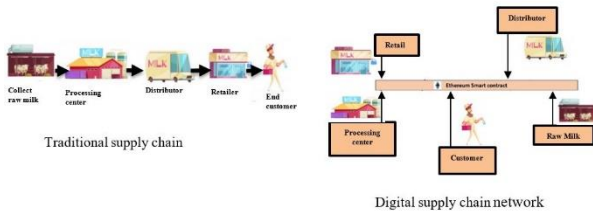
Fig 1:Traditional supply chain to the digital supply network

Table 1 shows the benefits would Blockchain brings to resolve the current problems in the supply chain

Table 4: Current problems and Blockchain impact in supply chain system

Supply chain actor	Current Problems	Blockchain impact
Famer/ Supplier	Capability to prove the origin and quality metrics of goods using a global and clear process.	Benefits from the improved trust by maintaining track by raw material production and supply chain from the raw material to the end customer.
Processor	Poor ability to track the goods produced to the final destination. Small ability to analyze measured content from raw material.	Value added from shared facts system with suppliers of raw materials and distribution networks.
Distributor	Customized monitoring devices with limited ability to work together. Limited certification skills and confidence issues.	Ability to have proof of position recorded in the database, and conditions certifications.
Wholesaler	Lack of confidence, and certification of the product path.	Capacity to test the origin of the products and the conditions for transformation or transportation.
Retailer	Lack of confidence, and certification of the product path.	Tracking any single commodity between the wholesaler and the final customer. Capacity to manage the returns of malfunctioning goods efficiently.
Consumer	Lack of trust about the product's compliance with the requirements and origin defined for the origin, quality and enforcement of the product.	Complete and clear view of the sources of the product and its entire journey from the raw material to the purchased finished product.

III. METHODOLOGY

This chapter lays forth the methods used to perform this analysis. Getting a good technique is essential for achieving a reliable outcome from the study. Figure 2 shows how propose model work in food supply chain. We apply it in diary supply chain as proof of the concept.

This architecture captures information regarding traceability using a range of IoT devices based on the type of event to be recorded. A transaction could be a movement of milk product, processing or store of milk, Distribute. Multiple data recorded from an IoT checkpoint is converted into a transaction and pushed to the etheteum network. All the transaction data check and validate within the smart contract

and then publish to the public ledger. The contract layer monitors every transaction data, to execute the smart contracts when an initial event takes place and it ensures expected data about the raw milk or milk product from the supplier, manufacture and distributor in the supply chain according to terms of trade agreed upon connecting to the blockchain network. Each entity involved plays a role, relationship, and interactions with the smart contract. Propose model contain only five participating entities named milk supplier, milk processor, distributer, retailer, customer.
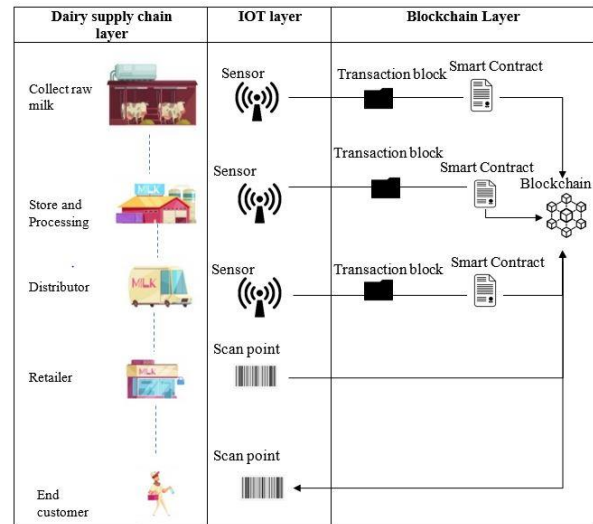
Fig 2:Supply chain solution with IOT model architecture

Figure 3 describe the transaction data processing flow of storing data in the blockchain. IoT devices generate data such as density, temperature, volume, etc. After digital signing and the hashing, such data will be sent directly or through the IoT gateways to the entire blockchain network nodes, Where they are verified, connected to the Transaction Pool and stored in blockchain.
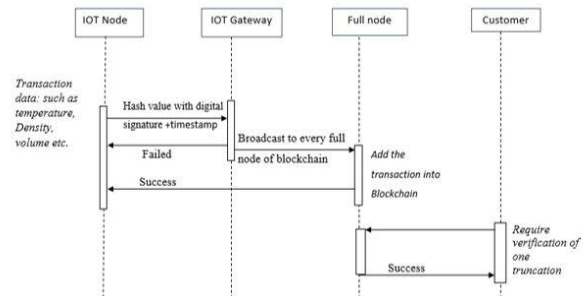
Fig 3: Transaction Data Processing Flow

Customers can access and validate all transaction data via their laptops or mobile phones. For example, one buys a package of milk from a supermarket and then he / she can use a mobile to check the 2-D barcode to gather all the transaction data relevant to it, including the farm from which the raw material was made, the day and time it was delivered, processing the manufacture, the collection of computer information, the packaging information. All of those information can be verified without human intervention by the blockchain system.

IV. RESULTS AND DISCUSSION

In this section, an evaluation will be made of the framework created and enforced. The experiments presented

here will first assess if the smart contract model performs as it should when users engage with its techniques. The first checks to be conducted on the smart contract system are on the performance of its execution. The features I have mentioned in the last chapters should be done effectively. So I set out the strategies of the smart contract to assess if these systems were really functioning as they should. What these tests did was effectively make a registrar user allocate distinct positions to a variety of other user accounts for testing this method. Then these user accounts were used to evaluate the various different approaches that altered the condition of the deal. It was checked that the blockchain network would also refuse his transaction if the user calling those methods did not have the required function or authorization to do so.

Figure 4 Shows part of the code that user on part of this tests. Some of the input functions are skipped to make it easy to read.

```
// 1st Test
it("1. Testing smart contract function supplyItem() that allows a farmer to supply raw milk", async() => {

    var event = supplyChain.RawMilk()
    await event.watch((err, res) => {eventEmitted = true })
    await supplyChain.supplyItem(originFarmerID,originFarmInformation,productNotes,{ from: originFarmerID })

    assert.equal(resultBufferOne[3], originFarmerID, 'Error: Missing or Invalid originFarmerID')
    assert.equal(resultBufferOne[5], originFarmInformation, 'Error: Missing or Invalid originFarmInformation')
    assert.equal(resultBufferTwo[5], itemState, 'Error: Invalid item State')
    assert.equal(eventEmitted, true, 'Invalid event emitted')
})

// 2nd Test
it("2. Testing smart contract function processItem() that allows a manufacture to process milk", async() => {

    var event = supplyChain.Processed()
    await event.watch((err, res) => {eventEmitted = true itemState = 1 })
    await supplyChain.processItem(upc, { from: originFarmerID })

    assert.equal(resultBufferTwo[2], originFarmerID, 'Error: Missing or Invalid ownerID')
    assert.equal(resultBufferOne[3], originFarmerID, 'Error: Missing or Invalid originFarmerID')
    assert.equal(resultBufferTwo[5], itemState, 'Error: Invalid item State')
    assert.equal(eventEmitted, true, 'Invalid event emitted')
})
```

Fig. 4.JavaScript code used for testing the methods and function

Tests on this front were satisfactory and shown that information was maintained as needed, with improvements in state / tracking and correctly managed clearance or quality management. Features for function base access control also worked correctly. An overview of the framework built and applied will be made in this portion. First, the experiments presented here will establish whether the reference implemented system performs as it should when users communicate with its processes.

For validate the proposed model, create simple web application, and provides ability to track the origin of the milk product. Here user can read details of each transaction. With the complete details, create RFID tag for each and product. Customers can access and validate all transaction data using that RFID tag.

V. Conclusion

The Blockchain based supply chain network focused in reference implementation. This research methodology was chosen in this research because Blockchain is still in its infancy. Companies must poses the knowledge and capability in Blockchain to adopt it. Moreover, It is important to realize that industrial solutions based on Blockchain should start with the willingness of the stakeholders to cooperate and to be involved. They need to reach a consensus on building knowledge and capabilities in Blockchain with a focus on providing value for all stakeholders. So, creating a culture of collaboration is critical.

According to the characteristics of Blockchain, stakeholders who use this Blockchain based supply chain system will advantage more when the number of joining users grows in this community. When more and more players in the supply chain participate, Blockchain becomes more relevant and credible and develops into market practice. This can be especially difficult as there are legacy processes, regulations and laws that regulate different facets of the company as stakeholders can incur costs as transitioning from legacy systems and combining with new systems and practices. In the future, due to the competitive nature of industry, many companies will be putting effort into the Blockchain based logistics network, not just in the private sector but also in public agencies. To ensure interoperability between different Blockchain based platforms, it is, therefore, necessary to establish standards and agreements.

Food provenance is one of the most challenging questions that companies in the FSC are trying to solve today and this research is a contribution to answering that question. The primary aim of this research is to establish a blockchain platform that can be applied within a Sri Lankan FSC and include its advantages and disadvantages in terms of food provenance and product traceability over conventional tracking systems It is clear from this research initiative that blockchains can be more effective in monitoring food provenance, avoiding significant degradation of food items, detecting and eliminating the source of foodborne disease in seconds, whereas contemporary systems may take as many weeks. It would also provide greater customer confidence that reflects the satisfaction of sales and customers.

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E-Farmer Management System for Empowering Sri Lankan Small-Scale Agriculture-Based Producers

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Abstract — **Sri Lanka had a strong agriculturally based economy. The agriculture sector of Sri Lanka contributes seven percent to the national GDP. Agriculture Industry can be defined as one of the most difficult industries when it comes to trading Agri products. The thirty years of a long war and the crisis situation in the country and policy changes in the various government administrations had caused a huge impact on Sri Lankan agricultural market systems. And the agriculture crisis caused a huge impact on small-scale producers in Sri Lanka to sell their products. To overcome this situation government has done several projects. Dedicated Economic centers are an example of such a project. The research was carried out in the Dambulla dedicated economic center to find out some significant issues that happened in the Sri Lankan agro-economic sector. The main objective of the research is to provide a feasible solution for those identified problems and empowering Sri Lankan small-scale producers by providing an effective platform to sell their products.**

Keywords — **Agro Economy, Dedicated Economic Centers, E- farmer Management System**

I. INTRODUCTION

Sri Lanka had a strong agriculturally based economy. The majority of Sri Lankans in rural areas depended on the agricultural economy. A large variety of crops are grown in Sri Lanka. Paddy is the main crop in the Dry Zone, vegetables, and fruits also important crops. There are two main cultivation seasons referred to as "Yale" and "Maha". For paddy cultivation.[1] Therefore, the agriculture sector of Sri Lanka contributes a considerable percentage to the national GDP (Gross Domestic Product). After the 1970 's this agricultural economy drastically faced a crisis due to the economic reforms implemented in the country from 1978 after the crisis agriculture sector become one of the most difficult industries when it comes to trading Agri products. [2]To overcome this situation government has done several projects.to provide a sustainable solution for those shortcomings. In 1999 an initiative was taken to establish a large-scale market center that would change the marketing situation for farmers. Dedicated economic centers are an example of such a project.[3] Dambulla dedicated agriculture center is the main economic center in Sri Lanka.

II. OBJETIVES

According to the Ministry of rural development, the main objectives of Dedicated economic centers are, Ensure obtaining reasonable prices for agriculture producers for their crops by providing a targeted market, Provide an opportunity for small scale producers to minimize their transport costs and wastage in transportation,[4] Provide opportunities for wholesale traders to purchase fresh fruits and vegetables, directly from producers, Encourage the business community by providing a competitive marketing environment for wholesale traders.[2] Create an opportunity to distribute area-specific agricultural products among consumers in all parts of the island, provide facilities for consumers to purchase food items at discounted prices. [4]

Marketing agro products are different when comparing to other marketing processes. As shown in fig 1 A large number of small-scale producers (farmers) and large-scale producers are participated in the marketing process because of The lengthiness of traditional market channels and unnecessary interference of the middle person to the marketing process, farmers are unable to get a reasonable price for their valuable crops. [5]Intermediate persons become key players of the marketing system as they have more power to decide the prices of agro products than farmers[6]. farmers have no idea about the market condition of their harvest.
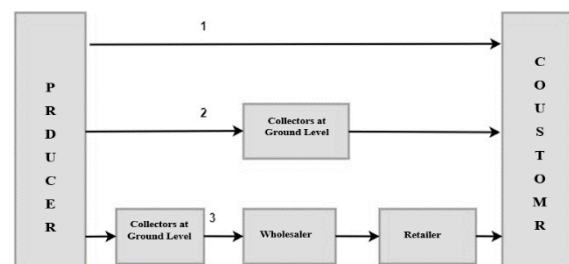
Fig. 1. Steps agricultural Marketing Source: Author

Therefore, the ultimate objective of the system is empowering small-scale farmers by providing a target market and limit the interference of intermediate persons to the marketing process, update farmers, with the latest market conditions. Encourage small scale farmers by providing competitive market information and reduce the lengthiness of current market channels by directly connecting farmers, buyers, and dedicated economic center into one platform to provide a sustainable solution for poor farmers who are great extent looking for a better life.[7]

III. RELATED WORKS

Table 5.Summary of Literature Survey

Autor	Title	Findings					
		Compatibility with any cell	Support the main three	Convenient	Understandable	SMS facility	Daily update Information
Karunarathna KNNS Vidhanagama DU(2015)	"E-farmer Management System for Agrarian Service Centre in Sri Lanka" The system provides information to get decisions through the internet in the form of text and images.[3]					✓	✓
Fernando ONN Wickramanayake GN (2014)	"Web-Based Agriculture Information System" design and development of a web-based agricultural information system for the main crops of Sri Lanka.[8]			✓	✓		✓
A consortium of local firm led by e-development labs	Govi Ganana Service A project that strengthen farmers knowledge about market condition[1]			✓	✓		
Similar apps Available in play store							
Seed Code Lab(2019)	"Weladapola" An app that provide price indexes and other related information about agro market[9]			✓			✓
S.I. Developer & Technology (2019)	"Badu Mila" App provides exact the daily commodity prices in Sri Lanka[10]		✓		✓		✓
Govipola (2018)	"Govipola" Govipola is an Agri App offering a digital marketplace for the farming community[11]	✓	✓	✓	✓		✓

IV. METHODOLOGY

Quantitative and qualitative methods are used to correctly identify the information, process, and communication requirements. Mainly knowledge is acquired using both structured and unstructured interviews with domain experts and from relevant documents by using a document analysis method to find the solution to the problem. All the Details and requirements are given from the head of the department and the staff members of Hector Kobbekaduwa Agrarian and the research center to get a broad idea about the Proposed system. As well as all the other important data were gathered by interviewing local farmers and buyers from the Dambulla area.

Fig. 2. Work Process of the system

farmer management system uses a centralized database, as shown in figure 2, Hector Kobbekaduwa Institute is deciding the prices of the vegetables, fruits, and rice along with the government. Those price indexes are sent to dedicated economic centers. From this new web-based system, those price indexes will be Sent to the registered. Farmers, according to their relevant crop by simple SMS alert every morning, then farmers can decide their prices and send them back to the economic center.[12] Then only buyers can know about price indexes. With this new system, the developer has reduced the lengthiness and interference of Intermediate persons to the marketing process by connecting Farmer, Buyer, and economic center into one platform. The researcher uses the agile Dynamic System Development Method (DSDM) for development. Mainly PHP, HTML, jQuery, AJAX, Bootstrap framework, Google Charts, SMS gateway technologies. The E-Farmer Management system has three main modules. Login Module, Administration module, and SMS module. The system will send daily updates of price indexes of vegetables to the registered farmers. And farmers can send their prices to the system too. Then the system will send those prices to buyers. Buyers can see all those prices by simply login to the system. The system will show the price of relevant crops with the farmer's details. buyer can order their preferred vegetables from there with this simple step, it reduces the lengthiness of market channels and reduces unnecessary participation of intermediate person to the marketing process, and give full power to farmers to decide the prices of their valuable crops.
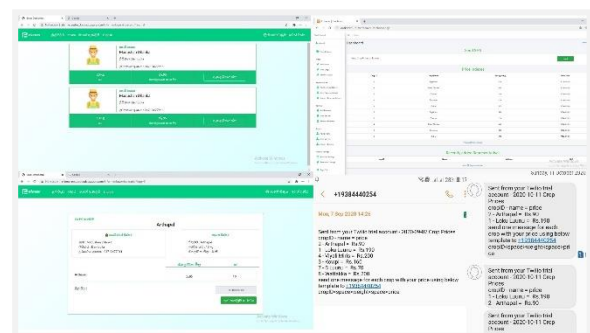
Fig.5. Screen shots of the web site and SMS notifications

V. RESULTS AND DISCUSSION

Evaluation of the system is done by using 50 farmers of the Dambulla area. It registered those 50 farmers to the system with their relevant crops and sent them to price

indexes of vegetables every morning for one week. A printed list of vegetables with their ID was given to farmers to provide a clear understanding. And ask them to send back their prices using those numbers. The system was evaluated considering the following identified criteria, Achieving project specifications and objectives Functionality of the system User-friendliness, Accuracy, Efficiency Usability, and Compatibility of the system. Evaluation results as follows.

Table 6.System Evaluation

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Easy to use	20	9	5	6	10
User Friendliness	18	10	10	7	5
Accuracy	25	10	3	7	5
Easy to access the main functions of the system	16	9	6	10	9

VI. CONCLUSION AND FURTHER ENHANCEMENT

The research was conduct to empower the small-scale farmers to sell crops through a system to minimize intermediate involvement.[13] This system has not covered other stakeholder considerations and product quality aspects issues faced by the buyer. Therefore, the following recommendations and future expansions are proposed. The researcher hopes to connect the government to the system as an end-user and develop an ERP system by connecting all the dedicated economic centers in Sri Lanka. Moreover, implement a cloud-based centralized database system where all the Buyers, Sellers, and farmers can access online with providing an island-wide market. Therefore, the wholesalers, retailers, and farmers to reduce the lengthiness and complexity of the current market process in Sri Lanka through; the system. It provides a new direction to the Sri Lankan agro-economy by providing new opportunities with the online vegetable market. Currently, the system has a smaller number of stakeholders, including mainly farmers, buyers, consumers, and Dedicated economic centers but with future enhancement government will become one of the main stakeholders. The government can also capture all the data about harvesting details, cultivating vegetable types, expected harvest season, harvest amount, and relevant areas. Furthermore, it will be given statistical information on the harvest and which crops to be produced within the country in the upcoming season. The system will provide a good understanding of the agro-economy field and its direction. Moreover, the government can encourage Sri Lankan small scale producers to grow some certain crops and provide them with fertilizer subsidies according to their requirements. As well as for the payment procedures system will link up with all the banks within the country. or another money transferring method such as Genie, Amex, or EZ cash.

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Descriptive Analysis and Data Visualization on Internet Usage During the COVID-19 Pandemic in Sri Lanka

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Abstract - This research is carried out to analyze the distribution of internet usage and identify the trends in internet usage during the Covid-19 pandemic situation. The sample data is gathered via a questionnaire and R programming language is used to analyze the sample data. By going through the analysis, age of 27 is identified as an average age group who is using internet more frequently and most of them are employable persons. Out of the sample, 10 hours per day is identified as a median value of internet usage on a daily basis and as the major proportion, 43.7% is used internet to continue their career life. Out of the sample, 46.22% have an uncertainty about their internet addiction, 34.45% revealed that they were not addicted to the internet and 19.33% have accepted their internet addiction. Though the acceptance of internet addiction is categorized into 3 levels, the average value of the internet usage in all the levels is higher than 10 hours per day. According to the analysis, within the Covid-19 pandemic period the internet usage of employable persons increased more due to the "work from home" concept. YouTube and Facebook play a major role for conveying information in day to day life and those become most prominent message delivery methods with compare to any other applications. According to the analysis, the potential is there for internet addiction with respect to the internet usage per day. This research has been able to graphically illustrate the importance of digital networks and service platforms based on internet during this global health crisis.

Keywords – addiction, internet

I. INTRODUCTION

The arrival of the Information Communication Technology (ICT) through World Wide Web (Internet) play a vital role in day today life and has affected individuals of different ages [1]. In the present scenario, ICT has become a most effective approach to deliver messages to other parties, and it has been influential in all areas of science, business, education, agriculture, military, etc. [4].Internet addiction (IA) has arisen as a potential problem for young people with the availability and mobility of new media, which refers to excessive device usage that interferes with their everyday lives. Often the internet is used to carry on research works, maintain the interpersonal communication and business transactions. Other than that, it can be used by someone to get into pornography, extreme gaming, chatting for long hours, and gambling [3]. The novel coronavirus disease, COVID-19, a transferable disease and caused by a variant coronavirus termed SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). Initially it was identified in December 2019 in Wuhan, China. Since then it has rapidly spread all over the world. The World Health Organization (WHO) confirmed this disease a pandemic on 11 March 2020. Governments in various countries have taken a range of security measures in order to reduce the impact of the pandemic. The WHO has encouraged testing and contact tracing to limit blowout within populations. Physical distancing which has been promoted by WHO keeps the safe distances between individuals. Moreover it reduces to have close contacts with each other. The subsequent regulations and recommendations are to close childcare, educational and higher educational institutions, cultural and entertainment-related locates. When it feasible, WHO encourages employees and companies to use remote (home) working practices [2].

Research problems which we attempt to address through this research during the Covid-19 pandemic situation are the frequency of internet usage of people in Sri Lanka, the usefulness of the internet for the career development, education, entertainment and social awareness, most frequently used devices to access internet and frequent software applications with trends. After analyzing the data, this research has graphically illustrated the importance of digital networks and service platforms based on internet during this global health crisis.

II. OBJECTIVES

The aim of this study is to find out distribution of internet usage and identify the trends in internet usage during the Covid-19 pandemic situation. In order to fulfill the aim of the research, some objectives are identified. Examine the purposes of using the internet and identify the novel mechanisms to get in touch with the world, investigate the frequency of internet usage among Sri Lankans are identified as objectives of this study.

III. METHODOLOGY

A questionnaire is shared with the people in Sri Lanka during the Covid-19 crisis situation. 130 responses are recorded in the database as a random sample records and after cleansing those records, 119 are selected for analyzing. R programming language is used to analyze the data set and obtained the summary of the sample with different graphical representations.

IV. RESULTS AND DISCUSSION

As shown in the Fig. 1, age distribution of the selected sample had normal distribution with Median 27 and mean 27.43. 72.27% of the sample is employees, 23.53% are university students in various disciplines, 3.36% of the sample is occupied for unemployed persons and 0.84% is for school students. Fig. 2 depicts that the 43.7% of the sample mainly uses internet for the career purpose, 28.57% is used it for education purpose, having entertainment is the main purpose of using internet for the 20.17% of the sample. According to the responses, average internet usage of the sample is 9.992 hours and it is shown in Fig. 3.

```
Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
15.00  25.00   27.00   27.43   30.00   40.00
```

Histogram of age distribution of the sample
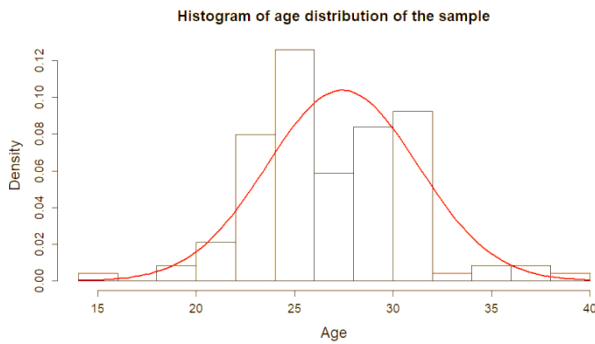
Fig. 5: Histogram for age distribution of the sample

Primary purpose of using internet
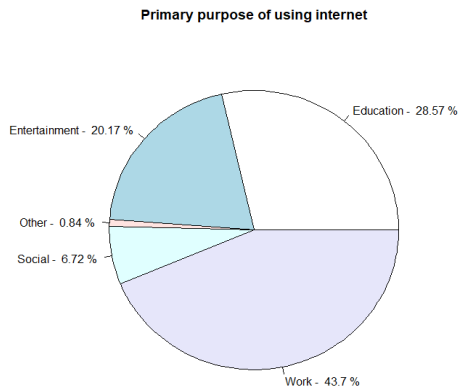
Fig. 2: Primary purpose of using internet

```
Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
2.000   5.000  10.000   9.992  14.000  22.000
```

Histogram and Normalization curve of Internet Usage per day
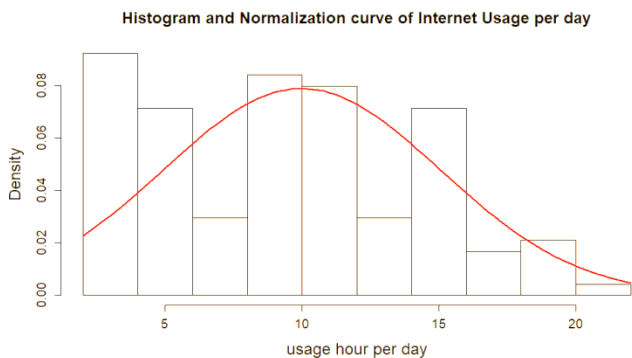
Fig. 3: Histogram and Normalization curve for internet usage per day

Majority of the sample uses Laptop Computers as the primary device to connect with internet where least is using smart phone as the primary device. 57.98% of the people use YouTube more than 2 hours per day where 82.61% of the sample uses Facebook more than 2 hours per day.

As shown in Fig. 4, 46.22% have an uncertainty about their internet addiction, 34.45% revealed that they were not addicted to internet and 19.33% have accepted their internet addiction.

Out of the people who believe that they are addicted to the internet, 65.22% are employees and 26.09% are university students. As the majority 60.87% completed their Bachelor's degree and some are reading their degree in this level. Laptops and Smart Phones are equally used as primary devices with the percentage of 47.83% and 60.87%

respectively. Average internet usage of this level is 11.39 hours per day.

Self Adiction Evaluation
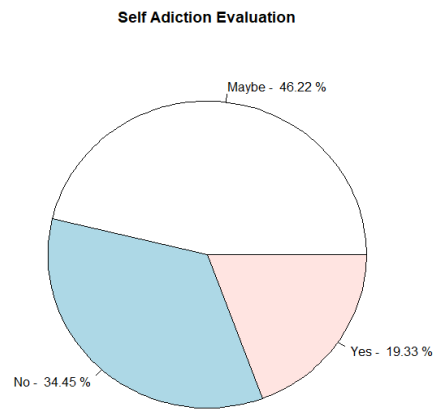
Fig. 4: Internet addiction self-evaluation

Out of the people who have uncertainty about the internet addiction, 74.55% are employees and 23.64% are university students. As the main proportion, 74.55% completed their Bachelor's degree and some are in the reading state. Laptops and Smart Phones are the two main devices which are used to connect with the internet and the   percentage of 47.83% and 60.87% are dedicated for each respectively. Average internet usage of this level is 10.00 hours per day.

34.45% strictly revealed that they were not addicted to internet. Out of this group, 73.17% of them are employees and 21.95% of them are university students. As the majority, 80.48% completed their Bachelor's degree and some are reading their degree in this level. Laptop is the most commonly used primary device which has 63.41% as a device usage. 10.00 hours per day is identified as an average internet usage of this level.

V.   CONCLUSION

This research has revealed that the employees who use the internet for career purposes and the university students who utilize the internet for academic purposes are the most dominant levels of internet usage. According to the analysis, within the Covid-19 pandemic period the internet usage of employable persons increased more due to "work from home" concept and the online lectures contributed directly to the higher internet usage of the university students. Average age is identified as 27, though the sample ranges between 15 and 40. YouTube and Facebook play a major role for conveying information in day to day life and those become most prominent message delivery methods with compare to any other applications. Moreover the potentiality is there for internet addiction with respect to the sample responses and internet usage per day. This research has graphically illustrated the importance of digital networks and service platforms based on internet during this global health crisis.

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A Deep Neural Network Based Hybrid Approach for Twitter Sentiment Analysis

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Abstract — **Twitter sentiment analysis results are used in multiple fields. Hybrid approaches which combine lexicons and machine learning models are proved to achieve best accuracies in sentiment analysis. Among all the machine learning techniques, Deep Neural Networks are widely used to conduct sentiment classification and are proved to perform better than other machine learning models. This research aims to compare the performance of a few Deep Neural Networks in Twitter sentiment analysis done in the hybrid approach. A set of 22,932 Tweets extracted from Twitter Standard API using the name of a popular mobile phone brand were preprocessed and classified according to SentiwordNet lexicon. In the initial step, the classified tweets were converted to numerical form and an embedding layer was created using the GloVe word embedding. Next, a simple Neural Network, Convolutional Neural Network and Long Short Term Memory Neural Network were build using the embedding layer and their performance was measured in terms of test accuracy. The results show that Long Short Term Memory Neural Network outperforms the other two models with a test accuracy of 84.94%. This result can be justified based on the nature of Twitter data. Long Short Term Memory Neural Networks are a type of Recurrent Neural Networks. RNN perform well with sequential data and Twitter data consists of sequences of words. As the conclusion, this study suggests that Long Short Term Memory Neural Networks are more suitable for Twitter sentiment analysis conducted in hybrid approach than simple Neural Networks and Convolutional Neural Networks.**

Keywords-Twitter, Sentiment Analysis, Deep Neural Networks

I. INTRODUCTION

Sentiment analysis is also known as emotion mining, sentiment classification or opinion mining. It is a sub field of Natural Language Processing research area. The purpose of sentiment analysis is to identify the emotion or the opinion with the intensity of negativity or positivity of text data according to [1],[2]. Also, sentiment analysis can identify if a text is subjective or objective [3].

Social media sentiment analysis aims to analyze social media user generated text content using sentiment analysis tools and classify data as positive, negative or neutral. This is a field of study that has been studied in many research due to its large number of applications.

With 330 million users around the world, Twitter is identified as the worlds' second mostly used social media network. Twitter users share text content related to numerous topics in the form of small text messages (tweets) creating zeta bytes of data each month. Most importantly, Twitter is used as a trusted source of user generated content by many researchers. Sentiment classification outputs of Twitter data can be utilized for so many applications. Few such applications are prediction of stock market prices [4], analysis

of product recommendations [5], prediction of election results [6] and health planning [7].

The methodologies and approaches used for social media sentiment analysis can be divided under three main classes: lexicon based, machine learning based and hybrid approach. Lexicon based methods use a lexicon of classified words. Text classification is done by assigning a sentiment score to each word in analyzing text according to the lexicon. The final class is selected by averaging the sentiment score of all words. Machine learning based methods train a machine learning model to learn the patterns from training text data and then classify unseen test data using the learned patterns. Hybrid methods are a combination of machine learning and lexicon based approaches. It is proved that hybrid methodologies produce best results than the other two methods [8].

There are a large number of machine learning models commonly used in hybrid approaches for sentiment analysis. Support Vector Machine, Logistic Regression, Naïve Bayes, Decision Trees and Random Forest and Neural Networks are some of them. Among them, Neural Networks are proved to produce the best accuracies in sentiment classification tasks. According to [9] Neural Networks are good adaptive learners and are good at learning patterns, recognizing sequences and generalization.

As stated by [10],[11],[12] Deep Neural Networks are a variety of Artificial Neural Networks that have multiple hidden layers. In the natural language processing field, deep learning based methods are used for recognition of named entities [13], POS tagging and to create word-vector representation [14],[15], [16], etc. In this research, the performance of a few most commonly used Deep Neural Networks for the hybrid approach for Twitter sentiment analysis is reviewed.

II. OBJECTIVES

Deep Neural Networks play a significant role in sentiment analysis. There are a large number of Deep Neural Networks used for sentiment analysis including Convolutional Neural Networks, Recurrent Neural Networks, Long Short-term Memory Network, Long Short-Term Memory network with attention mechanism, Gated Recurrent Unit, Deep Recurrent Belief Networks, Memory Networks and Transformer Neural Networks. The objective of this research is to compare the performance of Convolutional Neural Networks, Long Short Term Memory Networks and Simple Neural Networks for Twitter sentiment classification in terms of test accuracy to comment on best suitable Deep Learning Model for Twitter sentiment analysis conducted in a hybrid approach.

III. METHODOLOGY

Twitter provides a Standard API for academic purposes. To gather data for this research, we entered the name of a

popular mobile phone brand as the search keyword into the Twitter Standard API and collected 22,932 tweets. This number was reduced to 13,521 after preprocessing. It was observed that 41.04% number of Tweets were removed when preprocessing. The reason for this is the large number of tweets posted as retweets as part of marketing campaigns. During preprocessing duplicate tweets, emoji, emotions, numbers, special characters and stop words were removed. Case folding, lamentation and word segmentation were also performed on the tweets. Then the preprocessed data set was classified as positive, negative and neutral using the SentiwordNet lexicon. Results of lexicon-based classification are shown in Table 1. The data set was then divided as the training set (80% of the data) and testing set (20% of the data). Both data sets were then converted to numerical form using Keras python library. GloVe embedding was used to create an embedding layer.

To build the simple Neural Network, firstly the created embedding layer was added, and flattening was done to be able to directly add a densely connected layer. Then, a dense layer with sigmoid activation function was added to the model. Then Adam optimizer and binary cross entropy was used to compile the model. After compiling the model 80% of the training data set was used to train the model and the rest 20% was kept aside to calculate the training accuracy of the model. Finally, the test accuracy of the created model was measured using the test data set kept aside.

When building the Convolutional Neural Network, firstly the created embedding layer was added and then a one-dimensional convolutional layer with 128 kernels was added (kernel size=5). Then, feature size was reduced by adding a global max pooling layer. Finally, a dense layer with sigmoid activation was added. After that, the model was compiled and tested in the same way as in simple Neural Network.

The last model, Long Short-Term Memory Network (LSTM) was created by adding a LSTM layer with 128 neurons after adding the embedding layer. Then a global max pooling layer and a dense layer was added in the same way as when building the Convolutional Neural Network. Model compiling and testing was also done in the same way as before.

Table 2 contains the training and testing accuracies of the three models.

IV. RESULTS AND DISCUSSION

Table 1. Outcomes of lexicon based classification

Positive	Negative	Neutral
4051	2995	6475

Table 2. Performance of DNN models

	CNN	LSTM	Simple NN
Training Accuracy	90.01%	95.40%	85.52%
Test Accuracy	80.59%	84.94%	74.68%

The results show that there is a significant gap in training and testing accuracies in each model. This indicates that the models are overfitted.

Simple Neural Network produced the lowest test accuracy and Convolution Neural Network produced the second-best accuracy. Long Short-Term Memory Neural Network produced the highest test accuracy.

V. CONCLUSION

Twitter sentiment analysis outcomes are utilized in a variety of fields. Hybrid approaches are proved to produce the best results for Twitter sentiment analysis. There are a large number of machine learning models that can be used in hybrid approaches and among them all, Neural Networks are proved to produce the best accuracies.

Deep Neural Networks created by adding multiple layers to Neural Networks have an important role in sentiment analysis. The objective of this study was to conduct a comparison between the performance of simple Neural Networks, Convolutional Neural Networks and Long Short Term Memory Neural Networks for Twitter Sentiment Analysis in hybrid approach and identify which Neural Network is best suitable.

The results show that between the three models compared, Long Short-Term Memory Neural Network (LSTM) produce the best accuracy than the other two neural network models. This observation can be justified based on the nature of the data. LSTM is a type of Recurrent Neural Network (RNN). RNN is proved to produce better results with sequence data and Twitter data consist of a sequence of words.

Convolutional Neural Network (CNN) has produced an accuracy that is only slightly less than LSTM (80.59%). This proves that CNNs are also an optimal choice for Twitter sentiment analysis. CNNs are proved to work well with data that has a spatial relationship. When considering Twitter data, there is an order relationship between words that appear in the text. This explains the good performance of CNN for Twitter sentiment analysis.

In conclusion, this study suggests that Long Short Term Memory Neural Networks are better suitable for Twitter sentiment analysis than simple Neural Networks and Convolution Neural Networks.

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A Review on Feature Extraction Techniques for Plant Disease Classification

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Abstract — **There are many advances in computer vision that helps to identify and classify plant diseases automatically. A classifier will detect the plant diseases as healthy and diseased with the given features as input in automatic detection. So, feature extraction plays a vital role in the identification of a disease. The main objective of this study is to review commonly used feature extractors that are more suitable for plant disease classification. This review has been carried out by dividing into three main sub-parts, namely planning, conducting and reporting. In the planning phase, a search strategy was defined with search terms, inclusion and exclusion criteria to identify relevant publications. In the next stage, the defined strategy was followed to identify the relevant published papers and features engineering techniques used in each study were identified. Hand-crafted feature engineering and deep learning feature extraction are the two main types of feature extraction methods reviewed and analyzed. In the last stage, all the findings were summarized and documented. With regards to the results obtained from reviewed studies, usually hand-crafted feature engineering techniques require human experts, although they display good results in identifying plant disease. However, by using this method, unwanted features can be skipped, or redundant features can be removed. Deep learning methods consist of neural networks that do not require any human expert intervention to extract the features automatically. From this review, it is identified that Convolutional Neural Network (CNN) in the deep learning approach is the commonly used feature extractor in plant disease classification that provides a high classification rate with an average of 98%. In contrast, other hand-crafted feature engineering techniques rely on the features that they choose**

Keywords — Feature extraction, Deep Learning, Hand-crafted Features

I. INTRODUCTION

Plant Disease identification plays a vital role in every farming and gardening system. In general, a farmer recognizes symptoms of the diseases in a plant using naked eye observation, which requires continuous monitoring that is tedious and expensive. There are many advances in computer vision that helps to identify and classify plant diseases automatically[1]. A classifier will detect the plant diseases as healthy and diseased with the given features as input in automatic detection. Accuracy is the main parameter that every researcher used to calculate the performance of the model. The classifier's accuracy depends primarily on the features which are extracted[2]. So, feature extraction plays a vital role in the identification of a disease. Proper selection of the correct features results in high diagnostic accuracy. Hand-crafted feature engineering and deep learning feature extraction are the two main types of feature extraction methods reviewed and analyzed in this paper.

Hand-crafted features of the plant leaf image can be mainly divided into three types, shape, texture, and colour.

Hence Bera et al. have selected color and shape of the diseased part as features to identify rice diseases. After feature extraction and selection, they have used different classification techniques for the disease's identification [3]. There are a specific set of machine learning algorithms to extract each feature. In [4] they mentioned that color, shape and texture features can be extracted with Grey Level Co-occurrence Matrix (GLCM) , Blend vision and machine intelligence. Monika Jhuria, Ashwani Kumar and Rushikesh Borse have used colour, morphology and feature vectors to extract features from the existing dataset. They divided the colour image processing into three main distinct areas. They extracted the morphology feature using the erosion concept. For the texture extraction, they have used Daubecies 2-D wavelet packet decomposition. They concluded that they had achieved better results for colour and morphology when compared to texture, as the diseases are defined better by these features from the dataset [5]. Namrata Ghatol1 and Dr G.P. Dhok have suggested an image processing technique to detect and classify crop diseases with a texture-based feature approach. They have used Gray Level Co-occurrence Matrix to extract texture-based features like energy, contrast, correlation, mean and Homogeneity [6]. Sandeep et al. have mentioned there are various methods of feature extraction techniques that were used to identify species according to specific characteristics of the leaves. The study depicts that most studies have used shape, colour and texture features in leaves. They concluded that although the hand-engineered feature extraction method is successful in many studies, the performance of those approaches mainly relies on the features that they choose. With different leaf data and feature extraction techniques, these hand-crafted features are subject to change, which confuses the search for an active subset of features to represent leaf samples in species recognition studies.

Deep learning feature extraction includes various types of neural networks that automatically identify features by learning and adjusting the appropriate weights. Lee et al. have done a review on how deep learning extracts and learns leaf features for plant classification. They have learned essential leaf features using Convolutional Neural Networks (CNN) directly from the raw representations of input leaves. CNN itself automatically detect the features that are important to classify the plants according to the diseases with the help of CNN filters. They have concluded that the results show that the extracting features based on CNN can provide better feature extraction compared to the use of hand-crafted features[7]. Xiaolong Zhu, Meng Zhu and Honge Ren have proposed an improved deep CNN for plant leaf recognition. They have used inception V2 as the feature extractor consists of a layer-by-layer structure rather than using a conventional

CNN. Feature maps generated in the pooling layers were used to identify the features. They have concluded that this approach gave better results when compared to traditional CNN[8].

II. OBJECTIVES

In this study a Systematic Literature Review (SLR) has been conducted to determine the relevant related publications, and those papers were later analyzed deeper to identify the commonly used feature extraction techniques. The main objective behind this paper is to present the best feature extractors that can be used in plant disease identification by analyzing different recent methods of extraction of features. The broad range of applications on the field of plant disease classification makes it difficult for anyone to follow all possible useful ideas present in the literature, leading to missing potential solutions to problems. In this study, an effort has been made to highlight the progress made so far in the feature extraction phase of plant disease detection. This is a modest contribution to help new researchers to obtain an overall picture of recent best feature extraction methods

III. METHODOLOGY

The review was carried out by dividing the whole process into three main sub-parts, namely planning, conducting and reporting. In the planning phase, a search strategy was created. According to the strategy, search terms, inclusion and exclusion criteria were identified and defined. Search terms were used to filter only the related studies from large databases

Table 1. Search Terms

No	Search Terms
S1	"Feature Extraction" OR "Feature Engineering"
S2	("Feature Extraction" OR "Feature Engineering") AND "Image Processing"
S3	"Hand-Craft" AND ("Feature Extraction" OR "Feature Engineering")
S4	"Deep Learning" AND ("Feature Extraction" OR "Feature Engineering")
S5	("Feature Extraction" OR "Feature Engineering") AND ("Plant Diseases" OR Leaf Diseases OR "Crop Diseases") AND ("Recognition" OR "Identification" OR "Detection" OR "Classification")

In the conducting phase, a hybrid forwards and backward approach was followed to classify primary studies. The collected research papers were divided into two main categories as papers that have followed deep learning feature extraction methods and hand-crafted feature engineering techniques. They were stored in a local database. Then the necessary techniques for each purpose were extracted by reviewing and comparing. Finally, as the last phase, a table which returns all the crucial aspects of the features, methods and the comments was created

A. Hand-craft feature Engineering method

The computation of hand-crafted features is a two-step process wherein the first step characteristics of the images are located, and then each key point is distinguished with the help of a classifier. Reviewed studies have used several classifiers such as Support Vector Machine () and K-Nearest Neighbor (KNN)

B. Deep Learning feature Engineering method

Deep Learning has the capacity to construct and extrapolate new features from raw representations of input data without specifically telling which features to use and how to extract.

Widely used Deep learning feature extraction method in the plant classification area is CNN [3]. It learns by extracting the basic features in the first layers and evolving to learn complex features of the image in the deeper layers, resulting in more accurate image classification[9].

Table 2. Summary of Techniques

Feature	Feature Extraction Method	Comments and Accuracy
Texture Features: Contrast, Homogeneity, Energy, Entropy, Variance, Cluster Shade, Cluster, Prominence	Grey-Level Co-Occurrence Matrix (GLCM)	* Capture properties of texture, but they are not directly useful for further analysis, such as comparing two textures. * Easy to implement *High dimensionality
	Gabor Filter	* Sensitive to a different orientation and scale
	Local binary pattern (LBP)	* Very Simple * Low computational cost * Sensitive to image rotation
Color Features: Mean, Standard Deviation, Color moments	Color co-occurrence Method	* Competitive computational cost * It avoids the use of weights to combine individual color and texture features
	Color Histogram	* Represents the frequency distribution of color bins in an image * Easy to compute * Insensitive to small variations Not robust
Shape Features: Area, Euler Number, Orientation, Extent, Perimeter, Convex area, Filled area, Eccentricity, Major axis length, equidiameter, and Minaxislength	Elliptic Fourier and discriminant analyses	* Highly dependent on the segmented result of leaf images.
	Geometrical calculation + Moment invariants	* Instabilities and noise sensitivity

IV. RESULTS AND DISCUSSION

The history of plant identification methods extracted from the studies shows that existing plant disease classification solutions heavily depends on the experts' ability to encode domain knowledge. Many researchers have used hand-engineering methods for their characterization for many morphological features pre-defined by pathologists. Colour and texture features are extracted widely by the people rather than shape feature because it does not have any specific

details to reflect the plant disease's image. Some researchers have also used deep learning models to extract features for plant disease classification. Deep learning models can be used for both classification and feature extraction. Convolutional Neural networks (CNN), Probabilistic Neural Network (PNN), Back Propagation Neural Network (BPNN), and Radial Basis Function Neural Network (RBFNN) are examples of those deep learning models. The performance of these models highly depends on the amount of training data that is used. So, these are computationally expensive compared to other hand-engineered feature extraction techniques. Commonly used feature extractor out of the other deep learning methods is CNN. It extracts features from images and manages the entire feature engineering portion. Beginning layers in the usual CNN architecture extract the low-level characteristics, and end-level layers extract high-level characteristics from the image. From the studies, we can identify that all the issues with normal classifiers are addressed by CNN, and the accuracy of the CNN is also higher in the plant disease classification study area. Average accuracy achieved from the CNN considering all the reviewed papers is 98%. Below table shows the average of accuracy obtained by reviewing the papers with same dataset.

Table 3. Summary of Findings

Feature Extraction	Classifier	Average Accuracy
GLCM	KNN	91.37%
	SVM	95.8%
LBP	KNN	90.1%
	SVM	92.3%
CNN		98%

V. Conclusion

This study presents the main feature extraction methods that may help engineers, students, and researchers in selecting the appropriate algorithms for their plant disease classification. The usage of the feature extraction methods usually depends on the requirement of the classifier. Each method has its drawbacks and advantages. Before the deep learning approach, people need to spend time selecting the necessary characteristics when classifying the images. Too many hand-crafted features are available (local feature, global feature), so it will take too much time to select the correct .

features for a solution (image classification) and select the correct classification model. With regard to the studies, we can conclude that the most suitable approach for plant disease classification is deep learning models because the manual extraction is a complex task, and the identification is sensitive. Deep learning models can be used for feature extraction as well as for classification. So, without much human expert intervention with higher accuracy, we can classify plant diseases efficiently and effectively. This review makes a significant contribution by providing an essential and up-to-date analysis of the previous attempts made in the domain of feature extraction.

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A Smart Solution for Plant Disease Detection Based on IoT

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Abstract — **In human life, agriculture plays a key role. Nearly 60% of the population engages in certain agricultural practices directly or indirectly. Nowadays, however, farmers have stopped farming and migrated to other sectors because of less automation adoption and other factors such as increased demand for farm jobs. Farmers are therefore now increasingly dependent on the introduction of cognitive alternatives to take advantage of technological change. In the field of smart accurate farming, Arduino and the Internet of Things together build new dimensions. This proposed approach aims to develop a method of detecting plant conditions based on a TCS3200 colour sensor, Temperature and Humidity by DHT11 sensor as well as a Soil Moisture sensor for the application of soil. The method blends IoT with Arduino, considering various features such as colour, soil humidity, temperature, and various sensors to help recognize leaf disease in plants.**

Keywords — Arduino, IoT, Plant leaf disease detection

I. INTRODUCTION

From the advancement of agriculture to the improvement of yields, mechanical and compound advances have been made to recognize, examines, and data about the plant infections and condition in the cultivation area. Be that as it may, digitization in this field has been pretty much the equivalent. With the ascent of IoT, it is planned to make a computerized framework for agribusiness that will empower the rancher to make informed current condition information regarding his farm and to determine wrong circumstances ahead of time. Hence, it will help improve the nature of the plant and will likewise profit the farmers. Early recognition of sicknesses and condition measure is a significant test in the farming area.

Plant disease identification is very important for the normal state of a plant that interrupts or modifies its vital functions. Plant disease identification of affected plants is one of the first steps in diagnosing a plant's disease. Agriculture productivity and economy mostly depend on identifying plant diseases. Plant disease identification roles are a very important role in the agriculture field. If proper care is not taken in this plant or area it causes serious effects on plants and due to which respective product quality or productivity is affected. And detection of plant disease beneficial as it reduces a large work of monitoring in big farms of crops, and at a very early stage itself, it detects the symptoms of diseases.

Much difficult to analyze and inform the farmer regarding the plant conditions Thus, this process is not known to every farmer and the specialists must bear a huge cost and it takes a long time. In one of the researcher, has [1] introduced IoT application to checking plant illnesses and creepy crawly bothers. IoT innovation to percept data, and the function of the IoT innovation in horticultural sickness and bug control, which incorporates farming illness and creepy crawly bother

checking framework, gathering infection and bug data utilizing sensor hubs, information preparing and mining. The current study also focused on integrating sensor monitoring methods with IoT.

The scientist [2] proposed philosophy includes decreased computational unpredictability and focuses on bother discovery in a nursery climate as well as in a ranch climate also. The whitefly, a bio-attacker which represents a danger to a huge number of yields, was picked as the bug of interest. Another researcher[3] introduced bug control in agrarian estates utilizing picture handling methods in MATLAB.

This is achieved by interconnecting various sensors to the Arduino module. Various sensors are used to measure parameters such as soil moisture, temperature, and humidity to prevent severe loss in agriculture and contribute to the productivity of the farm. The website is designed to identify the current condition. However, mordent agricultural technology mainly focuses and hopes to achieve a profitable economy, and a better harvest [1].

The paper is organized in five sections II gives the project objectives. III mentioned the proposed methodology. Section IV describes results and discussions. Finally, Section V gives conclusions of the work.

II. OBJECTIVES

This research focuses on identifying current cultivation and smart greenhouse conditions detection mechanism using IoT. Variety of soil condition and crop infections and the changing temperature and humidity condition tend to reduce the healthy plants. Hence, the proposed system presents a method to detect the condition in the early stage and warn the farmers on the same.

III. METHODOLOGY

The proposed system will be trying to detect conditions from plant and greenhouse. The information gathers from plant and greenhouse cultivation current ecologic variables like temperature, soil moisture, Humidity, and Plant color [4].

- Temperature, Humidity values are detected by a DHT11 sensor. DHT11 is ultra-simplicity propelled suddenness sensor. Soil Moisture detected to use Soil Moisture sensor. The TCS3200 color sensor used to detect Plant leaves colors. The sensor consists of a solitary solid CMOS incorporated circuit.
- All sensors and Programs are installed in NodeMCU Module. It is work as a Wi-Fi shield to send the information cloud stage to detect and analysis plant condition.

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- Finally, sensor data values retrieve VB.Net plant disease application.
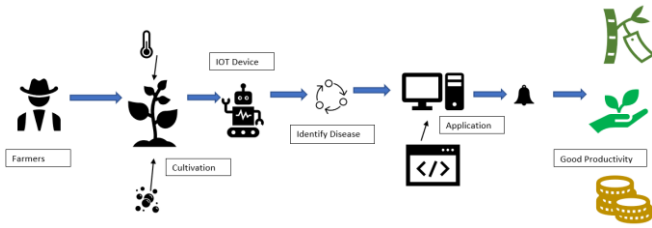
Fig. 1 Block Diagram of Proposed Approach
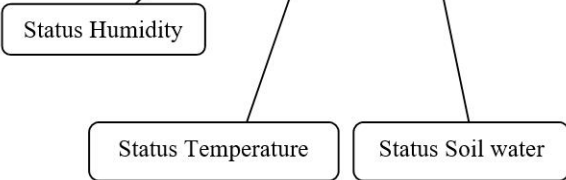
Fig. 2 UI of Web Application
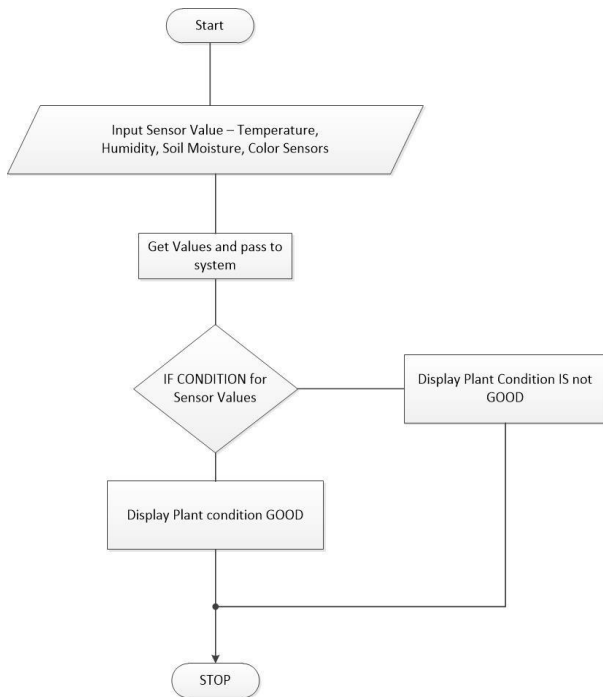
Fig. 3 Identify Cultivation Humidity, Temperature, and Soil Moisture

IV. RESULTS AND DISCUSSION

The proposed system we have taken into consideration the identification of plant conditions in cultivation. It is easy to see the difference between normal and affected foliage based on temperature, humidity and Soil Moisture. Table 1 shows the ranges of sensor values related to identifying healthy plants.

We have collected 100 sample leaves out of which 50 samples are normal and 50 samples are diseased. Initially, the standard values of healthy leaves are stored in the database. Then we took the healthy leaves from the samples and tested them in the software to check the system accuracy.

Table 1 Sensor Values

Temperature sensor values	40c Up = Diseased
	40c Low = Healthy
Humidity Sensor Values	90% Up = Diseased
	90% Low = Healthy
Soil Moisture	$450 \geq Moisture \geq 800$ = Diseased
	$450 \leq Moisture \leq 800$ = Healthy

CP-Correct Predicted   UP -Unexpected Predicted

$$Accuracy = \frac{CP}{CP + UP}$$

Equation 1 Formular of Accuracy

In our system, we considered two values for the analysis of the result, namely CP (Correct Predicted) and UP (Unexpected Predicted). Using the temperature sensor gives an accuracy of 88%, using a humidity sensor 82% and 85 % using a soil moisture sensor, respectively.

Fig. 4 Laboratory Testing

The Concept of identification of plant disease on plant leaves by utilizing temperature sensors is provided in Algorithm 1.

Start

Input temperature and Humidity

Input Color sensor value

If (min humidity<humidity<max humidity)

Display "plant is Normal"

Else

Display "plant is Diseased"

If (min Temperature<Temperature<max Temperature)

Display " plant is Normal"

Else

The notion of identification of plant disease on plant leaves to use the Humidity sensor is given in Algorithm 2.

Input Soil Moisture
if (450 ≤ Moisture ≤ 800)
{
  Display "Plant is Normal"
} else
  {
   Display "Plant is Diseased"

  }

V. CONCLUSION

A framework for monitoring the efficiency of the sheets is established throughout this work. The proposed methodology uses sensor devices to detect temperature, humidity, and soil moisture parameters of the leaves, which are then compared with a data set to verify that the collected values fall within the range defined in the dataset. Farmers, industrialists, botanists, food engineers and physicians will use the proposed model in various fields.

Display "Plant is Diseased"

Stop

Future enhancements regarding our proposed system will be implementing the scheme using appropriate IoT devices, hardware, and cloud. It is also planned to develop an advance web app to convey information about the plant condition to the farmers, in their local language (Sinhala). This system will benefit the farmers to increase their profit and improve their living condition.

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Efficient Deep Learning Models for Tomato Plant Disease Classification Based on Leaf Image

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Abstract — Tomato is grown in outdoor fields, greenhouses, and net houses in almost every country around the world. However, unfortunately, many diseases on these tomato plants have caused a considerable loss to the quality and the quantity of production that has affected the economy of the country. Accurate and faster detection of diseases in tomato plants could help to develop an early treatment technique while significantly reduce economic losses. Computer technology is playing a vital role in the study of visually observable patterns on the plants. Recently various image processing and pattern classification techniques are used to implement computer vision systems that are capable of detecting and classifying visual symptoms of plant diseases easily. The main objective of this study is to present an efficient and accurate model for the classification of tomato diseases, which will eliminate human error in the identification of tomato diseases based on naked-eye observation. This study has trained several deep learning models by building a CNN from scratch and fine-tuning VGG16, Inceptionv3, MobileNet architectures that are more efficient in visualizing the spots of tomato disease during their complete cycle of occurrence. Tomato leaf images belonging to 10 different diseased classes with a resolution of 256x256 were collected from the Internet to train, validate, and test the model. Images were normalized, and the image augmentation techniques were applied for the collected images to expand the size of the data set. To get the best optimal models, they were tested for many cases by changing the parameters. The proposed CNN model achieved an accuracy of 90% while other fine-tuned models VGG16, MobileNet, and Inceptionv3 achieved an average accuracy of 94%, 97%, 95% respectively. Experimental results show that our proposed system can effectively recognize ten different types of tomato diseases.

Keywords — *Computer vision systems, Tomato disease classification, Deep learning models*

I. INTRODUCTION

Agriculture is the primary occupation of many developing countries. A significant percentage of the population in these countries still depend on agriculture. Globally, annual fresh tomato production amounts to about 160 million tons which is three times more than potatoes and six times more than rice worldwide. According to the Census and Statistics Department Sri Lanka, the size and production of tomatoes grew by 25 percent and 71 percent respectively in 2000, and by 2010. In the tomato production, 80 percent is confined to six districts, with Badulla, Nuwara Eliya, Kandy, Matale, Anuradhapura, and Rathnapura. There was 7,261 ha of land planted in 2010, and a 75,335mt tomato harvest was achieved. This suggests a growing increase over the years in the production of tomatoes. However, unfortunately, many diseases on tomato plants have caused a considerable loss to the quality and the quantity of agricultural productivity, which has directly impacted the economic[1].

Each year tomato cultivators have faced severe losses. Thus, protecting the tomatoes from these diseases is the biggest challenge for increasing agricultural production. To monitor the health of tomato plants, knowledge of expertise is a must. Naked eye observation by experts is the most traditional way of monitoring plant diseases by looking at the leaf. Nevertheless, it takes excessive processing time as continuous and constant observation of the fields is a necessity of this method [2]. In some cases, farmers in remote areas need to travel long distances to get the assistance of an expert. It takes time, as well as an extra cost. If the expert has lacked knowledge, the mistakes are often, and there is a high possibility that prediction goes wrong. Due to the complexity as some diseases do not have visual symptoms and a large number of cultivated plants and existing pathological problems, even experienced agronomists and plant pathologists often fail to detect diseases [3]. So, it is not a good habit to rely entirely on an expert, agronomists, or plant pathologists.

There are many advances in computer technologies that help to recognize and classify plant diseases automatically. It eliminates the need for professional personals to continuous observation of fields, which takes time and cost [4]. Recent case studies show that soft computing models like Neural Networks, Decision trees, Support vector machine, and Naïve Bayes have been applied for the automatic plant disease classification. Deep learning has dominated computer vision over the last few years. The combined factors of widespread smartphone penetration, HD cameras, and high-performance processors in mobile devices and advances in computer vision paved by deep learning has led to a situation where disease diagnosis is based on automated disease recognition. A deep neural network is made up of the combination of deep learning and neural network, which mimics the general principles of the brain. The architecture of a deep neural network includes an input layer, several hidden layers, and an output layer. The layers will be trained to figure out the best filter weight values. Convolutional Neural Network has had ground-breaking performance over the past decade in several fields linked to pattern recognition. Many other deep learning architectures like VGG16, Inceptionv3, MobileNet, AlexNet, DenseNet, and GoogleNet also have been proposed recently.

II. OBJECTIVES

The main objective of this study is to evaluate different architecture models that can be used for plant disease classification and identify the best model. With the application of these models, the ultimate goal is to present an accurate model for classifying plant diseases that can be used for further improvements in this field. In Sri Lanka, around 15% of the tomato loss is due to the diseases. Continuous

monitoring of the crop is required throughout the growing stage to identify the plant diseases because if they do not control at the appropriate time, they can damage the tomato plant so much that most of them are lost. If the gardeners or start-ups are lack experience, they will not be able to identify the diseases at an early stage accurately. Rather than offering a guess, this study can at most give a definite answer on how the accuracy has varied with the different architectures.

III. METHODOLOGY

The methodology of this study is divided into the following steps:
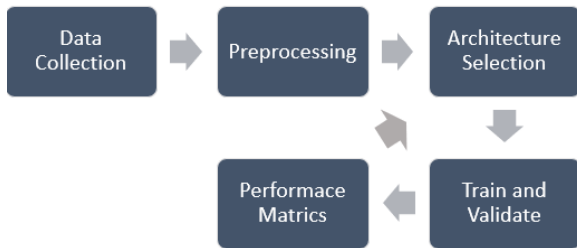
Fig. 1. Main steps of the methodology

A. Data Collection

Diseased tomato leaf images belonging to 10 different classes with a resolution of 256x256 were collected from the Internet. The entire dataset was divided into three main directories as train, validate and test where 17184, 4585, and 1161 images belong to each directory, respectively. Altogether there were 22930 images in the main directory. The purpose of using two different datasets for testing and validating is to ensure how the model performs with unseen data. Test data measure the performance of the final model while validate data was used to measure how the model performs during training.

Table 2. Summary of the dataset

Disease	Train dataset	Validate dataset	Test dataset
Bacterial spot	1684	425	54
Early blight	1761	480	159
Late blight	1713	463	138
Leaf Mold	1753	470	129
Septoria leaf spot	1682	436	63
Spider mites	1537	435	204
Target Spot	1659	457	168
Mosaic virus	1700	448	90
Yellow Leaf Curl Virus	1868	490	93
Healthy	1863	481	63
Total	17184	4585	1161

B. Image Pre-processing

Image pre-processing is a technique that is applied to enhance the input image for further processing by ensuring the relevant features are emphasized for further processing. In this study normalization and data augmentation techniques were applied within the pre-processing stage. A large number of different images are needed to construct an accurate classifier. But it is practically difficult to find such an amount of massive data. But by using data augmentation techniques, it is possible to generate new data by making changes to current data. Rotation, shear, zoom, horizontal and vertical flip are the augmentation options applied in this study.

C. Architectural Design

The success of the deep neural networks lies in the well-designed architecture. So, it is critical to identify which design gives the best results and under which circumstances they can be used. Here VGG16, MobileNet, inceptionv3 is used other than the CNN built from scratch.

1) Convolutional Neural Network (CNN)

CNN is a type of artificial neural network which is typically designed to extract data features by using high-dimensional data. The proposed CNN model comprises four convolutional blocks followed by batch normalization, max pooling, and dropout layers. Other than that, two dense and flatten layers were also included in the end. For each block, the Rectified Linear Unit (ReLU) activation function was used, but at the end, after the last dense layer, the SoftMax activation function was applied. A 0.001 fixed learning rate was used throughout the training. The number of epochs and the batch size was set to 15 and 27, respectively. The model was compiled by using the Adam optimizer and the categorical crossentropy loss function. The model was tested for many cases to identify the optimal set of parameters.

2) VGG16

VGG16 is a famous CNN model submitted by the researchers at the University of Oxford for the ImageNet Large Scale Visual Recognition Challenge (ILSCRC) in 2014 under the topic of image recognition [6]. In this study, a pre-trained VGG16 model was fine-tuned for the identification of plant disease. Pre-processing was applied before feeding the images to the input layer with the help of Keras VGG16 pre-process input function. The VGG16 model containing a total of 138,357,544 parameters was downloaded from the internet with the saved weights. The last layer of the model was removed, and a new fully-connected layer was added to make it fit for the requirements of this study. The same best set of hyperparameters on CNN were used in the VGG16 model.

3) InceptionV3

A team of researchers from Google has found the inception concept which belongs to the family of Deep Neural Network [7]. In this study, InceptionV3 is fine-tuned, which is the third version of the series. The model with 21,802,784 parameters was downloaded with Keras library. The specialty in this model is the addition of the global average pooling layer. Weights of the last layers were frozen, and the same set of hyperparameters were used like VGG16.

4) MobileNet

MobileNet belongs to the family of deep neural networks that are lightweight and faster. The size of a particular model mostly depends on the total number of parameters it has. The model was downloaded from the internet using Keras Library, and the images were pre-processed with the help of MobileNet pre-process function. When compared with other models, it usually applies less data augmentation. From the pre-trained model, the last five layers were removed, and a new dense layer was added with ten output nodes as there were ten disease types. The model was fine-tuned and the same best set of hyperparameters were used as in CNN.

D. Train and Validate

The fit () function was invoked by feeding the train images, validate images, setting epoch size, and steps for epochs. Finally, the performance metrics were evaluated, and the final model was predicted with the unseen data. These steps were followed iteratively by changing the parameter values until the best combination of the parameter was found to get the generalized accurate model.

IV. RESULTS AND DISCUSSION

This study is carried out to present an accurate model by evaluating the performance of various deep learning architectures in the tomato plant disease classification area that are commonly used today. A CNN, VGG16, MobileNet, and InceptionV3 has been built, fined tuned and trained successfully. The CNN model was implemented from scratch, and others were fine-tuned to make perfect for the study.
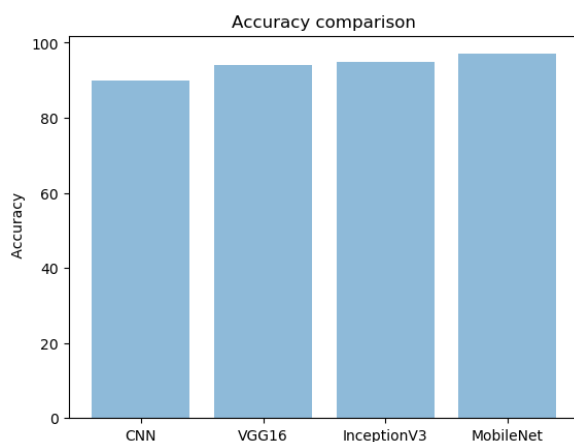
Fig. 2. Accuracy Summary

VGG16 model has taken a long time to train the model compared to the other two. That is because the total number of parameters used in those models were very high. So, we can conclude that when the parameters increase, the time that is taken to train the model also increases. When the

complexity of the model was very high, the model tried to memorize all the information, which results in a poor generalization for unseen data. So, each model was tested for more cases before finalizing the model. The MobileNet is not too complicated when compared with the Inception and VGG16 models as it contains a smaller number of parameters. So, the training time of it was lesser than the other models. When compared with inceptionV3, MobileNet works better with size, latency, as well as accuracy. This model can be easily used in mobile devices and embedded vision applications in future improvements.

V. CONCLUSION

Deep learning models have shown significant improvement in the context of pant disease classification. This study is carried out to present an accurate, efficient model for tomato disease classification by understanding different architecture models that can be used within the study area. A CNN model was built from scratch and other deep learning models; VGG16, InceptionV3, and MobileNet were fine-tuned. They have shown an average accuracy of 90%, 94%, 95%,97% respectively. All the models were able to classify ten different types of tomato diseases. With regard to the results, we can conclude that MobileNet is perfect for the study as it is lightweight, faster, and can be easily run on mobile devices. Future work includes extending this study to other crops and developing a complete decision support system run on smart mobile devices.

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Development of Monographs for Shading Devices in Sri Lankan Residential Buildings

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Abstract - **Shading devices are not a new concept for the world, those have been used to achieve aesthetically pleasing building facades, but not effectively sized or positioned to minimize the heat gain or provide the thermal comfort inside the buildings [4]. The extensive studies about sunshades have been carried out in the other countries and technical tables are developed for the public use but such are not available for Sri Lankans [5]. This short paper investigates the designing of a horizontal shading device for the openings facing on north and south directions in the Sri Lankan residential buildings. Sun paths for north and south directions are studied for all twenty-five districts and developed guidelines to design the shading device as well as a table and a graph to determine the length of the shading device for common dimensions used in the construction for windows and doors. Research shows that the length of the continuous horizontal shading device for north and south directions does not significantly change due to the position in Sri Lanka.**

keywords- Sun path, Shading device, Altitude of the sun

I. INTRODUCTION

Sri Lanka is an island located at a latitude of 5.9° and 9.8° N, and longitudes of 79.79° and 8.1° E (Presidential Task force on Energy Demand Side Management, 2018) [6]. As a result of low latitude, all external surfaces of buildings are liable to receive direct sunlight during the daytime [2]. The sun path for Sri Lanka does not show a great variation unlike other countries which are situated in higher latitudes. Reason for not showing a much difference between the sun angles for different locations in Sri Lanka is the tilt of Earth's axis of rotation with respect to the orbital plane. The axis of rotation is tilted by an angle of 23.5 degrees with respect to the plane in which all the planets go around the Sun [3]. This research leads to develop a chart that helps the general public on designing shading devices for different areas in Sri Lanka. There are different types of shading devices but here, it mainly focuses only on continuous horizontal shading devices, which is being commonly used in residential buildings in all parts of the country. All the calculations and the guidelines are tabulated covering all twenty-five districts in Sri Lanka.

II. OBJECTIVES

The objective of this research is to inform the general public about how to design and build an effective shading device for the openings which faces for north and south directions depending on the location of their construction. Therefore, the author's main target is to prepare a simple guideline that can be adopted by the general public for designing shading devices for residential buildings in Sri Lanka. Having properly designed effective horizontal shading devices will contribute to maintaining a comfortable indoor environment as well. This will also reduce the consumption of the energy used to maintain the thermal comfort of the building which is a motivation factor for the general public in accommodating the effective shading devices in residential buildings.

III. METHODOLOGY

The main focus is to build an effective shading device for openings facing north and south directions of a building. The variation of the sun path in Sri Lanka was studied with respect to the altitude changes as indicated in the Fig 1. In calculations, the height from the ground to the window is neglected and only the window height is taken. The lowest sun altitude was considered because according to the equation (1), the lowest angle provides the maximum length needed for the shading device.

The sun angle is obtained by 3D sun path software by Andrew Marsh [1]. The calculations were done for the north and south directions for all twenty-five districts. The findings for 25 districts are illustrated in two graphs (Fig 5 and Fig 6) for north and south directions.
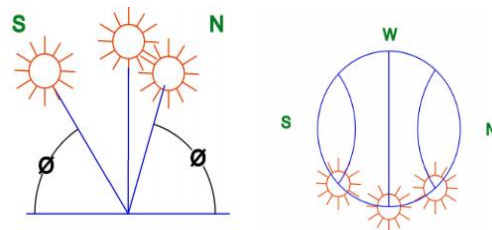
Fig 1. Annual Sun Path

For Horizontal Shading Device:

∅ = Altitude of the sun (VSA; Vertical Shadow Angle), L = Length of the shading device, H = height of the window.

$$\tan(VSA) = \frac{H}{L} \qquad (1)$$
$$Length = \frac{H}{\tan VSA} \qquad (2)$$
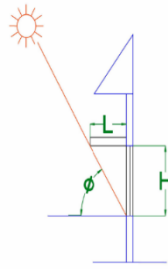
Fig 2. Horizontal sunshade Device Dimension

For Vertical Shading Device:

HSA = Horizontal Shadow Angle (Azimuth), D = Depth of the shading device, L = Length of the Window, H = Height of the Window.

$$\tan(HSA) = \frac{L}{D} \qquad (3)$$
$$depth = \frac{L}{\tan HSA} \qquad (4)$$
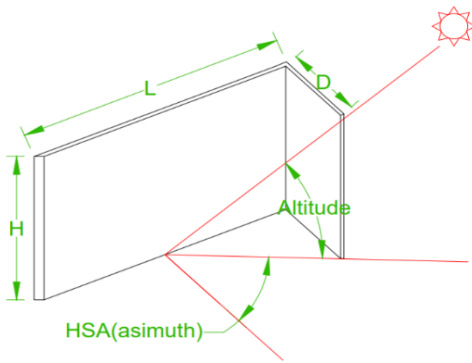
Fig 3. Vertical Sunshade Dimension

IV.   RESULTS AND DISCUSSION

The study on sun paths shows that there is no significant variation of sun angles hence the horizontal continuous shading device lengths are considerably equal for north and south directions in Sri Lanka.

In the case of vertical shading device, openings facing on the south direction has larger variations for the depth. The values for the depth of the vertical shading device for southern districts are smaller compared that for the districts in the northern part as shown in fig.7.

Jaffna	Kilinochchi
Mannar	Mulaitivu
Vauniya	Puttalam
Kurunegala	Gampaha
Colombo	Kaluthara
Anuradhapura	Polonnaruwa
Matale	Kandy
Nuwara-Eliya	Kegalle
Ratnapura	Trincomalee
Batticoloa	Ampara
Badulla	Monaragala

Fig 4. Legend for districts in North Horizontal Shade Length

North Horizontal Shade Length for all Districts in Sri Lanka
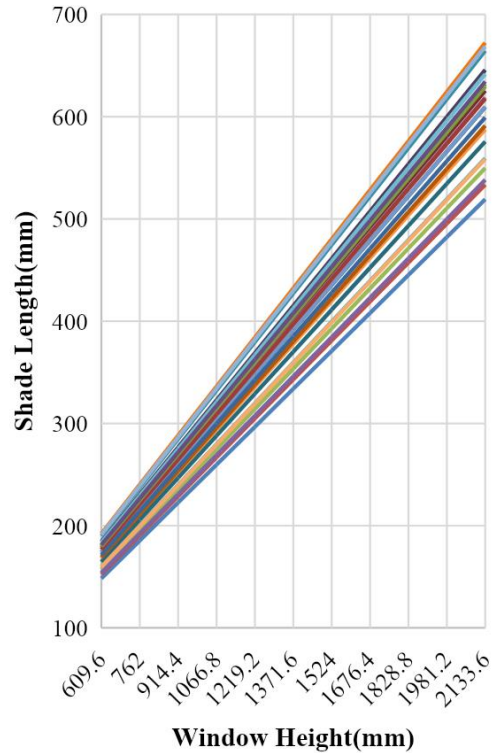
Fig 4. North Horizontal Shade Length

But for the northern direction there is no significant change as shown in fig.6. This is because the latitudes and longitudes for different locations in Sri Lanka do not have large variations like other countries. The calculated lengths for horizontal shading devices show approximately equal for all 25 districts as illustrated in (Fig 4 and 5) for both north and south directions. But there is significant difference for depth of the vertical shading devices for north (fig. 6) and south (fig. 7)

South Horizontal Shade Length for all Districts in Sri Lanka
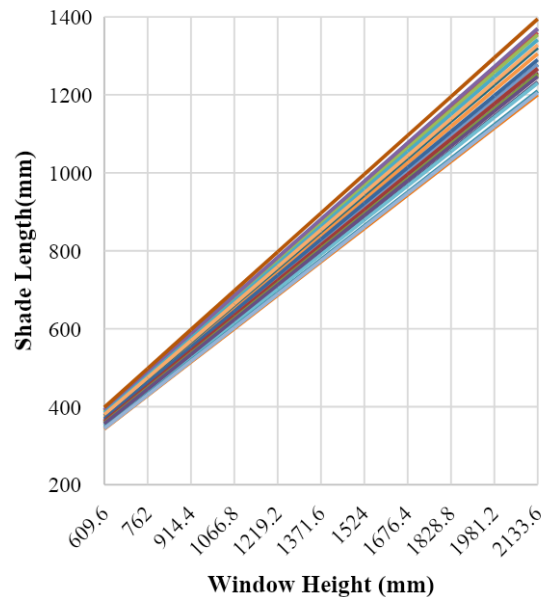
Fig 5. South Horizontal Shade Length

V. CONCLUSION

External shading devices such as horizontal or vertical louvers, overhangs are designed to protect the building envelope and the occupants from direct sunlight and provide thermal comfort.
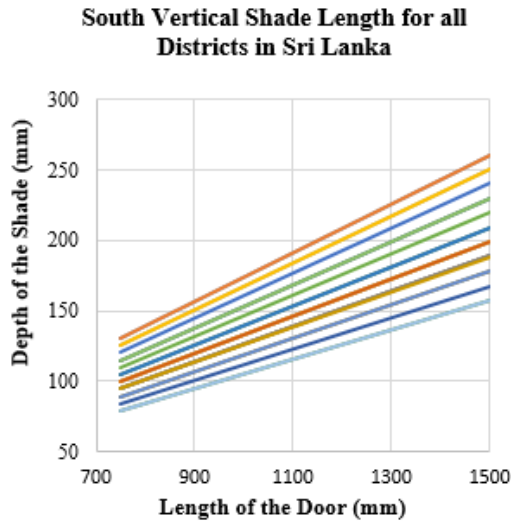
Fig 6. North Vertical Shade Length

3D sun path diagram was used to obtain the sun altitude for different areas and calculate the length of the shading device. This paper presents a step-by-step approach for designing the shading device guidelines for the general public. Here the length of the continuous horizontal shading device and depth of the continuous vertical shading device are calculated. For Sri Lanka, the variation of the lengths of the continuous horizontal and vertical shading devices from district to district is considerably negligible for the openings facing to north and south directions.

FUTURE WORK

The calculations will be carried out for horizontal and vertical shading devices which are not continuous. Energy efficiency simulations will be carried out to calculate thermal comfort. The results will be tabulated in a booklet and made available to the general public for designing shading devices for residential buildings.

Fig 7. South Vertical Shade Length

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Effects of Solvent System on the Polyphenol Extraction from Banana (*Musa spp. Var.* Ambul kesel) Pseudo-stem

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Abstract — **This research was conducted to investigate the effects of extraction solvent system on the best recovery of polyphenolic compounds from banana (Musa spp. Var. Ambul kesel) pseudo-stem. The investigated extraction conditions were: different methanol proportions as the solvent (10, 20, 30, 40, 50, 60, 70, 80, 90, 100 %, methanol/water), using the maceration technique with a water bath. Shaking speed was the 200 rpm for three hours in two repetitions and the solvent/solid ratio was 20 ml/g. This research was conducted at pH 5.0 at the reaction temperature of 60 ^{0}C as these were the optimum extraction conditions to extract polyphenols from this banana (Musa spp. Var. Ambul kesel) pseudo-stem according to the results obtained from the previous research work. The present study revealed that the best delivery of total phenolic compounds from banana (Musa spp. Var. Ambul kesel) pseudo-stem could be reached by utilizing 70% methanol as the extraction solvent system. The maximum yield of 1.35±0.18 g GAE/100g extract was recorded for total phenolic compounds using the optimum extraction solvent system.**

Keywords- banana pseudo-stem, polyphenols, optimization

I. INTRODUCTION

Plant polyphenolic compounds are synthesized in plants partly as a response to ecological and physiological pressures such as pathogen and insect attack, UV radiation and wounding [1]. As well as plant polyphenolics are contributing to plant's colors. Polyphenolics are secondary metabolites and are derivatives of the pentose phosphate, shikimate, and phenylpropanoid pathways in plants [2]. So far, there are more than 8000 polyphenolic compounds that have been identified and characterized in different plant species ranging from simple molecules such as phenolic acids to highly polymerized substances such as tannins [3]. In the last two decades, there has been more interest in the potential health benefits of dietary polyphenols as antioxidant. Several epidemiological studies and associated meta-analyses strongly showed that the consumption of these polyphenols offered better protection against chronic diseases such as cancers, cardiovascular diseases, cerebrovascular diseases, diabetes, ageing and neurodegenerative diseases [4]. The main classes include flavonoids, phenolic acids, stilbenes and lignin and tannins [5]. The total phenolic and total flavonoids in various solvent extracts of pseudo-stem of different banana cultivars varies from 7.58 to 291 mg gallic acid equivalent and from 4 to 80 mg catechin equivalent, respectively [6,27]. In reverse phase HPLC analysis of phenolic compounds from the banana pseudo-stem extracts indicated the presence phenolic acids such as tannic, pyrocatechol, catechol, gentisic, (+)-catechin, protocatechuic, gallic, caffeic, chlorogenic, ferulic, and cinnamic acids [26]. Literature

shows that the polyphenolic content and flavonoid content was about four times higher than in banana pseudo-stem flour (only the pseudo-stem sheaths without the tender core) than the flour of boiled tender core of the banana pseudo-stem [7]. It has been reported that banana pseudo-stem has 2.06% of tannins [8].

Solvent extractions are the most commonly used procedures to prepare polyphenolic extracts from plant materials due to their ease of use, efficiency, and wide applicability [28]. It is generally known that the yield of chemical extraction depends on the type of solvents with varying polarities, extraction time and temperature, pH value of the extraction medium, sample-to-solvent ratio as well as on the chemical composition and physical characteristics of the samples [29]. Depending on the solvent system used during exaction, a mixture of phenolics soluble in the solvent will be extracted from plant materials [2,9,29]. It may also contain some non-phenolic substances such as sugar, organic acids and fats. As a result, additional steps may be required to remove those unwanted components. Solvents, such as methanol, ethanol, acetone, ethyl acetate, and their combinations have been used for the extraction of phenolics from plant materials, often with different proportions of water [1,9]. Selecting the right solvent affects the amount and rate of polyphenols extracted [3,9]. In particular, methanol has been generally found to be more efficient in extraction of lower molecular weight polyphenols while the higher molecular weight flavanols are better extracted with aqueous acetone [10,28, 29]. The methanolic extracts of different parts of banana (*Musa paradisiaca*) registered higher phenolic contents [11], while the 90% ethanolic extract of banana (*Musa acuminata*) pseudostem shows the maximum phenolic content [12]. To obtain the highest phenolic compounds from banana pulp and peel from 15 banana cultivars, 80% methanol has been used as the best extraction solvent [13]. It has been reported that the best solvent to extract tannin contained D-catechin and gallic acid related phenolic compounds from Aralu was the 80% methanol [14]. One research study reported the antioxidant properties of three banana cultivars (*Musa acuminata* 'Berangan', 'Mas' and 'Raja' and found out the type of solvent used had a significant effect (p<0.05) on the extraction of antioxidant compounds from banana fruits and further concluded that 70% acetone was the best solvent to extract polyphenols from the used banana cultivars [15]. Sometimes, the polyphenolics bind with other plant components, such as carbohydrates and proteins and these interactions may lead to the development of some complexes that may be difficult to solubilize in organic solvents

[1,2,3,9,10]. Thus it is difficult to develop a general protocol for the phenolic extraction from plant materials and needs close screening strategies to establish a viable analytical method. In one study on the extraction of phenolic compounds from peanut hulls using methanol and ethanol, methanolic extracts gave higher amounts of phenolic compounds than ethanolic extracts [16]. The use of organic solvents, in mixtures with water, contributes to the creation of a moderately polar medium that enhances the extraction of polyphenols. In particular, methanol has been generally found to be more efficient in extraction of lower molecular weight polyphenols [9,10].

II. OBJECTIVES

Present study is aimed to investigate the solvent effect (effect of methanol concentration) on the best recovery of polyphenols from banana (*Musa spp.* Var. Ambul kesel) pseudo-stem.

III. METHODOLOGY

Out of more than 40 different cultivars of Banana (*Musa spp.*) in Sri Lanka, Ambul kesel cultivar was selected for this research. Ambul kesel was harvested fresh from Veyangoda area, Sri Lanka. After fruit bunch harvesting, the pseudo-stem was separated from the plant at ground level and transferred to the laboratory. Blanched banana pseudo-stem flour (BBPF) was processed [6,7,11,17] by peeling off the epidermis (pseudo-stem sheaths) manually from a sterile knife and sliced into small pieces and blanching the sliced pieces [steam blanching the samples for 1 minute followed by cooling in cold water (15 ^{0}C, 3 min) to prevent enzymatic browning] before dried in a hot air ventilated oven (Ueshima, model AG-1110, Japan) at 45 ^{0}C for 24 hours. The dried banana pseudo was ground in a blender (Panasonic, model MX-GX1511, Taiwan) and further sieved through a 600-µm mesh sieve. Then it was kept in an airtight plastic container wrapped with Aluminium foils and stored in a cool room (Lae Electronic, model CDC 80, Italy) at -10 ^{0}C.

Extraction of polyphenolic compounds from banana (*Musa spp.* Var. Ambul kesel) pseudo-stem using maceration technique by using a water bath shaker [17,18]

From the prepared banana pseudo-stem powder (BBPF), 5 g was extracted for 3 hours with 100 ml of *n*-hexane in two repetitions, in a water bath shaker (Clifton, model NE5-10D, UK) at ambient temperature for fat removal at 200 rpm. The extract was filtered using a Buchner funnel and the filtrate which contained the lipids was removed. The residue was re-extracted with 100 ml solvent (10% methanol/water) after adding approximately 2 cm^3 of 100 ppm sodium bisulphite and adjusting the pH value of the extraction medium to 5.0 with 1M HCl at 60 ^{0}C for 3 hours at 200 rpm in two repetitions. The new extract was filtered using a Buchner funnel and the filtrate was obtained. The extract was then centrifuged (Universal centrifuge, model Z306, Germany) at 4000 rpm for 20 minutes to remove pulp and the precipitate. Then the extract was concentrated using a rotary evaporator (Rotary vaccum evaporator, Roteva, India) under reduced pressure at 50 ^{0}C. Finally, the remaining water was removed by lyophilization (Freeze dryer, model FDS 8512, Korea). The crude extract obtained was kept in dark glass bottle, wrapped with aluminium foil and stored in a cool room (Lae

Electronic, model CDC 80, Italy) at -10 ^{0}C. The total phenolic content was determined by Folin-Ciocalteau assay [22,23] using gallic acid as the standard. The same procedure was conducted by changing the methanol concentration of the solvent [20,30,40,50,60,70,80,90,100 % (methanol/water)].

IV. RESULTS AND DISCUSSION

The yields of total phenolic compounds extracted from BBPF in relation to the methanol content in the extraction solvent are shown in Figure [8].
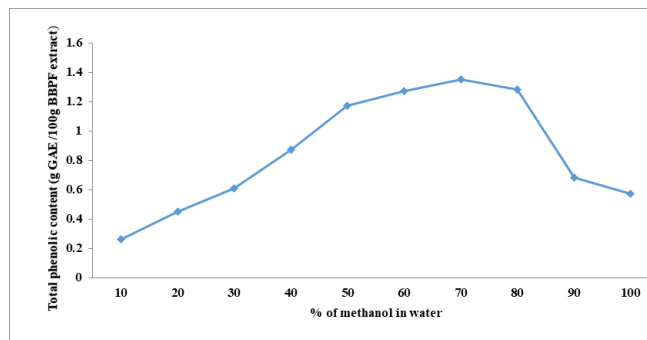
Fig. 1: Yield of total phenolic compounds extracted from blanched banana pseudo-stem flour (BBPF) in relation to the methanol content in the extraction solvent

The maximum yield of total phenolic compounds (1.35±0.18 g GAE/100 g extract) from blanched banana pseudo-stem flour (BBPF) has been extracted with the 70 % methanol solvent. Generally, the extraction yield of polyphenols is greatly depending on the solvent polarity. Amount and composition of phenolic compounds is observed to be diversified at sub-cellular level within the tissues [1,9,10]. The recovery of polyphenols from plant materials is reported to be influenced by the solubility of the phenolic compounds in the solvent used for the extraction process [2,3,10]. It is reported [6] that presence of phenolic acids such as tannic, pyrocatechol, catechol, gentisic, (+)-catechin, protocatechuic, gallic, caffeic, chlorogenic, ferulic, and cinnamic acids in the banana pseudo-stem. To extract these polar acids, moderately high polar solvent is needed [1,10]. Even though, the polarity of the extraction solvent increases after 70 % methanol, the extracted amount of phenolic compounds decreases. The reduction of the extraction of polyphenols after 70 % methanol occurs due to the incompatibility of the polarity of the solvent system with the polarities of the polyphenols in the BBPF. The use of methanol with water contributes to the creation of a moderately high polar medium that enhances the extraction of polyphenols. Relative polarities of methanol and water are respectively 0.762 and water 1.00. Hence, with the addition of water to methanol, the polarity of the solvent mixture increases continuously. Higher yield of polyphenolic compounds could be received with the matching of the polarity of the solvent mixture with the polarities of polyphenols in the BBPF. The results obey the general rule of "like dissolves like" principle. Another possible reason for the increased efficiency with the presence of some amount of water might be due to the increase in swelling of plant material by water, which increases the contact surface area between the plant matrix and the solvent. Aqueous methanol solvent can release the cell wall bound polyphenols from the

cells and neutralize the activity of polyphenol oxidase enzyme [10,20].

V. CONCLUSION

Solvent extractions are the most commonly used procedures to prepare extracts from plant materials due to their ease of use, efficiency and wide applicability. It is generally known that the yield of chemical extraction depends on the type of solvents with varying polarities, pH value of the extraction medium, extraction time, temperature, sample-to-solvent ratio and on the chemical composition and physical characteristics of the solutes [1,3,10]. The solubility of plant phenolics is governed by the chemical nature of the plant sample, as well as the polarity of the solvents used. Plant materials may contain phenolics varying from simple (e.g., phenolic acids, anthocyanins) to highly polymerized substances (e.g., tannins) in different quantities [1,9]. Moreover, phenolics may also be associated with other plant components such as carbohydrates and proteins [4,10]. These interactions may lead to the development of some complexes that may be difficult to solubilize in organic solvents alone. Therefore, there is no universal extraction procedure suitable for extraction of all the plant phenolics. Depending on the solvent system used during extraction, a mixture of phenolics soluble in the solvent will be extracted from plant materials. Aqueous methanol solvent has been used in extracting polyphenolic components from plant materials due to many advantages [2,4,28,29].

It is reported that presence of phenolic acids such as tannic, pyrocatechol, catechol, gentisic, (+)-catechin, protocatechuic, gallic, caffeic, chlorogenic, ferulic, and cinnamic acids in the banana pseudo-stem [26]. To extract these polar acids, moderately high polar solvent is needed. The use of methanol with water contributes to the creation of a moderately high polar medium that enhances the extraction of polyphenols [20,24,25]. Relative polarities of methanol and water are respectively 0.762 and water 1.00. Hence, with the addition of water to methanol, the polarity of the solvent mixture increases continuously [19]. Higher yield of polyphenolic compounds could be received with the matching of the polarity of the extraction solvent with the polarities of the polyphenols in the BBPF. The best recovery of polyphenolic compounds from banana (*Musa spp. Var.* Ambul kesel) pseudo-stem was obtained with the 70% methanol solvent and the optimum yield was recorded as 1.35±0.18 g GAE/100 g BBPF extract.

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Rescue Service Alert System with Level Specification for Vehicle Accidents Case Detection on Expressway

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Abstract — **Delivering accident information and conducting the rescue procedures in time are the main components to diminish the risks related to traffic mortalities in Myanmar. The aim of this paper is identifying the statuses of expressway accident victims by utilizing the data from the Sensor Fusion-Based Algorithm and comparing those sensor values with pre-defined dataset to specify the minor or major or critical accident level and, with the Object Detection in Fence Algorithm, the victims can receive the medical assistance from the emergency services. Since the user friendliness is the main preference in this paper, these algorithms are designed for applying in the smartphones built-in high technology sensors, which connects with the GIS, GPS and Geofence technologies.**

Keywords — *Accident Detection, Rescue Station, Sensors, GPS, Geofence, Dataset*

I. INTRODUCTION

In today's world, the road accidents are considered as one of the primary factors of raising the death rate while many people believe that the drivers do not notice about their speed limits of vehicles during the travel. When we think about the causes of death related to expressway accidents, exceeding threshold speed limits is not the only factor of the accident. There are other factors to increase the fatality rate such as the un-identifying of accident location and delay in sending the alert messages to the rescue services. According to "Road Safety in Myanmar 2017", stated that the linkage between fatality rate and expressway vehicle accidents was significant because the number of traffic mortalities were doubled within eight years, which was from 1853 cases occurred in 2008 to 4688 in 2016. Based on the declared information, it is possible that the increase in death rate was due to the late arrival or absence of emergency services to the accident location. Thus, it is essential to get the prompt response for saving the injured persons and minimizing the level of traffic mortalities rate as lower as possible. Therefore, the smartphone installed with powerful detective sensors are considered as one of the solutions to verify the accident data and deliver the prompt response to the rescue stations.

II. OBJECTIVES

The objectives of this paper are preventing the users from any hazardous circumstances on expressway by using built-in high technology sensors in smartphone, detecting the accurate accident place by applying GPS technology and GIS system, validating the status of accident with the values transmitted from accelerometer and gyroscope sensors, maintaining the data of emergency services by using Geofence Technology, and delivering the alert messages to the nearest rescue stations after validating the victim's status with the assistance of Object Detection in Fence Algorithm.

In 2011, Chris T., White J., Dougherty B., Albright A. and Schmidt DC.[1] "WreckWatch", a model of smartphone-based client/server application was designed to function with built-in sensors and communication interfaces to identify the reasons of accidents arisen and send the messages to the relevant emergency units. However, there is a week point occurred in this application that cannot recognize the risk of accident when the car is driven with lower speed, which is under the configured speed limitation of the application.

In 2013, Danish karim and Jaspal Singh [2] introduced the "Development of Automatic Geofencing and Accidental Monitoring System based on GPS Technology". It is able to identify the accident and protect the vehicles from the theft by using a single shock sensor installed in this system even though the predefined datasets in database to collect the users' information and the possibilities of the occurrence of accident. Besides, it is not indicated where and how the contacts of emergency services are kept even if it was said that the system should transmit the automated alert messages to the rescue stations. Therefore, there is a high possibility for the users to obtain limited information from the sender.

In 2013, the accelerometer sensors in the Smartphone were developed by Patel K.H [3] to obtain the information of accidents. By using GPS, this application automatically produced the location of accident and sent via pre-recorder voice message to the hotline of rescue services in India. However, this application was likely to misinform to the rescue services when the smartphone inclined or fell in any time while the driver drove the car even though a real accident did not occur.

In 2015, Dipesh Suwal, Suresh Manandhar, Shashish Maharjan and Ganesh Dhakal, [4] designed "D-Fencing Application", which could be used as smartphone to send alert message about the Geofencing Post Disaster Scenario. The system administrator sends alert messages of disastrous areas when the user approaches to those places. However, the system is not flawless as system administrator with the knowledge of Geofence performs the manual update of disaster information in database and delivers the warning notifications to users, who requested the information. If the system administrator is unavailable, it is likely to occur the high risk of receiving outdated information by users when the disaster takes place in the region in which the user enters. Therefore, it is obvious that the application is undependable because it is lack of automatic facilities to collect accident data, transmit the accurate alerts to the users and manage the database information.

III. Methodology

The accident detection system is operated in two main stages, which are gathering data with data processing and connecting to the nearest rescue stations. First of all, collect the values from Accelerometer, Gyroscope, GPS and then, managed those values in the accident detection dataset. Next, the system analyzes the collected data by comparing with the predefined dataset to specify the level of accident, which is defect of minor, major or critical. When the accident is confirmed, the system applies the GPS values received from accident detection dataset and starts looking for the Geofence technology generates the circular polygons that indicate the accident location as a center point. Finally, the system retrieves all rescue station's contact information in the selected polygon from the rescue service dataset and then, seeks the contact info of the nearest rescue service from the accident spot.

If there is rescue station unavailable in the first polygon, then the Geofence creates the new polygon with broader edges until it finds the nearest rescue station from the accident location. Then, the system informs the rescue station, which describes accident location, the information of user and vehicle and level of incident. To obtain the exaction result of prediction, sensor projected data stored in centralized database such as fixed data, rates of false alarm and death of accidents performs the main roles to predict.

Fig. 1. Accident Detection and Rescue Alert System

Sensor Fusion - Based Algorithm

Sensor Fusion-Based algorithm is selected to promote the dependability of data quality by combining the data received from different sensors while there is a concern of data insufficiency between the single sensors. The information generated from automated sensors cannot be reliable all the time. In this algorithm, the information can be obtained from various sources such as automated sensors, historical sensor data maintained in the central database and the non-automated sensors, examined and evaluated to attain the best output. To get the premium input data is crucial in this system. The following Sensor Fusion-Based algorithm can be used to receive the most relevant outcome of the accident detection process:

$$xi(t) = Ai\ xi(t) + Bi\ ui(t) + Wi(t)$$
$$yi(t) = Ci\ xi(t) - vi(t),\ (i = 1, 2, n)$$

Where t denotes the time and i denotes the total number of subsystems (i.e. accelerometers, gyroscopes and so on) to generate the data. The value of the subsystem xi(t) can be received by adding together of the value of noise at the period Wi(t), the existing state of the source xi(t) and, the signal value sent at the specific time ui(t). Once the value of xi(t) is obtained, the redundant noise value vi(t) is needed to remove from the current value of xi(t) to get the result of the subsystem yi(t).

Object Detection in Fence Algorithm

Once the accident is validated, an approximate of 1000 square meters range of polygon will be produced, and the accident is indicated as center point of the polygon range. Then, Object Detection in Fence Algorithm starts to seek the of rescue services near the accident spot in the range. If the rescue contact is unidentified, the Geofence will produce another polygon with larger edges and the rescue contacts will be sought by applying Object Detection in Fence Algorithm until the nearest contact is found. Then, the accident alert message indicating the information as well as the accident location will be sent to the closest rescue station. In this paper is that the system informs the rescue teams can take a prompt action to victims of accident.

There are three input values (P, Q and S) in Object Detection in Fence Algorithm. P is stated as a location of accident and Q is noted as polygon created to enclose P. S points out the available rescue services marked on Map. In some cases, the early values of inside is specified as 'False' when the searching process initiates in Polygon. However, the final inside value will be indicated as 'True' if S falls within Q or else, it will be shown as 'False' if S is not detected in the range of Q.

```
Algorithm:
Input: Incident Points as P, Polygon as Q, Rescue Station
Contacts as S
P denotes the location of accident
buf is a buffer distance.
Output: true if S contains Q, otherwise false
1: count = 0
2: R is an infinite ray in the +y direction, originating at P
3: for all edges e in Q do
4: if S is within buf of ex then
5:     ex,buf = ex -2 * buf
6: else if S is within buf of e or ebuf then
7:     return false
```

Datasets and Technologies Usage

An accident detection dataset or the sensors' primary data is required to verify the accident. Once the status of accident is validated, the recent calibration sensors data is automatically updated in the main server. To specify the level of accident, the accident detection system analyzes the updated data collected from those sensors such as accelerometer, gyroscope and linear acceleration, and compares it with the predefined system data.

Rescue Service Dataset connects Geofence to maintain the emergency service information (for example the contacts of hospitals). After confirming the accident, information including the level of accident and the details of last GPS location will be automatically sent to closest rescue services. Geofence can collect these datasets anytime because the rescue service datasets are always updated on the servers.

In this paper, smartphones are selected as the main theme that inexpensive and versatile machines installed with strong technologies. Android source code is an accessible open-source system and Android Studio assists developers to write the codes with auto-completion tools. Java is one of the most convenient languages with the large set of multifunctional class libraries such as connectivity, sensors and developers can

save their time not to rewrite the codes and, also avoid some unexpected errors.

Geofence produces fixed or modified virtual boundaries in live geographic places. Google Location API provides the powerful and high-level framework to choose the appropriate location provider and management automatically. Unlike the common APIs, Google Location API possesses the activity detection feature. Due to the accessibility to Google Maps Service, the Google Maps Android API is also chosen to show Maps, collect users' responses at the selected location and provide relevant information that the users request.

IV. RESULTS AND DISCUSSION

Unavailability of an informer to the emergency services will hinder the victims to receive the required medical treatment on time. The aim of this paper is preventing the victims from the death by providing the timely medical treatment at accident location.

Regarding to the Sensor Fusion-Based Algorithm, the sensors' values are used to estimate the levels of accident. If the smartphone may be tilted or dropped from its dock, the values will be exceeding the accident threshold limit. Then, the user will receive the verification message if these sensors' values exceed the predefined accident threshold of the system. Whether the user replies the message within twenty (20) seconds or not, the Geofencing technology assists the system to automatically generate the visual polygon nearby the accident scene. As a result of the visualized features of Geofence and the application of Object Detection in Fence Algorithm, the accident location along with the closest rescue stations are quickly spotted.

The accident detection system analyzes values received from the sensors such as accelerometers and gyroscopes and specifies the accident levels from defect of minor, major or critical, and then accesses the up-to-date rescue service dataset to retrieve all contacts of the rescue stations inside the Polygon to perform the rescue operations on time. The minor defect level is nominated by accident detection system as an active emergency case while the major and critical levels are determined as the significant damage and the occurrence of multiple fatalities respectively.

The client-server architecture will constantly update the live information on expressway in database server, so the users can retrieve data and ascertain the current situations. This system is intended to operate as the user-friendly version and, encourages the users to provide their personal and other information at the beginning of every trip on expressway. The information of users and vehicles are stored in Database, so the accident detection system can collect and analyze it anytime. The closest rescue station from accident location gets the system message, which includes the accident level, the information of victim and vehicle.
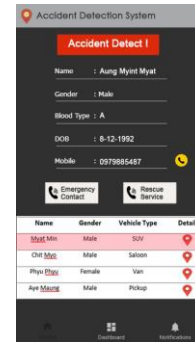
Fig. 2. Accurate Accident Information of System

V. CONCLUSION

This accident detection system presented is able to operate with the different trained datasets and Google APIs, so the vulnerabilities of similar researches may be worked out. After upholding the well-trained datasets in system, the current user's status on expressway is constantly traced and updated in the database so that the system can retrieve the data anytime to confirm the accident status. With the assistance of Geofence technology, the precise location of accident can be traced without any delay and then, the closest rescue stations nearby the accident will be identified and sent the message to save the victims on time.

The system analyzes the sensors' data to define the level of accident while waiting for the user's response for certain duration; even if the user is unconscious, the system will automatically send the contact message to the nearest rescue station via Geofencing for the medical and other arrangements. Moreover, the latest user information will be attainable from the system's database server in order to confirm the status of accident because the server is continuously synchronizing with the user's smartphone even the phone is turned off.

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Ontology Based Machine Learning Approach to Automatic Labelling for Research Papers on Wildlife of Sri Lanka

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Abstract — **Sri Lanka, being a global biodiversity hotspot, places great emphasis on biodiversity from an ecological perspective, socio-economic, and cultural factors. However, the wildlife of Sri Lanka is critically threatened due to several factors. Mainly human activities and needs supersede conservation measures. Lack of knowledge and technical support also hinder wildlife management activities. Findings of wildlife research studies could be incorporated into data-driven conservation and management decisions but the current contribution is not satisfactory. This research shows a novel data mining approach for finding hidden keywords and automatic labeling of past research work in this domain. We used the Latent Dirichlet Allocation (LDA) algorithms to model topics and identify the major keywords. Using the output of Topic Modelling an ontology model was also developed to represent the relationships between each keyword. Using the ontology instances we classified the research papers using Artificial Neural Network (ANN) to predict the labels for research papers in the wildlife domain. These approaches can be used for guiding future research endeavors, with the recognition of research gaps and by classifying the subjects related to a publication by the non-professional related fields. The experimental results demonstrated a 83% of accuracy for the proposed method.**

Keywords — ANN, LDA, ontology, topic modeling, wildlife

I. INTRODUCTION

Wildlife is critical for the sustenance of life on earth. Biodiversity conservation is crucial to preserving a stable global ecological balance. Sri Lanka is a global biodiversity hotspot consisting of a large variety of fauna and flora. It is one of the main sources of income generation through tourism and other means. The diversity of ecosystems is primarily due to its topographical and climatic heterogeneity, as well as its coastal effect [1]. This rich biodiversity is threatened due to unplanned land use, pollution, overexploitation, etc. Our research mainly focuses to resolve the inadequate application of wildlife research and technologies in the decision-making process.

From a technological perspective, there was prior work [2] [3] that has shown hierarchical relationship-based latent Dirichlet allocation (hrLDA), a data-driven model of hierarchical topics to acquire terminology ontology from a large number of amalgamate documents. Unlike traditional topic models, hrLDA relies on noun phrases instead of unigrams, deals with syntax and text structures, and enriches topic hierarchies with topic relations. Through a series of experiments, we are demonstrating hrLDA's superiority over established topic models, especially for hierarchy building.

In LDA there are inefficiencies to automatically label each paper separately and so prior research on Recurrent Neural Network (RNN) has shown some ideas for automatic labeling. They suggested convolutional neural networks [4], recurrent neural networks are widely used in text classification because of their natural sequence structure, which is suitable for natural language processing. However, there is a well-known problem with recurrent neural networks, that is, when the length of the text sequence is too long, the model is prone to gradient disappearance or gradient explosion.

Their approach incorporates text and word embedding to pick the most appropriate labels for the topics. Compared to the state-of-the-art competitor method, our model is easier, more effective, and produces better performance across a variety of domains

Our objective of the research is to provide technical solutions to find hidden keywords and research ideas using past research papers on wildlife in Sri Lanka. The main goal is to implement a model that can label given research papers automatically. Also using LDA and ontology model we have to find topics and the relations between each topic to improve research ides in a given circle.

This paper is organized as follows. In Section II, we define the core theories used by the proposed methodology, Section III, we discuss the results of the study. In Section IV, we discuss the conclusion of our experiment and suggest areas for future study at the end.

II. METHODOLOGY

We used a semi-automated methodology which shows in Fig 1. This methodology developed using LDA and Ontology in this study. The text data of the defined domain were collected and pre-processed for the input to LDA algorithms then compared with the ontology graph to the final output.

A. Data Collection

We collected information about past wildlife researches in Sri Lanka from 2006 to 2019, with the aid of the Department of Natural Resources, Sabaragamuwa University of Sri Lanka, and an extreme literature survey. After that, we accessed full research papers of selected papers from each domain. We've selectively applied the title and abstract data to the CSV file from those research papers.
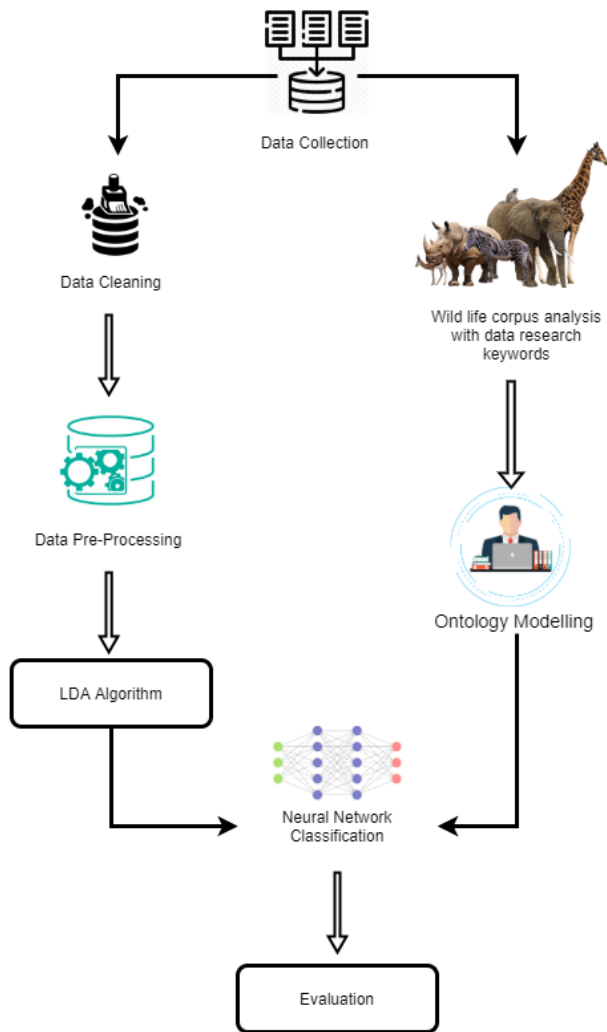
Fig. 1. Methodology

B. Data Cleaning

Data cleaning is the method of preparing data for review by deleting or altering data that is inaccurate, incomplete, obsolete, duplicated, or incorrectly formatted. Typically, this data is not necessary or helpful when it comes to analyzing the data because it can complicate the process or provide incorrect results.

We performed the following steps:

- Tokenization: Divide the text into sentences, and the sentences into words. Lower case the words and smooth punctuation

- Stop word removal: Delete words that have fewer than 3 letters. All stop words are removed.

- Lemmatizing: Words in the third person are shifted to first-person and verbs shifted to present from past and future tenses.

- Words are stemmed — words are reduced to their root form.

C. Data Preprocessing

Data pre-processing is so important because if our data set contained mistakes, redundancies, missing values, and inconsistencies that all compromised the integrity of the set, we need to fix all those issues for a more accurate outcome [5]. We used GloVe for the preprocessing works of our text data.

Glove stands for Global Vector for Word representation which provides a high level preprocessing vocabulary close to the pre-trained embedding [6]. So we can get preprocessing to result in tokens that are mostly covered by word vectors.

D. Topic Modelling-LDA

LDA helped adapt the textual data into a format that could act as an input to the LDA model for training. We began by converting the documents to a simple representation of the vectors as a group of words called Bag of Words (BOW). Using LDA we generated the major keywords and using those keywords, clustered the related keywords into specific topics. The topics from LDA were used as input to form the Ontology model.

E. Ontology Modelling

Ontologies contain features such as general vocabulary, reusability, machine-readable content, as well as ordering and structuring information for the Semantic Web application, enabling agent interaction, and semantic searching [7]. Automated learning is the problem in ontology engineering, such as the lack of a fully automated approach to shape ontology using machine learning techniques from a text corpus or dataset of various topics. So we used LDA to identify the major keywords. After using expert consultation we can easily model the Ontograph.

The ontology model was finalized using protégé tools, which is the most popular tool of ontology visualization [8]. The Protégé 5.5.0 tool is being applied for further development in various disciplines for a better understanding of knowledge with the aid of domain professionals in the wildlife.

F. Neural Network Classification

We used the RNN classification to train and test the model of our automatic labeling process. Here we used Long Short Term Memory (LSTM) to train our model. The neural network can be described in three sections or layers which are the input layer, the hidden / intermediate layer, and the output layer. The role of the input layer is to receive input signals from the outer field. It consists of neurons going to the secret layer. The learning of the neural network is completely supervised and thus the input given to the neural network has a response or output. The neural network takes input values and weights from the input layer as input and then goes to the hidden layer where the function sums up the weights and maps the results to the corresponding output layer units. ANN is the best suitable [9] for our model because the effectiveness of the model was high and our dataset was manually labeled using an ontology model and expert consultation.

III. RESULTS AND DISCUSSION

The results of this study were represented using abstracts of past researches which serves as an input. We used python language for LDA implementation and ANN. The tokenized and pruned text is then subjected to the LDA modeling algorithm. That gave production as word sets that collection could contain words that are linked to each other. The hidden keywords from the data set were identified and similar keywords cluster as one topic for each research paper using the LDA visualization model as well as the inter topic distance also calculated.

Ontology specified the explicit classes of the wildlife

domain of a given dataset through keywords of the research papers. Using the expert consultation we modeled the ontograph and with the help of LDA output, using ontology output we labeled the dataset for the ANN input. Then we vectored the data for a float from the text. Using ANN we trained our model for the specified classes for labeling the research papers. The model had 3 major layers as embedding layer, LSTM layer, and dense layer. Table I shows the feature's values to the layers of the ANN model. Fig 2 describes the classification vectors for each class.

Table 1 - ANN Feature Value Details

Features	Value
Epoch	100
Batch size	50
Optimizer	Adam
Loss	categorical_crossentropy
Activation Function(all dense layer)	ReLu
Activation Function(Final output layer)	SOFTMAX
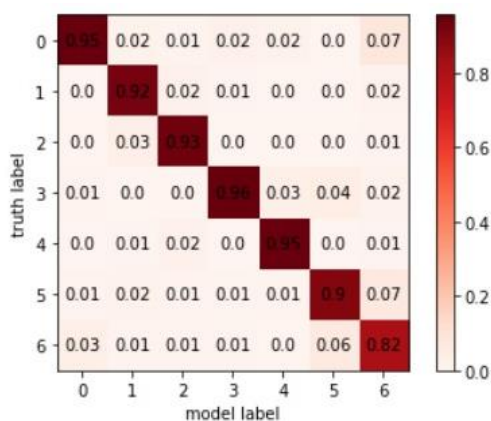
Fig. 2.   ANN classification model

Finally, the model tested using test data as research papers of wildlife in Sri Lanka. Fig 3 portrays the accuracy of the model.
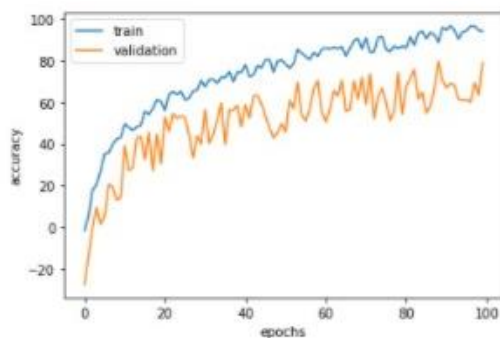
Fig. 3.   Accuracy graph for the ANN model

The gap between training and validation shows the accuracy of the ANN model. For the manually labeled dataset 83% accuracy was very remarkable amount.

IV.   CONCLUSION

In this paper, we have suggested an automatic labeling model for the research papers on the wildlife of Sri Lanka. We used a methodology which first uses LDA to extract the hidden keywords of each paper. Subsequently, ontology was developed to model the domain to label the data set with the help of domain experts. Finally, the dataset was trained and tested through RNN. After finishing the model, an accuracy of 83% was achieved, which is relatively high for domain-specific text data which. The results from both LDA-terminology ontology & ANN were manually analyzed.

This work reduced the complexity to label the research papers without any domain pre-knowledge. Using this method, the hidden keywords and the relations between the keywords are also identified to help future research ideas. It was observed that, ANN is better than other text labeling algorithms based on the accuracy of the model.

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Design of an Automated Power Sourcing Unit to Optimize the Operating Schedule of Industrial Loads

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Abstract — **This work proposes a novel methodology to automate a power sourcing unit. The main objective of the proposed power sourcing unit is to control the power supply for various loads connected to it by optimizing their operating schedule. This enhances the durability of the loads while reducing energy waste. The proposed power sourcing unit was tested by constructing a prototype model which controls four 3-Phase motors to maintain a constant pressure in a vacuum tank in an industrial plant. The implemented prototype consists of a microcontroller based switching scheme for controlling loads. In addition to the automated operating mode, the system consists of manual operating mode. In case of failure of the entire automated system, the process is allowed to be continued by switching into manual operating mode. It is believed that the proposed method will be very useful in modern factory automation.**

Keywords — Power Sourcing Unit, Factory Automation

I. INTRODUCTION

To bring about the 4th industrial revolution, rapid technological advances are needed to realize factory automation. Traditional automation systems are not capable of addressing the current market demands due to the rapidly changing products avenues [1]. The key challenge in modern factory automation is the development of reusable, maintainable and adaptable automation solutions [2].

An effective energy management for residential applications was realized by the appropriate modification of existing products for home automation using microcontrollers [3]. An autonomous and distributed demand-side energy management system for smart grid was realized by allowing users to optimize the daily schedules of their household appliances and loads minimizing the energy costs [4]. Study [5] improves the energy usage efficiency by eliminating waste through process optimization. An Arduino microcontroller that communicates with an Android application, wireless Zigbee and wired X10 technologies makes a cost-efficient hybrid system reducing the total energy consumed by some appliances [6]. An agent-based model is introduced, optimizing the load demand, through load prioritization, to improve the micro grids self-sustainability [7]. In [8], a generic optimal industrial load management (OILM) model for industrial energy hubs in smart grids was proposed. In another study, operating schedules for industrial units were optimized yielding a considerable reduction of energy costs by shifting processes with high power consumption to times with low energy prices [9]. A study [10], proposes a framework for optimizing the water distribution system operators and frequency regulation. A recent study suggests that manufactory load allocation can be used as an effective industrial demand response scheme to reduce operating costs for industrial multi-energy micro-grids [11]. But none of the studies on automating the power sourcing unit to optimizing the operating schedule of industrial loads were reported..

II. OBJECTIVES

In this study, an automated power sourcing unit for industrial use is proposed. A Prototype model of the proposed power sourcing unit is implemented to automate and optimize the operating schedule of four 3-Phase motors. The implemented prototype consists of a microcontroller based smart switching scheme for the industrial loads connected to it. The microcontroller can be reprogrammed to adapt the system into different operating conditions. In addition to the automated operating mode, the system consists of manual operating mode. In case of failure of the entire automated system, the process is allowed to be continued by switching into manual operating mode. The novelty of the proposed systems is its ability to adapt into various industrial environments and the cost effectiveness as compared to PLC based traditional control approaches.

III. METHODOLOGY

The prototype model of the proposed system is developed to control four 3-Phase motors in order to maintain a constant pressure level inside a vacuum tank. The reconfigurability in the design allowed it to be adapted to control any industrial load connected to it easily. The prototype model consists of three basic parts, sensor, microcontroller and operating (automated/manual) mode selection circuitry. Block diagram of the prototype model is illustrated in Fig.1.

The internal pressure of the vacuum tank is monitored by the pressure sensor and its output is fed into the microcontroller. Depending on the pressure sensed, the microcontroller controls the 3-Phase motors connected to it. Operating mode selection circuitry was developed to switch between automated and manual operating modes. This mode selection is a necessary requirement for assuring the process continuity of industrial plants. When the automated operating mode is selected, AC/DC power supply unit provides power to the microcontroller.
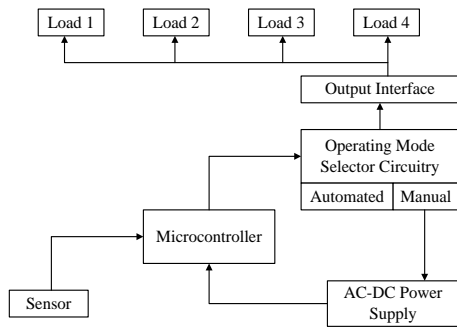
Fig.1. System Block Diagram

Fig. 2 depicts the operating mode selection circuitry and output interface for connecting various loads to the prototype model. Industrial loads (3-Phase motors) are connected to the output interface using the contactors and relays.

A. Automated Pressure Controlling System

In the operation of the proposed system, it is capable of indicating the status (Fig. 3) whether a particular load is connected with the power sourcing unit or not. In the automated mode, the microcontroller detects the number of industrial loads connected to the system through the output interface. This has been realized without using a current sensor as contrast to traditional methods.
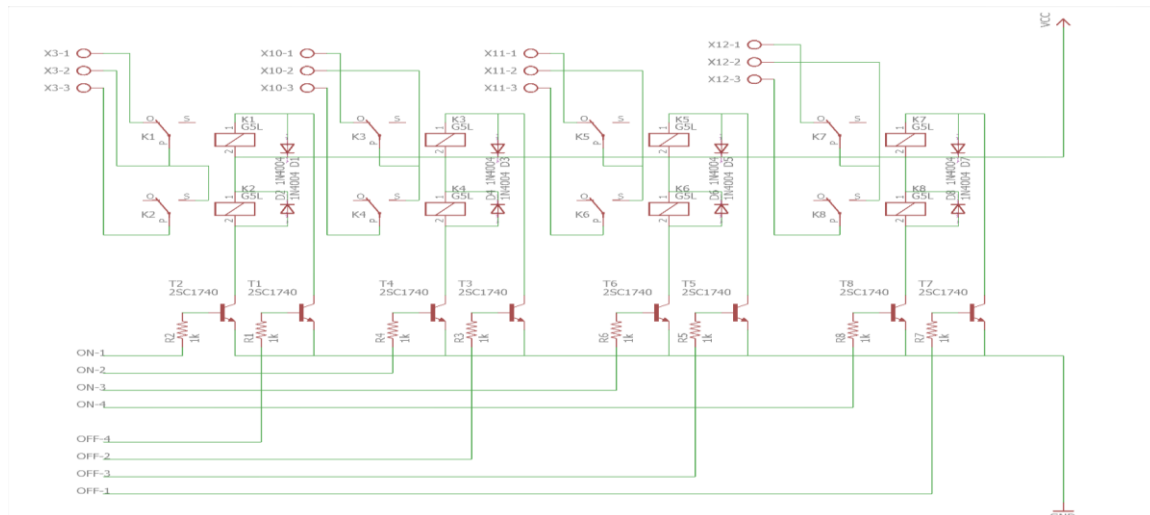
Fig. 2 Operation mode selection circuitry and output interface

If a current sensor is used, at the beginning, it is essential to flow a current through the sensor and wait for a certain time period for the loads to be powered. Therefore, the proposed system reduces the cost for current sensor, waiting time and risk of short circuit (3-Phase motor with neutral). This is a unique advantage of the proposed design.
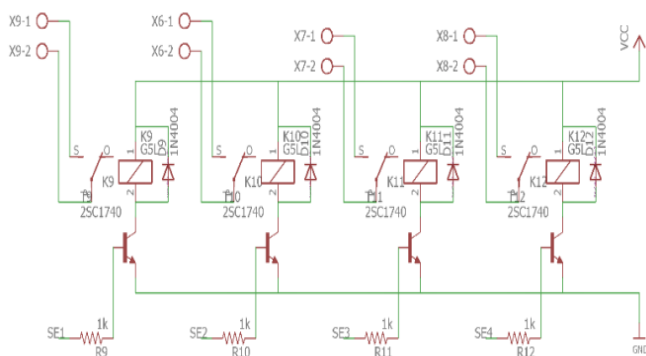
Fig.3.Circuitry for indicating the connectivity of the loads with the power sourcing unit

First, the microcontroller takes the count of industrial loads connected to the system. Secondly, it converts analog voltage input from the pressure sensor into digital and checks whether the value is smaller or greater than the reference value. The reference value is the digital value corresponding to the required constant pressure level to be maintained inside the vacuum tank. There are three possible conditions;(1) $P_i<P_r$ (2) $P_i>P_r$ and (3) $P_i=P_r$ where P_i is the internal pressure of the tank and Pr is the pressure required to be maintained.

The system is capable of controlling the switching ON/OFF the connected loads (3-Phase motors) and maintaining a constant pressure inside the vacuum tank. On the other hand, in each and every time of removing or adding a load to the system, it has the ability to identify the new condition and restart the system accordingly.Further, the designed system is able to switch the operating motors (Fig. 4) according to the pre-defined power sourcing time in the microcontrollers. EEPROM technology has been employed to record the number of hours that each motor was operated, and they were stored separately in the memory. Routine service requirements will be indicated with a RED colored warning light for the specific load and it will automatically be disconnected from the system. In addition, the system consists of an LCD panel which displays the operation periods of the connected loads together with the time left to the next service.

These additional features make the system more user-friendly, unique and efficient. The memory of the EEPROM is directly linked to the LCD panel and coded to display the number of days after the last service, and days left to the next service.

Fig.4.Circuitry for indicating the currently operating loads connected with the automated power sourcing unit.

B. Secured Manual Operating Mode

The manual operating mode is incorporated to assure the reliable and continuous operation of the loads if a fault occurred in the automated operating mode. Selector switches which are commonly used in the industry are utilized to indicate whether a particular load is working or not; by switching on the standard symbolic colors GREEN & RED respectively. Further, the use of the manual operating mode allows desired load(s) to be disconnected from the system without interfering with the entire process. To realize all the operations a novel algorithm was developed and implemented on microcontrollers. Further, the system is capable of connecting various types of loads and is controlled successfully.

IV. RESULTS AND DISCUSSION

Fig. 5. Prototype of the developed model

The prototype of the proposed smart power sourcing unit was built successfully and tested to automate the vacuum pressure controlling system of an industrial plant. Image of the prototype model is shown in Fig. 5. The cost effectiveness of the power sourcing unit against the ordinary manual operating mode was highlighted due to the optimized switching schedule of the loads connected to the system. On the other hand, the ultimate safety towards the employment of the industry was guaranteed with the usage of the standard industrial switches. Checking the pressure inside the vacuum tank and switching the operation of motors with reference to the predefined pressure ranges, optimizes the number of operating loads. Therefore, the effective working hours per

one particular service of a motor has been extended by significant numbers due to optimal usage of energy, providing sufficient rest for each motor equally and it's intelligence operation according to demand and supply. As a result of that, the cost for lubricants has been reduced drastically. Since the working time of each load has also been prioritized through the coding, the effective durability of each load has been increased. The in-built LCD panel gives the important details of each device to alert the management about the next service of the load and the RED light indicates the warning signal to the management if the specific load is out of service.

V. CONCLUSION

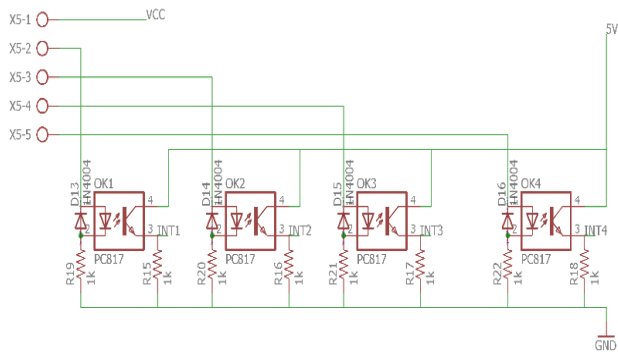This particular automated power sourcing unit can be used in any field which is required to automate and optimize the operation of power consuming loads, in order to maintain a constant operating condition. This concept can be employed to sense any detectable physical parameter and automate the process smartly. Ultimately, it reduces the cost and energy waste compared to traditional approaches. The proposed automation concept can be connected together with the IOT, cloud computing, and Big Data in futuristic industrial automation.

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Non-Intrusive Load Monitoring in Commercial Buildings: Recent Developments and Challenges

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Abstract — **Non-Intrusive Load Monitoring (NILM) in buildings is a very important topic widely researched since late 80s. It was developed with many productive contributions from many researchers, particularly in the residential buildings. To address the lack of detailed discussion in relation to NILM in the commercial building sector, this paper is focused on recent developments of the related technologies as well as highlighting future challenges.**

Keywords - Energy Disaggregation, commercial buildings, Non-Intrusive Load Monitoring

I. INTRODUCTION

Commercial buildings contribute to 48% of the electrical energy consumption of Malaysia in 2012[1]. Despite many energy conservation measures implemented, observed energy consumption of commercial buildings usually exceeds by at least 30% of the designed value[2]. In such cases, occupant behaviour can be identified as a key factor in building energy consumption. Unlike in the residential buildings, commercial building occupants are less motivated to conserve energy since they are not directly responsible for the payment of their utility bills. Therefore, it is required to motivate and influence the occupants to conserve energy by taking practical approaches such as by introducing a feedback/ reward/penalty mechanism[3].

However, the success of any such energy management approaches will depend on the accuracy and sensitivity that focus to the level of appliances and occupants. Compared to the conventional methods [4], Non-Intrusive Load Monitoring (NILM) methods have been popular in the last 3 decades [5]–[7] but its application in commercial buildings is still challenging due to its practical constraints. Therefore, this paper discusses the current challenges in applying NILM in the commercial building sector by reviewing the suggested solutions published in recent literature.

II. NILM FRAMEWORK

The concept of NILM was presented in 1989 by George.W. Hart. [8] Since then, it has been developed by a number of researchers to suit different built environments and appliances. However, the basic framework remains the same and it is shown in Fig. 1.

As shown in Fig. 1, the aggregate power consumption and other features (current, power factor, harmonics) of a building is monitored at its mains. Detected changes in those features are analyzed to identify the switching events of different appliances of the building. Accordingly, the individual energy consumption is disaggregated from the total.
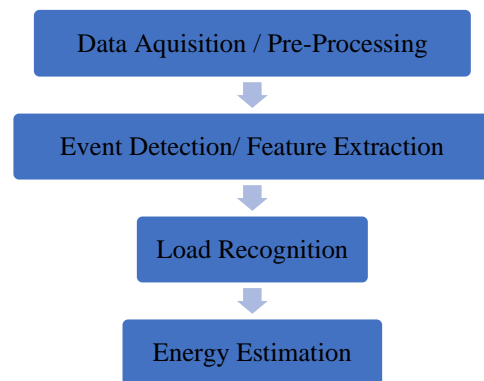
Fig. 1. General framework of NILM [7]

Data acquisition can be either low resolution or high resolution [6] depending on the algorithm. More features like start up transients, power/current harmonics can be extracted in high resolution data acquisition systems [7]. For load recognition, supervised and unsupervised algorithms are used [6], [7]. In supervised algorithms we need to train the algorithm with a known database of load signatures.

In contrast to the conventional methods where it is necessary to install energy meters at all sub circuits, the significance of NILM is its ability to disaggregate the energy consumption to the level of subcircuits while having metered only at the main breaker of the installation. Such detailed information on energy use of a building obtained at a relatively low cost is useful in implementing energy conservation measures on specific categories of appliances [5].

III. CASE STUDY

In order to provide a clear understanding of the NILM process, a simple case study in the Universiti Teknologi Malaysia is presented in this section. A postgraduate research lab was selected for the study and its load curve (excluding lighting and HVAC) during a weekday in the month of August 2020 is shown in Fig. 2 . The research lab consists of a cubicle for the lab in charge and 10-15 workstations for research students but only five research students are currently occupying and attending the lab on a regular basis. In addition to the computers used by the lab in charge and students, there is a common PC, printer (3 in 1),

mini refrigerator and a network switch. In addition to the regularly used equipment, the power meter itself consumed power from one workstation.
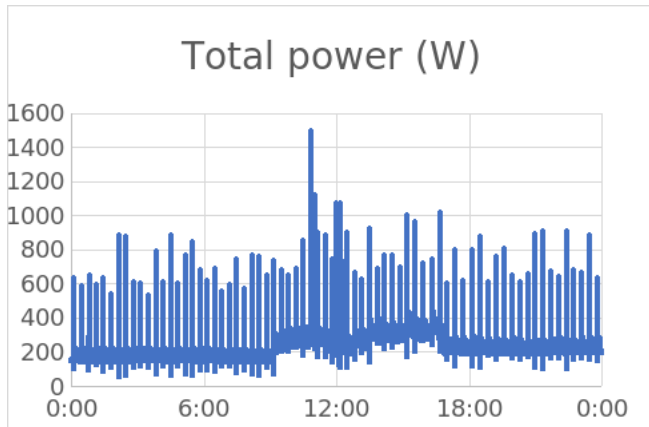
Fig. 2 – Daily load curve of the research lab selected for the case study

First of all, a median filter was applied on the load curve to remove impulsive noises. Then all positive and negative power changes were plotted as shown in Fig. 3. Two clear clusters; P+ and P- were identified from the plotted data so that 50<p<70 for p ϵ P+ and -60<p<-40 for p ϵ P-. From the power measurements done on individual appliances, two clusters were identified as the switching on and switching off events of the compressor in mini refrigerator
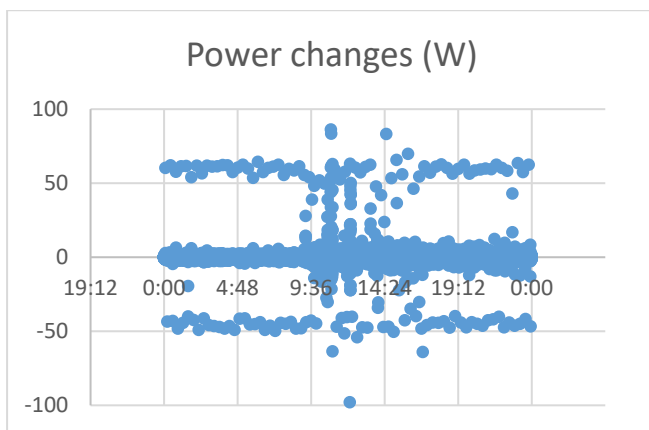
Fig. 3 - Detected power changes

Accordingly, 68 positive power changes and 62 negative power changes were identified for P+ and P- clusters. However, the actual power consumption of the refrigerator was also measured for validation purposes and it was found that the actual number of switching events was 71. Therefore, the estimation accuracy for the switching on and off events of refrigerator were 95.77% and 87.32% respectively

IV.   IDENTIFIED CHALLENGES & DEVELOPMENTS

NILM has shown significant success in the residential building sector [9][6][10] but its application in commercial buildings is challenging mainly due to the availability of large numbers of similar devices and high event density [9]. Presence of complex and variable power devices is also another barrier to disaggregate commercial building energy consumption [6], [7]. There are a significant number of published articles [9], [11]–[19] on the application of NILM

in commercial buildings and the identified key aspects are discussed in the following subsections.

A.   HVAC load disaggregation

Energy consumed through heating, ventilation and air conditioning (HVAC) systems accounts for a substantial portion of energy usage in commercial buildings. Because of the complexity and power variation, disaggregation of HVAC load is quite complex when compared to other loads. Norfold and Leeb [9] managed to identify start-up and shut down events of space-conditioning equipment in a laboratory building based on steady state power changes. In central air-conditioning systems, the main equipment such as chillers, pumps, cooling towers are sometimes metered separately but the end-use equipment are mixed up with lighting and other loads. In order to filter out the energy of end-use equipment, Ying et al. [16] proposed a method based on the Fourier Series Model (FSM). The basic mechanism of the FSM-based method is to separate the HVAC and other loads taking into consideration the dependency on the weather data. While most of the other methods required high resolution power measurements, Liang et al. [17] presented a sequential energy disaggregation algorithm which could extract HVAC energy consumption from low resolution (30 min) data using Day Type Classification (DTC) and Average Value Subtraction (AVS). However, none of the above approaches clearly address the issue of identifying power variation in central air-conditioning systems due to different thermostat settings.

B.   Individual disaggregation methods for Non-HVAC loads

Since a common method is unlikely to disaggregate all types of loads effectively, certain authors have proposed separate methods for each type. Jazizadeh and Becerik-Gerber [12] proposed a unique methodology to extract lighting energy by linking power measurement with the data acquired through light sensors. For the disaggregation of power electronic loads, Renaux et al.[18] suggested an algorithm based on the derivative of half cycle active power. A hybrid approach incorporating supervised self-organizing map and Bayesian identifier was proposed by Du et al.[13] for identification of plugged-in loads utilizing statistical information. Wave-form based estimator was proposed for the extraction of variable power loads by Wichakool et al.[15]. All the above approaches have shown significant success in the experimented scale, but it does not ensure the same performance when more than three different types of loads are mixed with or in case of multiple numbers of the same appliance.

C.   Association with occupancy data

Instead of relying entirely on aggregate power, some researchers have associated occupancy data in disaggregating the energy use of personal loads. Kavulya and Becrik-Gerber [11] associated visual observations to extract energy consumption and potential savings of computers and printers. Instead of visual observation which is not viable in continuous load monitoring, Thakur et al.[14] utilized the data acquired from location and audio sensors in their 'Wattshare' algorithm for energy apportionment among individuals living in a shared space of a commercial building. Chen and Ahn[20] suggested the utilization of Wi-fi connectivity of the occupants to extract their energy use events and based on the same concept Rafsanjani et al. [21] developed an algorithm to extract individuals' energy consumption using Density Based Spatial Clustering Algorithm with Noise (DBSCAN) and Quadratic

Discriminant Analysis (QDA). They have further improved their method by associating the distance to the load consuming point which was detected by an energy node locator[22]. Results of the above researches clearly indicated that the NILM performance can be improved by associating the occupancy data. Such approaches also demonstrate the ability of disaggregating total energy to the level of occupants rather than appliances.

V. CONCLUSION

NILM applications utilized in commercial buildings focus mainly on energy disaggregation at the appliance level. Such information is useful but not sufficient to manage individual occupants' energy usage. As a solution, there is a limited number of studies conducted on occupant energy monitoring in association with occupancy data.

Association of occupancy data in NILM is observed as an emerging research topic. However, the types of occupancy data used must be relevant to energy consumption and the methods of acquisition are to be practical and cost effective. As such, there is an opportunity to explore other occupancy data types which can easily be obtained but have not yet been associated in NILM. Disaggregation of energy to the occupant level can also be researched using such methods.

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Integrating a P&O through a Variable Steps Fuzzy Logic Control for a Photovoltaic System to Track the Maximum Power Point

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Abstract — **Based on the characteristics of solar cells, such modules have the ability to convert the sun irradiance into electricity. Although this is possible however it has a major drawback in terms of its low power extraction efficiency, the overall cost of the modules, and the interruption of service. The Perturb and Observe (P&O) technique was analyzed in this paper and a variable step adaptive fuzzy logic controller was applied to minimize the oscillation around the maximum power point and to apply an automatic step control to respond to the changes of the dynamic weather parameters in terms of temperature and irradiance.**

Keywords — *fuzzy control, perturb algorithm, maximum power point*

I. INTRODUCTION

Today, the world is facing a reduction of nonrenewable energy resources. Renewable energy is attracting multi nations and investments in this domain is growing and this is due to the green energy, free of pollution and the minimal maintenance required to produce a non-polluted energy source.

The use of photovoltaic systems that perform the conversion of solar energy into electricity has been implemented in wide spectrums with the aid of a tracking systems algorithms to extract the maximum power point (MPP) by utilizing a maximum power point tracking algorithm (MPPT) to extract the full power of those systems. Knowing that the dynamic changes in the environmental factors of irradiance and temperature makes the extraction of maximum power more complex [1].

In addition of the nonlinear characteristics of such systems, in this article we will present and analyze one of the several algorithms available in detecting and tracking the maximum power point through the use of a maximum point tracking algorithm (MPPT) known as the Perturb and Observe (P&O) algorithm [2].

As known from a (P-V) curve of a solar panel, there is an optimum operating point such that the PV delivers the maximum possible power to the load. The optimum operating point changes with the solar irradiation, and cell temperature. Therefore, on line tracking of the maximum power point of a PV array is an essential part of any successful PV system. A variety of maximum power point tracking (MPPT) methods are developed. The methods vary in implementation complexity, sensed parameters, and required number of sensors, convergence speed, and cost.

It is well known that photovoltaic systems are affected by factors that reduce their efficiency such as (i) changes on irradiation, (ii) changes on cells temperature, (iii) impedance variations at the system output, (iv) partial shading on the photovoltaic panel.

II. OBJECTIVES

The main focus in this research is to analyze the issues affecting the P&O from tracking efficiently the MPP and to adapt an intelligent fuzzy controller to use an automatic step size perturbation to get the most efficient and accurate results in tracking the MPP and guiding the operating point in moving in the right direction toward that point (MPP). The accuracy of tracking the MPP will be illustrated and examined as well.

Tracking accuracy of determining and implemented the MPP has played an essential factor in determining the efficiency of a photovoltaic system. Over the past and recent years, proposals are conducted in applying more control systems such as the Fuzzy Logic and Model predictive control and integrate them in the process of detecting the MPPT in a faster manner regardless of the dynamic weather conditions to ultimately getting a better and accurate results in regards of the extraction of the MPP. This will lead to more efficient photovoltaic system.

III. METHODOLOGY

In this section the modeling of the solar panel will be examined. Photovoltaic cell is the device that can convert the sun light into electricity using the photovoltaic effect. The incidence of light on the cell is generates charge carrier that generate an electric current if the cell is short-circuited [3]. Basically, the PV phenomenon is prescribed as the absorption of solar radiation, the generation and transport of free carriers at the p–n junction, and the collection of these electric charges at the terminals of the photovoltaic device [4]. The commonly accepted solar cell model is a one diode model, which is shown in Fig. 1. Such a photovoltaic cell model is a nonlinear system and can be represented as a current source model. The I-V characteristics of a photovoltaic cell is similar to diodes characteristic. This is represented by a set of equations [5].
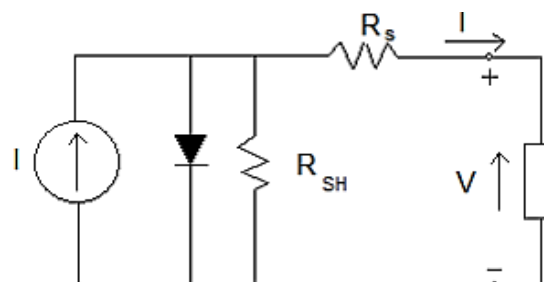
In this model we consider a current source (I) along with a diode and series resistance (Rs). The shunt resistance (Rsh) in parallel is very high, has a negligible effect and can be neglected. The output current from the photovoltaic array is [6,7,8]:

$$I = Isc - Id \qquad (1)$$

$$Id = Io\,(e^{qVd/kT} - 1) \qquad (2)$$

Where;
I_o is the reverse saturation current of the diode
q is the electron charge
k is the Boltzmann constant (k= $1.38*10^{-19}$ J/K)
T is the junction temperature in Kelvin (K)

From the equation (1) and (2);

$$I = Isc - Io(e^{qVd/kT} - 1) \qquad (3)$$

Using suitable approximation,

$$I = ISc - Io(e^{q\left(\frac{V+IRs}{nkT}\right)} - 1) \qquad (4)$$

Where;
I is the photovoltaic cell current
V is the PV cell voltage
n is the ideality factor.

The characteristic of photovoltaic arrays can be mathematically described as:

$$I = Ipv\left\{\exp\left(\frac{q(Vo+IRs)}{aNsKT}\right) - 1\right\} - Vo + \frac{IR}{Rsh} \qquad (5)$$

Equation (5) have a wide application in theoretical analysis of photovoltaic cell.

So we can approximately see (Vo+IoRs)/Rsh equal to zero. For the purpose of efficiency and stability, a maximum power point tracker (MPPT) is a power electronic DC-DC converter inserted between the photovoltaic array and its load. That would ensure the photovoltaic array will always works at its maximum power point as the temperature, insolation and load vary.

IV.   RESULTS AND DISCUSSION

P&O technique is considered as one of the easiest algorithms used to implement and simple to design. Its operation depends on periodic perturbation on the PV terminal voltage module and after that it compares the current power value at the PV output to that of a previous perturbation. As a result, and due to the perturbation, the operating point that needs to be moved in the direction of the maximum power point will continuously oscillate around the MPP but will never reach it to extract the maximum power of a PV system. Fig. 4 explains the MPP tracking procedure of the P&O technique.

The P&O with its simplified implementation it uses a voltage sensor, to sense the PV array voltage. By applying this technique this algorithm, tries to apply a fixed perturbation steps to reach the MPP however it will oscillate around it and this will result in not getting or extracting the maximum power out of a PV station due to applying fixed voltage steps. Further to that this algorithm does not adjust the perturbation steps in accordance to the dynamic rapid changes of whether the irradiation or temperature factors. To overcome this issue an adaptive Fuzzy logic controller agent can be integrated to apply a variable step size perturbation and to automatically change the steps based on the changes of the irradiance and temperature factors. The flow chart of the P&O algorithm is shown in Fig 2.
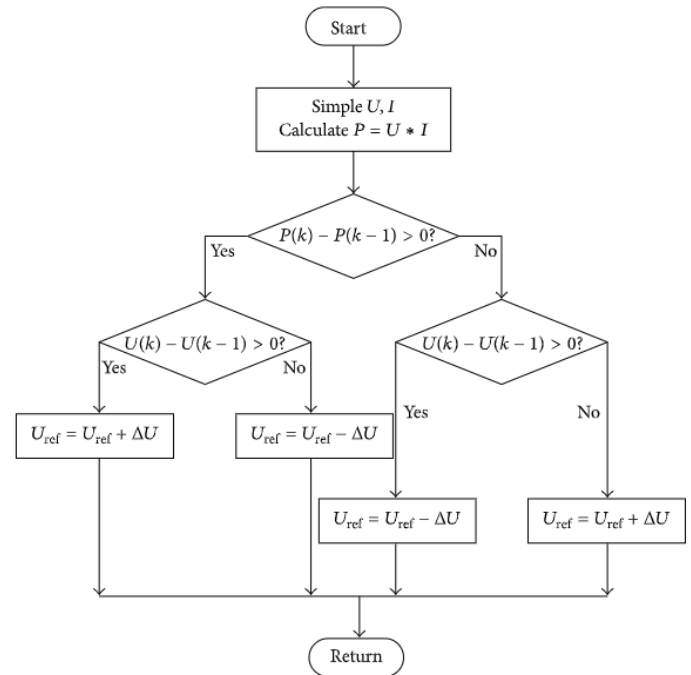
Fig. 2. Perturb and observe algorithm (P&O)

In the below simulation we set the P&O to extract the maximum power using an adaptive fuzzy P&O. Based on the results obtained we can verify that as the FLC was applied the oscillations were less and the tracking speed of determining the maximum power point was achieved as compared to the selection of P&O solely where it was evident that the oscillation affected the module in gaining stable power as shown in fig. 3.
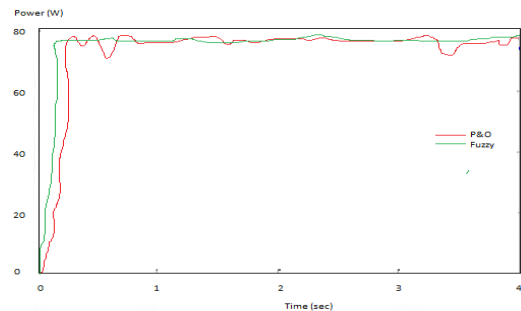
Fig. 3. Simulation results of Adaptive Fuzzy P&O

V. Conclusion

To reach and detect the maximum power point of a PV module a tracking algorithm shall be implemented. In this paper the P&O we addressed as one of the simplest algorithms that can detect the MPP from a PV module. The analysis of discussing its weak points revealed that due to the use of fixed step size perturbations the algorithm will guide the operating point to reach the MPP however it will oscillate around it and that will cause inefficient extraction of power.As a result of this fact a fuzzy logic controller agent was used to overcome the issues encountered with the use of P&O.

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Building Automation System to Optimize Energy Utilization Acquiring the Best Performance of Appliances in a Distributed Network

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Abstract — **In modern days, optimizing energy consumption is one of the most vital factors to be considered when designing a building. For example, cooling and heating spaces, ventilation, lighting are a few of them. Optimizing energy consumption, while maintaining the human comfort zone, is a challenging task. In this research, we introduced a novel system which is capable of optimizing the energy consumption automatically by considering the environmental factors as well as human behavioural patterns. The new system includes both hardware and software components. The hardware component called Sensor Data Monitoring & Appliances Controller (SDMAC) collects data and the software component Building Automation System (BAS) server processes the data and uses a rule engine to optimize the energy usage while maintaining the human comfort zone within the building.**

Keywords — Building automation system, Energy optimization, Internet of things (IoT), Distributed network

I. INTRODUCTION

Building automation systems are a new dimension in construction fields which is used to optimize energy consumption in modern buildings. There are various technologies and methods currently available for this purpose, but still building automation remains a challenging task. In this research, we introduce a novel building automation system which includes hardware and a software component. The hardware component called Sensor Data Monitoring & Appliances Controller (SDMAC) collects data and the software component Building Automation System (BAS) server processes the data and uses a rule engine to optimize the energy usage while maintaining the human comfort zone within the building.

Various methods and algorithms are used in existing BAS[1]. Although past research work has introduced worthy and useful BASs, it is still a challenging task to apply a BAS to an already constructed building because it requires infrastructure modification[2]. Among them, fuzzy logic embedded appliance control algorithms is a widely used technique in existing systems[3]. Fuzzy logic-based systems have shown their robustness in handling environmental factors and appliance controlling. However, the fuzzy logic-based system has drawbacks such as difficulty to update with new hardware devices. Apart from that, designing a BAS for a vast building is a complex task because it requires consideration of a heterogeneous and complex arrangement of the spaces in the building[4]. Besides, the type or the usage of the building also are important factors to be considered when designing a BAS. For example, it can be a warehouse, factory, office or a university lecture theatre. In each case, the duration and the locations of the building used by humans vary. Thus, it is necessary to consider the usage of the building when designing BASs.

The building's purpose, how it is occupied and used is another significant fact since it is directly related to the energy consumption of the building on a day-to-day basis[5]. For example, if the building is utilized as an educational institute, it may be used during regular office hours on weekdays. However, companies, industries, or hotels that are occupied for 24 hours, seven days a week will have high energy consumption all the time. Adopting IoT concepts, several specific circuits and devices have been developed and implemented for BAS solutions[6]. Therefore, currently, hardware platforms have extended their capabilities to communicate through different mediums and protocols [7].

Considering the limitations of the existing BAS and some of the challenges mentioned above, we designed a novel BAS which can manipulate electric appliances using Bluetooth, Infra-red (IR) or any other control medium. The speciality of our system is that it does not connect to the appliances directly but through an interface to the voltage controller (230V), which operates with Pulse Width Modulation (PWM) signals. Thus, the proposed system can manipulate a large number of electric appliances simultaneously, which is a limitation of the existing systems.

II. OBJECTIVES

The proposed system manipulates the appliances based on the specifications shown in Table 1 and 2. Those are the environmental factors and conditions considered by the proposed system. Furthermore, the proposed system can work with both digital and analogue signals.

Table 1. Room temperature in general

Temperature($°C$)	Condition in General
0-18	Cool
18-28	Normal
28-100	Hot

Table 2. Room humidity in general

Humidity	Condition in General
0-42	Dry
42-62	Normal
62-100	Wet

Another critical factor in a BAS is the selection and execution of rules concerning environmental sensor input

data. The selection of a corresponding rule may depend on human factors as well as extracted environment conditions.

However, when personalization is required in specific building spaces (cubicle, cellular office area, etc.), the impact of human variability is achieved through analyzing environmental behaviour along with human intervention. Then the proposed BAS requires executing appliance specific rules based on the personalization.

The proposed BAS should be a distributed system since it requires to manage the collection of distributed appliances and system modules as a means of message passing in a Wide Area Network (WAN). The proposed BAS solution should handle the complexity in the orchestration of appliance controlling, and sensor monitoring. The required functionality in distributing sensor and appliance orchestration has been integrated into electronic devices introduced as SDMAC - Sensor Data Monitoring & Appliances Controllers. The main components in the proposed BAS solution (SDMAC devices and BAS servers) should preserve the space and time uncoupling with communication. The discussed aspects of the proposed BAS solution are focused on procuring the best energy utilization and the performance of appliances in a building it is installed.

III. METHODOLOGY

The proposed BAS solution consists of two major components as the BAS server and the SDMAC module as shown in Figure 2 and 3. In figure 2, the nodes can be the air conditioning machines, light bulbs or any other electrical appliances. The BAS server manages the communication with a collection of "units" that consists of SDMAC modules and nodes (or appliances that need to be controlled). The "unit" is installed in a cubicle, conference room, server room, or any specific area inside the building where the automation of appliances is required. Since every rule is defined and is controlled according to sensor data inputs and the Key Performance Indicators (KPI) the BAS server is the main module of the system in charge of that task. The installed sensors direct sensor readings to the SDMAC module and the SDMAC forwards the unit sensor input collection to the BAS server. Then the rule engine extracts the Best Matching Rule (BMR) and computes the decision. Afterwards, the BAS server forwards the decision to the correct SDMAC module, and the SDMAC module executes the required controlling commands to the specific appliance according to the decision.
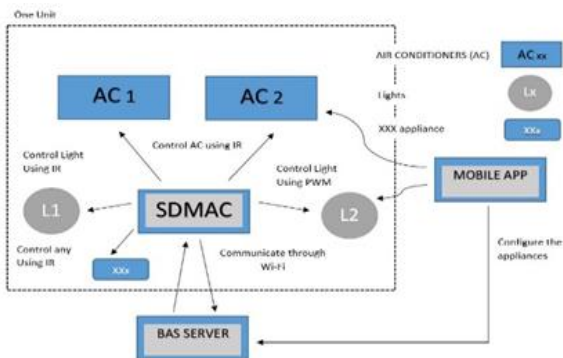
Fig. 1. Unit architecture

The availability of the SDMAC modules is crucial, and an SDMAC module generally mounts on a wall or ceiling. The SDMAC module withstands a load between 3A to 10A. The proposed BAS architecture reflects the potential of

extendibility with any type of a sensor with the SDMAC module since it can be introduced as an adapter into the system. In the prototype, the SDMAC module is capable of controlling eight appliances efficiently using the SDMAC has the capability to efficiently manage a load of 5 IR powered appliances and 3 Pulse width Modulation (PWM) (230V) powered appliances.

The implementation of the BAS server has reflected the capacity in controlling several numbers of units connected together. SDMAC module solution enables horizontal scaling. A single SDMAC module can communicate with the BAS server using Message Queuing Telemetry Transport (MQTT) protocol, and the mobile application can also communicate over MQTT in real-time.
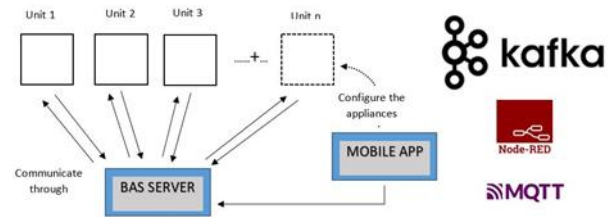
Fig. 2 – Floor architecture
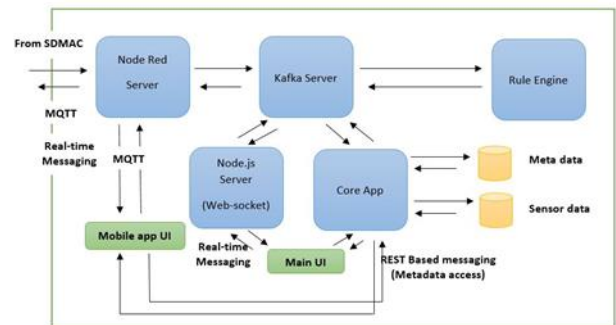
Fig. 3. BAS architecture

The influx database is used to store sensor input data and the "core app" manages the accessibility of data, through data managing interfaces. The rule engine is implemented using Drools, and it is capable of managing rules with forwards and backward chaining. The rule engine communicates with the Kafka server and the NodeJS server exploits as a web socket that connects to the Kafka server while controlling real-time streaming. The use of Kafka as the central message parser has extended the potential in integrating the solution with big data processing [8]. The metadata is the registry of appliances and their specific attributes.

Figure 4 illustrates the prototype of the SDMAC module, and most of the sensors are of passive type. However, it is possible to integrate active type sensors to the SDMAC module as well.

Fig.4. SDMAC device

In a large space, environment monitoring requires the collection of data from multiple inputs from small sensor monitoring devices, leading to higher accuracy in rule extractions. The small sensor monitoring device directly communicates with SDMAC and provides an abstraction on top of the collection of sensors with a sensor validation feature. Validation is required since each sensor has its accuracy level, and due to sudden power changes, some sensors may malfunction.
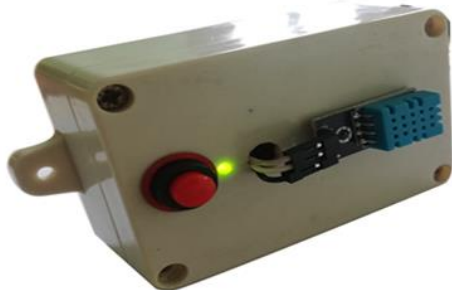
Fig. 5. The small sensor monitoring device

IV. RESULTS AND DISCUSSION

We have successfully tested the proposed BAS system in a real environment. There we performed two types of experiments. First, we tested the fail tolerance of the system. Our system performed consistently without any technical flaws. Second, we tested the energy-saving capability of the proposed system. We measured energy saving capability using a Current Transformer (CT) based real-time energy monitoring system. We used a portable air conditioner placed in a cubicle of 100 sq. ft. for this test. Table 3 shows the specifications of the test environment.

Table 3. General detail of the testing environment

AC Details		Cubicle Area Details	
BTU	12000	Size	100 sq. ft.
Rated Current	8 A	No of person	2

In the test, appliance energy consumption was measured using a portable air conditioner placed in one cubicle of a single floor. The air conditioner had dynamic state-changing capability against time by consuming considerable energy of the building. Therefore, this was an ideal appliance to examine energy usage in the existing building. According to the environmental condition of the room temperature and humidity was considered as sensor data.

Based on the experiment, the energy consumption of the air conditioner was measured within a time span of 180 minutes. The energy consumption had minimized by nearly 1.118 kW/h. The air conditioner's power usage without using the BAS was 3.331 kW/h while using the BAS with rule-based controlling was 2.213 kW/h. The experiment emphasized that the rule-based controlling worked perfectly and the appliances' functionality was controlled according to the environmental factors on which the appliance is

dependent on resulting in reduced power usage. Assuming every cubicle area of the building has similar characteristics then each cubicle of the floor could be measured using the above the mentioned method.
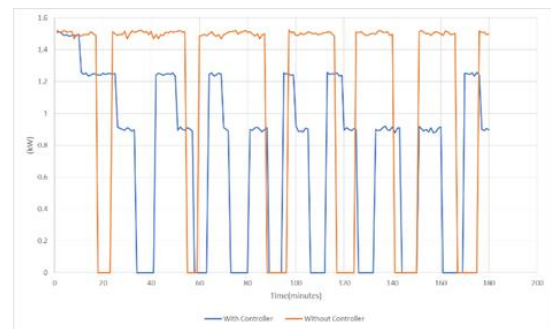
Fig. 6. Energy consumption level comparison (180 min behaviour)

V. CONCLUSION

In this work, we have introduced a novel building automation system which includes both hardware and software components. The uniqueness of our system is that it can control or manipulate large electric appliances simultaneously while preserving the human comfort level in the building. The experimental results show that our system saves a significant amount of energy and can run flawlessly for extended periods without interruptions.

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Facilitating Synchronous Online Learning through *ZOOM* in English Language Teaching for Undergraduates at the University of Kelaniya

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Abstract — **Educators worldwide are moving from traditional setting to remote education. Due to the lockdown, physical classrooms are also adapted to virtual. The research aims to investigate the perceptions of students in using *ZOOM* as a learning platform in the context of English Language Learning (ELL). The study is conducted online with 60 undergraduates who study at the University of Kelaniya. The thematic analysis explains prominent themes such as challenges, use of *ZOOM* and its features in English Language Teaching setting etc. In a period where the world is attempting to cope with a pandemic, the study is significant in developing strategies in while identifying student perceptions and to manage the challenges that they undergo while using the platform in ELL and adopt online teaching. In fact, the field of English Language Teaching (ELT) is now more inclined towards a blended learning approach in which the study's results will be substantial.**

Keywords — *Online learning, ZOOM learning, online teaching for ESL*

I. INTRODUCTION

Online teaching has been a commonplace practice since the outbreak of COVID-19 pandemic. Educators tend to move away from face-to-face (F2F) lessons and adopt online teaching instead [4]. In Sri Lankan context, it is true that there can be many challenges that the students encounter in the transition process where they adopt online learning. In the long run, however, it tends to bring positive effects such as providing the students the flexibility to work independently, at their own pace, promoting natural language acquisition [1][2]. It is important that tertiary education continues in a pandemic environment which makes online learning not only a positive step but a necessity.

The research questions addressed in the study are as follows;

    i. How do students perceive 'online learning via ZOOM' in English Language Learning?

    ii. What are the perceptions on 'pre-recorded ZOOM sessions' vs live ZOOM sessions?

    iii. What are the challenges that students undergo in online learning via ZOOM?

As illustrated in Fig. 1. The interface is user-friendly and contains several options such as screen-share, whiteboard, chat etc. Hence, the research questions explore student perceptions of using the platform for language learning while considering the challenges. Identifying the challenges will lead to have a better online learning experience in the future when the concerns are addressed. In terms of online teaching, there is asynchronous learning where students have the ability to access a pre-recorded material. The study also draws attention to learner preference of pre-recorded sessions versus live ZOOM sessions concerning English Language learning. Hence, the study contributes to an ongoing challenge in the country in the field of ELT where interaction and engagement is most substantial in language acquisition.

Fig.1.Screen capture of Zoom application window. (A) GalleryView, (B) ControlBar,(C) ParticipantPanel,(D) ChatPanel [6].

II. OBJECTIVES

The research addresses a current challenge in the field of English Language Teaching (ELT). Digital Divide is a burning concern which questions the fairness of continuing distance learning in a time of a pandemic when some undergraduates are unable to be a part of the session which they would have otherwise be.

The objectives of the research are (i) to investigate the perceptions of students regarding online teaching in ELT context, (ii) to evaluate the preferences of online teaching in ELT and (iii) to explore the challenges that are faced by the English language learners when they learn via ZOOM.

III. METHODOLOGY

The research follows a qualitative approach as it deals with factual data and perceptions. 60 participants who are undergraduates at the University of Kelaniya are chosen as the sample group. They belong to either Faculty of Humanities, Social Sciences or Commerce and Management Studies who have taken part in online ZOOM lectures for more than two months. The rationale is that they are familiar with ZOOM hence, will be able to share the experience.

The participants were to fill in a Google form which mostly includes multiple choice questions followed by two open ended questions. The data was analyzed thematically while main themes were identified with the answers that the participants had provided.

IV. RESULTS AND DISCUSSION

Addressing the question regarding the online learning experience, 4 questions and 2 open ended questions were included in the Google form. The participants rate their experience as follows.
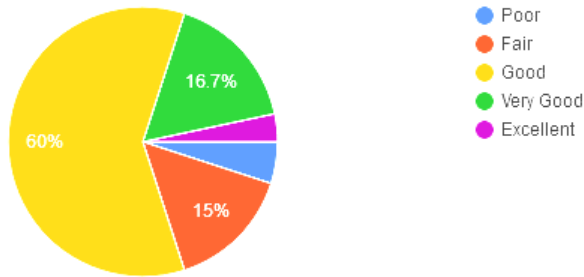
Fig.2. Rating online learning experience

Figure 1 illustrates how the participants have rated their online learning experience. Notably, the majority has rated the experience as being favorably 'good', 'very good' or 'fair' which shows that there is room for improvement. Having the ability to engage in remote learning has been 'progressive' and perceived as a way of learning in 'a relaxed space'.

In a nutshell, the participants were asked whether they feel relaxed during ZOOM lectures, traditional lectures or whether they do not feel a significant difference between the two. 51.7% feel more relaxed in traditional classrooms, 36.7% do not feel a difference, and however, 11.7% only feel more relaxed in ZOOM lectures. The proportions are repeated in the question about inquiring feeling anxious during lectures. Hence, there is the implication that ZOOM language teaching has more room for improvement in terms of 'student engagement' which has been the challenge. Unlike in a physical classroom, the students at times are not provoked to be 'forward' or outspoken since they are in an isolated space. Active learning, as the results presents, happen more in physical classrooms hence the learners choose it over virtual concerning engagement factor.

In online teaching, just as much as synchronous teaching, there is the option of asynchronous teaching where the teachers upload pre-recorded videos or ZOOM videos after recording with or without students. Islam et al. (2020), in their research find out that a majority of 53% of the participants prefer pre-recorded videos. The findings of the present research contrast with that of Islam et al. (2020) where students prefer live streamed ZOOM sessions as illustrated in Figure 3 [3].

As illustrated in Figure 2, the majority of participants prefer to take part in live ZOOM sessions rather than merely watching recorded lectures. It reiterates that they feel more engaged in live sessions and they enjoy participating. If the learning is totally replaced, they would rather go for real-time sessions which are more 'active' where learners could pose questions immediately. However, future research can investigate into the reasons why 30% would prefer uploaded sessions. There could be different reasons such as linguistic competency, network issues, having the opportunity of learning anytime etc.
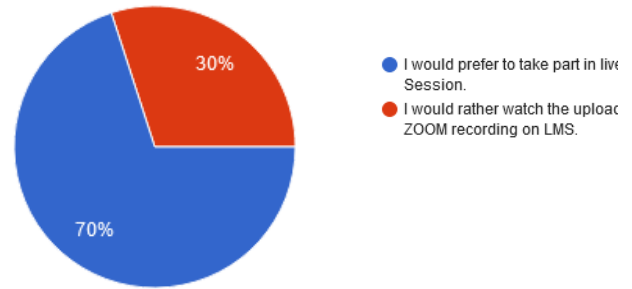
Fig. 3. Preference for Live stream ZOOM session versus Pre-recorded Sessions out of 60 responses.

In relation to the above concerns related to engagement factors and interest factors, the author has posed a question on the use of two prominent features that are used by the participants. Screen share has is a commonly-used method whereas 'breakout rooms' (group/pair) method is not used as much as the PowerPoint. The researcher assumes that this could have an impact on student interest on ZOOM lectures to be less interesting compared to traditional setting. However, further research can be conducted in order to verify the validity.
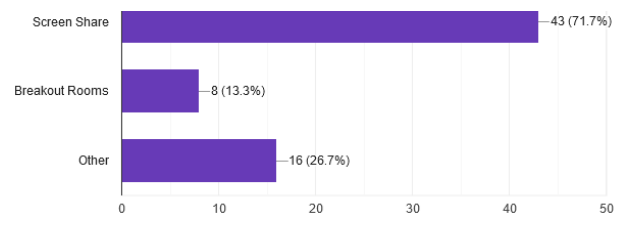
Fig. 4. Familiarity with Common Features in ZOOM

In terms of language acquisition, the research analyses the perceptions on linguistic improvement. Notably, the participants have been enrolled in 6 weeks (or more) in a ZOOM lecture series. Hence, the assumption is that these tertiary learners are able to self-evaluate their improvement.
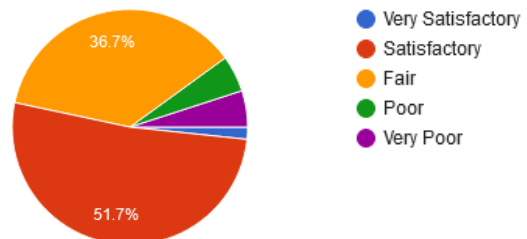
Fig.5. Perceptions on Language Improvement

Thus, the data shows that the majority of the participants consider their improvement has been 'satisfactory' or 'fair'. However, it needs to be noted that very few have rated it as being 'poor' or 'very poor'. Constant attention is required to make it a better experience. There could be reasons why the progress was slower as compared to a physical setting. Technical issues, lack of student-centeredness could be among these concerns.

Drawing from the data gathered from open ended questions, there are recurring themes such as (i) Preference for live stream ZOOM sessions, (ii) Challenges such as Network issues and (iii) ZOOM as a continuation of course. The ideas presented by the participants explain how important they

perceive having ZOOM lectures as a means of continuing learning which would otherwise be interrupted time to time due to the pandemic.

V. CONCLUSION

The study investigates several dimensions in relation to ELT in online setting. The findings show that the students overall, perceive that they have a good experience in online learning concerning English language acquisition at tertiary level. However, when they rate interest, it is clear that they are moderately engaged. Moreover, it can be concluded that students prefer live ZOOM sessions to pre-recorded ones. Majority has highlighted on the engagement which they have in a physical setting being converted in a similar manner as opposed to recorded sessions where active learning does not take place. Majority of the participants prefer evening lectures to morning ones. The recurring idea in the open-ended question is that ZOOM has been very useful in continuation of English Language education for tertiary level students at the University of Kelaniya. Except

for technical issues, prominently network issues, the participants do find ZOOM useful with a user-friendly interface compared to Skype and Google Meet. Further research can be conducted in order to investigate into the reasons for mediocre engagement within the ZOOM platform and to look into ways to develop English Language Teaching and learning experience via ZOOM.

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Perceptions On *"Kahoot !"* as An English Grammar Learning Tool: A Study Conducted at Undergraduate Level

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Abstract —The purpose of this study was to investigate the perceptions of undergraduates on *Kahoot!* as an English grammar learning tool. The study used both quantitative and qualitative methods to obtain data. Data were collected from 50 undergraduates studying at the Faculty of Science, University of Kelaniya using a survey questionnaire and semi-structured interviews. The quantitative data gathered from the questionnaire were analyzed using SPSS whereas qualitative data from the interviews were analyzed thematically. Results showed that Kahoot! is a motivating and effective means to assist undergraduates in improving their English grammar. The data obtained from this study are of relevance to researchers, instructors, and policymakers since it may inform teaching practices in higher education classrooms within the Sri Lankan context.

Keywords — perceptions, Kahoot! , learning grammar

I. INTRODUCTION

The intervention of technology into every part of our lives has transformed how activities are performed on a daily basis. Its continuous progress has made immense changes in our personal as well as professional lives. It is evident that the intervention of technology into the field of education is significant to reshape the future of it. Incorporating technology into the field of education has created various innovative learning and teaching modals and tools which increase the convenience and efficacy. It has assisted learning by providing a great favor and benefit to students and teaching by equipping teachers with right tools they need in order to improve students' engagement into their teaching process. Therefore, teachers need to be sensitive to these technological changes and adapt their teaching strategies according to the current needs and preferences of the learners. Moreover, teachers and educators should try to replace traditional textbooks with learning software in order to enhance students' engagement in learning.

There are wide varieties of learning software developed to assist language teachers in their classrooms. In addition, teachers now have the opportunity to integrate play-based learning activities via technology . The incorporation of play in learning has seen the emergence of a unique concept of game-based learning which is also known as gamification. According to Warschauer and Healey (1998) (as cited in Sørensen & Meyer, 2007) [12], games have been conceptualized as an enjoyable factor in language learning since they create an enthusiastic environment by increasing motivation and authentic communicative practices in which learners and even the teachers become more interested in the learning and teaching process. Thus, the features of gamification based software such as being interactive and responsive are suitable for English language classrooms. One such technological software that has proven to be invaluable in the language classroom is *Kahoot!* which "can be used as a teaching as well as an assessment tool where the users are encouraged to learn, play and socialize in classrooms thus making the learning process an active one (Graham, 2015) [6]. In *Kahoot*!, quizzes are integrated with game design elements, like graphics, music, sounds, points and competitive leaderboards with the aim of generating students' motivation to make a playful and competitive atmosphere (Wang 2015) [15].Thus, there is a need to investigate students' perceptions regarding *Kahoot!* for language learning.

A large number of studies have been conducted on student perceptions and experiences on *Kahoot!* in higher education classrooms across a variety of disciplines (Wang 2015 [15];Plump & LaRosa 2017 [11]; Nicolaidou 2018 [10]). It is necessary to investigate students' perceptions of *Kahoot!* in higher education in the Sri Lankan context as well. There is also a lack of studies on the effectiveness of *Kahoot!* as a tool which can be utilized to learn grammar with regard to undergraduates who learn English as a Second Language in the Sri Lankan context.Given this background, it is worthwhile to examine more in-depth undergraduates' perceptions of *Kahoot!* as a tool to learn grammar. In attempt to address this research purpose, the following research questions guided this study: RQ 1**:** What are university students' perceptions on the use of *Kahoot!* to learn grammar in English classes ? RQ 2: To what extent does *Kahoot!* enhance undergraduates' engagement and motivation towards learning grammar?

II. OBJETIVES

Previous research studies associated with *Kahoot!* have primarily focused on the benefits instead of understanding how these platforms are perceived by students within the higher educational context, especially while learning English grammar. In response to this problem statement, the present study aimed to realize better insights into students' perceptions of *Kahoot!* through qualitative and quantitative data analysis. The data obtained from this study are of relevance to researchers, instructors, and policymakers because it may inform teaching practices in higher education classrooms within the Sri Lankan context.

III. METHODOLOGY

This study employed a mixed- method research design that involved 50 first year undergraduates from the Faculty of Science, University of Kelaniya who followed the course "English for Biology". According to Tashakkori and Creswell (2007) [13], mixed-method which is a combination of both qualitative and quantitative measures offers multiple perspectives to examine a research problem, expands the understanding of a complex issue, and leads to better interpretation of the findings.The participants were selected through convenient sampling, consisted of those who have intermediate to low levels of proficiency and fluency in English. This research took place over a period of four weeks. The participants learned English grammar lessons accordingly, and then participated in the online quiz-games in

each lesson either in the middle of the lesson as exercises or at the end of it as recap activities.

The research instruments which were utilized to collect data were a survey questionnaire consisted of 22 items and semi-structured interviews. The questionnaire items were adapted from Gardner's Attitude and Motivation Test Battery (AMTB) according to the need of this study. The items in the questionnaire were ranged using five-point Likert scale which participants had to tick based on what their responses were towards each item. The survey questionnaire was given to students to answer on the last day of the research period. The items in the questionnaire were also thoroughly explained orally through translation by the researcher for the participants who found it very hard to understand. Then, the data gathered from the questionnaire were analyzed using the Statistical Package for the Social Sciences (SPSS).

The researcher has conducted semi-structured interviews with eight students. The participants were selected conveniently based on their availability and willingness to take part. The semi-structured interviews were audio taped, transcribed and coded. After coding the data, the prominent themes and recurring ideas were identified which were later interpreted to draw meaning from it. Thus, the study applied thematic analysis whereby data gathered were categorized into themes and sub-themes so as to be comparable.

IV. RESULTS AND DISCUSSION

Through the data gathered from semi-structured interviews, five major themes associated with students' perception of *Kahoot!* as a grammar learning tool were identified as follows: (1) attention and focus, (2) interaction and engagement, (3) motivation and competition, (4) learning and knowledge retention, and finally (5) fun and enjoyment. Table 1 presents a summary of the themes emerged from semi-structured interviews with few example excerpts.

Table 1. Themes and example excerpts

No	Themes	Example Excerpts
01	Attention and focus	*"Kahoot! helped me to memorize grammar rules"* *"The music creates a feeling of suspense and encourage me to concentrate and work harder"* *"Playing Kahoot! helped me to pay attention to grammar and focus while studying in class"*
02	Interaction and engagement	*"I enjoyed joining with my classmates to answer grammar questions"* *"I was more involved and active in class, feel that Kahoot! increased classroom interaction"* *"It helps us get to know each other more"* *"I like to use my name because I want everyone to know I am a good student"* *"I like to see my name among the top five players"* *"Kahoot! gives us a chance to discuss the correct and wrong answers together"*
03	Motivation and competition	*"Playing against other students motivates me to learn grammar"* *"It is exciting and motivating to see my name suddenly excelling in the leaderboard"* *"I revise grammar rules in to do well during the quiz"* *"I am more interested in grammar classes especially when I get high scores in Kahoot!"*
04	Learning and knowledge retention	*"Kahoot! improved my grammar knowledge. I was more prepared for taking the weekly quiz"* *"We had the chance to correct our mistakes and learn from each other"* *"I remember the grammar items I got wrong. Kahoot! helped me understand that I am not the only student who got wrong"* *"I find it helpful when the teacher discusses the wrong answers to Kahoot! questions"*
05	Fun and enjoyment	*"The class is more fun with Kahoot!"* *"There is a lot of positive energy in class when we participate in Kahoot!"* *"I post a picture of my rank on whatsapp for my family and friends to see"* *"I feel very proud when I am among the top five players"*

The analysis of the semi-structured interviews revealed that all of the participants (N=08) seem to agree that *Kahoot!* sessions assisted them to focus on grammar lessons. These findings are in line Vygotsky's (1978) [14] beliefs about the role of the Zone of Proximal Development (ZPD) in facilitating learners' cognitive growth and improving higher-order learning. According to him, cognitive functions, such as concentration, focus, memorization, and attention are stimulated by social interaction. The positive impacts of enhanced attention found in this study are also similar to those mentioned in previous literature (Caldwell 2007[3]; Wang & Lieberoth 2016[16]; Licorish, et al. 2018 [8]). Many students stated that the sound effects found in *Kahoot!* sustained their engagement and focus, which is consistent with Wang and Liberoth's (2016) [16] experiment with *Kahoot!,* and is linked to Malone's (1981) [9] ideas of the role of music and sounds in stimulating students' sensory curiosity. Qualitative data analysis showed that *Kahoot!* increased students' opportunities for interaction with peers and teachers and facilitated students' deep engagement with content materials. These comments show elements of collaborative and active learning, which ties well with Wang's (2015) [15] study who found similar conclusions. *Kahoot!* was particularly helpful in changing the dynamic of the lesson, as they seemed to feel that they were a part of the discussion rather than passive learners.

Qualitative data analysis showed that all of the students (N=08) believed that *Kahoot!* created a friendly competition in the classroom which enhanced their motivation. Malone's (1981) [9] intrinsic motivation theory declares that motivating tasks are often associated with fun and enjoyable activities. These findings have also been recently confirmed by Cameron and Bizo (2019) [4] who state that gamified platforms engage students in their learning. This finding can also be associated with Krashen's (1988) [7] Affective Filter Hypothesis which states that a lowered affective filter allows the input to strike deeper and be acquired. Qualitative analysis showed that students perceived *Kahoot!* as a platform that would allow them to perform on their own. Ali and Hadithy (2018) [1] found that there was a significant increase in active learning, student's self-directed learning and a general improvement in summative assessment outcomes with the use of *Kahoot!*. Additionally, around five students expressed that the ranking obtained while playing *Kahoot!* added an element of joy and gave them an opportunity to 'take pride' in their accomplishments, which boosted their self-esteem. The same conclusion can be drawn from the study of Benhadj et al.

(2019) [2] which they conducted with Moroccan students. These positive perceptions are also in accordance with the results of (Wang & Lieberoth 2016 [19]; Plump & LaRosa 2017 [11]; Licorish et al. 2018[8]) that showed university students found the implementation of Kahoot! to be beneficial and enjoyable.

Themes from the qualitative phase were used to develop the survey instrument for the second quantitative phase. 22 items using a 5-point Likert-scale were grouped into five categories and all statements required a response of (strongly agree 5, disagree 4, neutral 3, agree 2 or strongly disagree 1). The descriptive statistics and analysis of the survey are summarized in Table 2.

Table 2. Survey questions and results (removed due to page limit)

Many students value the interaction and engagement offered by *Kahoot!*. Over half of the participants (60%) strongly agreed that '*Kahoot!* makes the class more interactive and lively. In addition, nearly half of the respondents (46%) strongly agreed that learning grammar through *Kahoot!* increases their attention in class. These results indicate that students perceive Kahoot! as a useful tool to learn grammar.. The vast majority of students (30%) reported that they focus more during *Kahoot!* to get a good ranking. In addition, the competitive element motivated by class ranking found in *Kahoot!* received the highest percentage of satisfaction of all statements in this category as 62% strongly agreed that 'It was fun to compete against other students. Remarkably, only 12% disagreed and about the same percent were neutral which shows that the motivating factor of competition is not important for all students as has been previously documented by Ryan and Deci (2000) [5]. These results imply that the majority of undergraduates perceive that *Kahoot!* increases their engagement and involvement to learn grammar when implemented in class due to the competitive factor found in *Kahoot!*. Only 30% strongly agreed that using nicknames makes them willing to participate more in *Kahoot!* while about 12% did not really care about the anonymity feature in *Kahoot!*

The results show that over 32% of the sample believed that participating in *Kahoot!* sessions helped them to learn grammar. The majority of students supported that it was fun and entertaining to participate in *Kahoot!* sessions. Significantly, statement number 21 received the highest percentage of all 22 items as more than 62% of undergraduates strongly agreed that they like to compete with their colleagues. More than half of the participants believe that *Kahoot!* should be implemented in higher education.Evidence from both the qualitative and quantitative phases suggest a general acceptance of *Kahoot!* as a tool to improve English grammar among university students.

V. CONCLUSION

In conclusion, after the analysis of data gathered during the research, it has been confirmed that *Kahoot!* is a motivating and effective means of assisting undergraduates in improving their English grammar. After the grammar lessons, the teacher gave quizzes related to grammar points they had learned using *Kahoot!*. It helped the students to recall the previous grammar points. After seeing the score in *Kahoot!,* students could measure their knowledge. Also, it could build a good atmosphere in class. The system in *Kahoot!* allowed the students to do the quiz together, but provided the opportunity to respond personally. Thus, it was able to build a competence between them. The atmosphere in class focused the learning process. Based on these facts, it can be summarized that students accept *Kahoot!* as an effective learning tool.

Nevertheless, given the fact that this is a small-scale research, these findings should be treated with caution and should not be overgeneralized. On the other hand, they should be used for further, extensive research into the matter so that a clearer picture is formed of the influence that *Kahoot!* can have on the teaching of English grammar to undergraduates in Sri Lankan universities. The results also implied that interactive platforms such as *Kahoot!* could be integrated as part of the grammar teaching pedagogy to increase students' focus, reduce boredom, and lower distraction.

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A Case study of Undergraduates' Perception on Generic Skills acquired from the University Education

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Abstract - **Undergraduates' perception on the knowledge and skills they acquired from the University education is a determining factor to measure their satisfaction of the entire university education. This research is oriented on analyzing the perception of the undergraduates' generic skills that they acquired throughout the University education. The research was conducted as an online survey where a sample of 62 final year undergraduates from a State University was distributed with the online questionnaire. Identifying the relationship between the generic skills (10 skills) which is the independent variable and overall perception which is the dependent variable. The results of the study reveal that undergraduates have a high perception on computer literacy, ethical sensitivity & acting morally, prioritizing/planning & decision-making, and negotiating/Teamwork so that the University education has led them to enhance those generic skills. Multiple regression analysis reveals that the generic skills such as Prioritizing and planning of work, Applying subject knowledge, Ability to cross-culturally, and Negotiating and teamwork are significantly affecting on undergraduates' overall perception on generic skills they acquired by the University education.**

Keywords – Undergraduates, Generic Skills, Education

I. INTRODUCTION

Aim of any Degree Program is to produce academically and professionally competent personals to the relevant industry. The academic procedure of the University or the curriculum of any degree program will orient on designing the graduate's profile to be sharpened with knowledge, skills, and attitudes. Competencies or the skills inculcated in the graduates' profiles decide the employability of the students.

Undergraduates' and graduates' perception on higher education is measured by many scholars and researchers especially focusing the areas such as competencies, skills, employability, industry perspective of the graduates, gap analysis of education and industry, etc.

Harvey, Locke, and Morey (2002) defined employability as the ability to acquire, keep, and excel at a job. Further, they point out that Employability is about making closer links between education and the world of work. Students are more diverse but so are higher education institutions and graduate career opportunities. In response, institutions are developing a variety of ways of enhancing students' employability [1].

Wang & Tsai (2014) states that employability is measured in both aspects of personal competency and job competency. Personal competency is concerned as the career planning and development skills and core skills. Job competency refers to specific employability, including fundamental competency (work attitude and personal attributes) and Functional competency which is consisted of two subcategories such as Leadership competency and professional competency (professional management skills and technical skills) [2].

Numerous studies have discussed the relationship between core skills and a successful career (McCabe, 2008[3]; McCabe & Savery, 2007[4]; Pool & Sewell, 2007[5]).

Employability will be determined by a broad range of skills/competencies. Many scholars have introduced and defined the employability skills or the competencies in different angles. i.e: Core skills, generic skills, process skills, metacognition (cognitive skills),

Ruben (2007) has focused on seven elements which are essential to establish and maintain an outstanding HEI. The framework is constructed on the integration of approaches to assessment, planning, and improvement. The evaluation areas used to define excellence in higher education are (i) Leadership, (ii) Purposes and plans, (iii) Beneficiaries and constituencies, (iv) Programs and services, (v) Faculty/staff and workplace, (vi) Assessment and information use, (vii) Outcomes and achievements (Ruben, 2007, as cited in Brusoni et al., 2014) [6].

According to Finch et al. (2013), graduate employability is affected by five high-order skills, these factors include Soft-skills, Problem-solving skills, Job-specific functional skills, and Pre-graduate experience. They investigated 17 factors that influence graduate employability through the subjective perspectives of employers when they consider engaging new graduates [7].

Today, the business environment is much competitive and challengeable where the generic skills are more required to achieve the success of any business organization. Thus, employers now focus on adaptation, cost reduction, increased productivity, and new markets, products, and services. The employability of the graduates will be determined by the generic skills they inculcated in their graduate profiles. Flexibility, team spirit, initiative, adaptability. innovative, problem-solving, capacity to deal, service-oriented, to make decisions, take responsibility, and communicate effectively, making information and social skills are some of the prominent and timely important generic skills.

Proficiency in the broad range of generic skills has become the main requirement for the modern worker. Catering to the industry requirements, shaping the graduates' profile with generic skills will lead to the integrity of higher education and employability of graduates. Therefore, it is essential to analyze the undergraduates' perception on generic skills they acquired from university education.

II. OBJECTIVES

The major objective of the study is to analyze the undergraduates' perception on the generic skills they acquired from the University education.

The study was led by three specific objectives such as:

(i) to determine the most significant factor/s (generic skills) affecting on undergraduates' high perception

(ii) to determine the factor/s (generic skills) which are effectively addressed by the University education

(iii) to determine the factor/s (generic skills) which should be addressed more effectively by the University education

III. METHODOLOGY

The research is based on a qualitative method where primary data was gathered based on an online questionnaire survey. The sample of the study was determined based on cluster sampling technique where all the departments of the Faculty of Arts from a state University, identified as clusters and out of them one Department was selected on convenience based sampling technique. The sample frame was consisted of final year undergraduates of a particular degree program of that selected department. The list of email addresses of the final year undergraduates was collected from the particular Department and the list was consisted of 62 undergraduates. All the undergraduates were distributed with a Google form where initially demographic data was gathered and secondly 10 process skills were measured based on Five-point Likert scale questions. The scale was designed as 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The participants of the survey were allowed two weeks of the period for responding (from 11th – 24th of May 2020). At the end of the allocated period, 43 responses were gathered.

The generic skills measured in the study are (1) Computer literacy, (2) Commercial awareness, (3) Political sensitivity, (4) Ability to work cross-culturally, (5) Ethical sensitivity and Acting morally, (6) Prioritizing and Planning and Decision-making, (7) Applying subject understanding, (8) Coping with complexity, (9) Problem solving and Resolving conflicts, (10) Negotiating and Teamwork.

Initially, reliability analysis was conducted followed by the descriptive statistics to identify the level of the undergraduates' perception. Then correlation analysis and multiple regression were conducted in order to identify the most significant generic skills among the 10 generic skills. All the statistical tests were conducted using SPSS 16 version.

IV. RESULTS AND DISCUSSION

During the survey, out of 62 participants, 43 responses (with 69% response rate) were recorded, thus the non-respondent rate is 31% with 19 non-respondents. Gender distribution of the responses was recorded as 33% representing meals and 67% representing females.

A reliability analysis reveals a high Cronbach alpha coefficient as 0.934 which indicates the high internal consistency of the gathered data.

The following Table 1 and Figure 1 show the level of the undergraduates' perception on 10 generic skills they acquired from University education. Each generic skill is belonging to one of the categories of mean scores. i.e.: 1-2.33 =low

perception, 2.34-3.66 = moderate perception, 3.67-5 = high perception.

Table1: Mean perception of the respondents towards generic skills

Factor No.	Generic Skills	Mean ($\bar{X}$)	Standard deviation (SD)	Interpretation
1	Computer Literacy	4.00	1.18	High perception
2	Commercial Awareness	3.61	0.98	Moderate perception
3	Political Sensitivity	3.54	1.14	Moderate Perception
4	Ability to work cross-culturally	3.42	1.03	Moderate perception
5	Ethical sensitivity and Acting morally	3.86	1.08	High perception
6	Prioritizing and Planning and Decision-making	3.86	0.89	High Perception
7	Applying subject understanding	3.63	0.98	Moderate Perception
8	Coping with complexity	3.37	0.90	Moderate perception
9	Problem solving and Resolving conflicts	3.54	0.86	Moderate Perception
10	Negotiating and Teamwork	3.86	0.83	High Perception
	Overall	3.72	0.83	High Perception

Figure 1 indicates that students have a high positive perception on "computer literacy", "ethical sensitivity and acting morally", "prioritizing and planning and decision-making", "negotiating and teamwork".
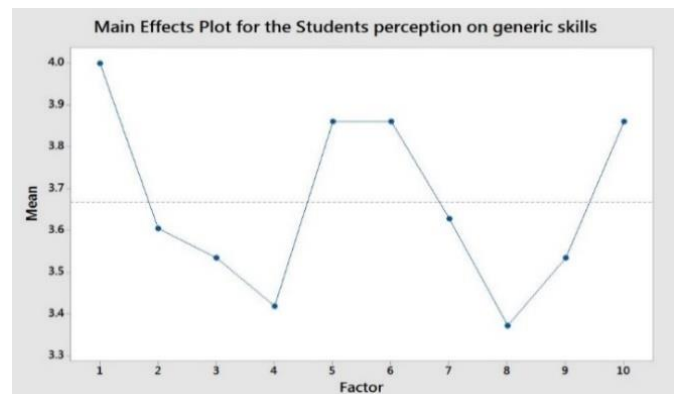
Fig. 1: Mean effect plot for the respondent's perception on generic skills

Spearman's rank correlation was used to analyze the strength of the relationship between generic skills and undergraduates' overall perception on generic skills. As the findings in Table 2, there was a significant correlation among all categories with the undergraduates' overall perception.

The multiple regression with the stepwise method was used to investigate the undergraduates' perception on generic skills according to 10 generic skills across the undergraduates' overall perception. The result of this analysis showed that four of the generic skills were significantly associated with undergraduates' overall perception such as "Prioritizing and Planning", "Applying subject knowledge", "Ability to work cross-culturally" and "Negotiating and Teamwork".

Table 2: Correlation between ranks on generic skills and overall perception

Correlation between two variables	r	Sig.
Computer Literacy and Overall Perception	0.667	0.000
Commercial Awareness and Overall Perception	0.660	0.000
Political Sensitivity and Overall Perception	0.758	0.000
Ability to work cross-culturally and Overall Perception	0.615	0.000
Ethical sensitivity and Acting morally and Overall Perception	0.698	0.000
Prioritizing and Planning and Decision-making and Overall Perception	0.852	0.000
Applying subject understanding and Overall Perception	0.828	0.000
Coping with complexity and Overall Perception	0.752	0.000
Problem solving and Resolving conflicts and Overall Perception	0.601	0.000
Negotiating and Teamwork and Overall Perception	0.612	0.000

The strength of the four predictors was R^2 = .888, which implies the combined contribution of the four predictors of 'Prioritizing and Planning' competencies were the main predictor of undergraduates' overall perception, while 'Applying subject knowledge' and 'Ability to work cross-culturally' were the second and third predictors respectively, and 'Negotiation and Teamwork' was the fourth. This means that the four predictors contributed 88.8% to students' overall perception, with a significance of p = 0.00 < 0.05.

Table 1: Regression analysis of students' overall perception on generic skills

Model	Unstandardized Coefficients		Standardized Coefficient	t	Sig.
	B	Std. Error	Beta		
Constant	0.068	0.232		0.292	0.772
Prioritising and Planning	0.309	0.084	0.332	3.692	0.001
Applying subject knoeledge	0.321	0.072	0.380	4.483	0.000
Ability to work cross-culturally	0.187	0.056	0.233	3.337	0.002
Negotiating and team work	0.170	0.071	0.171	2.397	0.022

V. CONCLUSION

Descriptive measures indicated clearly that each generic skill represents one of the categories of means score from high, moderate or low perception, in the undergraduate's perspective.

Generic skills such as Computer literacy, Ethical sensitivity and acting morally, Prioritizing and planning, and Negotiating and Teamwork are the most preferable skills which are directly related to the undergraduate's high perception according to their perspective.

The result of this regression analysis indicates that four of the independent variables ('Prioritizing and Planning', 'Applying subject knowledge', 'Ability to work cross-culturally' and 'Negotiating and teamwork') were significantly associated with undergraduates' overall perception. This indicates that University education is currently addressed those generic skills in the curriculum. Prioritizing and Planning competency was the main predictor of undergraduates' overall perception while Applying subject knowledge and ability to work cross-culturally were the second and third predictors respectively, and negotiation and teamwork was the fourth.

The study concludes that generic skills such as Computer literacy, Ethical Sensitivity, Applying Subject knowledge, Ability to work cross-culturally should be addressed at the university education more effectively in order to ascertain graduates' employability.

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A Descriptive Study for Identifying Occupational Problems Among the Information Technology Employees: A Case Study

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Abstract — IT is a very common, trending industry that is involved with world development. An expansion in the IT industry has been seen since the mid-1990s with several local and foreign businesses taking up activities to appeal to the foreign market. As IT corporations are building on information employees, the emphasis is on absorbing skilled workers. There are a lot of problems affecting the employees. They cause to rise in the turnover rate in the industry. The study has been conducted to identify the problems in the IT industry in, Sri Lanka. This study is conducted to find out the reasons for rising the turnover rate in Sri Lanka. This study is to help to understand what are the main reasons that cause employee turnover. We used the questionnaire survey to collect the data set. The data set is about 132 and analyzed the collected data using SPSS software. We used descriptive statistics to identify the ratio of each problem that IT workers have during their lifetime. The majority of married people seem to be leaving the IT industry, while young, single males seem to remain and work in the industry. The cause is for this is that they can't balance their working life with their career life. This study reveals that result with the ratios.

Keywords — Employee Turnover, IT industry, IT turnover

I. INTRODUCTION

IT Industry plays a major role in the world development path. It has become an essential part of the world economy. The history of employee turnover research starts from the 20th century. The economists of the employee turnover research mainly understood from a micro perspective to study how salary, the market of the labors, and the unemployment rate influence employee turnover. Industrial psychologists study employee turnover since the 1970s. They pointed out that there were shortages of economists' study, the range of determinants that used to explain employee turnover was too narrow. Their study was difficult to clarify how decisive influence factors affected employee turnover [1]. Employee turnover is a ratio of the percentage of workers a business must replace with the average number of remaining employees in a given time span. It is a costly burden and a major problem for most companies. Many factors takes a role in the employee turnover ratio of each company. The IT industry has been developed rapidly over the past few decades. Through the software giants in the world have begun globalization and economic liberalization, it is investing massively in Sri Lanka [2]. Low staff morale and rising turnover rates in Asia have put additional burdens on HR managers in order to maintain market profitability, their efforts to retain talent and reduce turnover. The employee is currently resigning and the wave of labor litigation is leading to worker's and the organization was badly hurt by the worldwide organization and more damage to the business itself. There are two types of turnover. [3]. They are voluntary and involuntary. And also more types of turnover. Most of them are aligned under these main two types. There is various kind of reasons for this turnover problem. If most people can't manage their personal life with the office work because of so many reasons, they are directly affected by this turnover rate.

Every kind of company needs the right leader for the company's progress. Where the company has leaders responsible for overseeing, regulating, supervising, and having a strategy [4]. Leadership is the main reason for rising up the turnover rate. Motivating and retaining high performing employees has never been an easy task for IT managers. Management theorists suggest that hygiene factors, such as pay, influence employees' motivation, attitudes, and turnover [5].

II. OBJECTIVES

The object of this research is to identify the reasons that are affecting most employees' turnover rate who are working in the IT industry. We focus on this research to identify the main reasons for the employee turnover rate. Eby and Freeman (1999) developed and partially tested an integrative framework for understanding the sources and implications of intrinsic motivation. They realized job design and intrinsic motivation are impacted by job design and the intentions and actions of employees were affected [5]. The motivation of the career is caused to remaining the employees in the company. The objective of this study is to find out, what are reasons and the problems that the employees have. The employees having so many problems and they decide is this career need for their life, can they live the life as they needed, and if the career is trouble to their lifestyle; they will turning away from it. So we are studying their lifestyle and focus on their troubles. Are those troubles due to their career, or other personal issues, etc.

III. METHODOLOGY

Within companies, online social networks can increase the size of social groups for employees as they reduce a lot of the friction and costs associated with contacting others [6]. Mining of data from large data sets and the process of discovering patterns using statistics, machine learning, data correlation, data plotting, or data visualization, and data evaluation are called data mining [7]. We designed a questionnaire survey covering the reasons that can be causing what problem. Data were collected through the mail and social media. Social media is the most popular way that the employees of a company or in general any group of people are gathering together. They releasing their own stress by using this social media. It was very helpful to collect this data set. The data set is about 130.

After collecting the data, a pilot survey has been conducted to check the analysis. We removed all the null values and

conducted a descriptive analysis using SPSS software. The null values were considered as the responses that were filled only required questions. We are going to analyze the data by using the percentages. If the percentage is high, it will affect the employees' career life. As an example, most of them having fatigue during the working hours, it is a career problem. They need to have a break within a few hours. And also if they do not have leisure time to gather with their friends, they need some leisure time to gather with friends apart from the busy lifestyle. Like this, the survey questionnaire helps to find out the problems that they have.

IV. RESULTS AND DISCUSSION

Table -1 Demographic Factor Analysis

Valid	Percent
Age	
25-30	23.3
30-35	60.2
35-40	6.8
41-45	6.0
45-50	2.3
Above 50	0.8
Gender Status	
Male	71.4
Female	27.8
Marital Status	
Married	24.8
Unmarried	74.4

This is about the results of the demographic factor of descriptive analysis. According to the results, most of them are male, unmarried, 30-35 age people. It means a high percentage of unmarried people are working in the industry. Most of them can't manage the busy lifestyle with their personal day-to-day work. There are only a very few employees falling in the above 50 year age group.

Table -2 Physical, Organizational, and Social Factor Analysis

Percent	Strongly Disagree	Disagree	Agree Somewhat	Agree	Strongly Agree
Personal	**Factor**	**Analysis**			
You are fine with your office time	3	7.5	39.1	36.1	13.5
You can balance your personal life with your work	3.0	16.5	37.6	30.1	12.0
Your company have the facility work online	3.8	6.0	15.0	39.8	34.6
You have leisure time in your Life	3.8	12.8	40.6	32.3	9.8
There are Motivational Programs in your company	9.0	28.6	33.1	21.1	7.5
You are satisfied with your Income	8.3	12.8	36.8	30.8	9.8
You have enough time to improve your knowledge	6.0	12.8	51.1	20.3	9.0
You have enough support to improve your technical knowledge	3.8	9.0	27.1	41.4	17.3
Organizational	**Factor**	**Analysis**			
Are there possibilities for the Development of your Career	4.5	10.5	57.1	24.1	96.2
Does your organization has possibilities for Development		6.8	12.8	55.6	21.2
Do you have to engage with projects continuously		11.3	18.8	48.9	17.3
Does your organization Work on time		5.3	27.8	42.9	20.3
Do you have Inflexible Office time	4.5	18.8	19.5	30.1	22.6
Are you satisfied with the Payments of your company	6.0	15.8	32.3	31.6	8.3
Can you manage your workload	5.3	30.1	27.8	24.1	9.0
Do you work your best in your working hours	0.8	3.0	21.1	49.6	21.1
Are you happy with your working time	5.3	22.6	31.6	28.6	8.3
Social	**Factor**	**Analysis**			
Do you have time to gather with Friends	2.3	27.1	44.4	21.8	3.0
Are you satisfied with the Working Environment	3.8	12.8	38.3	30.8	11.3
Are you satisfied with the Culture in your company	3.0	12.0	29.3	39.8	14.3
Do you have the ability to work in a peaceful Mind with group members in your company	2.3	8.3	36.8	38.3	12.8
Did you make new friends during your career lifetime?	1.5	4.5	24.8	41.4	26.3
Do you have time to make new friends other than from the company?	5.3	7.5	20.3	43.6	20.3

This table shows the descriptive analysis results of personal, organizational, and social factors. These factors are effective for every employee. They should have the ability to manage their career life with these factors.

If we consider the results, 2.3% of them are can't work with a peaceful mind in their company. 36.8% amount of people are agreed with the statement of the company environment. 39.1% of people were agreed somewhat with the working time. It means they are not sure is it fine or not. Because they facing problems at some time because of office time. And also 37.6% of people were agreed somewhat with balancing their personal life with work life. They do not sure are they balancing work life with their personal life. And also according to the responses, only 21.8% of people have time to gather with their friends. According to these results, it shows why they can't handle them with their career.

Table -3 Physical Symptoms Factor Analysis

Percent	No Pain	Mild	Moderate	Severe	Very Severe	Worst Pain Possible
Fatigue	21.1	17.3	27.8	3.8	0.8	
Muscular Tension	22.6	21.1	24.1	3.0	0.8	
Headaches	10.5	20.3	33.1	8.3	1.5	
Depression	39.8	14.3	12.8	3.0	3.0	0.8

Anxiety	36.1	16.5	9.8	5.3	2.3	0.8
Discouragement	33.1	15.8	15.0	3.0	1.5	0.8
Irritability	33.8	18.0	10.5	4.5	2.3	
Disinterest	37.6	14.3	9.0	3.0		

Table 3 includes the results of the physical symptom factor analysis. Physical symptoms are having the employees after working long hours. It may lead to serious health problems. They need a break after a few hours to have a healthy life. So it is also a huge problem in the industry.

V. CONCLUSION

The study was conducted among the employees in the IT industry. The data was collected using a questionnaire survey. We collected 132 data samples. The questionnaire was distributed using social media and mail. Once the data was collected a descriptive analysis was conducted.

The study reveals that personal problems have an effect on the employees' career lives. They are caused for their mentality. Most married people are leaving the industry. Family problems, mental wellbeing, company environment, satisfaction in the chosen career, and the motivational programs all have a direct effect on one's career life. Career satisfaction, the ability to manage personal life, available leisure time, and physical wellness should be made available in every kind of career. People do everything in their life to be happy, enjoy their life with the family. If the career does not go to help with that factor, they start to think about it again and again. The result is they tend to leave that job. This study can be extended to give a solution to these problems. This is a common problem in the world. This needs a real solution to the development of the technology industry.

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Improving Grading of Hand-written Students' SQL Queries in Database Courses

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Abstract —This paper discusses the challenges involved in the process of manually grading hand-written SQL queries in student's scripts with a view of coming up with some guidance to improve the process. The challenges stem from experience in teaching and grading SQL Queries in 200 and 400 level Database courses at the University of Botswana. The challenges are presented with a view of detailing the issues involved in SQL query grading that could help formulate a systematic approach to the process. We investigate the structure and execution of SQL queries, specifically that of the SELECT query. We also review assessment methods from literature as a guide to a new approach that we suggest for guiding the grading of students' queries.

Keywords — SQL, grading, assessments, database

I. INTRODUCTION

Databases, especially relational databases, are ubiquitous in computing systems that form part of our everyday life [1]. SQL is the most common language used to create, update, and query such systems. This makes SQL query formulation a fundamental skill for software developers [2]. Consequently, a database course, including a topic in SQL, is almost always one of the core courses required for students undertaking a computing undergraduate degree qualification [3]. Teaching and assessment of SQL query writing skills is therefore an essential aspect of every course in design and development of databases. Both formative assessments and summative assessments, which generally use paper-and-pencil tests for assessing SQL skills against a standard and for assigning grades, are used [4]. Formative assessments such as laboratory-based exercises use practical problem cases to reinforce understanding through practice, with visual tools which somehow provides a 'guide' that enables students to write, validate, then evaluate the query based on the query's expected results. In this process, continuous reformulation of the query is performed until the expected required results are obtained, thereby correcting the query, and increasing the likelihood of learning the skill by students. Summative assessments, which are usually involve students writing down answers to questions in a constrained environment, do not have this advantage and consequently some students end up writing partially correct or completely incorrect answers. This paper focuses on summative assessment evaluation.

In a written test or examination setup, students are presented with a database schema, with or without relation instances, and a description of a request which they must translate into an SQL statement. Basically, they are presented with a database schema and asked to write SQL queries to satisfy a given information need. Although SQL has been found to be syntactically simple, relatively concise, and highly structured [3], this is not easy for students because they must basically emulate a Database Management System (DBMS), a software system that performs several behind-the-scene operations that are not noticeable by the user, executing an SQL statement [2]. In addition, they have no means of testing the query for correctness. Consequently, students usually come up with different solutions for SQL queries which may be completely wrong, partially correct or correct depending on several factors. Dekeyser [3] summarises problems students have in relation to writing SQL queries. They include difficulty with memorising the database schema, misunderstanding the basic elements of SQL and first order logic and the relational data model in general. Also, students incorrectly perceive query problems as being easy, and they have difficulties with grasping the declarative nature of SQL.

The main aim of students' assessments through query formulation is to assess students' ability to demonstrate understanding and interpretation of a database creation, update, or retrieval request. How this is interpreted and enacted differs among assessors. Grading written SQL queries poses a challenge in most situations. Grading is usually carried out by comparing a student's written answer to a model answer (or several variations of the same) and awarding a mark out of a given ideal/perfect score based on the degree of match between the two. There are many issues to consider during this process such as query structure, syntax of the constructs of the query, query semantics and ultimately what the query might result in if it were to be evaluated. Additionally, if the assessor is assessing a considerable number of scripts, or if many assessors are involved in marking the same set of scripts, then consistency becomes an issue.

Grading is very important as it ultimately determines the individual's query formulation skills [5] and strongly influences a student's learning approach [6]. Challenges and issues related to grading are discussed in this paper with a view of developing a systematic way to help assess SQL queries, and ultimately to develop a system to assist in such.

II. OBJECTIVES

The question that arises then is – how can SQL queries be graded? What rewards and penalties can be applied during the grading process to emphasize important considerations in formulating queries and hence reinforce the learning process? What criteria should be used to eliminate variability and subjectivity in awarding marks?

III. METHODOLOGY

In our experience, grading SQL queries is usually carried out in an ad-hoc manner. We therefore look at our experience in grading students' queries, as well as the approaches for grading that have been followed by other researchers.

Grading students' written SQL queries has been found to be slow, tedious, and error-prone and hence might impact students' grades [7, 8]. This has resulted in efforts to either automate or semi-automate the process. The basis for allocating marks to a solution differs amongst assessors, resulting in the same query being allocated different marks in different settings. A SQL SELECT query consists of clauses which serve different purposes in the execution of the query and differ in terms of significance.

Based on our experience, the challenges mainly stem from issues in weighing different aspects of the query and consistency during the grading process as discussed below.

a) Syntax

● Spelling – The reserved keywords in the clauses must be spelled correctly. This also applies to the names of relations and columns.
● Order - The clauses must appear in following order: SELECT, FROM, JOIN, WHERE, GROUP BY, HAVING, ORDER BY.
● Case sensitivity and quotes- SQL keywords are case-insensitive and string literals should be enclosed in single quotes.

b) Semantics

● Order - There is an element of reliance/dependence between consecutive clauses such that a wrong step might render subsequent clauses invalid or wrong. For example, if one or all the relations listed after the FROM clause are wrong, this might invalidate subsequent steps.

● Results – supposing the query is executed, what it ultimately results in is important for purposes of assessment. In addition to a correct query with the wrong end-result (columns stated after the SELECT clause), there is possibility of overstating (stating more than is necessary) and understating (stating less than what is needed) in the clauses.

d) Variations – The same query can be written in different ways. This might involve use of sub-queries, use of aliases, or different ordering of components of the query.

e) Dialects – Although minor, there are several different 'dialects' of SQL and an assessor should be aware and be able to embrace these. e.g. some DBMSs require a semicolon at the end of a SQL statement.

f) Query optimization – A query might be correct in the sense that it gives the correct output if it were to be executed. However, the method of getting results might involve longer steps than is necessary.

g) Consistency - Different assessors assessing parts of the same set of scripts, or the same assessor assessing a lot of students' scripts, might result in inconsistency in allocating marks if a systematic way of doing this is not adopted. This problem has been identified before by researchers and efforts to help with this has been presented in literature, for example, Dekeyser et al [3] proposes a tool, SQLify to assist with automatic assessment of SQL queries.

Grading therefore presents a great challenge. Usually the same technique conceptualized when setting up the question and envisioning a solution is probably the same method applied when marking. However, unless this is clearly outlined, captured and used during the grading process, there is possibility of applying a different criterion during the grading process. The grading may also be influenced by other factors such as syntax and semantics of the student's solution, how other students have approached the solution and even how the student answered other questions if grading is approached script-by-script rather than question-by-question.

IV. RESULTS AND DISCUSSION

The importance of proficiency in writing SQL queries cannot be over-emphasized. It is therefore essential that the extent of this proficiency, using the important elements recognized as checkpoints, is properly evaluated. It is important that when an SQL query assessment is conceptualized, one bears in mind the points that would be considered as the extent or level of demonstration of ability to write that query.

Criterion-referenced assessments [9] have been recommended by researchers for assessing skill rather than performance, using a pre-set criterion. This contrasts with norm-based assessments, where students' grades are allocated based on the performance of other students in their cohort such that the grades follow a pre-determined distribution. Previous efforts for assessing SQL queries have focused on accurately determining students' SQL formulation skills in a way which is closer to how they will apply them in the real world [2]. Paper-based assessments therefore can therefore be evaluated based on how best the students demonstrate what needs to be done to accomplish the task at hand (join tables, selection criteria).

Curriculum design usually incorporates development of learning outcomes for courses. It is important that these are extended under the different topics that are taught in the course. Specific objectives for a taught topic must be defined clearly. They can later be adopted for assessment.

In our case, for the 200-level introductory database course the high-level learning outcome is stated thus:

At the end of this course, students should be able to:

- *use Structured Query Language*

At course level this is broken down to low-level learning outcomes. For SQL data manipulation using the SELECT statement, for example, the learning outcomes as adopted from [10]:

Students should be able to:

- *Use compound WHERE conditions.*
- *Sort query results using ORDER BY.*
- *Use aggregate functions.*
- *Group data using GROUP BY and HAVING.*
- *Use subqueries.*
- *Join tables together.*
- *Perform set operations (UNION, INTERSECT, EXCEPT).*

The low-level learning outcomes could be used as grading criteria. Several of these could be tested in one question and the marks allocated used to show level of attainment of this outcome. For example, if the question is marked out of 3, marks could be 0 – completely wrong, 1- Poor, 2 - Average,

3 – good. Similarly, if marked out of 4 marks could indicate levels such as Poor, satisfactory, good and excellent. This could be applied to either the whole question or grading of a specific criterion, the total then being a summation of marks attained in all criteria tested in that question. For example, given the following question:

Consider the following relational schema:
STUDENT (stud-id, stud-name, age, address)
COURSE (c-code, c-name)
TAKING (stud-id, c-code, grade)
Write the query below in SQL.
Get the names of students who are doing both CSI471 and CSI481.

The main features that could be examined in this query are:

-   Use of compound WHERE statement/set operation (INTERSECT)
-   Joining of tables
-   Listing the names of students

The solution can be presented in different ways, for example:

(a)   *SELECT stud-name*
FROM STUDENT, TAKING
WHERE STUDENT.stud-id = TAKING.stud-id AND c-code = 'CSI471'
                    INTERSECT
SELECT stud-name
FROM STUDENT, TAKING
WHERE STUDENT.stud-id = TAKING.stud-id AND c-code = 'CSI481';

(b)   *SELECT stud-name*
FROM STUDENT, TAKING
   WHERE STUDENT.stud-id = TAKING.stud-id AND c-code IN ('CSI471', 'CSI481');

(c)   *SELECT stud-name*
FROM STUDENT S
INNER JOIN TAKING T ON S.stud-id = T.stud-id
WHERE c-code IN ('CSI471', 'CSI481');

Using the learning outcomes to assess the solution instead of trying to assess the different clauses could help remove bias and therefore achieve consistency in marking. The focus of the assessor moves away from the granular elements of the query to the extent to which the student has attained the skill such that they can practice it later on (with the help of tools for minor mistakes). This also eliminates bias regarding the way in which the solution is written (variations like longer query vs shorter query, ordering of clauses etc).

In a trial run of this method, the example query from section IV was re-graded from past examination papers. It was previously awarded 4 marks in one setting and 5 marks in another. Using our recommended approach, the query will only need to be awarded a maximum of 3 marks for the 3 features recognized above. Regrading 30 past examination scripts with this method moved the average from 1.88/4 (47%) to 1.75/3 (58%). This means that the older, ad hoc approach generally disadvantaged students by awarding lower marks. Allocating more marks seemed to deviate

attention from assessing the main features of the query, and hence seemed to 'cloud' one's judgement when grading.

The main drawback of using this approach is the need for prior planning and careful recognition of the features examinable in queries. Also, some elements of the query consist of sub-elements, which in some cases can be easier to grade if allocated marks individually rather than being given a single mark as a group/feature. The method also did not solve the problem of including unnecessary information (attributes, tables, conditions), which in some cases affects query results. The focus was only on demonstration of knowledge of the features tested. While this method does not offer a complete solution, it offers a step in the right direction towards improving grading and detecting SQL skill proficiency of students.

V. CONCLUSION

This paper presented the challenges involved in grading SQL queries manually. The challenges result from the various issues involved when presenting a query including syntax, semantics, order of the constructs and even different variations of the solution or dialects. It is important, therefore, that a focus for grading is developed such that the assessor can concentrate on the aspects that signify skill attainment in query writing. Criterion referenced assessment has been recommended in literature for skill assessment. We suggest development of clear and detailed learning outcomes in curriculum development for database courses and SQL topics such that these could be utilized as criteria for grading. Future work envisioned for this line of research is development and evaluation of this method in comparison to ad hoc methods of grading.

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ISSN 2756-9160 / November 2020.
International Conference on Advances in Computing and Technology (ICACT–2020) Proceedings

Intergrating Information Communication Technologies to Arts Faculty Undergraduate English Courses in Sri Lanka: A Survey

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Abstract — **The overarching objective of this study was to find out how feasible and sustainable the introduction of computer-aided instruction is for the development of English language skills among arts undergraduates whose medium of instruction for the degree is their first language; i.e., Sinhala or Tamil. The descriptive research design was adopted for this purpose, and a survey-type questionnaire was deployed. The purposive sampling method was used when selecting the sample and data were collected from a total of 102 arts undergraduates in four arts faculties in Sri Lanka. Percentages were generated in order to tabulate the data. The main findings of the study reveal that these students are not only ICT literate to a notable extent but that they are positively inclined towards the introduction of technology-enhanced learning practices for the enhancement of their English proficiency.**

Keywords — undergraduates, English, ICT

I. INTRODUCTION

In the Sri Lankan context English proficiency has become an inevitable educational and social requirement for individuals wishing to become upwardly mobile, secure lucrative employment opportunities and belong to the entity of the socially "elite" community. Additionally, the fact that this language acts as a 'lingua franca' used to bridge the communication gap between different ethnicities in the country has further enhanced its potential of being used as an effective communication tool. Therefore, the need for becoming a proficient users of English has been acknowledged by most Sri Lankans, and recent governments have made various attempts to promote and facilitate the acquisition of this second language (L2). This is notably so in the education and higher education sectors.

In terms of the penetration of Information and Communication Technologies (ICTs) in Sri Lanka, there is no denying that it has managed to infiltrate all spheres of modern living in the country; including social, political, economic and educational milieus. Out of these, much attention has been paid to the task of incorporating the use of ICT in the field of education specially among adult learners. This information can be substantiated by observing the computer literacy surveys conducted by the Department of Census and Statistics in Sri Lanka over the years. For instance, the 2016 report on "Computer Literacy" states that out of the 28% of computer literate people in the island, a majority falls into the age category of between 15 to 19 years with a percentage of 63 computer users [1]. Considering the above statistics, it is apparent that most of the youth who belong to the school-going age in our country are already familiar with computer usage by the time they enter the university, and that the necessary context for the integration of ICT in education has already been put in place.

Under these circumstances, the potential successfulness of the systematic integration of Computer Assisted Language Learning (CALL) practices into university ESL programmes seems to be inevitable. However, with regard to the current educational set up in Sri Lanka, the purposeful and effective synthesis of CALL into ESL study programmes still remain at the infantile stages. Nevertheless, the rapid infrastructure facility developments in the education sector - notably in higher educational institutions focusing on the development of ICT and English literacy skills of students - have paved the way for introducing effective methods of using technology for learning and teaching purposes.

Since this study is based on a feasibility survey of introducing CALL for teaching ESL to Arts undergraduates, a cursory glance at the way on which the L2 is taught is required. In all state universities in the country, either English Language Teaching Units (ELTU) or Departments (ELTD) have been established with the objective of improving the level of English of the undergraduates so that they may be able to use it for general and academic purposes. In the case of the undergraduates who are required to follow their degrees in English medium, such as those following their degree programmes in medicine, engineering, science, architecture, management, commerce, law and technology, there is no option for them but to acquire the English language by whatever means possible because such degree programmes are only offered in the medium of English. Nonetheless, the above scenario considerably differs in faculties involving in the study of the Arts and Humanities since the majority of students follow their degree programmes either Sinhala or Tamil (their first language). In such a context, minimal exposure to the L2 has resulted in low proficient arts undergraduates.

The research questions posed were:

1. How ICT literate are these Sinhala and Tamil medium Arts undergraduates?

2. Have they already been exposed to this type of instruction during their English courses, and if so to what extent has it been integrated into these programmes?

3. Research Question 3: Are these learners receptive to the adaptation of CALL for learning ESL?

The study is timely and important as it was conducted in order to obtain a birds-eye view of the present circumstances before making claims about the impact of introducing computer technology for second language acquisition (SLA) in Arts faculties. This study was necessary in order to deliberate on the various aspects that needed to be studied

when evaluating the feasibility and sustainability of the implementation of CALL into our university system.

II. OBJECTIVES

One of the main intensions of conducting the research was to find out whether the introduction of effectively selected CALL activities for purposes of teaching ESL to arts undergraduates would be welcomed by them. The fact that this generation of digital natives is invariably drawn towards technology can be manipulated to promote the acquisition of English by disseminating knowledge on how computers can be used to develop language skills in fun, educational and interactive ways. Due to the flexibility of time and place that technology-enhanced learning activities offer, it is presumed that with substantial training on CALL, these ESL learners would be able to considerably improve their English language proficiency by the time they graduate.

III. METHODOLOGY

For the study, the descriptive research design was adapted so as to understand the contemporary landscape of ICT use for learning the L2 in Sri Lankan arts faculties, its awareness, usage and the undergraduates' attitude towards its integration into the Arts Faculty English programmes.

For this purpose, a survey-type questionnaire was developed for the Sinhala and Tamil medium Arts undergraduates. The research population consisted of Arts undergraduates attached to Sri Lankan state universities following their degree programmes in their first language. The sample size responding to the CALL questionnaire included a total of 102 Arts undergraduates in their first or second year of study. The total sample consisted of 79% females and 21% males falling into the age group of between 20 to 24.

IV. RESULTS AND DISCUSSION

Research Question 1; How ICT literate are these Arts undergraduates and what is the availability of the resources for ICT engagements?

To measure the extent of their ICT literacy, a set of questions were presented in the format of "Can do" statements indicating the respondents' ability or inability to perform a particular computer-related task. From the tabulated data, 93.1% of the respondents reported that they can start, use and shut down a computer, 59.4% stated their ability to use a word processor such as Microsoft Word, 70.3% said they can create presentations using presentation software such as PowerPoint, and 71.3% mentioned that they can use either and/or laptop computers, tablet PCs and smart phones. With regard to their internet usage, a little more than three quarter of the sample claimed that they use the internet to gather information, while 44.3% stated that they use the internet to develop their English language skills.

In addition, 70% of them claim to be able to use a smart phone, laptop or desktop computer. In terms of their ability to use the internet, the majority (76%) mentioned that they are able to surf the internet to gather information while close to 63% mentioning that they use it for social networking purposes. Close to half of the sample claimed that they use the internet for developing their English skills.

Since this was a preliminary survey of the context in which CALL could be integrated, another important aspect of its implementation was to find out about the availability of the resources that are needed for IT related engagements. Based on the analysis, out of the total number of participants, 36.1%

had desktop computers and 60.7% had laptop computers. Even in cases where learners did not have their own personal computers, 85.3% mentioned that they owned phones with internet capability.

Research Question 2: Have the Arts undergraduates already been exposed to CALL during their English courses and if so to what extent has it been integrated into their English programmes?

The following figure details the mode of instruction that is being adapted at present when teaching English to arts undergraduates.
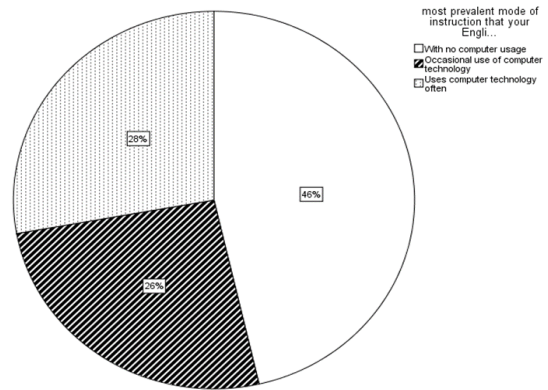

Fig. 1. Current Mode of Instruction of the arts undergraduates

It is sticking to note that 46% stated that the English teachers did not resort to the use of computer technology during instruction. However, a little over a quarter of them stated that ICT was used very frequently in the English class. This points positively to the potential of such usage on a larger scale.

Research Question 3: Are these learners receptive to the adaptation of CALL for learning ESL?

In figure 2, the preference towards the adaptation of computers for learning English is strikingly high as 89% insisted on going for the blended mode of instruction while in fact 10% of the cohort went so far as to claim that they prefer only computer-led instruction. Strikingly, only 1% ended up opting for the teacher-fronted mode of instruction.
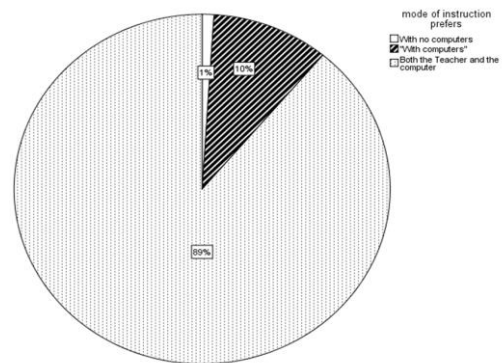
Fig. 2. Preferred Mode of Instruction of the arts undergraduates

Several straightforward "yes/no" questions were posed in order to find out their willingness to use ICT for developing English skills. For the question: "Do you think using computer technology can improve your English learning experience?", almost all the respondents answered in the affirmative (98%). Moreover, 96.1% stated that they are willing to engage in self-learning activities using ICT if they are given the necessary training and skills to do so. Furthermore, a percentage of 87 said "Yes" to the statement "I would like the teacher to use

computer technology to teach us English" with only 6.1% being undecided about this claim.

Since the whole point of the study is to evaluate the possibility of integrating Computer-assisted Language learning practices into ESL Arts undergraduate programmes, knowing that the respondents are proficient users of computers points towards its successful integration. In fact, it can be observed that close to half of them already use computers for language learning purposes. This data indicates that students are invariably inclined towards the use of technology for enhancing their English knowledge.

The finding that the majority ascertained to the possession of having one or more of the following ICT empowered devices: desktop computers, laptop computers, smart phone, and/or tablet PCs. With such ready access to computers at a personal level, even if computer facilities are poor within the universities, learners could still engage in CALL activities using their own machines. Hence, this finding indicates a lot of potential for introducing autonomous learning practices to the students using CALL. Yet another Striking finding of the research was the fact that almost all the respondents strongly recommended the use of the blended mode of developing ESL An unexpected finding was made when one tenth of the participants in the study went so far as to claim that they preferred to be taught exclusively through the use of technology rather than through face-to-face teacher fronted sessions.

V. CONCLUSION

Two things that emerge from this presentation of the tabulated data and discussions are; firstly, the fact that there is a radical and almost alarming inclination among the learners to believe that teachers are in fact replaceable.

Secondly, this points towards the unsuccessful methods of teaching English which has remained confined to traditional teaching formats even in the present context. As such, English educators should adjust their teaching strategies and pedagogy so as to evolve and develop with the changing educational landscape that invariably demands a "do or die" situation where there is no question as to whether one needs to consider CALL for future integration as it is indeed a ubiquitous requirement. These insights are crucial when considering the possible integration of technology-enhanced learning practices into the Arts undergraduates' English programmes.

From the finding of the student questionnaire, there is no doubt about the fact that the undergraduates are already convinced about the potential benefits of using information communication technologies to develop the L2 and to them including these types of technologies seem a highly welcome and worthwhile move. The fact that most of them appear to be already familiar with ICTs is an added incentive to the proponents of CALL since not much training or convincing is required in order to get these undergraduates to learn how to use and engage in technology enhanced learning practices for developing their English skills.

In sum, there is no question about the fact that students in Sri Lankan Arts faculties are yearning for a well-balanced synthesis of the two elements – teacher and computers – and it is high time action is taken to address this need.

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Analysing the Tweets about Distance Learning during COVID-19 Pandemic using Sentiment Analysis

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Abstract — **With the COVID-19 pandemic situation, distance learning has become a mandatory alternative for the education system in almost every country. Even though this approach seems beneficial for both students and teachers, its effectiveness depends on various factors. For example, the availability of internet facilities and the economy of the users because of the cost of the required tools and components. Under these circumstances, several recent research has investigated the effectiveness of distance learning using different approaches. In this study, we analyze the effectiveness of distance learning using sentiment analysis. In our experimental analysis, we used a twitter data-set which consists of 202,645 tweets posted between 23rd July and 14th August in 2020. This is the period where many countries were locked down due to the pandemic. Our analysis consists of three stages. First, preprocessed the data to remove irrelevant tweets. Second, classified the tweets into three main classes namely positive, negative and neutral based on their polarities. There we observed that 54\% sentiments were classified as positive, 30\% as negative and 16\% as neutral. As the final stage, further, we performed statistical data analysis to find whether there is a relationship between user experience on distance learning in different countries and the economic stability of those countries.**

Keywords — Distance Learning, Sentiment Analysis

I. Introduction

With the ever-changing world of technology, people experience a greater impact on every aspect on the day to day lives. Align with that, the education sector has been changed drastically with the advancement of technology. The way the students are taught and interact with teachers has been changed a lot with the internet, online classes, mobile applications and websites. The term, e-learning or electronic learning is a type of distance learning that deliver learning and training through digital resources. Even though e-learning is nothing new in this century, people have to adapt to this education system with the effect of the COVID-19 pandemic. In this pandemic situation, people have to follow the COVID-19 guidelines and precautions such as maintain social distance. Therefore, students cannot attend schools or universities physically. But at the same time, they need to learn to live with this situation and continue education. As a result of that, most of the educational institutes in the world move to online platforms for conducting lectures. There are several online platforms and online course providers such as Coursera, edX and Udacity. They play a major role in this modern education system by offering online courses from reputed universities in the world [1].

Distance learning provides a considerable number of benefits for both students and lecturers such as they can manage their time effectively for studies without wasting time for travelling [2]. At the same time, when considering the economic feasibility in different countries in the world, practically some of the distance learning approaches are not fruitful. For example, continues technical issues because of not having proper infrastructure and internet bandwidth as required, the difficulty of evaluation and assessment, the limited facility for collaborative learning and delivery of course content may not productive as productive in physical lecture hall [3]. Lately, the natural language processing(NLP), Sentiment Analysis(SA) has used to data mining related to sentiments or opinions for a specific topic [4]. Therefore, in this study, we use sentiment analysis to analyze the effectiveness of distance learning during the COVID-19 pandemic by extracting users' opinions from recently posted tweets.

We have presented our research in detail in the following sections. In the next section, we discuss the objectives of this study. Then, we present our analysis of prediction models and the performance of each model. After that, we present the results and discuss the findings of the study. Finally, we conclude this paper with the future directions of our research.

II. Objetives

In recently, various methods have been used to predict and analyze the effectiveness of various distance learning methods such as e-learning. However, we hardly find existing research which has used sentiment analysis to classify users' opinion of e-learning into three classifiers namely positive, negative and neutral during the user experience of COVID-19 pandemic. It is more accurate if the analysis is done using the opinions of people who are engaging with distance learning. In this situation, collecting social media data is the most suitable method to collect relevant information. For that, we chose twitter dataset for this study. Moreover, it is not possible to get accurate insights from more than two hundred thousand user statements manually. As a result of that, we used sentiment analysis in NLP for extracting insights from tweets. Therefore, in this research, we analyze the effectiveness of distance learning during the COVID pandemic using the opinions extracted from Tweets [5].

The main objectives of this research are as follows:

- Studying different distance learning methods use worldwide.

- Classifying the users' opinion about distance learning as positive, negative and neutral during the COVID-19 pandemic in the world.

- Classifying the users' opinion about distance learning as positive, negative and neutral during the COVID-19 pandemic in country wise.

III. Methodology

This section presents the details of experimental design and analysis of the study. Sentiment analysis of micro-

blogging posts can proceed in many ways. In our study, we used the way of identifying the most suitable classifiers out of a large pool of mined data [6]. In the first stage, we retrieved data from the data source. In the next stage, preprocessed the data for handling missing values and removing irrelevant data. Then, the sentiments were extracted and classified them based on the polarity into three classes namely positive, negative and neutral. Finally, performed a statistical data analysis as explained in below. The flow of methodology is shown in Fig. 1.
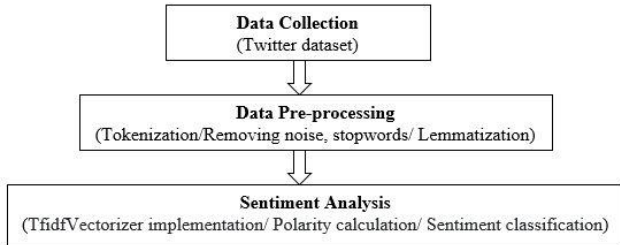

Fig. 1. Flow of the methodology

Twitter has become a popular social media that has a large and rapidly growing user base where users create status messages called tweets. Twitter users are useful for real-world up to date situations such as the current situation like COVID-19 pandemic because tweets express their opinion towards their experience of usage in products, services and new trends [6]. Therefore, we used a dataset which consists of 202,645 tweets posted between 23rd July and 14th August in 2020. This is the period when a considerable number of countries has been under the Lockdown situation. These tweets have been collected with Twitter API by using hashtags and keywords such as "#distancelearning", #onlineschool", "#onlineteaching" and "#virtuallearning".

Due to there are irrelevant features included and the varying language structures included in tweets, it is important to preprocess the data to standardize certain tokens of tweets. Therefore, first, we removed three irrelevant features and keep the rest of the six (06) features for the analysis. Then missing values in the country column are replaced with 'unknown'. Secondly, performed the tokenization, removing stop-words, punctuation marks and hashtags. Then performed lemmatization to achieve the root words to improve the results.

- tokenization - tweets are split into individual words based on the space
- removing stopwords - remove common words such as a, is and has
- lemmatization - grouping together the inflected forms of a word so they can be analyzed as a single item

For the second stage, sentiments were extracted from tweets using TfidfVectorizer module from sklearn library. After assigning individual scores to all the words, polarity and subjectivity were calculated using TextBlob. Then classified the sentiments into three classes namely positive, negative and neutral based on their polarities as shown in Table 1. As the final stage, statistical data analysis was performed to find whether there is a relationship between user experience on distance learning in different countries and the economic stability of those countries.

Table 1. Polarity classification

Polarity value	Sentiment
> 0	Positive
0	Neutral
< 0	Negative

The results of above every stage are discussed in the following section.

IV. RESULTS AND DISCUSSION

This section presents the results of the study. In the first stage of the methodology, after removing irrelevant features, six features remain namely, "tweet content", "location(country)", "username", "retweetCount", "favourites" and "cretaedDateTime".

After classifying the sentiments based on their polarities, we obtained results as shown in Fig. 2. It shows that the majority of people have stated their opinion about distance learning positively. In percentage, 54\% of tweets are in positive, 16\% of tweets are in neutral and 30\% are negative. However, it is worth to mention that according to Fig. 3, the highest number of tweets from developed countries or from the countries where part of that country is developed. Moreover, when considering their polarities, it has been clearly shown that a considerable number of them are positive. It reveals that people with sufficient facilities get true benefit from the distance learning approach.
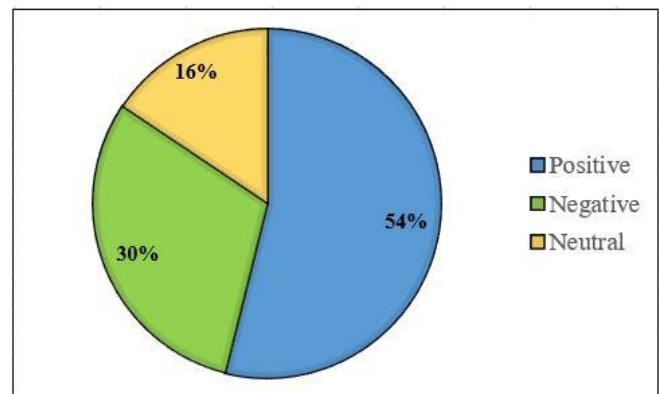

Fig. 2. Sentiment classification based on the polarity

According to the statistical data analysis performed, the highest number of tweets have been posted from the United States as shown in Fig. 3. Then we calculated the positive, negative and neutral polarity counts by country and we obtained the results as shown in Table 2. Moreover, sentiment classification and internet usage of few selected countries were comparatively summarized as shown in Table 2. Overall, users who are in developed countries where internet usage is comparatively high, have a high percentage of positive opinions about distance learning. For example, United States and Canada have above 92\% internet usage percentage. Nevertheless, the users who are in Yemen has a strongly negative opinion about distance learning and also they have less internet usage which is 26.72\% in percentage. According to these results, users from South Africa states the highest percentage of positive opinions about distance learning. Even though internet usage of South Africa is comparatively low, it has a highly developed economy and advanced infrastructure [7]. Moreover, other than the developed countries, Philippine and India have a strong economy and their internet usage is also comparatively sufficient. Therefore, it reveals that there

is a relationship between user experience on distance learning in different countries and economic stability and internet usage of those countries.

Table 2. Sentiment classification and internet usage comparison by country

	United States	Canada	Philippine	South Africa	India	Yemen
Positive	53%	64%	43%	84%	52%	2%
Negative	21%	17%	13%	2%	10%	84%
Neutral	26%	19%	44%	14%	38%	14%
Internet Usage	96.26%	92.7%	60.5%	56.2%	54.4%	26.7%

Fig. 3. Top Countries that posted tweets

However developed countries are dominant in this dataset and that has become a limitation in this study. For the future works, this research can be extended to analyze the effectiveness of distance learning for developing countries and also the Sri Lankan context separately. Further, this study can be performed using different datasets to obtain more accurate results.

V. CONCLUSION

In this research, we analyzed the effectiveness of distance learning during the COVID-19 pandemic using sentiment analysis of NLP. Here we used a recently released twitter dataset to extract the user opinion on distance learning. Then we classified them into three classes based on their polarity. According to the sentiment analysis and the statistical analysis performed, it can be concluded that if sufficient internet and other required facilities are available, distance learning is best suited as an approach for continuing the education system.

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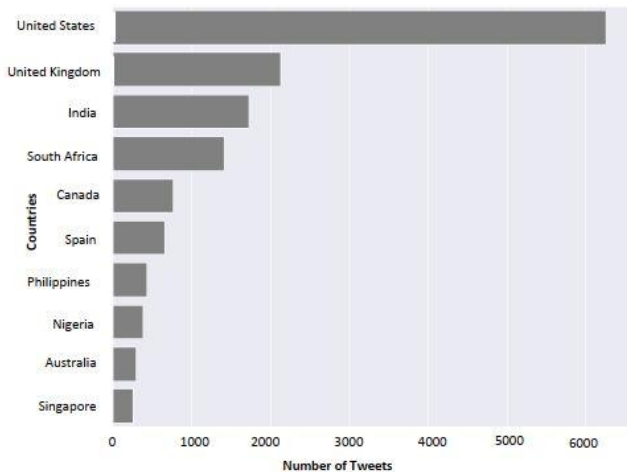[7] T. H. Foundation, *2020 Index of Economic Freedom*, 2020 (Accessed on: October 11, 2020). [Online]. Available: https://www.heritage.org/index/country/southafrica?version=986

A Literature Review in Personality Predictions Based on Twitter Text Modality

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Abstract — **Automatic personality detection of an individual's character qualities has numerous significant useful applications. Personality assessment is used to evaluate the individual on different aspects. With regards to assumption examination, for instance, the items and administrations prescribed to an individual ought to be those that have been emphatically assessed by different users with a comparable Personality type. This paper gives an overview of the advancement of personality prediction from twitter text modality, the regular issues looked in performing said task, and further upgrades that can be applied later on.**

Keywords — *personality prediction, social media, machine learning, deep learning, big five model*

I. INTRODUCTION

In these days computerized personality detection is another and forthcoming field. There have not been numerous extensive writing reviews done in character location and our paper is the first which gives the reader a bird's-eye perspective. It gives the idea about on the ongoing patterns and advancements in the field. Texts often reflect different aspects of the author's personality [4]. There is no ongoing work which gives the reader a general point of view of the advances mechanized personality detection specially using text dataset. As indicated by the Merriam-Webster dictionary the social media is characterized as types of electronic communication. Online media is an inescapable aspect of the Internet, as insights show that individuals burn through 1 in like clockwork of their Internet use via social media. A perception with respect to Facebook use detailed that clients sign into their Facebook accounts from 2 to 5 times each day, with a normal of 5 - 15 minutes for every meeting [14].

II. PERSONALITY MEASURES

A. Personality Measures Theories

Personality Theories fall into fundamental 4 classifications.

Psychoanalytic Theory: - As indicated by Freud, the per sodality is comprised of three segments as id, inner self and superego. id alludes to the drive vitality that is liable for the human needs like sustenance, thankfulness and urges like scorn, desires and so on. The superego or soul, represent profound quality and Social standards, speak to what an individual need to be. Conscience the third part chips away at the guideline of reality that intervenes between the requests of the primary segment id and the second segment superego and afterward picks the most reasonable answer as long as possible [1].

Trait Theory: - Present-day attribute hypothesis attempts to show character by setting of various grouping measurements (generally following a lexical methodology) and developing a poll to measure them. Analysts have utilized different plans for personality demonstrating, for example, 16PF, EPQ-R and three quality character model PEN where there are super-factors Psychoticism, Extraversion, and Neuroticism (PEN) at the head of the pecking order. The Myers–Briggs Type Indicator (MBTI) is one of the most generally managed individuality tests, given a huge number of times each year to representatives in a great many organizations. The MBTI character measure arranges individuals into two classifications in every four dimensions: self-preoccupation versus extraversion, detecting as opposed to intuiting, thinking as opposed to feeling, and judging as opposed to seeing. The most mainstream measure utilized in the writing on mechanized character discovery is by a wide margin the Big-Five-character qualities, which are the accompanying paired (yes/no) values [2].

Humanistic Theory: - Maslow accepted that character depends on close to home decisions not on nature or sustain. He recommended that individuals have and are inspired to assist them with pursuing their necessities or want that was spoken to in and the last level: self-realization that is creating and developing to arrive at genuine potential [1].
Social Cognition Theory: - The social insight hypothesis see character in the type of social communications. An individual's conduct is influenced by nature in which he remains [1].

The Trait hypothesis is most broadly utilized in examining the character in the field of Psychology. Dissimilar to different speculations this depends on finding the contrasts between the characters of people. The blend of different characteristics frames a character that is consistently one of a kind for each person. Most examinations on character forecast have zeroed in on the Big Five or MBTI personality models, which are the two most utilized personality models.

Big Five: The present Researchers accept that there are 5-character qualities. Large Five recommends that the attributes can be ordered on 5 unique classes. Careful marks for these 5 characteristics are as yet hard to concur for some of them. The famous abbreviation is OCEAN for traits.

Extraversion (EXT): - Individuals with high Extroversion quality have high certainty, Positive vitality, and positive feelings, friendly and inclination to communicate more with others. They are garrulous in nature. It repudiates saved conduct. Components identified with this quality are vitality,

garrulity, carefree, well disposed, helping and so forth. These individuals like themselves just as about their general surroundings. Individuals with low extroversion are saved, calm.

Neuroticism (NEU): - It is repudiated sure or secure nature. individuals with high neuroticism touchy or apprehensive. This characteristic is described by trouble, grouchiness, and passionate insecurity. They experience negative feelings and feelings effectively, similar to outrage, uneasiness, sorrow, pessimism and so forth. It alludes to the inclination to encounter negative enthusiastic states and see oneself and the world around contrarily. Variables like volatile, on edge on edge and so on are some related attributes.

Agreeableness (AGR): - This is the propensity to be agreeable with others as opposed to being dubious. They are benevolent and enjoyed by their associates just as individuals encompassing them. They don't care to battle or contend as opposed; they are harmony creators. Humble, amenability, supportive, understanding, kind, touchy and so forth are the qualities that go under the umbrella of suitability.

Conscientiousness (CON): - It alludes to the fitness of being consistent, self-taught, capable, zeroing in on accomplishing objectives, and organizes designs rather than unconstrained conduct. It contrasts indiscreet conduct. It means how cautious, careful, genuine an individual is. It is an approach to control driving forces and act in a manner that is adequate socially by everybody around. These individuals are extraordinary at arranging and sorting out viably. These incorporate components as arranging, capable, difficult work, assurance, eager, control and so forth. They are acceptable in administration characteristics.

Openness (OPN): - It mirrors the scholarly degree of an individual. How inquisitive, innovative novel an individual is. It likewise reflects how creative or autonomous an individual is. Transparency is identified with individuals' enthusiasm to attempt to new things, the capacity to be defenseless, and the ability to consider new ideas. Basic characteristics identified with transparency are: Imagination, different interests, Originality, Daring, Cleverness, Intellect, Creativity, Curiosity and so forth.

III. APPROACHES USED

There is a critical developing enthusiasm for computerized personality prediction utilizing web-based media among specialists in both the Natural Language Processing and Social Science fields. Up until now, the utilization of customary personality tests has generally been restricted to clinical brain research, advising and human asset the board. Be that as it may, computerized character forecast from web-based media has a more extensive application, for example, online media advertising or dating applications and sites [3].

There have been numerous techniques utilized for personality detection as demonstrated as follows.

Questionnaire: - The most punctual type of approach utilized for character expectation was in the type of inquiries. Clients

were posed a few inquiries that had various options, from which the client needed to choose one. These Questions were distinctive for various character qualities.

Semantic Similarity: - In this for the characteristics there are pre-characterized jargon or word reference words. The client's words present in the posts are checked for the semantic comparability, for example, comparative implications have the same score. The separation is discovered and hence the attribute was anticipated.

Machine Learning: - Classical approaches can't deal with the vast amount of data. This is one of the upsides of Machine learning calculations. Machine learning algorithms utilize computational techniques to "learn" data legitimately from information without depending on a foreordained condition as a model.

Deep Learning: - Models are prepared by utilizing an enormous arrangement of marked information and neural network architectures that contain numerous layers. Deep learning can be utilized to foresee the character attributes with more precision. It measures a similar path as human minds do. The component extraction measure is and there is no over-burden [1].

Table 4 : Popular Datasets, Model, Methodology

Dataset and Model	Methodology
Big Five, MyPersonality	Deep learning architecture - AttRCNN
Big Five, MyPersonality	Neural Networks like CNN, RNN
Big Five, MyPersonality	XGBoost, Logistic Regression, SVM
Big Five, MyPersonality	LIWC, Semi supervised, PMC

IV. APPLICATIONS

Employment screening: - In human assets the executives, character attributes influence one's reasonableness for specific positions.

Criminology: - If the police know about the character qualities of the individuals who were available at the wrongdoing scene, it might help in lessening the hover of suspects.

Specific medical care and guiding: - As of 2016, almost 33% of Americans have looked for proficient directing for psychological well-being connected issues.

Word extremity location: - Personality recognition can be misused for word extremity dis-ambiguation in estimation vocabularies, as a similar idea can pass on various significance to various kinds of individuals.

Suggestion frameworks: - People that share a specific character type may have similar interests and diversions.

Upgraded Personal Assistants: - Present-day robotized voice aides, for example, Siri, Google Assistant, Alexa.

V. PERSONALITY PREDICTION FROM TEXT REVIEW

Personality detection is where data about a person's character attribute is recognized, given a lot of information. There have been a few ways to deal with automated character

prediction dependent on various types of datasets, for example, social media post, face Tube, speech, smartphone, video, essays, handwriting, travel pattern, gender, age. This paper will mainly focus to review personality prediction using text dataset.

A. Baseline Methods for Text

The following subsections summarize the models, dataset and techniques which had been used in machine learning, deep learning-based personality detection on text modality.

a) Twitter - text Dataset

Most of the personality prediction research studies was attempted on Twitter. In the year of 2016, the authors in this paper [5] This study had used text classification to predict personality based on text written by Twitter users. Dataset consists of last 1, 000 texts in the form of tweets and re-tweets. Collection of tweets from users is also made into a single document/ one long string, then it was preprocessed and labeled according to Big Five personality dimensions. The languages used for this study are English and Indonesian. Classification methods had implemented. Those are Naive Bayes, K-Nearest Neighbors and Support Vector Machine. Finally testing conducted using 10-fold cross-validations. Testing results showed Naive Bayes method was slightly outperformed the other methods.

In the year of 2017, the authors in this paper [6] The aim of this research is to analyze how twitter (dataset) can be utilized to improve the user experience in character assessment. propose a manner by which the client's character can be anticipated through information mapping accessible to general society on their own twitter utilizing DISC (Dominance, Influence, Compliance, Steadiness) assessment. Text mining and sentiment analysis had performed for every user dependent on his/her ongoing tweets. Downloaded more than 1,000,000 tweets utilizing catchphrases.

In the year of 2017, the authors in this paper [7] Twitter user's data for Bahasa Indonesia, the native language of Indonesia. It's possible without a tool with predefined words (LIWC, MRC) but by assessing the user's choice of words. The personality prediction framework based on Support Vector Machine and XGBoost prepared with 329 instances of users. Assessment results utilizing 10-fold cross-validation shows that the framework figured out how to arrive at the most elevated normal exactness with SVM and XGBoost. To build personality prediction used the five-factor model which also known as big five model. This framework built on XGBoost managed to perform significantly better than on SVM.

In the year of 2018, the authors in this paper [8] presented optimization techniques for automatic personality recognition based on Twitter in Bahasa Indonesia. Evaluated a progression of techniques implementing hyperparameter tuning, feature selection, and sampling to improve the machine learning calculations utilized. The personality forecast framework is based on machine learning algorithms and used big five model. There are three machine learning calculations utilized in this study, to be specific Stochastic Gradient Descent (SGD), and two ensemble learning calculations, Gradient Boosting (XGBoost), and stacking (super learner). By executing this arrangement of optimization strategies, the current examination's assessment results show immense improvement by accomplishing 1.0 ROC AUC score with SGD and Super Learner.

VI. CONCLUSION

This paper gave an understanding on existing endeavors of the task of personality prediction from twitter text dataset to-date, alongside the different sorts of twitter dataset which have been used for said task. A portion of these strategies utilize a closed-vocabulary approach with psycholinguistic devices. Recently have taken a stab at applying semi- supervised and unsupervised learning out how to handle this issue. Further enhancements to the current condition of personality prediction can be made by extending the objective language, applying more appropriate algorithms or preprocessing strategies to accomplish higher accuracy. In future robust deep learning models can build then accuracy can be improved.

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