

Kelaniya International Conference on Advances in Computing and Technology

KICACT -2016

“LEADING INNOVATION THROUGH COLLABORATION”

Abstracts

Faculty of Computing and Technology
University of Kelaniya,
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Kelaniya International Conference on Advances in
Computing and Technology
(KICTACT - 2016)

“Leading Innovation through Collaboration”

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ABSTRACTS

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Faculty of Computing and Technology
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Sri Lanka

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(KICTACT - 2016) “Leading Innovation through Collaboration”

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Analysis of Emotional Speech Recognition Using Artificial Neural Network

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Abstract

This paper presents an artificial neural network based approach for analyzing the classification of emotional human speech. Speech rate and energy are the most basic features of speech signal but they still have significant differences between emotions such as angry and sad. The feature pitch is frequently used in this work and auto-correlation method is used to detect the pitch in each of the frames. The speech samples used for the simulations are taken from the dataset Emotional Prosody Speech and Transcripts in the Linguistic Data Consortium (LDC). The LDC database has a set of acted emotional speeches voiced by the males and females. The speech samples of only four emotions categories in the LDC database containing both male and female emotional speeches are used for the simulation. In the speech pre-processing phase, the samples of four basic types of emotional speeches sad, angry, happy, and neutral are used. Important features related to different emotion states are extracted to recognize speech emotions from the voice signal then those features are fed into the input end of a classifier and obtain different emotions at the output end. Analog speech signal samples are converted to digital signal to perform the pre-processing. Normalized speech signals are segmented in frames so that the speech signal can maintain its characteristics in short duration. 23 short term audio signal features of 40 samples are selected and extracted from the speech signals to analyze the human emotions. Statistical values such as mean and variance have been derived from the features. These derived data along with their related emotion target are fed to train using artificial neural network and test to make up the classifier. Neural network pattern recognition algorithm has been used to train and test the data and to perform the classification. The confusion matrix is generated to analyze the performance results. The accuracy of the neural network based approach to recognize the emotions improves by applying multiple times of training. The overall correctly classified results for two times trained network is 73.8%, whereas it is 83.8% when increasing the training times to ten. The overall system provides a reliable performance and correctly classifying more than 80% emotions after properly trained.

Keywords: *Confusion matrix, Neural Networks, Short Term Features, Speech Emotions*

Human Body Component Tracking and Object Detection Using Monocular Video Sequence

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Abstract

Medical education plays a vital role in a country's education system. It is essential that a medical student should be provided with a realistic environment in order to effectively learn and practice disease diagnostics. According to medical education, initially, diseases are determined by diagnosing abnormal heart and lung sounds. Practicing such diagnostics requires a large pool of patients representing each disease which needs to be learnt. However, providing such a large number of patients for an examination session is impractical. Finding patients representing each disease to be learnt is another challenge. The current method used to practice diagnostics via heart and lung sounds is either by using a dummy or a healthy human and identifying disease according to symptoms described by the performer or the doctor/lecturer. This leads to an unrealistic examination environment for the medical student, thereby decreasing the productivity of the medical education system. Meanwhile, object detection in human body pose and component tracking from video inputs has been an active research field motivated by various applications including human computer interaction, motion capture systems and gesture recognition. One of the most important biomedical applications focuses on building simulators to carry on activities in the medical field. Most current tracking methods include multiple cameras and many markers placed on key body points. This makes the examination environment become less realistic and the methods are proven to be slow and unreliable. Furthermore, many tracking systems must be initialized by a human operator before they can track a sequence. Pose tracking using 3D Time of Flight (TOF) cameras exists. However, purchasing TOF cameras are expensive and since they only detect infrared emitting surfaces, they are difficult to be used for many applications. Several learning-based techniques have been proposed for monocular sequence view, but these rely on accurate body silhouette extraction and require relatively large number of training images. SimHaL (Hybrid Computer-based Simulator for Heart and Lung disease diagnosis to enhance medical Education) is an ongoing project which intends to build a hybrid computer-based simulator with an integrated human and computer components. Its aim is to enhance the productivity of medical education by simulating patient examination in a more realistic environment. Therefore it acts as a simulator for disease diagnosing by identifying relevant heart and lung sounds by medical student. The current state of SimHaL focuses on detecting the location where the Chest piece of a stethoscope is placed on a patient's torso. Since the major target is to build an optimal realistic examination environment for the medical student, a single camera is used to monitor the activity. The output is a monocular

video sequence which is the only source available for identifying the torso and the Chest piece as objects. The methodology focuses on object detection categorized into two approaches:

1. Detecting the chest piece of the stethoscope
2. Detecting the patient's torso

In order to identify the chest piece, a circle detection program is implemented using OpenCV. Here the monocular video sequence is divided into frames and circle is detected based on a provided range of radius value. The provided radius value range approximates the radius of the chest piece. Other circles detected in the background will be discarded if their radius value is not in the provided radius range. Next, the motion detection of the identified chest piece is obtained by computing the difference of Cartesian coordinates of circles detected in adjacent frames. Circles with differences which exceed a certain threshold value, are discarded. Currently this threshold value is set as a fixed value assumed to be the width of the patient's torso. This avoids unusual movements of any detected circle and makes sure the circle detected in the current video frame is the same circle which was detected in the previous one, but has now moved to a new location. Results of this approach consists a concurrent output of x and y Cartesian values relative to the video frame along with a video sequence with a circle drawn in each frame. Radius of the circle is the radius of the chest piece detected at the beginning and the x and y values indicates the circle's center. The current status of the research concludes identification of the chest piece. Detecting the human torso and thereby determining the location where the chest piece is placed is yet to be implemented.

Keywords: *object detection, component tracking, virtual reality*

Detection of Vehicle License Plates Using Background Subtraction Method

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Abstract

The detection of a vehicle license plate can be considered as a primary task of a License Plate Recognition System (LPRS). Detecting a vehicle, locating the license plate and the non-uniformity of license plates are few of the challenges when it comes to detection of a license plate. This paper proposes a work to ensure the detection of license plates which are being used in Sri Lanka. The work here, consists of a prototype which was developed using the Matlab's predefined functions. The license plate detection process consists of two major phases. They are, detection of a vehicle from a video footage or from a real time video stream and license plate area isolation from the detected vehicle. By sending the isolated license plate image to an Optical Character Recognition (OCR) System, its contents can be recognized. The proposed detection process may depend on facts such as, the lighting and weather conditions, speed of the vehicle, efficiency in real time detection, non-uniformity effects of number plates, the video source device specifications and fitted angle of the camera.

In the license plate detection process, the first phase, that is; the detection of a vehicle from a video source is accomplished by separating the input video source into frames and analysing these frames individually. A monitoring mask is applied at the beginning of the processing in order to define the road area and it helps the algorithm to look for vehicles in that selected area only.

To identify the background, a foreground detection model is used, which is based on an adaptive Gaussian mixture model. Learning rate, threshold value to determine the background model and the number of Gaussian modes are the key parameters of the foreground detection model and they have to be configured according to the environment of the video.

The background subtraction approach is used to determine the moving vehicles. In this approach, a reference frame is identified as the background from the previous step. By subtracting the current frame from that reference frame, the blobs which are considered to be vehicles are detected. A blob means a collection of pixels and the blob size should have to be configured according to facts such as the angle of the camera to the road and distance between camera and the monitoring area.

Even though a vehicle is identified in the above steps, it needs a way to identify a vehicle uniquely to eliminate duplicates being processed in next layer. As the final step of the first layer, it will

generate distinct numbers using the Kalman filter, for each and every vehicle which are detected from the previous steps. This distinct number will be an identifier for a particular vehicle, until it leaves the global window.

In, the second phase of the license plate detection will initiate in order to isolate the license plate from the detected vehicle image. First, the input image is converted into grayscale to reduce the luminance of the colour image and then it will be dilated. Dilation is used to reduce the noise of an image, to fill any unnecessary holes in the image and to improve the boundaries of the objects by filling any broken lines in the image.

Next, horizontal and vertical edge processing is carried out and histograms are drawn for both of these processing criteria. The histograms are used to detect the probable candidates where the license plate is located. The histogram values of edge processing can change drastically between consecutive columns and rows. These drastic changes are smoothed and then the unwanted regions are detected using the low histogram values. By removing these unwanted regions, the candidate regions which may consists of the license plate are identified. Since the license plate region is considered to be having few letters closely on a plain coloured background, the region with the maximum histogram value is considered as the most probable candidate for the license plate.

In order to demonstrate the algorithm, a prototype was developed using MATLAB R2014a. Additional hardware plugins such as Image Acquisition Toolbox Support Package for OS Generic Video Interface, Computer vision system toolbox and Image Acquisition Toolbox were used for the development. When the prototype is being used for a certain video stream/file, first and foremost, the parameters of the foreground detector and the blob size has to be configured according to the environment. Then, the monitoring window and the hardware configurations can be done.

The prototype which was developed using the algorithm discussed in this paper was tested using both video footages and static vehicle images. These data were first grouped considering facts such as non-uniformity of number plates, the fitted angle of the camera. Vehicle detection showed an efficiency around 85% and license plate locating efficiency was around 60%. Therefore, the algorithm showed an overall efficiency around 60%.

The objective of this work is to develop an algorithm, which can detect vehicle license plates from a video source file/stream. Since the problem of detecting a vehicle license plates is crucial for some complex systems, the proposed algorithm would fill the gap.

Keywords: *License Plates, Matlab R2014a*

Smart Meter- Multifunctional Electricity Usage Meter

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Abstract

Internet of things (IoT) is the modern concept which makes new approach to make connect people and people, people and devices via internet. This concept is a great solutions for many practical problems of people. Such as connecting people with each other easily, controlling remotely, managing people or devices easily etc. This concept combined with other technologies will make more use for people. Such a modern technology is Multi-Agent technology; connecting these two technologies will make great solutions for many human problems. Software agents are well trained computer programs for certain task with different environment conditions. These agents can act autonomously with sudden changes in artificial environment. (A) Multi-Agent system (MAS) is the collection of software agents who play in artificial environment. Applying IoT and MAS together is great way of creating solutions for major problems of people. One of such problem is uncontrollable power usage. Smart Meter (SM) is the solution for this problem, which is integrated both IoT and MAS concepts. Electricity is the major type of energy which is used for everything in modern world. So electricity plays major role in industry as well as the domestic. More than 50% of domestic use electricity as their first power source. With the great usage of electricity the wastage also becomes higher. This wastage make uncomfortable to domestic economics so people need a better way to eliminate the wastage. And also it will put the world at risk. Because all resources which are used to generate electricity have decaying characteristics, this wastage will make quick reach to end of the resources. Looking at the two tasks of this problem, the key factor of acting on this issue, so people must think on this issue and must act themselves so the wastage must represent to them in manner, which they can feel the problem. Representing current usage in representative manner and predicting future usage according to past usage details will be much easier to understand on how they must act for themselves as well as the world. Implementing the methods to act according to the future plan is one important component for this concept, and remote access and automatic control will add new value to this concept and will make better and easy way to eliminate wastage. Developing countries are struggling to eliminate wastage of electricity because they spend big portion of their economy to generate electricity. If the wastage elimination plan is more expensive it is not feasible for those country. Then it need less expensive power saving equipment. So the smart Meter is such equipment which developed using less expensive equipment such as Arduino, RPI, etc. Complete SM system contains three parts they are, Physical system – which contains a component connected to the home electricity system to collect consumption data of home

areas. This system contains microcontrollers, sensors, etc. Processing Unit – this is the system which contain multi-agents and other software which is used to control micro controllers. This is the core of the SM which does all calculations, and all analytical processes and report generating processes. UI Component is the third system which is used to display analytical results of those generated by Processing Unit and it lets user to control the electricity system remotely. All three units of the SM can be built cost effectively which is appropriate to developing countries. When considering the situation in Sri Lanka another major issue is that there is no good connection between domestic system and service provider so the use manual system of collecting of details of consumption. So it will take more time to process consumption data to service provider and make analysis report of domestic. But using the system SM is the best way of collecting consumptions details and also analyzing the consumption data of domestic to make sense on people to save the power because SM will predict the future data consumption and weaknesses of the power consumption of the user. SM uses an analytical program called R in the core module and it is programmed to generate the forecasting for the users' future consumption of data to represent in understandable manner. This SM concept can be extended for industrial users and this can be extended to make power grid in the area as well as the country. So then it will give new interface for the Power Grid concept. This will lead the whole country to stand for power saving as one. SM is the MAS which is integrated with IoT concept to achieve the above tasks, which is implemented using MadKit agent platform and Java language. Each software agent is assigned for a task. These agents work together to bring out one major task alive. All devices which are connected to the central system communicating with each other as well as with the user, will bring out the concept IoT. Together these two technologies will make a complete solution for electricity wastage.

Keywords: *Smart Meter, Eliminate the Wastage, Act Autonomously, artificial environment, Multi-Agent system*

Context-Aware Multimedia Services in Smart Homes

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Abstract

The evolution of “smart homes” technologies exposes a broad spectrum of modern personal computers (PC), consumer electronics (CE), household appliance and mobile devices for intelligent control and services in residential environments. With high penetration of broadband access networks, PC, CE and mobile device categories can be connected on home networks, providing a home computing context for novel service design and deployment. However, conventional home services are characterized by different operations and interactive usages among family members in different zones inside a house. It is prospective to realize user-oriented and location-free home services with modern home-networked devices in smart home environments.

The contribution of this paper proposes a reference design of a novel context-aware multimedia system in home-based computing networks. The proposed system integrates two major functional mechanisms: intelligent media content distribution and multimedia convergence mechanisms. The first mechanism performs intelligent controls on services and media devices in a context-aware manner. This mechanism integrates face recognition functions into home-based media content distribution services. Some devices capable of capturing images can recognize the appearances of registered users and infer their changes of location region inside a house. Media content played in the last locations can thus be distributed to home-networked devices closer to the users in the current locations. The second mechanism offers multimedia convergence among multiple media channels and then renders users a uniform presentation for media content services in residential environments. This mechanism can provide not only local media files and streams from various devices on a home network but also Internet media contents that can be online fetched, transported and played onto multiple home-networked devices. Thus, the multimedia convergence mechanism can introduce an unlimited volume of media content from the Internet to a home network.

The development of a context-aware multimedia system can be described, as follows. A conceptual system playground in a home network contains several Universal Plug and Play (UPnP) specific home-networked devices that are inter-connected on a singular administrative network based on the Ethernet or Wi-Fi infrastructure. According to UPnP specifications, home-networked devices are assigned IP addresses using auto-IP configuration or DHCP protocols. Then, UPnP-compatible devices can advertise their appearances on a network. When other neighbor devices discover them, they can collaborate on media content sharing services in a network. In addition, some UPnP-

compatible devices are capable of face recognition to capture the front images of users inside a house. Those captured images can be sent to a user database and compared with existing user profiles corresponding to individuals in the family community. After any registered user is recognized, the system can refer to the stored details of this particular user and then offer personal media services in a smart manner. On the other hand, the components and functionalities of the proposed system can support intelligent media content distribution and multimedia convergence mechanisms. Technically, the proposed system combines several components such as UPnP control point, UPnP media renderer, converged media proxy server, image detector and profile database of registered users and family communities. Though there are diverse media sources and formats in a home network, users remain the same operational behavior on sharing and playing media content according to common UPnP and Digital Living home Alliance (DLNA) guidelines.

Prototypical development achieved a proof-of-concept software based on the Android SDK and JVM frameworks, which integrates the distribution of intelligent media content and converged media services. The resulting software is platform-independent and application-level. It can be deployed on various home-networked devices that are compatible with UPnP standard device profiles, e.g., UPnP AV media server, media player, and mobile phones. Real demonstration has been conducted with the software implementation that runs on various off-the-self home-networked devices. Therefore, the proposed system is able to offer friendly user experience for context-aware multimedia service in residential environments.

Keywords: *Multimedia service; context awareness; home AV entertainment; home computing; home networks.*

Intelligent Recruitment Management Engine

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Abstract

A system which can be used to automate the recruitment process of an organization is proposed in this paper. The system is designed targeting the human resource department of an organization in order to simplify the massive process of data extraction from a large number of curriculum vitae (CVs), on the other hand to reduce the cost and time which have to be spent on the interview process and to allocate most suitable interviewers from the organization for each interviews by analyzing the past data. Information extraction is used in-order to retrieve data from CVs as well as from the cover letters. An ontology map is created to analyze and categorized the extracted key words through this system. Then the CVs are sorted and prioritized according to the requirements of the organization. We come up with a prediction component which will be embedded in the main system to predict the future of the incoming values such as the cost and time of the recruitment process of a particular organization by analyzing the past records. Hence we believe that this system will enhance the efficiency and effectiveness of the recruitment process of any organization.

Keywords: *information extraction, information optimization, ontology, prediction*

Development of a Location Based Smart Mobile Tourist Guide Application for Sri Lanka

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Abstract

Tourism plays a momentous role in the accomplishment of macroeconomic solidity in Sri Lanka. It is one of the main industries that generates a higher emolument for Sri Lanka. The amount of foreign currency earnings from tourism industry has decreased significantly during the past few years according to observations and collected data. This can be partially attributed to the lack of loyalty of the physical tour guides as well as not modernizing the tour guide booklets regularly. Considering the above issues, we propose a mobile application named “Live Tour Guide” to make the travelling easier for the tourists and thereby creating a positive impact on the economy of Sri Lanka. A meticulous investigation was carried out in order to find out the software and hardware requirements to develop this automated tour guide application. The feasibility analysis for the system was carried out under three areas; i.e Operational, Economic and Technical. Since this application consists of the details about the hotels, attractive places and the longitudes/latitudes of different locations it was needed to use an exterior source to collect these respective data. Under the assumption that the particular websites are updated regularly, the dedicated websites were used to gather the required information. Direct observation data collection method was also utilized to identify the work carried out by the tour guides, their behavior, the way that they treat the tourists etc. The system has been developed focusing on two main elements; Mobile Application and Web Server. The Web Server is used to access the cached data or information through the Mobile Application. Information regarding different locations such as, longitudes and latitudes were gathered with the use of the Global Positioning System (GPS). Google maps was employed to access the map based services. Central web server can be accessed through the Internet by using wireless connectivity or 3G connection. The Web Server serves the contemporary location information and it also provides the details of the hotels and attractive places situated close-by, so that it will allow the tourists to plan out their journey accurately in advance with a minimum effort. An external database has been developed using MySQL in order to maintain the details of the places of interest. Java Script Object Notation (JSON) objects are used to exchange the location data over the internet and the application program. Google Maps Application Programming Interface is used to access the Google Map. The “Live Tour Guide” mobile application has developed in order to provide the real time location based services according to the requirements of the tourists. The system has been tested to operate on any smartphone with Android Operating System version 4.2

or later. When a user enters the source and the destination, it will display the route, estimated time for the journey without traffic and the distance between the origin and the destination. Along with that it provides two options to select as “Locations” and “Hotels”. Those two options will provide the details of all the available hotels as well as attractive places located close-by along the preferred route. Apart from the mobile application, “Live Tour Guide” web application has also been developed for maintaining the database in a user friendly manner that can be used by the travel agencies. By using all the above mentioned technologies together with the real data, the objective of developing this “Live Tour Guide” android based application was successfully achieved. Even though some of the solutions are already available as tour guides, this “Live Tour Guide” application allows the tourists to plan out their tour before they start up their journey, by providing various kinds of origins and destinations. It will allow tourists to choose the locations that they are preferred to visit during their journey, since it provides all the information including the prices as well. Any user who is equipped with an android based smartphone, eligible to use this application. However, in future this system should be enhanced by enabling to display all the public places that are available within a selected route as well as it is needed to find out a way of accessing the “Live Tour Guide” application accurately even without having an internet connection. Currently, the database updates manually, but it is better to focus on updating it automatically within regular intervals, so that it will operate more accurately. Due to this innovative application, more tourists can be attracted and will gain a positive impact on the economy of Sri Lanka.

Keywords: *Tourism Industry, Mobile Application Development, Web Service, Android, Global Positioning System*

An Emotion-Aware Music Playlist Generator for Music Therapy

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Abstract

Music has the ability to influence both mental and physical health. Music Therapy is the application of music for rehabilitation of brain activity and maintain both mental and physical health. Music therapy comes in two different forms: active and receptive. Receptive therapy takes place by making the patient to listen to suitable music tracks. Normally music therapy is used by people who suffer from disabilities or mental ailments. But the healing benefits of music can be experienced by anyone at any age through music therapy. This research proposes music android mobile application with auto generated play list according to its user's emotional status which can be used in the telemedicine as well as in day-to-day life.

Three categories of emotional conditions; happy, sad and anger were considered in this study. Live images of the user is captured from an android device. Android face detection API available in the android platform is used to detect human faces and eye positions. After the face is detected face area is cropped. Image is grey scaled and converted to a standard size in order to reduce noise and to compress image size. Then image is sent to the MATLAB based image-recognition sub-system using a client server socket connection. A Gaussian filter is used to reduce noise further in order to maintain a high accuracy of the application. Edges of the image is detected using Canny Edge Detection to identify the details of the face features. The resulting images appear as a set of connected curves that indicate the surface boundaries.

Emotion recognition is carried out using the training datasets of happy, sad and angry images that are input to the emotion recognition sub-system implemented in MATLAB. Emotion recognition was carried out using Eigen face-based pattern recognition. In order to create the Eigen faces average faces of three categories are created by averaging the each database image in each category pixel by pixel. Each database image is subtracted from the average image to obtain the differences between the images in the dataset and the average face. Then each image is formed in to the column vector. Covariance matrix is calculated to find the Eigen vectors and associated values. Then weights of the Eigen faces are calculated. To find the matching emotional label Euclidean distance between each weight is calculated for each category. By comparing the obtained Euclidean distances of input image with each category, the class of the image with lowest distance is identified. The identified label (sad, angry, and happy) is sent back to the emotion recognition sub-system. Songs that are pre-categorised as happy, sad and angry are stored in the android application. When

emotional label of the perceived face image is received, songs relevant to the received emotional label are loaded to the android music player

200 face images were collected at the University of Kelaniya for validation. Another 100 happy, 100 sad and 100 angry images were collected for testing. Out of the 100 test cases with happy faces, 70 were detected as happy, out of the 100 sad faces 61 were detected as sad and out of 100 angry faces 67 were successfully detected. The overall accuracy of the developed system for the 300 test cases was 66%.

This concept can be extended to use in telemedicine and the system has to be made more robust to noises, different poses, and structural components. The system can be extended to include other emotions that are recognizable via facial expressions.

Keywords: *Gaussian Filter, Canny Edge Detector, Eigen Face*

Advanced Real Time Traffic Controller System Based on Fuzzy Logic and Motion Detection Sensors

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Abstract

Traffic congestion in intersections are becoming a major concern in metropolitan cities. The customary traffic light signals (TLS) are being operated in predetermined traffic light patterns based on the traffic weights calculated through previous statistics on particular junctions. This method becomes inefficient for day to day growing automobile usage in a country like Sri Lanka. Another reason for inefficiency is determining a pattern of traffic flow through statistical analysis is less reliable. A sophisticated solution for this issue is recommended in this paper by controlling the TLS respect to real time traffic flows using motion detection sensors and fuzzy logic technology. The objective is to maximize the traffic flow rate and reduce waiting on junctions. The motion detection sensors are to count the flow rate on the path toward the junction from reasonable distance. Fuzzy logic is the intelligence in the system which acts like a human traffic operator. The Matlab fuzzy logic toolbox is used to design the fuzzy logic. A model of road junction installed with the advanced real time traffic controller system is animated to display the results. The traffic light will act on the decisions made by fuzzy logic system according to the instantaneous traffic load in the roads approaching the junction. The sensors are installed twenty five meters before the intersection in all the paths approaching the junction and this helps the fuzzy logic system to efficiently decide the next signal change time and foresee incoming vehicles to make decision in advance and reduce the vehicle waiting latency. The sample traffic flows applied in a simulation and the response of traffic light signals are observed and these scenarios are compared with a customary traffic light controller system. This model is more efficient than the current traffic light controller system available in Sri Lanka.

Keywords: *fuzzy logic, motion detection sensors, traffic flow, simulation*

Two Tier Shield Unapparent Information Deliver along with the Visual Streams

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Abstract

Information put out of sight for various security purposes have become highly exciting topic in the industry and also academic areas. Encryption provides the ability of data hiding. With the development of the technology, people tend to figure out a technique which is not only capable in hiding a message, but also capable in hiding the actuality of the message. Steganography was introduces as a result of those researches. The current study is conducted in order to hide a file inside a video file. Generally, steganography benefits do not use in the industry or students even though it is widely discussing topic in modern information world. The major aim of this research is the ability to hide any type of file in a video file and retrieve hidden information. There are few algorithms/systems developed to embed a file into video files. It is a great challenge to extract secret information directly from the video, which is embedded already. The existing applications require a considerable time to embed a small message and some are not freeware. Focuses areas of the research are confidentiality, authentication, increase hidden data size, integrity, assure unapparent perceptual transparency of video file (cover object) and send/receive video files. Video consists of frames called I, P and B frames. Each frame uses LSB technique to hide information. This original message can be any kind of file type and almost all popular video file formats for carrier. Identifies the type of the message and encrypts the message file using AES256 with given key. Encrypted message size stores in four bytes and type of the message file stores in another four bytes. Propose algorithm decides the number of frames require to hide the secret information according to size of both carrier video and the secret message. Firstly, reads the video header to retrieve important information and skip the header. Video file Splits in to bitmap images with having pre-defined frame gap between two images, corresponding to the secret message size. Every bitmap image consists of red, green and blue colors and bitmap image pixel has 8 bit for each color and total of 24 bits called bit depth. Writes message size followed by the message type in the bitmap images. Then, writes the message. Each encoded image adds into the original video file. In the process of retrieval, skips the header frames and fetches the images from the video according to the pre-defined gap between images. Reads first eight bytes to identify the message size and type of the message respectively. Then, decodes the encrypted message and decrypts the message with same secret key, which used to encrypt the message. Carrier video file can be watched during the both process of encode and decode. This method doesn't increase the size of the carrier, though the existence of the message cannot be detected. AES256 key size encryption supports the dual layer security of classified information. Proposed solution supports unique feature that can delete the hidden

information, which concealed inside the video without affecting the video carrier. Encoded video is guaranteed the original quality of the carrier. So, this proposed way-out emerges along with an application called SilentVideo1.0. The system was tested to assure the quality of the final product. Testing focused on the accuracy of the propose algorithm, which is ability of hiding the existence of the information as well as the ability of retrieving the information correctly using the application. Test results guarantee the success rate of the proposed algorithm goes up to 85 percent. Furthermore, the application was evaluated for exactness of the input and output information by black box tests using 200 samples from different video formats. The aim of this work was propose a strong resolution for steganography in digital media with multi-tier protection. The hidden file capacity will be increased using sound track of the video file as well. Upcoming versions of the system will be upgraded with latest cryptographic involvement and increase the conceal message capacity along with the lowest encoding and decoding time frame.

Keywords: *Steganography, AES, Bitmap, Encode, Decode*

The Staff Perception on the Effect of Virtual Learning Environment in Distance Education.

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Abstract

Technology has removed the distance barriers and has given lot of opportunities for education through human computer interaction. Today, the impact of technology has dramatically changed the distant education system and many educational institutions are looking for different methods to expand their existing practices in regard to technology in order to bring student centered environment (Florida Virtual School, 2006). In order to respond to learner's requirements and overcome the geographical challenges of students who have spread over Sri Lanka, most of the Sri Lankan universities have introduced the Virtual Learning Environment (VLE) systems for distance learners. The aim of this research paper is to investigate how the usage of VLE contributes the attainment of the academic improvement of distance learners. Thus, this research paper explores how the ways VLEs are developed and how the ways the teachers make use of it affect the learners' performance and whether teachers are satisfied with the performances of distance learners. For this qualitative study, two Sri Lankan government universities from western province are selected. The sample of study consists of 10 staff members from both universities where VLE is used for teaching distance learners. The research has used both semi-structured and structured interviews in order to collect data. The data is collected both via primary and secondary sources. The interviews were used as the primary source while websites and records of relevant institutions were used for secondary sources. The collected data is analyzed by considering the staffs' perspective on the contribution of VLE in distance education. The results of the research brings out various aspects regarding staffs' perceptions on contribution; effectiveness, usefulness and convenience of Virtual Learning Environment especially it shows that VLE has a significant effect on pass rate of all subjects when it comes to the distance education.

Keywords: *Virtual Learning Environment, Human Computer Interaction, Distant Education, Effect, Staff Perspective.*

Mobile Management Information System Application Development on Cloud Platform

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Abstract

Cloud computing is a relatively new but well documented area of information technology in recent years. Fundamentally, cloud computing takes advantages of the World Wide Web where thousands of computers are networked together and they are interconnected with each other. As with the traditional client-server systems, people use these computers to exchange messages, send emails, write and read blogs. However in cloud computing, when they use these network resources as services, without the knowledge of where the program is running.

In traditional client-server systems, additionally, when a user wants to run an application, they had to use a computer installed with the relevant application software. Once they were set up computer in their own premises they will need supporting software, keep track of software upgrades, security and so on. With cloud computing, by contrast, users do not need any of the above but simply access an application via the cloud service provider which can be accessed from anywhere in the world. Cloud computing is the future of enterprise software developments and, as such, many legacy systems will to be redesigned according to the new requirements and integrated with newer systems to continue business success. Broadly speaking most of these legacy applications in an organisation are running in a somewhat isolated environment and it is not easy to integrate with other applications. In particular, these applications are running on different platforms. Consequently, it is difficult to modify an application, transfer and retrieve data, and subsequently deploy new applications. This report first presents a literature review on comparing software system architectures and the current software application deployment issues in the context of an insurance business domain in Sri Lanka. It is followed by a discussion of the process of moving services into the cloud. The report describes a three-step methodology for identifying relevant services and the associated implementation strategies to migrate services into cloud. Finally, as a proof of concept, an application demonstrator was developed with the principal goal of providing a practical insight of cloud service integration.

Keywords: *cloud computing, cloud services, application integration, cloud migration, Cloud based application development*

Experience in teaching ICT for medical students through Moodle

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Abstract

Moodle is the most widely used free open-source-learning platform that serves educators and learners across the globe to create online courses. A resource is an item that a teacher can use to support learning, such as a file or link. An activity is a general term for a group of features in a Moodle course that makes the students to interact with the teacher or with other students. Student interactions with the Moodle resources and activities can be assessed using Moodle logs.

Moodle course contents can be mainly classified as resources and activities. Resources includes files (links to files; eg. PowerPoint, PDF), pages (HTML pages with an editor created by the teacher), uniform resource locators (a web link for the students to reach on their web browser) and books. Activities includes quizzes, assignments, questionnaires, forums and surveys. Quiz allows teachers to design and set quiz tests. Assignment enables teachers to grade and give comments on uploaded files as students' assignments. The Questionnaire enables teachers to collect feedbacks.

Faculty of Medicine, University of Kelaniya started using Moodle based virtual learning as an intranet service in 2008 and at present, the Faculty uses Moodle based Computer Assisted Learning (CAL) system of University of Kelaniya to deliver teaching and learning materials to students. Over the period of 8 years ICT Centre of Faculty of Medicine delivered the ICT course through Moodle platform and the ICT course consist of introduction to computers, internet and email, information literacy, word processing, electronic presentation, spreadsheet, image and video editing and R-programming language. ICT course is delivered during first 3 terms of the 1st year in the medical curriculum and this study was done to assess the 1st year medical students' Moodle usage pattern.

We analyzed the ICT course log of medical students in the first two terms which was held from 01/02/2016 to 30/06/2016. Hundred and seventy medical students were in the 1st year and the practical classes were conducted on group basis (i.e. approximately 60 students per a class) and each practical class had 3 hour sessions. All together 45 classes were conducted using Moodle during the 1st and 2nd semesters which contained 48 assignments and the breakdown as follows; 15 Moodle resources containing 12 files, 2 Pages and 1 URL and 33 Moodle activities containing 7 Quizzes, 10 Assignments and 16 Questionnaires.

Moodle course log related to ICT module was downloaded. We considered the number of "views" and "posts" for the analysis. View is an event where the user has visited the course, activity or resource, whereas post is an event where an entry is made to Moodle database such as quiz attempt, file submissions or questionnaire submission. We calculated the average number of views and posts

for each resource and activity by dividing relevant total log entries with number of available resources and activities in the ICT course.

Total 23,395 records were found for the period. Number of records relevant to students' entries were 21,509 (92%) and the rest were administrator 339 (2% and teacher 1547 (7%) logins. 21,258 (99%) hits were recorded through the faculty network and the rest were from the other fixed and mobile data networks during the study period.

The average number of "views" per resource during the course as follows; 107 for page, 103 for file, 104 for URL and the average number of "views" per activity as follows: 314 for quiz, 248 for assignment and 109 for questionnaire. The average number of "post" per activity during the course as follows; 92 for quiz, 59 for assignment, 55 for questionnaire. Overall average views per activity and resource were 194, 104 respectively.

Comparison of the average number of views for term 1 vs term 2 as follows; 368 vs 241 for quizzes, 155 vs 72 for questionnaire, 110 vs 100 for files and the average number of posts were 112 vs 66 for quizzes and 77 vs 38 for questionnaire.

Limitations of the study as follows; calculation of average number of views could be overestimated as there could be multiple visits by the same student, also ICT module is not a compulsory course and number of student's participation in the practical were varied during the study period.

According to the results, Quiz and Assignment have the highest average number of views and posts and other resources such as files, page and URLs have less number of views. Therefore, Moodle activities (quiz and assignments) should be encouraged instead using Recourses (reference materials).

Keywords: Moodle course Log analysis, ICT course, Moodle activity, Views, Posts

Animal Behavior Video Classification by Spatial LSTM

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Abstract

Deep learning which is basis for building artificial intelligent system is become a quite hot research area in recent years. Current deep neural network increase human recognition level of natural images even with huge dataset such as ImageNet. Among successful architectures, Convolution Neural Network (CNN) and Long Short-term Memory (LSTM) are widely used to build complex models because of their advantages. CNN reduces number of parameters compare to full connected neural net. Furthermore, it learns spatial features by sharing weights between convolution patch, which is not only help to improve performance but also extract similar features of input. LSTM is an improvement of Vanilla Recurrent Network (RNN). When processing with time-series data, RNN gradient has tend to vanish in training with backpropagation through time (BTT), while LSTM proposed to solve vanish problem. Therefore it is well suited for manage long-term dependencies. In other words, LSTM learn temporal features of time-series data. During this we study focused on creating an animal video dataset and investigating the way that deep learning system learn features with animal video dataset. We proposed a new dataset and experiments using two types of spatial-temporal LSTM, which allow us, discover latent information of animal videos. According to our knowledge of previous studies, no one has used this method before with animal activities. Our animal dataset created under three conditions; data must be videos. Thus, our network can learn spatial-temporal features, objects are popular animals like cats and dogs since it is easy to collect more data of them and the third is one video should have one animal but without humans or any other moving objects. Under experiments, we did the recognition task on Animal Behavior Dataset with two types of models to investigate its' differences. The first model is Conv-LSTM which is an extend version of LSTM, by replacing all input and output connections of convolutional connections. The second model is Long-term Recurrent Convolutional Networks (LRCN), which proposed by Jeff Donahue. More layers of LSTM units can easily added to both models in order to make a deeper network. We did classification using 900 training and 90 testing videos and could reached the accuracy of 66.7% on recognition rate. Here we did not do any data augmentation. However in the future we hope to improve our accuracy rate using some of preprocessing steps such as flip, rotate video clips and collecting more data for the dataset.

Keywords: *Spatial LSTM, LRCN, Animal behavior dataset, Video classification.*

Multi-Agent-Based Secure Textual Communication

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Abstract

The study designed to show that the security of textual communication can improve by incorporating Agent Technology. Furthermore, the usage of dynamic encryption mechanism tightens the security of the communication. While online communication media are facilitating an effective communication, significant threats are arising day by day due to high access rate of large data. Therefore, privacy, confidentiality, and security become more significant facts in the means of Information and Communication Technology. A network attack or malicious software such as viruses and worms may cause communication failure or loss of data. An intruder can modify, steal or erase a message while it is passing through the communication media. Thus, the importance of information security is increasing rapidly. An agent-based secure communication system is proposed to make more secure transmission of data that will improve the efficiency, security, and robustness. The execution of security protocols in a fair and accessible way by incorporating software agents will be a better approach to overcome the security threats. In this study, autonomous agents have been created and simulated using Java Agent Development Environment (JADE) platform that is skilled with the knowledge of several encryption methods to select the most suitable encryption method based on the message type. Furthermore, an Agent ID is used by every agent for the purpose of identifying each other to communicate. Another essential feature of agents is the ability to communicate with each other using a specific way with the aid of Agent Communication Language (ACL), and it gives a unique way of communication in between agents. A vital aspect of this method is to ensure the security level of the encryption methodology applied. Adding software agent to this process will add one more layer of security other than the encryption. Several benefits can be possible through adopting dynamic encryption method in the system. Secrecy is high, in the means of neither the receiver nor the intruder knows the encryption method which used. Encryption, dynamic encryption, and agent-based approach used to achieve three levels of security in textual communication. Obviously, the security is improved by adding these three tiers, and it is tough to break all these three layers and retrieve the message.

Keywords: *Multi-Agent System, Java Agent Development Environment (JADE), dynamic encryption, Security,*

A Working Group Construction Mechanism Based on Text Mining and Collaborative Filtering

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Abstract

Massive Open Online Courses (MOOCs) are popular in E-learning research domain with the advance of internet technology (Sa'don, Alias, and Ohshima 2014). MOOCs easily provide higher education courses for registered users as well as institutions or teachers who can offer courses in order to join more students than traditional education. However, producing high-quality learning materials may cause increase time, cost and efforts. For the purpose of reusing materials and reducing the cost of re-creating materials, the Learning Object (LO) concepts have been introduced. The content management systems which used these LOs are called Learning Objects Repository (LOR). The stored LOs in the repository can be easily searched by users. In this paper we introduce a working group construction mechanism for users on LOR. The proposed mechanism uses text mining technique to analyse the similarity of groups to construct prototypes of working groups. Then find the users' preferences about LOs based collaborative filtering to optimize constructed prototypes. Hence users on LOR can find quickly and easily their interesting learning materials via relevant working groups. This mechanism reduces the consuming time for re-creating learning materials by improving the quality of production.

This study is based on a Google MOOC FRA project (<http://googleresearch.blogspot.tw/2015/03/announcing-google-mooc-focused-research.html>).

There are 3 parts of the system (Fig. 1 (a)) as: *conversion tool* between ELO (<http://edxpdrlab.ncu.cc/>), Course Builder, Open edX, and SCORM 2004; *Authoring Tool* for ELO; and *Repository for ELO* (Fig. 1 (b)). The user on the ELO repository can access the working groups which related to themselves and reduce the time consumed about re-creating learning materials and improving production quality.

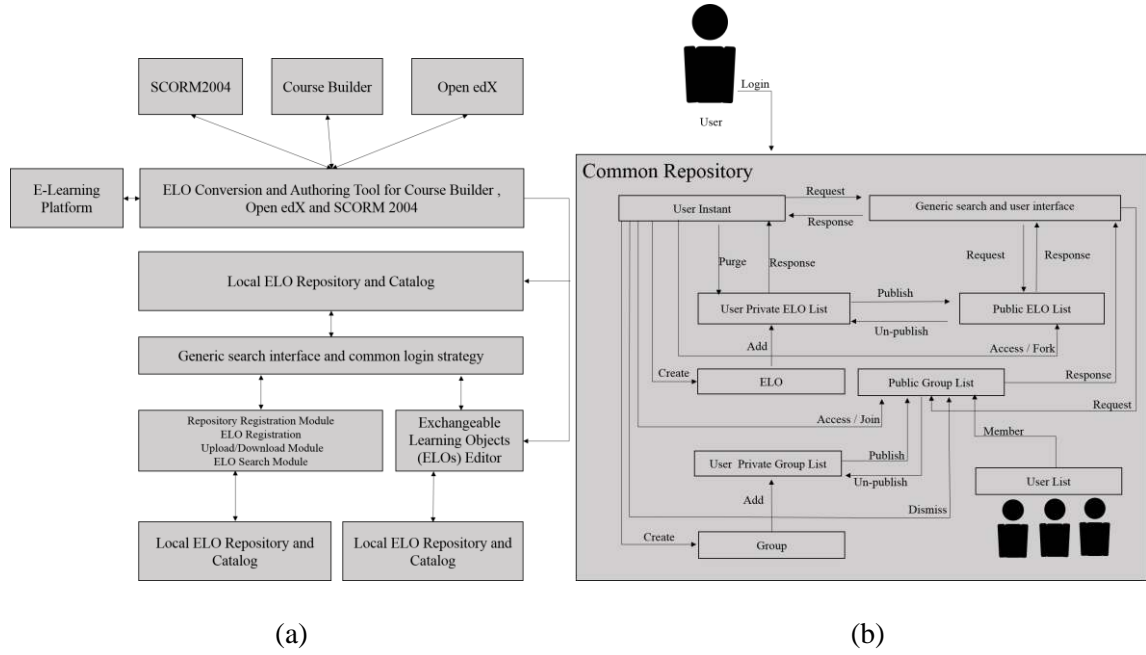


Fig. 1. (a) Overall scope of ELO project, (b) Overall system architecture of Common Repository

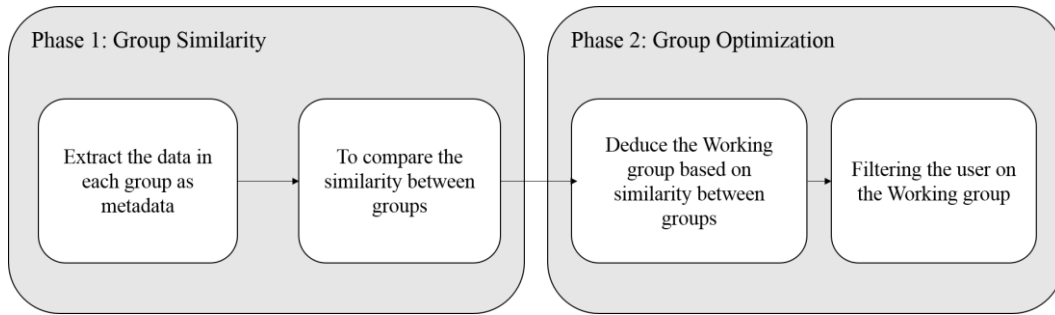


Fig. 3. Overall workflow of the proposed mechanism

The proposed working group construction mechanism for users on Common Repository (CR) can be divided into two phases as, *Group Similarity* and *Group Optimization* (Fig. 3).

Our system is developed with Python and HTML on Ubuntu. The Django framework is used on the server. We use Relational Database (RDB) to store the ELO contents. We postulate n users ($U = \{u_i | i = 1, 2, 3, \dots, n\}$), m ELOs ($L = \{l_i | i = 1, 2, 3, \dots, m\}$), and p groups ($G = \{g_i | i = 1, 2, 3, \dots, p\}$) on CR. Term frequency tf is,

$$tf_{i,j} = \frac{n_{i,j}}{\sum_{k=1}^m n_{i,k}}, \quad (1)$$

where, $n_{i,j}$ is the number of times the metadata M_i appears in a group j . For example, $tf_{\text{Taiwan}} = 17/20 = 0.85$ and $tf_{\text{Australia}} = 3/20 = 0.15$ for a group with 20 people (17 Taiwan and 3 Australia) with a

nation metadata field. Term importance across all groups (Inverse document frequency *idf*) measures whether a term is common or rare across all groups.

$$idf_i = \log \frac{|G|}{|\{j: t_i \in g_j\}|} \quad (2)$$

where, $|G|$ is the total number of groups in the repository and $|\{j: t_i \in g_j\}|$ is the number of groups that contain metadata M_i . For example, $idf_{\text{Taiwan}} = \log|2/2| = 0$ and $idf_{\text{Australia}} = \log|1/2| = 0.3$ for groups with 20 people in each, G1 (17 Taiwan and 3 Australia) and G2 (20 Taiwan). *tf-idf* measures which term is important enough to present a group as,

$$tfidf_{i,j} = \frac{n_{i,j}}{\sum_{k=1}^m n_{i,k}} * \log \frac{|G|}{|\{j: t_i \in g_j\}|} \quad (3)$$

The Jaccard Similarity Coefficient calculates similarity between groups as,

$$J(g_i, g_j) = \frac{|g_i \cap g_j|}{|g_i| + |g_j| - |g_i \cap g_j|} \quad (4)$$

For example, Jaccard Index $j = 2/3 = 0.66$ for two groups G1 and G2, with n attributes (intersection and union of the attributes are 2 and 3). Pearson Correlation Coefficient (PCC) filters out the users that are not related to this working groups (Table 1) as,

$$\rho_{u_i, u_j} = \frac{E[(u_i - \mu_{u_i})(u_j - \mu_{u_j})]}{\sigma_{u_i} \sigma_{u_j}} \quad (5)$$

For example, PCC $p = 0.54773$ for two users, U1 and U2, who have rated four ELOs with the rating history of U1 and U2 are $\{1, 2, 3, 4\}$ and $\{2, 1, 1, 4\}$.

Table 1: The implication for the absolute value of PCC (Meijuan 2013)

The absolute value of PCC	Relevance
1	Perfect correlated
0.7~0.99	Highly correlated
0.4~0.69	Moderately correlated
0.1~0.39	Modestly correlated
0.01~0.09	Weakly correlated
0	Irrelevant

There were 30 simulated users, 50 simulated ELO courses, and four simulated groups on CR.

There were four original groups on CR, Group_1, Group_2, Group_3, and Group_4, with 5, 6, 5, and 6 members consecutively (Fig. 4).

ID	Name	Members
1	Group_1	Incents58 joshbruce851 Gire1986 Mott1961 Therstorted69 Thapt1936 Mined1976
2	Group_2	Pergersuse Timseat Knother Wheript Anorthems1964 Yese1993 Heiset Sheys1978
3	Group_3	Preaccs Awassome Harys1960 Bacracks Hiontion83 Huble1943 Thertheplied
4	Group_4	Experkee Tweeks Offard Squity67 Acep1952 Suraces Fuly1938 Arche1956

Fig. 4. The members of the original group

The proposed working group construction mechanism generated several working groups (Fig. 5).

11	Group_1_Group_4	Incents58 joshbruce851 Gire1986 Mott1961 Therstorted69 Experkee Tweeks Offard Squity67 Acep1952 Suraces
12	Group_2_Group_3	Pergersuse Timseat Knother Wheript Anorthems1964 Yese1993 Preaccs Awassome Harys1960 Bacracks Hiontion83

Fig. 5. The members of the working group

The working groups, Group_1_Group_4 and Group_2_Group_3 has more like-minded persons than the original groups.

We proposed a working group deduction mechanism for users on CR. The proposed mechanism uses text mining technique to analyse the similarity of groups to deduce prototypes of working groups and find the users' preference about ELO based on collaborative filtering so that we can optimize these working group prototypes. For users on the LOR can easily discover the materials that they are interested via accessing the working groups which related to themselves and reduce the time consumed about re-creating learning materials and to improve production quality.

Right to Privacy in Cyberspace: Comparative Perspectives from Sri Lanka and other Jurisdictions

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Abstract

Right to privacy in cyberspace could be considered as a critical issue which has many implications towards individual liberty in the modern world. In view of the incidence of violations of right to privacy through abuse of personal information in cyberspace, it becomes necessary to explore the legal mechanisms that have been employed to address this issue and ensure the right to privacy in cyberspace in Sri Lanka and other comparative jurisdictions.

The first research objective is to identify and examine legal provisions regarding right to privacy in cyberspace at the international level. The second research objective is to identify and analyze laws relating to right to privacy in cyberspace in United Kingdom and compare these legal provisions with Sri Lankan law. Thereby the strengths and weaknesses of the Sri Lankan legal framework regarding right to privacy in cyberspace would be examined and options for necessary reforms would also be suggested. Qualitative research methodology was employed in the research.

The results of the research revealed that right to privacy has been recognized at the international level under UN Guidelines for Regulation of Computerized Personal Data Files (1989) and more recently under UN General Assembly Resolution on Right to Privacy in Digital Age (2013). In UK, the Data Protection Act (1998), Regulation of Investigatory Powers Act (2000) and a series of regulations enacted pursuant to EU Directives assume significance. In spite of the positive features in these statutes, UK approach towards data privacy has been criticized for its inherent lacunas and inconsistencies (Raab & Goold, 2011). In fact, the need to reform UK law according to privacy principles which would result in strengthening the right to privacy in cyberspace within the country has been considered (Raab & Goold, 2011).

On the other hand, it could be seen that Sri Lanka does not recognize right to privacy in its Constitution or in any other specific legislation. In fact, relevant Sri Lankan statutes such as Electronic Transactions Act (2006) and Computer Crimes Act (2007) could be seen to be devoid of specific provisions relating to right to privacy in cyberspace. However, certain legislation in this area contain provisions which are relevant to right to privacy in cyberspace. For example, the Telecommunication Act (1991) has provided that interception of telecommunication transmissions is a punishable offence and it could be seen that preventing or obstructing the transmission of a telecommunication messages or intruding, interfering or accessing telecommunication messages have also been prohibited.

Furthermore, it could be seen that this issue has been addressed to a certain extent through the Computer Crimes Act, which has penalized dealing with unlawfully obtained data, illegal interception of data and unauthorized disclosure of information. In addition, right to privacy has been recognized by the judiciary under the common law of Sri Lanka, where actions have been brought under Roman-Dutch Law. Thus it is evident that in spite of the absence of specific constitutional or legislative recognition of right to privacy, it has been recognized under common law by the Sri Lankan judiciary in a variety of legal contexts. Therefore it is to be seen whether the Sri Lankan courts would recognize this right in relation to protection of personal information in cyberspace.

However, it is asserted that there is a pressing need to reform Sri Lankan law in order to reflect the recent trends at the international level. In spite of the availability of a remedy for violation of right to privacy under the common law of Sri Lanka, statutory recognition of right to privacy in cyberspace would provide for clarity and certainty in this area of law, which would ensure effective legal protection regarding right to privacy in cyberspace in the country.

Keywords: *Right to privacy, data privacy, cyberspace, common law.*

Driver Assist Traffic Signs Detection and Recognition System

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Abstract

Traffic signs or road signs are signs that are initiated at the roads to provide information of the overcoming behavior of the road to drivers and pedestrians. Since 1930s with the increment of the use of vehicles, road signs were introduced in Europe. Latterly many countries have adopted them to standardize their signs to enhance the safety of road users.

Since the number of vehicles is an increasing factor in the world, road traffic became an increasing factor. Specially in urban areas the pedestrian activities at the road is generally high along with the road traffic. It is possible that drivers may lose their concentration to the traffic signs because of closing vehicles and pedestrian activities. There are many notification boards with various colors and textures at road sides. This also may cause the problem that hard to detect the traffic signs clearly to the eyes. Violating traffic signs may cause drivers to make accidents and also unnecessary problems like penalties from the law.

To ensure more safety and convenient drive, automation of traffic signs recognition took apart. Computer Vision is a promising approach for addressing this problem which is an interdisciplinary field that emphasis, how the computers can be made to gain high level understanding from digital images. First automated traffic signs recognition was reported in Japan in 1984. Since then number of methods have been developed for traffic signs detection and recognition.

This paper presents ‘Driver Assist Traffic Signs Detection and Recognition System’ which is capable of detecting, recognizing and indicating traffic signs at the road side to the driver to ensure a safety and convenient drive by acknowledging the behavior of the road.

The proposed system mainly consists with two phases which are detection phase and recognition phase. In both phases I have used classifiers with different technologies which are computer vision image processing techniques and machine learning techniques respectively.

In detection phase I have used a cascade classifier to analyze the each frame of the input to find traffic signs of it. For the purpose of training the classifier I have provided over 3000 positive samples of images with region of interests (ROIs) which includes traffic signs and provided over 15000 negative samples of images which does not include any traffic signs. Haar-like features of the images were used to train the classifier with a proper false alarm rate. Aspect ratio changes for most of 3D objects with the location of the camera. Since the classifier is very sensitive to the aspect

ratio of the traffic sign I have to use many training images as possible to achieve almost all the orientations of traffic signs to the training set of images. The main objective of the detection phase is to classify the presence of traffic signs and return the coordinates of the sign for each frame.

In recognition phase I have used machine learning techniques to train a category classifier support vector machine (SVM) to recognize and indicate the detected traffic signs by the detector.

Histogram of Oriented Gradient (HOG) features were used to train the SVM by extracting the features from the training sets and stores them in separate classes as separate categories. For each coordinate that returned by the detector, used to crop the original frame and make an input image to the category classifier. For each input image the category classifier gives a separate score for each category by matching the HOG features of the image. The highest score gives the nearest category and I have obtained an optimal score value to ensure the accuracy of the recognition phase. The main objective of the recognition phase is to choose the correct category of the detected traffic sign by the detector and indicates the traffic sign category.

In the detection phase I used LBP and HOG as the feature extraction methods along with the Haar like feature and obtained that the higher accurate technique is to use Haar like features. In recognition phase I chose 11 categories of traffic signs for the training process. I have obtained an optimal value of -0.04 as the score for the best accuracy of the recognition phase.

The proposed system can detect, recognize and indicates traffic signs with great accuracy not only at the daylight but at night also and can be implemented to use in any vehicle. Detection process achieves over 88% accuracy and in recognition process accuracy of classify the category of a detected sign is over 98%. In real time testing overall system achieves over 88% of accuracy over 45-50 km/h speed.

Key words: *Computer Vision, Machine Learning, Image Processing, Object Detection, Image Classification*

Android Tablet based Menu and Order Management System for restaurants

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Abstract

The traditional way of taking order services in a restaurant is that, once the customer selects the food and beverages from a paper menu, the waiter uses a pen and paper to take the order. Then the waiter gives the order to the kitchen and the customer has to wait until the order is received. This process is unsatisfactory, low efficient and contain mistakes. The customer may have to wait for a long time until he receives the order. During peak times the waiting time will be much longer. In another situation the waiter might have lost the paper or the waiter's hand writing might be difficult to understand by other people. This may cause the kitchen and the cashier mess up the orders and also may cause calculation errors. On the other hand, the paper menu can be hard to navigate and may be outdated. When the menu has a large number of menu items it makes the menu appear overwhelming to look through. Because of that, customers may not see all the items that they are interested in. When changes in price or item updates are required for the menu, the costs for reprinting and environmental concerns associated with reprinting need to be considered.

Several order service systems that were implemented were studied. Some of them had attractive features, but the user interaction and friendliness of such systems were not satisfactory. These studied systems were analyzed and the attractive features for the order service were identified. These features were implemented such that they are user-friendly.

The main objective of this work was to develop a tablet based restaurant menu and order management system to automate the manual order service system and to overcome the drawbacks of the studied systems. This implemented system contains four systems, a mobile application for customers and three web based systems for the admin panel, kitchen and cashier. The order is taken by a mobile device namely, a tablet placed on the restaurant table which acts as a waiter. The mobile application is started by a waiter, logging into the system and assigning the table number and a waiter identification. The waiter identification and table number are saved in the application until that particular waiter logs out. The mobile application has four subsystems namely, display subsystem, assistance subsystem, commenting subsystem and ordering subsystem. The display subsystem displays the complete restaurant menu by categories, special offers' information and allows the customer to browse all the currently available menu items by category. The assistance subsystem allows the customer to call a waiter 2 for any assistance needed. The commenting subsystem allows customers to create user accounts for adding comments and share experience on Facebook/Twitter. The ordering subsystem allows to select the desired items and make the order.

Once the customer makes the order, first he will be able to view the order information that he has ordered including the payment with/without tax and service charge. After the customer confirms the order, the order is transmitted to the kitchen department via Internet for meal preparation. The kitchen web system displays all order information that are received from the tablets. This include the customer details, table number, the waiter identification and the details of the order. After the order is prepared, the waiter will deliver the order to the customer. At the same time, the cashier web system receives the details of the delivered order and the bill is prepared. The web based admin panel system allows the restaurant's management to add/view/remove/ update menu items and waiters, view reservation information and their cooking status/payment status, update service charge/tax, viewing revenue information over a time period.

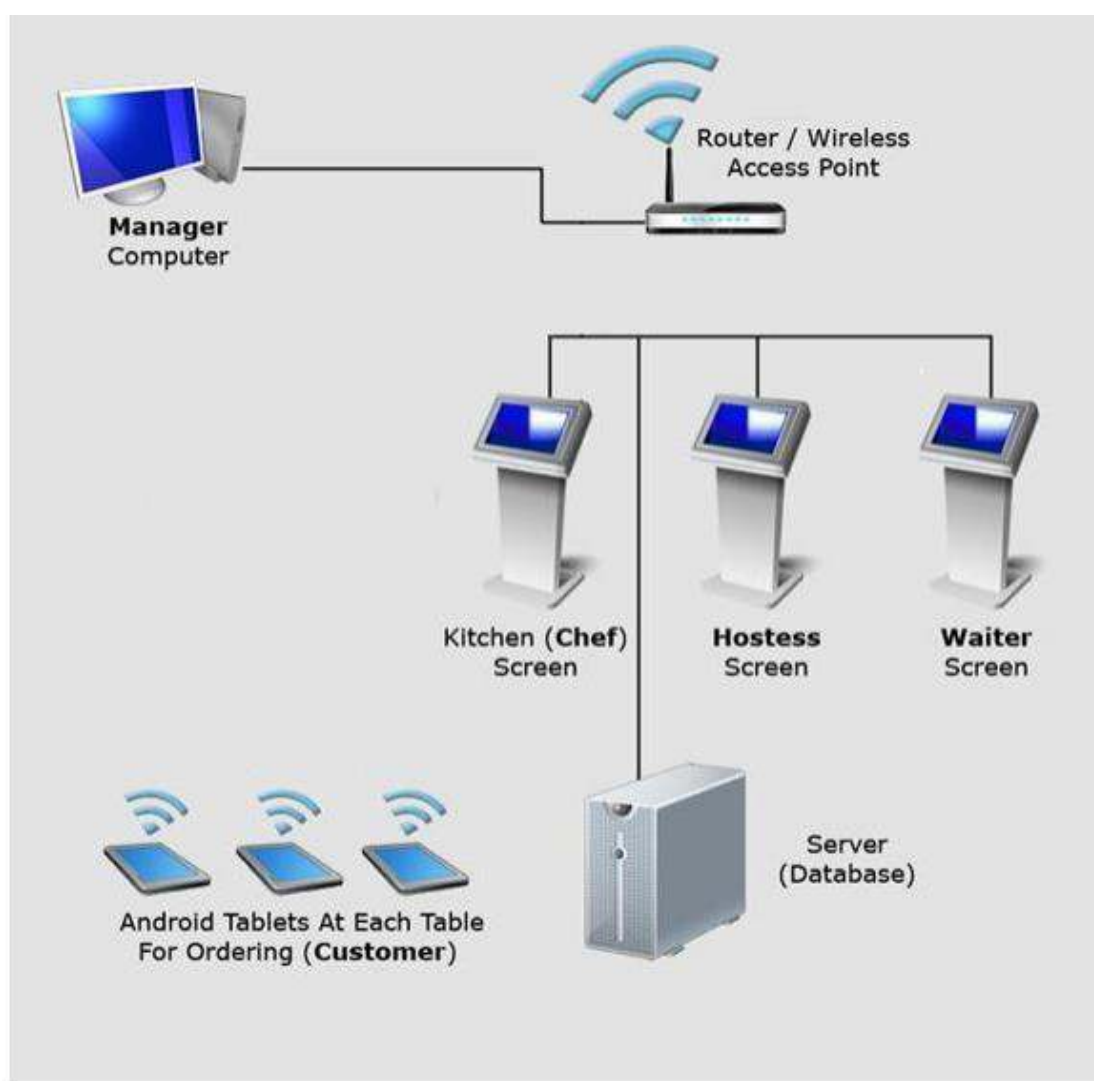


Figure 1: Architecture of the System

The produced design artifacts in this work have covered design concerns including architecture, application behavior and user interface. Figure 1 shows the architecture of the system. The implemented system consists of the server and a central database. The restaurant managers can

access the database using admin panel to make appropriate redeployments for food materials and evaluate the business status at any time. All ordering and expenditure information is stored in a database. This system is designed to be used on android tablets (screen size-7"). It can also be used on smart phones with smaller screen sizes. It is compatible with versions 2.3 and later. Eclipse and phpStorm were used as the IDEs. Mainly used languages are HTML, JavaScript, PHP, JAVA, XML. The system uses PHP to create web service to return JSON data with the 3 server. This implemented system adopted different testing approaches to test the prototype software and discovered bugs during these testing was corrected.

This system provides a more convenient, more maintainable, user-friendliness and accurate method for restaurant management. Other than that, the tablet based menu replace the paper waste, reduce the waiting time and increase the efficiency of the food and beverages order service system. By using this system, the restaurant can reduce the running cost, human errors and provide high quality service as well as enhancing customer relationship.

As future development, features such as paying the bill directly through the menu application should be created. In addition, this application will be developed for other platforms such as Blackberry and iOS.

Keywords: *Restaurant Mobile Application; Android food ordering system; Android Mobile; Android application; Order Management System for restaurants;*

Adopting SDLC in Actual Software Development Environment: A Sri Lankan IT Industry Experience

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Abstract

Systems Development Life Cycle (SDLC) and its variant forms have been around in systems development arena as a steadfast and reliable development approach since 1960s and are still widely used in software development process in information technology (IT) industry. IT industry has been adapting SDLC models as a solution to minimize issues aroused in a large number of failure projects. Though SDLC models powerfully model that software projects undergo some common phases during its development process, most software development organizations in the Sri Lankan IT industry today only use SDLC models as a token to show off their process quality but fail to adhere to them in real-time, thus failing to grasp the real benefits of SDLC approach. This study sought to find the causes behind the practical difficulties of a medium Sri Lankan IT Company to find a fitting SDLC model in their development process and the limitation to adhere to such model-based approach. The research instruments were questionnaires that were administered to a sample frame consisting of employees, experts and the managers. Interview schedules were also used.

The findings of the study indicate that the main cause behind difficulty in finding a fitting model as extreme customer involvement, which causes regular requirements changes. Company concentrates more on winning the customer than following proper requirements definition approaches suggested by SDLC to define clear-cut requirement specifications, which result in inefficient customer interference throughout the development process demanding inconvenient changes to be addressed down the line. Most of the software projects with version releases involve maintenance and bugs fixing while developing the next release. As customers become system users, their demands become more insisting, making maintenance process tedious and development of next phases more challenging. Lack of proper customer management approaches is strongly visible in all areas of development and customer demands cause poor resource management and increased stress on work force. Study findings suggests that the main reasons behind the limitations in companies to follow a proper SDLC approach are: limitations in budget and human resource, unrealistic deadlines, frequent requirements changes, vague project scope definitions, nature of the project (whether offshore or local), need of using new technologies yet lack of timely availability of knowledge expertise, project team diversity and company's own business model interfering the project dynamics. Future work will focus on further investigations incorporating number of Sri Lankan IT companies covering all ranges of business magnitudes.

Keywords: *Adopting SDLC, Sri Lankan IT Industry, Limitations of adopting SDLC approach*

Augmented Reality and its possibilities in Agriculture (In Sri Lankan Context)

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Abstract

Since Sri Lanka is an agro country, its economy is mostly based on agriculture and agro based industries, animal husbandry and other agriculture based businesses. In Sri Lanka, Agriculture continues to be the major occupation and way of life for more than half of the total population. Since information technology and Internet network have become essential part in business processes recently it has considerable influence to be used in agriculture in the process of development. Nowadays the Internet-based applications are more and more successful in agriculture and different parts of the food industry. When it comes to information technology field the emerging trend is Augmented Reality (AR). The field of Augmented Reality (AR) has existed for just over one decade, but the growth and rapid progress in the past few years has been remarkable. The basic goal of an AR system is to enhance the user's perception and interaction with the real world through virtual objects. There are several application areas, such as extension services, precision agriculture, E-commerce and information services where augmented reality can be used. When it comes to the application areas of technology Agriculture is an area where advanced technology is always introduced with a delay. This research analyze on how augmented reality can be used in agriculture. Certain applications of the AR in agriculture are already present in European countries, but it's still in the infant stage in Asian countries especially in south Asian countries. In Sri Lanka many opportunities to use these techniques in agriculture can be predicted. Following are some instances of possibility of applications of AR in agriculture. The research areas such as In Sri Lanka many agricultural research centers like Sri Lanka Council for Agricultural Research, Gannoruwa Agricultural Complex, Agricultural Research and Development Centre exist where enrichment of an image becomes necessary. Here AR can be used to add dimension lines, coordinate systems, descriptions and other virtual objects to improve investigation and analyze of the captured images. Another aspect where the AR probably will visit in the near future is the cabin of modern agricultural machinery and mobile machinery. Some components of this system already exist and are being used in the form of simple displays that show the use of GPS. Adding the large displays or special glasses, where on the image fields will be imposed lines drawn by the computer which are showing the way for passage or plot boundaries, is a logical development of existing solutions. The third area is animal Husbandry and farming. A system of AR can be developed and installed in the farms of Sri Lanka for farm monitoring. Use of suitable software may allow determining individual pieces on the screen, with simultaneous administration of the relevant information about them. The following can be shown. The data insertion, information about the

health status of farm animals, etc. Finally in crop production it is possible to identify plants with a camera and appropriate AR system. This gives the ability to detect pests and to plan appropriate protective procedures. While studying the use of Augmented Reality technology in agriculture, it can be concluded that different types of services offer different possibilities. Mobile systems develop very dynamically both in regards to the speed of data transmission and services. New devices like tablets and new services like Cloud Computing, Near Field Communication (NFC) have great potential in agriculture. Augmented Reality can be allied with all those technologies and expands the possibilities to evolve towards a new era in agriculture in Sri Lankan agro farms. However, the whole assessment of topic must not be done only on the basis of the technology and taken out of its environment randomly, since the whole area is very complex, this paper focuses on finding and analyzing what is Augmented Reality and tries to highlight the possibilities in agriculture.

Keywords: *Augmented Reality, Agriculture*

Optimizing the Member Selection for Ensembles of Classifiers: An Application of Rainfall Forecasting in Sri Lanka

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Abstract

A collection of classifiers trained to do the same task is called an ensemble of classifiers. Ensembles can be created using a set of classifiers of the same type or using a set of classifiers in different types (Artificial Neural Networks (ANN), Support Vector Machines (SVM), Decision Trees, ect.). The generalization ability of an ensemble is significantly increased than that of a single classifier. To achieve increased generalization ability the members of an ensemble has to be accurate (able to produce correct forecast) and diverse (errors in different regions of the error space). However accuracy and diversity are two conflicting conditions that have to be balanced carefully to achieve good performance. Thus members for an ensemble need to be selected carefully in order for them to have the perfect balance between accuracy and diversity. This study aims to optimize the member selection for the ensembles using Genetic Algorithms (GA) to increase the ensemble performance in the context of time series forecasting. The selected application is rainfall forecasting in Sri Lanka. Rainfall is very difficult to forecast accurately because it is a very complex hydrological process. Forecasting rainfall requires manipulating huge datasets with large number of variables. But accurate rainfall forecasts are in high demand because of the close relationship rainfall has with human life.

There are three steps in creating an ensemble; creating the pool of classifiers, selecting the members for the ensemble from the pool and combining the selected members using a combiner method. The performance of the ensemble depends on the techniques used in each of these steps. First a pool of classifiers, including different types of classifiers such as SVM, Back Propagation Network (BPN), Radial Basis Function Network (RBFN) and Generalized Regression Neural Network (GRNN) was created by training the classifiers using different training data. Then a number of ensembles were created by selecting different combinations of classifiers from the pool randomly and combining them using a separate GRNN. These ensembles were the initial population of the GA. A simple binary genetic algorithm was then used to create new generations of ensembles and find the ensemble that gave the best result. The fitness of the ensembles were calculated to balance the accuracy and the diversity of the ensemble. The chromosomes were ranked and sorted according to their fitness. Then, the mating pool was prepared by selecting the chromosomes with highest fitness and the pairs were selected using roulette wheel rank weighting. Mating took place using one point crossover with 0.6 crossover probability and the new generation was mutated with 0.1 mutation probability. To train and test the models rainfall data from 1961 to 2001 (41 years) of Colombo, Sri

Lanka is used. Input data set consisted of 26 variables obtained from the NCEP_1961-2001 dataset and the output data was daily rainfall of Colombo. The dataset was partitioned to training data (first 60%), validation data (next 20%) and testing data (the remaining, more recent 20%). To create different training datasets from the available training data moving block bootstrap method was used. The dataset containing 10958 records was split into 9863 overlapping blocks of length 1096 and out of these 9863 blocks 10 blocks were selected to train each classifier. To validate the proposed method another two ensembles were created using two well known ensemble creation methods bagging and boosting. The performance of the best ensemble (ENN-GA) was compared with the performance of a single SVM, BPN, RBFN, GRNN, the best performing ensemble in the initial population (ENN), bagging model and the boosting model. Forecasting accuracy of each model was measured for the test dataset using Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and the Coefficient of Determination (R^2).

The best performing ensemble comprised of two SVM, three BPN, two RBFN and five GRNN. The number of generations for convergence was 287. The following table summarizes the results for individual classifiers, ENN, bagging, boosting and ENN-GA.

Classifier Type	SVM	BPN	RBFN	GRNN	ENN	Bagging	Boosting	ENN-GA
RMSE	9.21	9.44	8.69	8.22	8.16	8.11	8.04	7.99
MAE	5.44	5.36	5.04	4.76	4.98	5.14	4.77	4.67
R²	0.50	0.47	0.55	0.60	0.55	0.54	0.58	0.61
T-Critical two-tail	1.960554664	1.960554811	1.960554811	1.960554811	1.960558216	1.960558365	1.960557621	1.960562414
run time (s)	1	1	1	<1	2	2	2	2

The proposed model ENN-GA gave more accurate results than the single classifiers used in the study with smaller RMSE and MAE values and larger R^2 and the time and space requirements were very small. The proposed model managed to predict the overall rainfall with reasonable accuracy; zero rainfall accurately, smaller rainfall with slight differences and some higher rainfall with considerable differences. These higher differences were obtained for very high rainfall that occurred suddenly. Although the number of these occurrences were very few the difference between the actual and forecasted rainfall was high. The RMSE values were larger compared to MAE values because the errors in high rainfall were magnified in RMSE.

The proposed method outperform the single classifiers, ENN model and bagging and boosting models in forecasting rainfall for Colombo, Sri Lanka.

Keywords: *Artificial Neural Network, Ensembles, Genetic Algorithms, Time Series Forecasting*

Low Cost Electronic Stethoscope

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Abstract

Among many medical devices, stethoscope is the most widely used device for medical diagnosis. Auscultation is a non-invasive, pain less, quick procedure that can identify many symptoms and was used as early as 18th century. However, major drawbacks of conventional stethoscope are extremely low sound level and lack of ability to record or share the heart and lung sounds. These problems can be overcome by an electronic stethoscope and have the potential to save many lives. Although electronics stethoscopes are already available in the market, these are very expensive. Therefore, objective of the project was to build a low cost electronic. At the basic level, it would facilitate listening to the heart sounds more clearly. Among other facilities is the ability to control the sound level, to record the sound and share as digital information and also to display the sound using graphs for improved diagnostics. Recording and sharing facilities were included due to the importance of tracking patient's medical history, and also to discuss among group of physicians. It can also facilitate remote diagnostics where experts may not be readily available. 50 mm sized chest piece of an acoustic stethoscope was used as the chest piece due to its optimized design. Chest piece's diaphragm was placed against the chest of the patient to capture heart sounds. Those sounds were converted to electronic signals by a microphone. Electret condenser microphone was selected from several other types of microphones due to the smaller size (radius 3 mm) and ability to detect the low frequency sounds (~ 30 Hz). Those electrical signals were amplified by the pre amplifier. TL072 integrated circuit was used as a pre operational amplifier. It provided a gain of 3.8. Output signal of the preamplifier circuit was sent to the Sallenkey low pass filter circuit. It filtered the first heart sound (S1, from 30 Hz to 45 Hz), and second heart sound (S2, 50 Hz to 70 Hz). Filtering was done by setting the cut off frequency as 100 Hz and that value was given by the capacitor values 0.047 μ F and resistor value 33 k Ω . Getting the advantage of TL072 being a dual operational amplifiers in the single die, second operational amplifier was for the filter circuit. Output signal of the filter circuits was amplified to the appropriate amplitude by using audio power amplifier for the headphones and speakers. LM386 integrated circuit was used as the audio power amp. It provided an gain about 20. Speakers and headphones were used as the output. Facility was provided to use any standard 3.5 mm headphones. Constructed circuit was validated by, comparing the original heart sound and amplified output via a digital oscilloscope. Once the implementation was completed, it was compared for the sound quality against an acoustic stethoscope by six independent observers. Five of them heard the heart sounds more clearly by the electronics stethoscope than the acoustic stethoscope. Accuracy of the heart sound was consolidated by a

person who has grip knowledge about anatomy. Recording facility was provided using open source software “audacity” and using the computer audio card to capture the sound. Saved file of the heart sound can be used in several ways such as; it can be stored in a database, can be share via e mail and also for play back for further examine in diagnosing process. Heart sounds were visualized as a graph on the computer. An Arduino was used to digitize (1024 resolution) the audio signal and send the data through virtual com port to the computer for graphing. It can also be used to record sounds to an SD card when a computer is not available. As a result similar sound quality has been found when comparing between direct listening and a recorded sound. In conclusion, the implemented system was considered a success due to low cost, ease of implementation and the ability to provide the most useful functions required from an electronic stethoscope.

Keywords: *Electronic Stethoscope, Heart Sounds, Auscultation*

MySight – A New Vision for the Blind Community

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Abstract

People read newspapers, books, articles and many other materials every day. It is a basic human need which is forbidden for blind people by nature. Sometimes, braille education might be the ultimate solution for such person. As stated by The National Federation of the Blind (NFB), less than 10% of the blind children are engaging with braille reading in United States. Every year a lot of people lose their vision fully or partially. According to the findings, diabetics is one of the major causes for blindness and nowadays it is spreading rapidly. Therefore, the present consequence is significant regarding the blindness. According to NFB, most of the blind people are unemployed and a lot of blind students give up their studies due to the difficulty of learning. The problem is that there are not enough teachers to teach Braille system and also the learning of Braille system is really hard. Therefore, it is feasible to find a method such that a blind person could read newspapers, textbooks, bills, etc. without the braille system. There are several smart applications available which use internet connection to find the Portable Document Format (PDF) of the particular newspaper, book or document and then reads that PDF document audibly. But the problem is that they require the PDF document of the particular reading material to be on the internet available in PDF format which is not practical when all the books have no PDF versions. Currently AIRS-LA, BARD MOBILE, iBlink Radio, NFB Newslite, Voice Dream Reader are the top five applications for the usage of the blind community. Since, they need an internet connection and use huge amounts of data, it is not suitable for real time reading. The problem is if a blind person wants to read something in an area which does not have an internet connection, he cannot use any of the mentioned applications. Therefore, there is a great necessity of an application which is portable, effective and work in an offline environment. This research is completely focused on finding a way which could let the blind people to expose to a new kind of reading. The main objective of this research was to develop an android application which could identify words and various kinds of symbols written using a standard font in a given document, and then convert them into an audible format such that a blind person could understand. It also should be easy to use by a blind person by providing voice notifications and smart touch techniques. “MySight” is a revolutionary application which could change the entire reading and learning techniques of a blind person. This would replace the braille system currently used by the blind people and let them read and learn effectively and easily. The application was designed in such a way that a blind person could simply get handled with its functionalities and experience the maximum benefit. Also, this can be considered as a method which could let them read like a normal person.

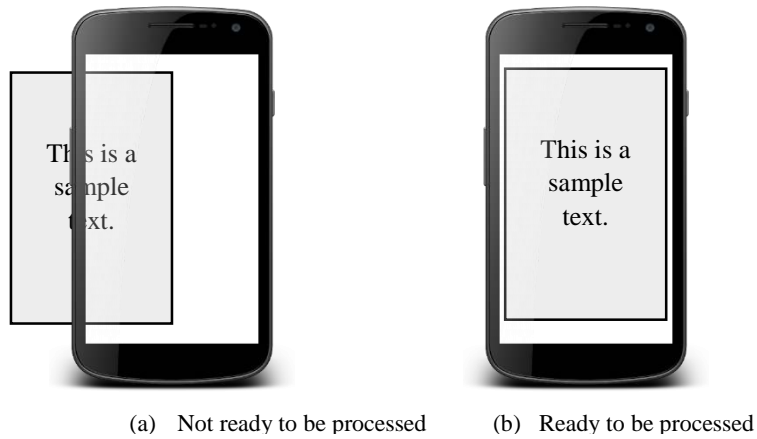


Fig. 1. Before capturing the text

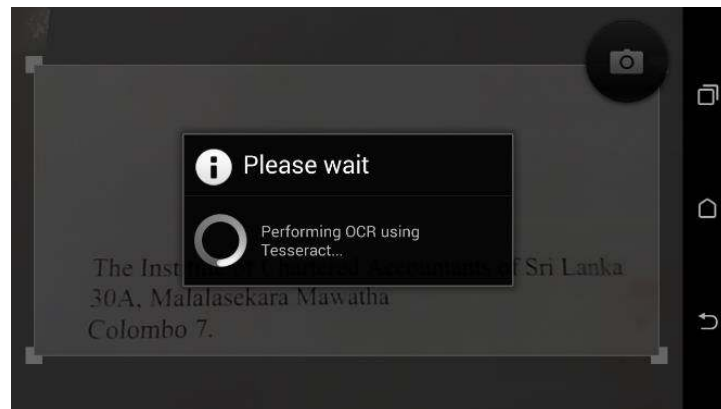
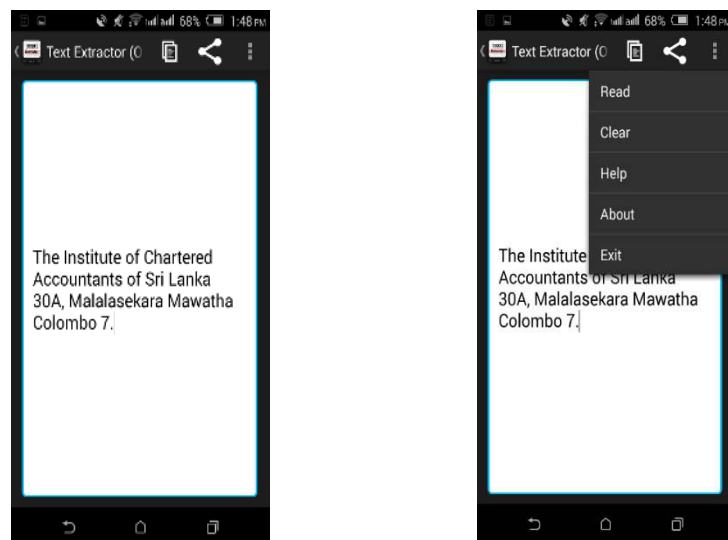


Fig. 2. Capturing the text



a) Detected text (b) Available text operations

Fig. 3. After capturing the text

The first step was to find an appropriate and efficient Optical Character Recognition (OCR) technique which compatible with the Android platform. In order to fulfill that requirement, the Tesseract OCR library was used. The reason behind choosing Tesseract is, now it has become a leading commercial engine because of its accuracy. The next step was interface designing. Fig.2 shows how the application captures the text. Fig.3 (a) shows the interface after detecting the text and the Fig.3 (b) shows the text operations that can be performed once it detects the text. Once the OCR implementation completed, the application can detect the text using the captured image. At the same time it can convert the text as a sound output through the mobile phone speaker or headset. For the future improvements, the application should be enhanced to guide the blind person to capture the image of a paper or a page of a book. If the four borders of the page are not captured, the application should say the user to move in the corresponding direction. Fig.1 (a) shows the page which is not fully detected to mobile camera. In that situation the border of the page can be identified using the edge detection. If the four borders of the page are not presented in camera preview, it indicates that the page is not ready to be processed. The adjustment can be identified using the distance from the edges. Then the user can be notified by giving a sound output asking to move to left, right, forward or backward until the image is ready to be processed as in Fig.1 (b). For the above improvements, OpenCV library is going to be used for edge detection and the smart voice commands for giving instructions to the blind person. Furthermore, the application will be tested with the blind community to evaluate the applicability and the effectiveness of the application in the real environment.

Keywords: *Text-to-Speech, Blind community, OCR, Android, Tesseract*

AWRSMS: An Approach to Enhance Apparel Warehousing and Retailing through IoT

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Abstract

When considering about the modern trends of the Information and technology field; Internet of Things (IoT) is one of the pivotal and emerging technology. In human dependent existing systems such analysis can be done only if someone runs a query and checks for it. When it comes to Warehousing and storage industry, manually collected data are sent to an Enterprise Resource Planning (ERP) system or to a warehouse management system. These systems have some limitations such as mismatches of issuing stock, problems in handling the inventory items and placing them in the warehouse. Warehouse management system manages all the functions in a warehouse but both the systems use manual methods to collect data, such as barcodes. So errors are occurred when entering large number of data into the system. Even a well trained staff member can fail due to common human failures such as fatigue. There's a very less number of systems which are fully automated, convert captured data into information in real time and these systems are not able to control both warehouse's and retail shop's functions. Moreover any of these are not using new methods to do customer promotion. To give a comprehensive solution to limitations of existing systems the above mentioned Apparel Warehouse and Retail Shop Management System (AWRSMS) is developed. The system manages the functions in both warehouse and retail shop in apparel industry. It involves organizing, automating and synchronizing the activities of these both places in effective and efficient manner, using the technology IoT. In this system, all the data about stocks, incoming goods, dispatching items, will be collected using Radio Frequency Identification (RFID) tags and readers and collected data will be sent to the system's database which stored in a web server. By using these data the system executes several functions such as providing details of returns, new arrivals and dispatched items, mismatch of dispatch, available items, details about stock updates and selected items with relevant reports. This system is implemented as three major modules; web application, data capturing module and customer promotion module. The promotion module enables the location based promotion process inside the retail shop and it is one of a newest and significant function included in AWRSMS. It is a combination of mobile application and a web application. In this module the marketing manager can add promotions into the database using web application. Through the mobile application customer receives the ongoing promotion details. In this process when a customer comes near to the particular sales area which has an ongoing sales promotion, system detects the customer's phone and send the promotion message to them, using IoT beacons. Mobile application installed in customer's phone continuously searches for beacon

ranges, connect with them and receives relevant promotion messages using Bluetooth Low Energy (BLE) signals transmitted by the beacons. Android studio, JAVA and XML are used as developing tools of the promotion module. Rest of the system is developed using spring framework, Java EE, Hibernate framework and MYSQL. Testing and evaluation was carried out in three procedures to verify whether the system has achieved the intended objectives. First one is the module testing, done by dividing each main function as a module and tested their functionalities, evaluated with intended results immediately after completing each module. White box testing methods were used to carry out the module testing. Test cases have been designed for each module and testing was carried out based on them. Statement coverage for all the test cases was within 85%-100%. All the modules of main web application got 100% accuracy level, Promotion module achieved 96% and data capturing module obtained 82% of accuracy level. After integrating each module, the final testing phase was carried out by using black box testing. All the modules of web application achieved 100%, promotion module 98% and data capturing module 76% of accuracy level. To ensure that the user requirements were achieved as intended, a questionnaire have been given to a selected sample which consist of 50 members, including AWRSMS's end customers, people who are knowledgeable of technology and management, and people who aren't. Questions of this questionnaire categorized under user friendliness, user experience, functionality, suggestion and recommendation. Questions made under user friendliness and user experiences mainly focused the end users who are not expert in technology to measure the usability of the system. The selected users had to comment by using the system without knowing the inside functions. Then the functionality section mainly focused the technological people who tested the overall system. The intention was to figure out the relevancy and compatibility of each and every function with user requirements. Suggestions and the recommendation sections were carried to explore the further improvements. The positive feedbacks which have been gained by user friendliness of AWRSMS is 80% and 78%, 84%, 76 % was obtained for recommendation, user experience, and functionality respectively. 64% of the sample gave suggestion to upgrade the functionalities. When comparing aims objectives and gathered outcomes of the system AWRSMS has been completed in intended and successful manner. By obtaining the required resources and doing further improvements such as using industry level RFIDs, and improving mobile application by adding more features and developing it also for IOS platform, the Apparel Warehouse and Retail shop management system will be an ultramodern and significant approach for the Apparel industry.

Keywords: *IoT, ERP, AWRSMS, RFID, IoT beacons*

Cost Effective High Availability Transparent Web Caching with Content Filtering for University of Kelaniya, Sri Lanka

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Abstract

The rapid growth of Internet usage at University of Kelaniya with the concept of “Bring Your Own Device” have increased issues with traditional proxy systems. The key problem is to introduce a suitable web caching system with content filtering which will enable end users to access internet without setting up proxy server details on their devices.

On this study it is intended to analyse the network flow of University of Kelaniya and introduce a transparent system which will cache and filter the content according to university’s existing policies. The implementation should be a cost effective and a high availability caching mechanism which will allow users to browse internet without changing their browser settings.

This will introduce a free and open source proxy system “Squid” and a content filtering system, “DansGuardian” on two dual NIC Linux boxes based on Ubuntu operating system and will be placed between Local Area Network and the firewall. Squid is a FOSS proxy widely used in the community as a traditional proxy provider. In this scenario squid will be configured as a transparent proxy which will listen on port 3128, using Linux IP tables all http traffic coming to LAN side interface will be redirected to port 8080. Default gateway for the servers will be the firewall while all internal subnets will be routed to LAN L3 devices by the servers. Between L3 device and servers, load balancing will be done based on port grouping. Before forwarding cached traffic according to squid rules, they will be checked against the content filtering policies of DansGuardian which listens on port 8080. Once content filtering is done it will be sent to the requester. End users are configured with DHCP and with No-Proxy browser settings and therefore they may not notice any traditional proxy as all caching and filtering will be transparent to the users.

After testing and fine tuning wireless users for 2 months, the system was integrated for the whole network. As an influencer for BYOD, removing existing proxy settings enabled any authorized user to access the Internet through the local network. Number of detected end computers were drastically rising and therefore high bandwidth necessity was also going up. Analysing loading times and bandwidth peaks, it was confirmed that the system was stable. This made the subscribed Internet use rise up to 100% on peak times and more than 50% on off peak compared to 80% and 10% record for the traditional proxy. User comments were also positive than for the previous system as now they can bring their devices and do the browsing without consulting IT helpdesk for the proxy

settings. Implementation of the transparent proxy in University of Kelaniya was the first long term transparent proxy installations in a Sri Lankan University which influenced other institutes to adopt the concept. Only downfall was this implemented system cannot detect or cache https traffic which were encrypted.

Web caching and content filtering is crucial when it comes to network bandwidth considerations. In a university it has to be done with saving advantages for Education. The implemented system is a cost effective and reliable solution to address the problem on government and educational background. This will allow any authorized user to access network with their own device without any major changes.

Keywords: *Computer Network, Web Caching, Content Filtering, Transparent Proxy, Load Balancing.*

An Automated Solution for the Postal Service in Sri Lanka

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Abstract

The significant development in the field of e-commerce is becoming the only option for many business activities. Even though, most of the businesses use numerous technological advancement in the modern world, the postal centers in Sri Lanka are still operating in manually and it face abundant challenge of dealing with postal activities manually such as parcel handling, selling postal products, etc. The primary reason for the issue is the lack of human resources in the postal centers. The main objective of this research is to implement an automated solution to overcome the current loosing ends in traditional postal service in Sri Lanka. Based on requirements and feasibility analysis, system mainly covers mails/parcels scheduling and domestic tracking system for the customer to track their mails or packagers which post through the postal service. The online shopping cart function for service communication locales (Post Shops) would be able to sell their products and the e-post card creator function would be able to send post cards via internet. Customers would be ensure the secure online transactions with the online payment gateway. The research strategy shows the importance of the automation for Sri Lanka postal sector. Therefore, after conducting the research, it aims to address almost all the activities related to postal sector with user friendliness and accurate.

Keywords: *Sri Lanka postal service, E-commerce, E-post card, Domestic mail tracking*

Student Attendance Management System Based on Fingerprint Recognition

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Abstract

During lectures in the university, traditionally students' attendance is taken manually by using attendance sheets given by lecturer in class and not by an automated system. At the end of the semester, the students' attendance is used in calculating the final grade of each subject. Supporting staff manually input attendance data into excel sheets based on signature lists collected during lecture hours. This manual method requires a lot of stationery materials. It will be a tedious job to maintain the record by the user and the retrieval of the information is not as well. Hence, this manual process consumes a lot of human and physical resources, and has many disadvantages such as, expensive and time consuming data entry process, large manual data insertions prone to errors, sometimes lecturers find it inconvenient to track and analyze attendance registry due to dishonest behaviors of students and lack of automated system. The lecturers are responsible to monitor all the students' attendance for the whole semester and it is apparent that the current manual process is highly inefficient. Because of this problem, an automated system is needed in order to reduce the human intervention and the physical resources used in recording the attendance of the students more accurately and efficiently and to forward the attendance to final grading process. This manual system was analyzed and identified the necessary features for the automated system as functional and non-functional requirements. As a result, this implemented system is mainly comprised of development of student attendance management system using fingerprint authentication. A fingerprint device will be provided at each lecture hall at the faculty. This system will record the attendance of students in class when the class begins. The main objectives for this study were to reduce the paper usage, avoid human errors, compare efficiency between the proposed system and the manual system, generate effective reports, and use various sensor technologies to enhance the User Interface experience. The implemented system significance can be discussed from three perspectives such as faculty, lecturers, and students. This system can keep the track of students, courses, time table details etc. This system can only be accessed by the authorized people and there are different privilege categories. Student Attendance Management System provides useful analysis graphs for lecturers with other calculation processes and flexible report for all students.

To fulfill all analysed requirements, the system consists of three modules. The first module allows the system administrator (admin) to log into his account and to accomplish the functions such as, adding new students, modifying students' information and deleting students, adding new course modules and modifying/deleting course details, enrolling students in courses, marking student

attendance, adding students' tutorial marks, practical marks and final marks for each course modules, generating attendance reports, result sheets for each course and each student. Furthermore, reports can be printed or sent via email, generating data analysis graphs for each course unit, managing time table details, adding new users and modifying user information, provision to change login password. The second module of this system defines itself in terms of being used by the lecturers. Lecturer has to enter their login user name and password in system. There are the privileges for lecturers provided by the system such as only view the students' details, mark students' attendance/tutorial marks/practical marks/final marks can only be entered by the relevant lecturer, generate attendance reports and can be printed, view time table details, change login password, send special notices to the admin. The last module is for the students. This module provides a web based system for students with the privileges such as view their personal details, time tables, his/her attendance details and results.

Student Attendance Management System uses JAVA to implement the front-end and has connectivity with MySQL. The implemented system is based on the database, object oriented and networking techniques. With the Fingerprint module, can check fingerprint, while up to 600 fingerprint memories and 60,000 transaction records contained. It can also get information out of it, because the fingerprint machine supported USB cable and USB Flash Drive both. NetBeans used as the IDEs. Mainly used languages are JAVA, JavaScript, PHP. Student Attendance System consists of a server and a central database. The system administrator can access the database using admin panel. Test cases were created for each criterion and Simple Unit Tests, System Testing, Integration Testing, Security Testing and Performance Testing were successfully done to check all the functional requirements.

After analysis of this system's goal and research direction, a set of objectives were established, such as implementing the attendance system with N-tier architecture, testing the software in a real environment, generating effective reports like attendance reports/results sheets. Implemented system is faster and more accurate than the existing system.

As the future work, I am planning to implement the fingerprint machine using a GT-511C1 fingerprint scanner and Arduino and also using Wi-Fi shield fingerprint machine can be passed among the students during the lecturer. Further, the efficiency of this automated system can be enhanced using the Multi Agent Technology introducing different software agents who bare distinct responsibilities within the system. Finally, this system can be integrated into current information system used within the faculties in the university.

Keywords: *Students Attendance Management System, Fingerprint recognition, Calculating Final Grades, Report Generating, Software Testing*

Investigation on the Adaptation of Business Intelligence and Analytics in Sri Lankan Supermarket Sector Organizations

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Abstract

In the era of the fast moving technology, every company and firm try to get the competitive advantage over the other firms in participating actively in the competition of the market. As the businesses get larger and distributed, the data collected each day rise from megabytes to terabytes each day. Increasing amounts of data give the opportunity to companies to use analytics to understand the hidden patterns in the data they collect and harness valuable business insights to gain competitive advantage. We present the results of a study on the adoption of business analytics in the Sri Lankan supermarket industry conducted to evaluate their readiness to use the state of the art business intelligence technologies available today.

The main reasons for selecting supermarket sector over another industry is due to the nature of transactions, volume of transactions, high competitiveness, requirement for analysis, proven ability to get good results by using business intelligence techniques, loyalty card systems, the huge volume of customer data and transaction data collected each day are significant. Furthermore, the supermarket sector exhibits a huge competition among the three leading conglomerates and one appearing conglomerate. In order to gain competitive advantage these companies should understand the patterns hidden among these data such as the behaviors of their consumers and the trends in the market. However, it is unknown whether they are adequately and successfully adopting the business intelligence technologies for competitive advantage even though they have sufficient data assets.

Through a through literature review the factors were identified that should be considered related to assessing the readiness of a company for business intelligence and analytics. A questionnaire was made based on the review of literature elaborating the seven factor model referred as “BI readiness Assessment” which can be used to determine the states of various issues related to organization’s ability to utilize BI. “BI readiness Assessment” describes seven readiness factors, which they have also referred as potential barriers to the ability to deploy BI. We used this model, originally developed for the context of the United Kingdom, for the context of Sri Lanka and thereby evaluated the Sri Lankan supermarket sector organizations in terms of the seven factors of BI readiness to understand the overall readiness and adoption of analytics.

The research was designed as a case based qualitative research in which all identified leading supermarket sector conglomerates were analyzed as cases. The four leading conglomerates were identified based on their variety as well as annual turnover and the government owned Supermarket

Company. Extensive open ended interviews with IT managers and the heads of BI departments of the respective organizations based on the questionnaire developed were used to collect data to develop the cases. The questions covered the seven factors of the model, in order to verify each a set of open ended questions were defines and gathered details through answers.

Qualitative data that had been received is translated into useful information through context analysis. The questions under each seven factors considered are translated to numerical values and given the ranks according to Mann–Whitney U-test. The ranks for the main seven factors are derived then with the weighted average for each point. By comparison of the ranks the results are derived.

In Sri Lanka there are only five main supermarket chains and all of them are interviewed, and gathered details. So the coverage is 100%. Four of them belong to private sector two of them are part of the big conglomerates, the other one is owned by the government of Sri Lanka. In the study we came across with different levels of usage of business analytics; Firm 1 is using query processing for analytics, Firm 2 is using a business intelligence tool, Firm 3 is having a stable ERP culture in which they perform analytics as well as an ongoing project to implement a BI system based on Hanna, Firm 4 is having a strong infrastructure design but still in the process of implementing the infrastructure and the Firm 5 shows as an outlier, which doesn't uses any business intelligence or analytics, the firm is still in the process of getting point of sales systems all outlets, from all details of stores all over the country nothing is collected and put into a common system or linked. The summary of our analysis based on the seven-factor model is given in Table 1. As per the methodology I used the qualitative analysis

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5
Strategic alignment	Average	Good	Good	Good	Bad
Continuous process development	Average	Average	Good	Average	Bad
Culture around use of information and analytics	Good	Good	Good	Good	Bad
Decision process engineering culture	Average	Average	Average	Average	Bad
BI technical readiness	Good	Better	Better	Good	Bad
DW technical readiness	Average	Average	Average	Average	Bad
Functional use of BI	Average	Good	Good	Good	Bad
Business: IT partnership	Good	Good	Good	Good	Bad

Table 1: Summary of the Analysis

As shown by the summary of the analysis, it is clear that all large-scale supermarket sector companies use and utilize BI and analytics for a considerable scale, hence their sufficiently ready for the analytics world. However, the world is now moving in to the world of “big data”, which is largely characterized by unstructured data and, investigating the readiness of these companies for analytics in the big data world would be an interesting future research that extend this study. Our study indicates that except “Firm3”, the other firms are not ready to analyze big data yet.

Keywords: *Business Intelligence, Business Analytics, Super Market*

Data mining approach for Sales Prediction

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Abstract

Nowadays predictive analysis is more popular among companies to improve their business profits. Those companies differentiate what they do from “Data Mining”. The characteristic deduction is that data mining is limited to the discovery of patterns, whereas predictive analytics allows the application of the patterns to new data to predict unknown values. The main aim of data mining is to extract knowledge from the data at hand, increasing its intrinsic value and making the data useful.

Today most business areas using many strategies to improve their business profits. They are mostly use traditional methods. Therefore, the company’s efficiency and profitability, goes to the critical situation. When considering today’s business arena, the most important things are good efficiency and correct strategies for a business. Converting to the new technologies companies can achieve their business goals and they can reveal their sales life-cycle.

This research proposes for a medium scale tyre dealing company which is situated in Colombo. It is important to company to accurately predict their future order details and salary income before having unprofitable occasion. Company could conduct sufficient stock when talking prediction support. That is the best solution to reduce time, save importing cost, growth for income and manage resources.

Data mining algorithms and techniques used for the prediction process and used MS SQL Server 2008 R2 with Analysis Server and Business Intelligent Development Studio for modeling process. Analysis Services contains number of standard data mining algorithms. Decision Tree, Neural Network and Clustering data mining models were attempted for the prediction. Decision Tree is a graph of decisions and their possible consequences, represented in form of branches and nodes. A Neural Network is a parallel distributed processor that has a propensity for experiential knowledge and making it available for users. Clustering is used to place data elements into related groups without advance knowledge of the group definitions. The best algorithm was selected for each model and it focused on five main attributes which were referred to as factors affecting a sales process such as Item Code, Item Type, Item Quantity, Item Value, Item Sold Date, etc. variables were used in data mining process. Among those variables five variables were selected for the mining process.

Dataset arranged with 30% data for testing process and 70% data for the training process. According to the predicting probabilities, Decision Tree algorithm were performed 99.53%, Neural Network

algorithm were performed 73.36% and Clustering algorithm were performed 67.79%. Clustering model belongs to the lowest predict probability value. Therefore Clustering model was the worst model. Decision Trees model contains highest predicted value 99.53%. Therefore it was the best model. Neural Network model was also a good model. The Score results indicate that Decision Trees mining model has the best score 1.00 and followed by Neural Network mining algorithm with score of 0.92 and clustering mining algorithm with 0.94. Considering the data mining lift chart for mining structures, it graphically represents the improvement that a mining model provides when compared against a random guess, and measures the change in terms of a lift score. By comparing the lift scores for various portions of the dataset and for different models. According to the Lift chart representation, Decision Trees curve present in upper in the chart with comparing other carvers. By considering lift chart, score and target population with predicting probabilities, Decision Trees algorithm was the best one for prediction process.

Finally, Data mining model was implemented using Decision Trees algorithm. According to these predicting results, the company can handle their imports optimizing the available resources; storage, time, money. Therefore this research would benefit the Company to improve their incomes.

Keywords: *Data Mining, Decision Tree, Neural Network, Clustering*

Applying Smart User Interaction to a Log Analysis Tool

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Abstract

A log file is a text file. People analyze these log files to monitor system health, detect undesired behaviors in the system and recognize power failures and so on. In general these log files are analyzed manually using log analysis tools such as Splunk, Loggly, LogRhythm...etc. All of these tools analyze log file and then generate reports, graphs which represents the analyzed log data.

Analyzing log files can be divided into two categories namely, analyzing history log files and analyzing online log files. In this work analyzing history log files is only considered for an existing log file analysis framework. Most of the log analysis tools have the feature for analyzing history log files. To analyze a log file using any of the mentioned tools, it is necessary to select a time period. For example, if a user analyze a log file according to the system health, the analyzed log file specifies the system health as 'good' or 'bad' only for the given time period. In general these analysis tools provide average system health for a given time period.

This analysis is good but sometimes it may not be sufficient as people may need to know exactly what happens in the system each second to predict the future behavior of the system or to get some decisions. But using these tools, it is not possible to identify the log file in detail. To do such analysis a user has to go through the log file line by line manually. As a solution for this problem, this paper describes a new smart concept for log file analysis tools. The concept works through a set of widget and it can replay executed log files.

First the existing log file analysis framework was analyzed. This helped to understand the data structure of receiving log files. Next the log file analysis tools were studied to identify the main components and features that people most like. The new smart concept was designed by using replayable widget and graph widgets. The replayable widget uses to replay the inputted log file and the graph widgets graphically represent the analyzed log data.

The replayable widget is the main part of the project and holds the new concept. This is a simple widget that acts just as a player. It has two components; a window and a button panel. Window shows the inputted log file and the button panel contains play, forward, backward, stop and pause buttons. The log lines which is shown in the window of the replayable widget, holds a tree structure (Figure 1: Left most widget). The button panel contains an extra button to view the log lines. These buttons are used to play the log lines, go to requested log line, view the log line and control playing log lines.

It was important to select suitable chart library to design the graph widgets. A number of chart libraries were analyzed and finally D3.js was selected because it provided chart source, free version without watermarks and it also had more than 200 chart types. It has a number of chart features and also it supports to HTML5 based implementations. The following charts were implemented using D3.js chart library.

- Bar chart according to the pass/failure count
- Time line according to the time of pass/fail occurs
- Donut chart according to the total execute count
- Donut chart for Total Pass/Fail Count

Every graph widgets are bind with replayable widget, so that updates are done according to the each action. The replayable widget and the graph widgets are implemented by using D3.js, JavaScript, JQuery, CSS and HTML5. The replayable widget is successfully tested and the implemented interface successfully runs in Google Chrome web browser.

Figure 1 shows a sample interface of the design which is generated using a sample log file that had about 100 of log lines. Left most widget is the replayable widget that holds considered log file as a tree structure. Top right most widget is one of the graph widget represented as a bar chart shows pass/failure count and the bottom right most widget is another graph widget represented as a time line shows the time of pass/fail that occurred for the given log file. In addition the analyzed log file can also be visualized using donut charts.



Figure 1-sample interface of replayable and graph widget

This paper described the new smart concept for log file analysis tools. The existing analysis tools that were mentioned did not contain this new concept. Most of the log file analysis tools use graphs for data visualization. This system was successfully implemented and it was evaluated by a number of users who work with log files.

This new concept will help log analysts, system analysts, data security teams as well as top level management to extract decisions about the system by analyzing the widgets to make predictions. Furthermore, analyzed data would be useful to collect non-trivial data for data mining and machine learning procedures.

As future work, the system could be enhanced to add features such as zooming and drill down method to customize graphs and identify a mechanism to filter data according to user requirements.

Keywords: *log file, log file analysis tools, D3.js, Replayable widget, Graph widget*

Object Recognition Application - Mind Game

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Abstract

Visualizing is one of the main methods to remember something. For students who are studying something can remember things as a story or a component of an image. This application is designed to develop this skill by giving this application as a playing game to use.

How to play this game? First this app will show a sequence of images and the user should remember what he see, not only the image but also how that image is drawn. The color combinations, shape, angle and much more details are there in a single image. The more the user can remember the things in a single image can score high in this game. Now this application tests up to what average the user remember things. User will be provided a drawing canvas and a pencil tool and then he is asked to draw the first image of the sequence what he remember. And then the second canvas is given to draw the second image. Next third canvas etc.

Then the application process the images and match corresponding images of the sequence and offer score to the user considering the details he remembered accurately. How this application works? Most important part of this application is object recognition part. There are many algorithms in present to recognize object and patterns such as feature based methods, appearance based methods, geometric based methods etc. Most popular and widely used techniques are edge and angle based algorithms and pixel based algorithms. Among these methods appearance and geometric based techniques are the narrowly used techniques to develop applications. So in this research I cover that area. My recognition algorithm is to identify images by converting image details into a mathematical model. First this algorithm will identify the shapes in the image and each shape will be given some sequence of values which is based on relative area, perimeter, position co-ordinates of shapes and other special characteristics which are evaluated by a standard function. Each shape in any image will have its own mathematical structure to describe the roll of it in an image. So after processing all shapes of the image as mathematical points, the image can be saved as a mathematical structure. So for each object, objects will have a unique mathematical model.

When recognizing object in a new drawn image, this new image is converted into a mathematical model using the same algorithm and match with other mathematical models which are previously processed and saved.

Main advantage of this method is number of values which need to be saved as image data in this mathematical model is massively low when compared with other feature based techniques. This

increases the speed efficiency. So this way is considerably efficient than edge and angle based techniques to recognize images with non-discrete lines.

To match the models I apply a nearest neighbor algorithm to mathematical models, then the most matching image is selected. In the developing side, previously processed mathematical models which represents the images are saved as a two dimensional matrix. Rows in the matrix represents the image identity (image name or object name) and characteristics of images. And one column in the matrix represents a single image. So the number of rows in the matrix is equal to the number of characteristics of the image plus one. And number of columns in the matrix is a variable which depends on the number of images we are saving. And the matrix is saved in a .mat (Microsoft Access Table, used by MATLAB to save data in binary data container format) file. By this method, retrieving and reading data for matching images is very easy because this single matrix represents the whole database of images.

Accuracy depends on the growth of the matrix. Because if the matrix has more details about objects, then the program can identify objects accurately. To increase more the accuracy of identifying objects, simply we can increase the number of images which are drawn in different angles or different ways of same object and saving those in the matrix. For example, if the object we want to recognize is a tree, then we can save set of drawings of mango trees, coconut trees, pine tree etc. in the matrix. So any tree will be identified accurately as a tree by the program, no matter what the genre of tree is.

In the gaming application these methods are used to define different gaming levels and give the user a new experience. Preliminary the objective of this research was to recognize non-discrete pencil drawing objects accurately. Secondly above techniques are used to develop the application which gives an exercise to the human brain while giving a gaming experience.

Designed algorithm is flexible to process any number of images at once and convert those into mathematical models and save all those mathematical models in a single matrix. And the designed program accurately identifies the pencil drawing objects using this matrix.

Later, by including more image processing techniques such as image segmentation, this method will be able to enhance more to process and recognize other complex images too.

Keywords: *Object Recognition, Appearance based algorithm, Mind game, Mathematical model, nearest neighbour*

Use of Library and Internet Facilities for Seeking Information among Medical Students at Faculty of Medicine, University of Kelaniya

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Abstract

Information plays a vital role in education. Students are always seeking information as an aid for their studies. With the development of the internet, which is proving to be an incomparable information resource for learning and research, students are more inclined to use it for finding information. For medical students, many of the tools that support medical education and transmit health research are now available online. There are e-books, e-journals, subject-specific databases, academic and professional websites with numerous educational resources. Therefore, the internet is considered as a rich information resource that can support medical education worldwide.

The study was conducted with the objective of assessing the frequency and purposes of using the faculty library and internet facilities by medical students of Faculty of Medicine, University of Kelaniya. A survey was carried out from May to June 2016 on MBBS students at Faculty of Medicine, University of Kelaniya. Students who are in their second to fifth academic years were included in the study while first year students were excluded as they were considered to be still in a period of adjustment to the system. Data collection was done using a self-administered questionnaire distributed among the students that visited the Information and Communication Technology (ICT) centre and medical library of the faculty. Two hundred forty six (85%) students responded to the questionnaire. This consisted of 27% (n=67), 20% (n=48), 30% (n=75) and 23% (n=56) from year 2 to 5 respectively. According to the responses provided in the survey, information required by medical students are mainly sought by library material (70.3%), the internet (59.3%), using personal text books (54.9%) and discussions with colleagues (37.4%). Only 13.9% of the students stated that they visited the library at least once a day, while 33.9% goes there several times a week. Those that visit the library once a week or less, but more than once a month represented 30.2% of the responders. A considerable proportion (22%) visits the library less than once a month (or never goes there). The main resources accessed in the library by students were: textbooks (92.7%), past papers (36.2%) and journals (4.9%). When it comes to frequency of internet usage 82.8% of the medical students stated that they accessed it several times per day. While 11.9% accessed internet only once a day and 5.3% accessed internet less frequently than that. Devices used by the responders for accessing the internet included smartphones (55.7%), tablets (32.9%), laptops (32.9%) and desktops (13.0%). When it comes to data access method for connecting to the internet, mobile data (75.8%) and Wi-Fi (73.2%) were most prominently featured, whereas dongle

connections (20.3%) and wired connections (3.7%) were less popular. The most frequent reasons noted for accessing the internet were: for finding information related to studies (53.3%), for emailing (30.1%) and using social media such as Facebook (37.0%). Based on the responses of the sampled students, the faculty internet facilities (Wi-Fi or wired) were used by 80.9%. The times of the day for logging on to the faculty internet for most students were '12 noon-2 pm' period (47.5%) and 'after 4 pm' period (22.8%). When inquired about problems faced while finding information via the internet: 55.3% noted connection being too slow as an issue, while 34.6% found the inability to access faculty network E-resources outside of the faculty as a hindrance. The other issues expressed were: not having enough time (16.7%), lack of ICT knowledge (6.9%), inadequate information searching skills (6.9%) and not having a device to connect to the internet (2.4%). The results show that even though less than 50% of the sampled students are regular (at least several times a week) visitors to the library, over 70% seek information related to their studies from library material. In contrast, while nearly 95% of the students were daily internet users, only around 60% used it as a source of information. Only about 53% utilised the internet for their academic requirements. The efforts of the university in providing internet facilities appears to have been worthwhile, with over 80% stating that they are consumers of the faculty Wi-Fi and/or wired internet connections. Yet, mobile data connections were the most frequently noted method of obtaining web access. This is reflected by the finding that smartphones and tablets were the most frequently used devices when accessing the web compared to laptops and desktops. The finding of the study that; more than one fifth of the students rarely visit the library could probably mean that they rely on personal text books in their studies. In addition it could also be a reflection of the influence of ICT in academic activities of students. These findings could be explained by the ever increasing influence of ICT in education as well as day-to-day life. Especially, availability of Wi-Fi within the faculty, affordability of mobile internet connections and, handheld devices like smartphones and tablets becoming versatile while also becoming accessible for most people has clearly made an impact in this regard. Recent upgrades to the faculty internet facilities may alleviate the complaint of slowness in connection. Expanding the Wi-Fi network to student hostels and the North Colombo Teaching Hospital at Ragama would help in addressing unavailability of faculty network E-resources outside of the faculty. Even though library based information seeking is still prominently featured, findings of the study show a possible shift towards the internet becoming the main source for information among medical students. The faculty medical library and ICT centre have to be sensitive when it comes to student information source preferences. By working together and adapting to the changing landscape, these two departments of the faculty could play an ever increasing role in improving students' use of educational resources online.

Keywords: *Information Seeking Behavior, Access to Information Libraries, Medical Students, Medical Internet*

Resource Efficiency for Dedicated Protection in WDM Optical Networks

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Abstract

The ever increasing demand for bandwidth is posing new challenges for transport network providers. A viable solution to meet this challenge is to use optical networks based on wavelength division multiplexing (WDM) technology. WDM divides the huge transmission bandwidth available on a fiber into several non-overlapping wavelength channels and enables data transmission over these channels simultaneously. WDM is similar to frequency division multiplexing (FDM). However, instead of taking place at radio frequencies (RF), WDM is done in the electromagnetic spectrum. In this technique the optical signals with different wavelengths are combined, transmitted together, and separated again. It uses a multiplexer at the transmitter to join the several signals together, and a demultiplexer at the receiver to split them apart. It is mostly used for optical fiber communications to transmit data in several channels with slightly different wavelengths. This technique enables bidirectional communications over one strand of fiber, as well as multiplication of capacity. In this way, the transmission capacities of optical fiber links can be increased strongly. Therefore, the efficiency will be increased. WDM systems expand the capacity of the network without laying more fiber. Failure of the optical fiber in terms of fiber-cut causes loss of huge amount of data which can interrupt communication services. There are several approaches to ensure mesh fiber network survivability. In survivability, the path through which transmission is actively realized is called working path or primary path whereas the path reserved for recovery is called backup path or secondary path. In this paper we consider traditional dedicated protection method in which backup paths are configured at the time of establishing connections primary paths. If a primary path is brought down by a failure, it is guaranteed that there will be available resources to recover from the failure, assuming the backup resources have not failed also. Therefore, traffic is rerouted through backup path with a short recovery time. In this paper, we investigate the performance by calculating the spectrum efficiency variation for traditional dedicated protection in WDM optical networks. To evaluate the pattern for the spectrum efficiency we use various network topologies where the number of fiber links in each network is different. Spectrum efficiency is the optimized use of spectrum or bandwidth so that the maximum amount of data can be transmitted with the fewest transmission errors. Spectrum efficiency is calculated by dividing the total traffic bit rate by the total spectrum used in the particular network. The total traffic bit rate can be calculated by multiplying the data rate by the number of connections (lightpaths). The total spectrum would be the multiplication of the frequency used for a single wavelength and the total number of wavelengths (bandwidth slots) used in the network. In this paper, we carry out

the investigation with detailed simulation experiments on different single line rate (SLR) scenarios such as 100 Gbps, 400 Gbps, and 1Tbps. In addition, this paper focuses on four standard optical network topologies which consist of different number of fiber links to identify how the spectrum efficiency deviates for each network. To evaluate the performance, we considered 21-link NFSNET, 30-link Deutsche network, 35-link Spanish network, and 43-link US network as specimens. In our simulation study, spectrum efficiency for each networks are plotted in separate graphs and compared with each other. Our findings are as follows. (1) Spectrum efficiency for each SLR is almost similar and comparable in all the network topologies. (2) Unlike network topology with low number of fiber links, the spectrum efficiency for network topology with high number of fiber links are higher, therefore, the spectrum efficiency increases when the number of links are increased.

Keywords: *wavelength division multiplexing, dedicated protection, single line rate, spectrum efficiency.*

Android smartphone operated Robot

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Abstract

In the present an open-source Android platform has been widely used in smartphones. Android platform has a complete software package consisting of an operating system, middleware layer and core applications. Android-based smartphones are becoming more powerful and equipped with several accessories that are useful for Robotics. The purpose of this project is to provide a powerful, user-friendly computational Android platform with simpler robot's hardware architecture. This project describes the way of controlling robots, using smartphone and Bluetooth communication. Bluetooth has changed how people use digital device at home or office, and has transferred traditional wired digital devices into wireless devices. The project is mainly developed by using Google voice recognition feature which can be used to send commands to robot. Also motion of robot can be controlled by using the Accelerometer and the buttons in the Android app.

Bluetooth communication has specifically used as a network interface controller. According to commands received from application, the robot motion can be controlled. The consistent output of a robotic system along with quality and repeatability are unmatched. This project aims at providing simple solutions to create a framework for building robots with very low cost but with high computational and sensing capabilities provided by the smartphone that is used as a control device. Using this project concept, we can help disabled people to do their work easily ex: Motorized wheelchair, remotely controlling some equipment using the smart phone. Also using this project, we can build Surveillance robot devices and reconnaissance devices can design home automation and can use to control any kind of device that can be controlled remotely. Many hardware components were used such as Arduino Uno, Adafruit Motor Shield Bluetooth module and Ultrasonic Distance Measuring Transducer Sensor. The Uno is a microcontroller board based on the ATmega328P. It contains everything needed to support the microcontroller; simply connect it to a Computer using a USB cable or power it with an AC-to-DC adapter or battery to get started. The Arduino use shield boards. These plug onto the top of the Arduino and make it easy to add functionality. This particular shield is the Adafruit Industries Motor / Stepper / Servo Shield. It has a very complete feature set, supporting servos, DC motors and stepper motors. The Bluetooth module is used to connect the smart phone with robot. It uses AT commands. The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2 cm to 400 cm or 1" to 13 feet. Its operation is not affected by sunlight or black

materials. It comes with an ultrasonic transmitter and a receiver module. This system has two major parts. One is Android application and the other is robot hardware device. When developing this Android application new Android technologies were used ex: Google Voice and motion of the phone. To improve the security of this Application a voice login is added. In addition, a program is added to change login pin and to develop robot scan program and finally to develop two control programs using buttons with accelerometer and Google voice inputs. Arduino IDE and Arduino language is used to program the robot. Arduino has a simple methodology for running the source code. It has a setup function and a loop function. We can define variables and other things inside setup function. The loop function is running always according the content of the function body. AFmotor header is used to develop the code file to get functions to control the motor shield and the motors and used SoftwareSerial header file to make connection between Arduino and Bluetooth module. Using Black Box test method, integrity, usability, reliability, and correctness of the Android application is checked. Finally, user acceptance tests are done for different kind of users. A field-test is done to test whether the robot can identify the object in front of it and the distance limit is coded to the program. Today we are in the world of robotics. Knowingly or unknowingly, we have been using different types of robots in our daily life. The aim of this project is to evaluate whether we can design robots ourselves to do our work using a low budget and simple way. Finally, we think this project will be helpful for students who are interested in these areas and this will make a good solution for human matters. This project has many applications and a very good future scope. It also allows for modification of its components and parameters to get the desired output. This project allows customizing and automating our day-to-day things in our lives.

Keywords: *Android, Smartphone, Robot, Arduino, Voice recognition.*

Braille Messenger: SMS Sending Mobile App for Blinds Using Braille

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Abstract

The mobile phone is one of essential device for people in day to day life. Mostly they use mobiles for communication, entertainment and scheduling tasks etc. Among those tasks when considered about the communication, people use voice calls, online chatting, Short Message Service (SMS) to communicate with each other. But typing a message is not much easier for blinds or Visually Impaired (VI) people.

At the beginning of the mobile era, mobiles have tactile buttons (hard keyboard). So typing texts using tactile buttons is much easier for blinds than using touch screens. But with the increases of mobile technology, the market targets the best featured mobiles with accessibility features (Screen Reading feature) like Voiceover in IOS, Narrator in Windows and Talkback in Android etc. So blinds also could to move on smart mobile phones.

But at the beginning, to type texts on smart mobiles just used same QWERTY or 4X3 soft keyboards that sighted people are used to input texts. In this method blind user need to move finger on keyboard then system speak out the touched key and if user need to input that key need to double tap on that key.

But when consider about blind or VI people their familiar way of reading and writing is the System of Braille which founded by Frenchman Louis Braille. So designers have introduced braille to text method to type texts. But when designing the app by targeting braille input, Multi-touch capability of the device must be considered. Even though most of mobile phones have Multi-touch capability, count of points that can be detect simultaneously is different. It can be 2, 5 or 10 etc. So if someone come up with a design with using 6 point of multi-touch features that not suitable for devices which having less number of multi-touch points than 6 and app won't produce the expected output. As a solution for that problem if someone come up with a design with using only basic multi-touch feature (2 points), that design reduce the efficiency and usability who have mobile devices which capable with best multi-touch feature (10 points).

Therefore, I come up with a solution by giving different User Interface (UI) designs by checking multi-touch capability of the device. I developed 3 different UI designs to support for mobile devices with having different multi-touch capabilities.

Design A: Type a single braille character using 2 fingers & needs to tap 3 times to insert a single character. Target the devices which have only basic multi-touch capability of points of 2.

Design B: Type a single braille character using 3 fingers & needs to tap 2 times to insert a single character. Target the devices which have multi-touch capability with less than 6 points but greater than 2 points.

Design C: Type a single braille character using 6 fingers & by single tap can insert a single character. Target the devices which have best multi-touch capability of points of 10 or more than 6 points.

Here at the first user have to register reference points one by one. Because here I design the user customizable UI which means no restriction way of putting fingers on screen. User just need to register fingers for position 1, 2,3,4,5 and 6 respectively. Then I used K-NN algorithm to detect input finger. I considered each reference points' (x, y) coordinates as center of each class. Here I assume that user will not reposition his/her hand from the device. But with repeatedly touching users' touch points automatically drifting from the first registered reference points and it may cause to increase error rate. So here I used K-Mean algorithm to update reference points/centers of each class with each single user tap. If user repositioning his/her hand he/she has to register reference points again since there is a greater variance between registered reference points and currently touched points. Here I using 6-bit Braille encoding method with voice and vibration feedback.

Most of apps use Text-To-Speech (TTS) engine to read text. Here I included vibration rhythms to identify braille characters for blind-deaf people. But this feature available only for Grade 1 Braille system. Moreover, Braille Messenger to become more user-friendly I have used some simple patterns to run commands like adding WHITE SPACE, BACKSPACE, ENTER etc. To determine those patterns, I store the coordinates of draw pattern and then by using

Mathematical algorithm I classify the command. As well as I hope to provide the most frequently using words which have more than 5 characters as predicted word. But here I just hope to provide a single word (most frequently used word) rather than presenting list of all prediction words.

When I tested this app with participate of 3 blind people including one pseudo blind averagely I got the 92.3% of accuracy of detecting inserted braille characters and 95% accuracy of detecting draw pattern commands. With the time, speed of typing on design A, B & C was increased respect to number of sessions tried and with the 2 hand I got the maximum speed of typing which was 16 WPM.

Keywords: *Blind, Braille, Smart Mobile Devices, Text Entry Method, Universal Design*

End-user Enable Database Design and Development Automation

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Abstract

Information System (IS) is a combination of software, hardware, and network components working together to collect, process, create, and distribute data to do the business operations. It consists with “update forms” to collect data, “reports” to distribute data, and “databases” to store data. IS plays a major role in many businesses, because it improves the business competitiveness. Although SMEs are interested to adopt IS, they are often suffered by other factors: time, underline cost, and availability of ICT experts. Hence, the ideal solution for them is to automate the process of IS design and development without ICT expertise for an affordable cost. The software tools are available on the Web to generate the “update forms” and “reports” automatically for a given database model. However, there is no approach to generate the databases of IS automatically.

Relational database model (RDBM) is the most commonly used database model in IS due to its advantages than the other data models. The reason of the advantages of the model is its design, but it is not a natural way of representing data. The model is a collection of data that is organized into multiple tables/relations linked to one another using key fields. These links represent the associations between relations. Typically, tables/relations represent entities in the domain. A table/relation has column/s and rows where column/s represent the attributes of the entity and rows represent the records (data). Each row in a table should have a key to identify that row uniquely. Designers should have to identify these elements from the given data requirements in the process of the RDBM design, which is difficult for non-technical people. The process of design of RDBM has few steps: *collect the set of data requirements, develop the conceptual model, develop the logical model, and convert it to the physical model*. Though there are approaches to automate some steps of the process of design and development of RDBM, they also request the technical support. Thus, it is required to develop a mechanism to automate the database design and development process by overcoming the difficulties in the automation approaches of RDBM, so that non-technical end-users will be able to develop their databases by themselves. Hence, a comprehensive literature survey was conducted to analyze the feasibilities and difficulties of the automation of the process of RDBM design and development.

Uduwela, W. et al., the author says that the “form” is the best way to collect data requirements of the database model for its automation, because form is in semi structured way than the natural

language (the most common way to present the data requirements is natural language) and it is very closer to the underline database.

Approaches were available to automate the development of the conceptual model based on the given data requirements. This is the most critical step in the RDBM design process, because it needs to identify the elements of the model (entities, attributes of them, relationship among the entities, keys and the cardinalities). Form based approaches were analyzed using the data available in the literature to recognize the places where the user intervention is needed. The analysis says that all approaches need user support and it is needed to make the corrections of the outcome, because the elements are not consistent among business domains; it differs from domain to domain and with the same domain also. Further, they demand user support to make the initial input according to the data requirements (set of forms) to identify the elements of the conceptual model.

The next step of the process is developing the logical model based on the conceptual model. The outcome of the logical model should be a normalized database to eliminate the data insertion, updating and deletion anomalies by reducing its data redundancies. Data redundancies often caused by Functional Dependencies (FD) that are a set of constraints between two sets of attributes in a relation. The database can be normalized by removing undesirable FDs (remove partial dependencies and transitive dependencies). We could not identify any approach that generates normalize database diagram automatically from the data requirements directly. Existing approaches request the FDs to generate the normalized RDBM. Designers' high perception power and skills are needed to identify the correct FDs, because it also depends on the domain which is a problem for the automation. FDs can be found by doing data mining, but it also generates an incorrect set of FDs if there are insufficient data combinations. Developing the physical model from the logical model is straightforward and relational database management systems help to automate it.

According to the analysis, it can be concluded that the existing approaches on conceptual model development cannot develop accurate models as they has to develop distinct models for each problem. Normalization approaches also cannot be automated as FDs also vary among business domains and with the same domain also. These concludes that there should a database model that can be designed and developed by end-users without any expert knowledge. The proposed model should not be either domain specific or problem specific. It would be better if the approach could convert the data requirements to the database model directly without intermediate steps like in the DBM design process. Further, it would be better the proposed model could be run on the existing database management systems too.

Keywords: *Database, Forms, conceptual model, Functional Dependencies, Normalization, ICT, SME*

An Application of Context Assured Ontology for Rule Based Cluster Selection in Psychotherapy

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Abstract

Personality trait analysis is considered as a very important requirement mainly in psychotherapy. A consultant should have a sound awareness about the client's personality to commence effective therapy sessions. In this research OCEAN model for personality trait analysis is computationally implemented. OCEAN model is an effective model used in psychology to determine the human temperament composition. Expert knowledge associated with the five dimensions of the OCEAN model is captured and stored in form of rule based expert clusters. Additionally, an upper ontology is designed to control the context associated with the OCEAN model. Ontologies are very good at storing domain associated knowledge in forms of triples. Various lexicon combinations, depicting contexts, could be grouped together and can be assigned as a specific object property. Different properties of the same object will depict various contexts, the object could be exposed to. Here, the upper ontology will act as the navigator which shows to specific knowledge cluster. The knowledge clusters are used to determine the sub facets of a particular trait as well as the intensity.

Once the client enters the experiencing psychological discomfort through text to the interface, it's natural language processed and important semantics are identified. Subsequently, depending on the semantics captured, entered text will be sent to an established SPARQL query module. Defined SPARQL queries in the module are mapped with a particular region of the created ontology. Therefore, execution of a particular SPARQL query will, question a specific region of the ontology. End points of the defined ontology are further mapped with created different rule based expert clusters.

Ultimately, client's entered problem, in form of text will be directed to a particular rule based expert cluster, which contains expert knowledge captured from psychologists. Eventually a similarity index is calculated and percentile compositions of the personnel traits are derived as per the dimensions of the OCEAN model.

Developed prototype, got evaluated in two forms. Primarily, more than 30 expressed psychological inconveniences are captured from two famous discussion forms, which are globally available to share psychological snags across community. By name, those are "Panic Center" and Daily Strength". Each of these stories captured are fed as the input to the prototype and OCEAN reports are generated. Henceforth, scenario and the generated reports are shared with the psychologist, in

order to evaluate the accuracy of the final outcomes. After evaluating the final outcomes of the prototype with the expert knowledge of the psychologist, more than 80% accuracy depicted.

As the second mechanism, results are compared against, Truity, which is one of the very famous questionnaire based online trait evaluation site. A trait evaluation questionnaire designed using OCEAN model was attempted in Truity and at the end final result sheet was obtained. Next, covering the same set of questions in the attempted questionnaire along with the same answers provided, an artificial story was created. Afterwards, this artificial story was provided as the input to the prototype and another OCEAN report got generated. Eventually, both the Truity generated report and the prototype generated reports are compared against. Though there`re small variations visible in the percentile values, inflations and deflations patterns of both the reports are almost identical.

As conversed above, both these validations mechanisms have evidenced that the prototype generated OCEAN report is also depicting an acceptable level of accuracy. Though there`re ample of questionnaire based online trait analysis tools available, it`s almost no text based trait analytics approaches. A questionnaire based mechanism will limit the express-ability of the user / patient, hence the patient is restricted via some pre-defined set of questions. But, with this prototype, no restrictions applied. Liberty is provided, for the free flowing thoughts of the user to be entered.

Other than, requesting the patient, who is psychologically distressed to fill a questionnaire which is not fair, this prototype allows to express anything what comes to the mind about the user`s cognitions. Also, the chances of misinterpreting the questions in the questionnaire and providing of wrong answers, are also addressed through this system.

To get the optimal from this system, definitely it has to be used under the governance of a psychologist or a psychiatrists. This prototype is targeted to provide digital diagnostic assistance to the consultants. Hence, domestic use of this without the intermediation of the consultant, will not give the intended benefits. The ultimate intension of this research is to improve the interaction between the consultant and the patient, through a computational intervention. Because, the active ingredients in therapy comes with the live interactions between the consultants and the patient. As proved in literatures, the 100% computational replacements of therapy has become an utter failure. But the effective blend of computing with live therapy has improve the efficacy of psychotherapy in great heights.

Keywords: *Ontology, SPARQL, OCEAN, Rule Based Expert Cluster, Natural Language Processing*

Students' Perspective on Using the Audio-visual Aids to Teach English Literature and Its Effectiveness

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Abstract

The field of education is renewing in each and every second. Human Computer Interaction plays a vital role in it. Thus, the government authorities have paid more attention on this aspect in order to provide a qualitative education. According to the reports which were published by the Ministry of Education, the government has conducted trainings, workshops and seminars on using the modern technology including the modern audio and visual aids in all around the country. Yet, most of the teachers of English Literature still do not use them within the classroom and the students learn the subject in a conventional classroom environment. In this respect, this study explores how effective it is to use audio visual aids to teach English Literature which is considered as a traditional subject in order to enhance students' literary competence and the students' perspective on using the audio-visual aids to teach English Literature. For the study, as the sample, forty five students who are from Grade Ten and learn English Literature as an optional subject for the GCE Ordinary Level Examination were selected from four government schools in Kandy district and Matale district. Data was collected through a questionnaire and participant observation. Through the questionnaire, students' preference for the subject and their views on teaching methods with and without the modern audio-visual aids were studied. Learning behavior and the students' involvement with and without the audio-visual aids were studied through participant observation. The qualitative analysis of data revealed that there is a high involvement of the students when they learn this subject with the modern audio-visual aids. The quantitative data analysis provides the initial evidence that their teachers' conventional teaching process is less productive and provides a lessened contribution to reach the expected goals of teaching and learning English Literature. The findings suggest that it is necessary to implement this pedagogical tool to teach English Literature as it has the ability of bringing a highly constructive learning environment.

Keywords: *Modern audio-visual aids, English Literature, Literary Competence, Students' Perspective, Human Computer Interaction*

Performing Iris Segmentation by Using Geodesic Active Contour (GAC)

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Abstract

A novel iris segmentation technique based on active contour is proposed in this paper. Our approach includes two important issues, pupil segmentation and iris circle calculation. If the correct center position and radius of pupil can be find out in tested image, then the iris in the result will be able to precisely segment. The final accuracy for ICE dataset is reached around 92%, and also can get high accuracy 79% for UBIRIS. Our results demonstrate that the proposed iris segmentation can perform well with high accuracy for Iris's image.

Keywords: *GAC, Iris Segmentation, ICE, UBIRIS*

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