Unique Dining Experience with the Use of Emerging Technologies

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

Keywords: Restaurants, Service innovation, Deep learning

I. INTRODUCTION

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

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

II. OBJECTIVES

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

III. METHODOLOGY

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

IV. DISCUSSION

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

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

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

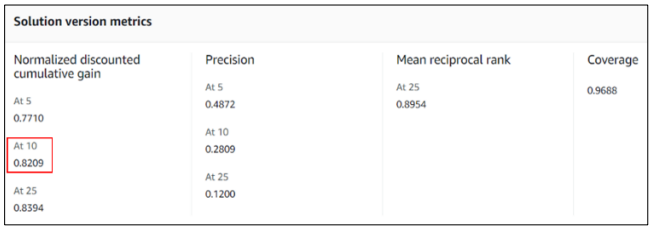

Fig. 1. Solution metrics for the AutoML recipe

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

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

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

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particular food item from the menu. This helps diners overcome confusion and dissapointment especially in the case of food items with foreign or unfamiliar names.

Fig. 2. Personalised food item recomemendations generated

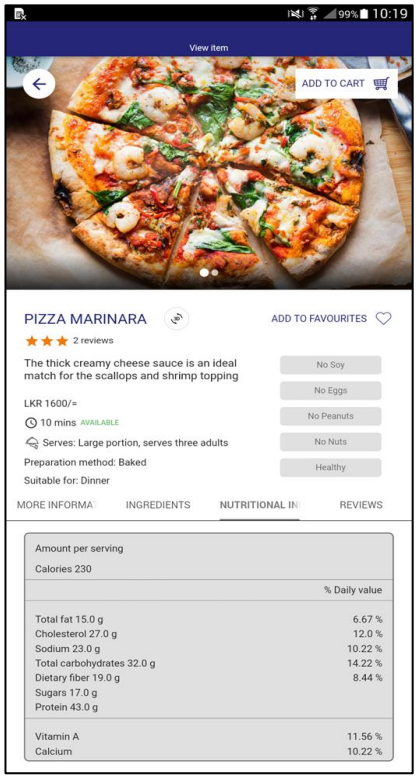

Fig. 3. Detailed information regarding each food item

Blockchain technology can be recommended to implement a feature to facilitate end-to-end traceability of ingredients from the 'farm to the fork'. It is a fairly new technology defined as a public ledger containing all executed transactions that are stored on a distributed database in the form of encrypted blocks [2]. Information such as the crop cultivation conditions, use of fertilizer, processing and distributing conditions can be recorded using Blockchain supply chain systems. Sensors and Internet-of-things (IoT) implementations will be required to track levels of pesticide and fertilizer usage in crops. RFID tags, Quick Response (QR) codes or barcodes used to label each produce, allows the end-user to gather traceability data by scanning this code. This will be particularly valuable in ensuring authenticity of Organic and Halal certified [4] food items.

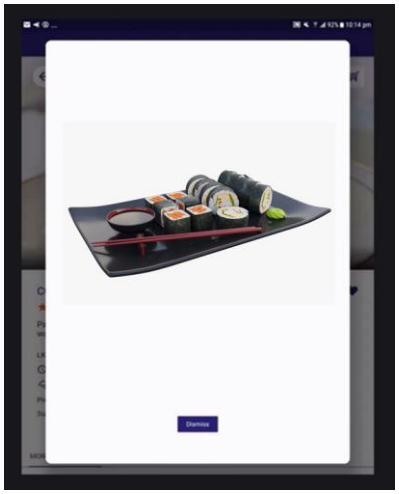

Fig. 4. Food item viewed as a 3D model

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

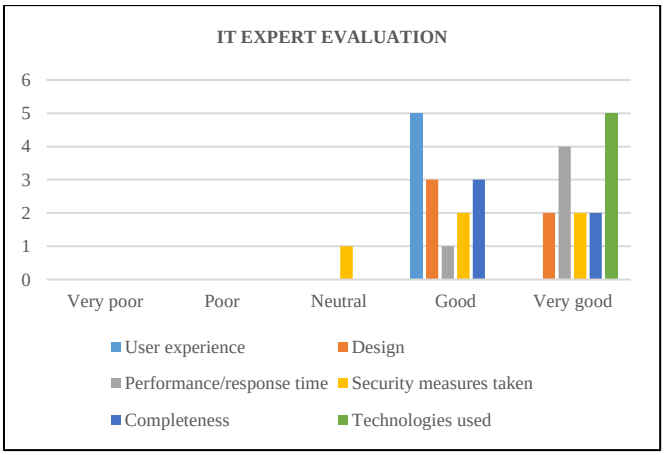

Fig. 5. Overview of IT expert evaluation

V. CONCLUSION

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

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

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