Internet of Things (IoT) and Cloud Enabled Tables

Meesala Shobha Rani . Nikitha Gajjala . Prathamesh Dasari . Ronit Chatterjee

Department of Computer Science and Engineering, MVJ College of Engineering, Bengaluru, India

Received: 12 August 2022 / Revised: 22 August 2022 / Accepted: 09 September 2022

Abstract – The main objective of this paper is to build a hassle free experience for the customer by providing them with service of ordering food with the help of an QR Code. Managing all information related to the menu, orders, customer support and provides with a customer freedom experience and also avoids all kinds of human errors and misunderstandings between the customer and the management. The paper proposes a novel notation of being a smart restaurant which shows us the reduction of human work with the least possible human error and thus increases the work efficiency with a user-friendly approach. The work is made at an administrative end where there is a guaranteed administrative access only. The work is completed with the help of both software and hardware parts. Software of this work deals with JavaScript, Html, CSS as for the frontend and the backend deals with Mongo Db. Hardware part of the work deals with a printer to print the selected menus by the customer and technology used here is Raspberry Pi.

Keywords — Hassle free experience; customer; QR Code; managing; menu; orders; customer support; customer freedom experience; human errors;

I. INTRODUCTION

Food and Beverages are now a fast-growing industry nowadays. It being one of the most basic needs of humans, the industry never runs out of customers. The quick development of remote media transmission with the help of internet and electronic appliances. This helps the industry to grow and achieve new heights. Here the aim of this work is to develop a food ordering system which is completely built for the ease of the customer. Customer here is made to feel the experience of a hassle free ordering of food. The work shows us problems that are faced by the customers such as 1- Wrong orders being served. 2- Waiting in the queue for table reservation. 3- Confusions between customer and staff. 4 - Payment related issues. Thus these kinds of issues will return in loss of customers and will create a bad reputation of the restaurant. According to this work a QR Code will be provided which can be represented as the one stop solution for all the problems. Once the QR Code has been scanned the customers can access the 1- Smart menu, 2- Order details, 3- Payment details. On the other hand the management can also access all the information that the customers can access plus some added functionality such as overall orders and payment related information. The four

main areas where the work is overcoming all the problems faced by previous works and providing the solution for them are 1-handling all kinds of orders and reservations. 2- provides the best possible menu for all kind of customers according to their budget. 3- printing of the orders as per the customer and retrieve and provide all the data regarding the order to both customer and the management. 4- analysis and managing of all information related to orders history, payments history, customer history. This paper presents the implementation of concepts such as IoT and Cloud Computing and an alternative to replace the old unconventional menus, making customer experiences pleasant and hassle-free. This paper also shows how a raspberry pi can be used to implement the proposed smart menus which is affordable to new start-ups and efficient.

II. LITERATURE REVIEW

According to the conducted Literature Survey on preexisting software platforms, functionalities and technologies that has been done prior to the proposal on our research are summarized as follows: The simplicity and ease of access of a menu are the main things that facilitate ordering food in a restaurant. In **Intelligent e-Restaurant using Android OS** (2015) [1], the author aims to provide the restaurants with a tablet menu that would recommend dishes based on a recommendation algorithm, which has not been implemented elsewhere. In addition to this, they run the app on an Android based tablet & not on an iOS based tablet, which is more expensive alternative. They use a cloud-based server for storing the database, which makes it inexpensive & secure. [1]

With the advancement in technologies, the mobile phone is a brilliant product. With the help of this smart gadget, we can make our usage as smart as possible. Some products are commercially available in the market, which allows restaurant food ordering through internet, android applications, GSM, Bluetooth, RFID, and Wi-Fi wireless technologies. Food ordering is a process of ordering food from a local restaurant or food cooperative through a web page or app. Much like ordering consumer goods online, many of these allow customers to keep accounts with them in order to make frequent ordering convenient. The main purpose of **ERestaurant: Online Restaurant Management system for Android (2015) [2]** is to design an advanced erestaurant online management system using android smart mobile with Bluetooth wireless technology. The menu will be displayed automatically using android application on the table and we can directly order the food items with the help of Android Phone. The controller also takes the responsibility to display the menu items selected on the LCD display unit. At the Kitchen section, using wireless RF communication the selected items will be display on LCD along with user table number.

In most of the restaurant meal ordering is relying on the interaction with waiters to place order into the kitchen. In busy hours of restaurant, this coordination is a challenge result in un-satisfaction to the customer. To realize this, **Intelligent Restaurant – Menu Ordering System (2015) [3]** is design. This Restaurant uses modern innovation such as multi-touch module, RF module, Meal Serving Robot and database to improve quality of services of Restaurant and to enhance customers' dining experience. A meal-serving robot is a line following robot, which is design-using sensor to track the black line path predetermined for serving. Android Application - PayPal is use for online payment.

Natural Language Processing (NLP) directed to ambiguous representation for software

requirements. Ambiguity at different levels creates different representation and meaning. This paper reduces the issues of ambiguity levels for the Software Requirements Specification (SRS) using formal methods. In **Formal Specification for Online Food Ordering System using Z language (2017) [4]**, results show the effectiveness in specifications through Z language. The Z specification is created for the commercial application of online food ordering system to improve the order details accuracy and efficiency. The stakeholder needs for food ordering system are gathered from the work goal. The system is designed using Unified Modelling Language (UML) illustration of use case diagram. The specification is created for the system behaviour to remove the ambiguity. Along with this, Z/EVES tool is used for the evaluation of Z specifications for the demonstration.

In **Near-Field Communication Sensors and Cloud Based Smart Restaurant Management System**

(2017) [5], here it was introduced an efficient and user-friendly Smart Restaurant Management System. This system will solve key problems faced by restaurants today through the use of technologies such as Mobile and Web applications, Internet of Things (IoT), Near-Field Communications (NFC) sensors, and cloud computing. Restaurants have many inefficiencies due to human limitations that can be resolved through automation and device-to-device communication. This Smart Restaurant Management System accomplishes this by providing two interfaces for the two types of users in restaurants; an Android mobile application for customers and a web application for restaurant staff members. The Android mobile application allows customers to have a seamless dining experience with features such as finding available parking spaces easier through internet connected infrared proximity sensors in the parking lot, finding available tables at the restaurant easier through NFC sensors, ordering dishes through an interactive menu, and being able to pay the bill from their NFC equipped phones. The web application provides staff members benefits such as collecting data and statistics on the restaurant's performance in real time and automating the order placement system for waiters and cooks via IoT technology.

Among the important benefits of mobile applications are portability and accessibility. Integrating a native mobile application with a Web portal increases the value and quality of the final system. A developer of the **Experiencing Native Mobile Health Applications Development (2017) [6]** is presented in this paper discussing about the main motivational factors and decision criteria in the selection of the most appropriate mobile ecosystem. Also the main software design decisions associated to the required functionality are analysed and taken into consideration for the implementation and validation of a mobile application in the Health domain.

III. METHODOLOGY

This section describes how QR tables was designed and implemented explaining the process of each functionality, their flow in the system and technologies used. In order to develop the system first, a requirement analysis was done and according to those requirements QR tables is developed. Users can scan the QR code . It will contain the restaurant menu pop up, table reservation feature, meal ordering facility, ability to view past food reviews, view customized menu and orders are managed for kitchen staff through the admin section of the web application. Qr tables is created with many popular technologies like sensor and Signal handling, Java Script, Html, CSS, Mongo DB, Raspberry Pi. QR tables shows table

availability with the best accuracy using real-time data. Reservation status of the tables are collected using a sensor and status. A unique food recommendation is also done. The modelled menu is created using front end software and every food item can be viewed as an image. QR tables scan code is used as a smart restaurant and food ordering system. The purpose of QR tables scan code is very useful to current society. Using this scanner people can easily order their food items without any delay. Especially, customers can check table availability through scanning the QR code just by entering the restaurant's area. It will help to reduce the time delay in ordering foods. The mobile application will use Mongo DB as a database among a few other technologies. After scanning the QR code, users may login as a user or as an admin. When logged in as an admin, manager role and food ordering processes can be managed. When logged in as a customer, they can check availability, order food items and manage payments through the web application. When comparing QR tables with other applications, it has many advantages over existing systems in the current market. It increases the number of customers that can be satisfied in a given time period and handles the processes within the restaurants properly.

A. SYSTEM'S ANALYSIS

The structure of the system can be divided into three main logical components as in fig 1, the first component must provide some form of menu management, allowing the restaurant to control what can be ordered by customers. The second component is the web ordering system and provides the functionality for customers to place their order and supply all necessary details. The third and final logical component is the order retrieval system. Used by the restaurant to keep track of all orders which have been placed, this component takes care of retrieving and displaying order information, as well as updating orders which have already been processed.

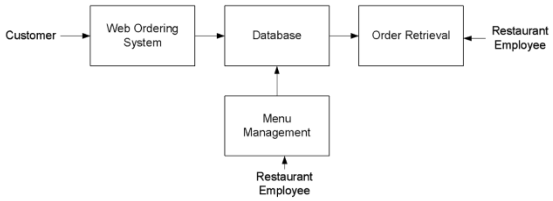


Fig 1: Architecture Block Diagram

B. FUNCTIONAL REQIRMENTS

This system requires three components, essentially provides a layer of isolation between the end user and the database. Firstly, allowing the end user to interact with the system through a rich interface provides a much more enjoyable user experience, particularly for the nontechnical users which will account for the majority of the system's users. In addition, this isolation layer also protects the integrity of the database by preventing users from taking any action outside those which the system is designed to handle. Because of this design pattern, it is essential to enumerate exactly which functions a user will be presented with and these functions are outlined further, grouped by component. Below we show the complete design of the work through an ER diagram, as shown in fig 2.

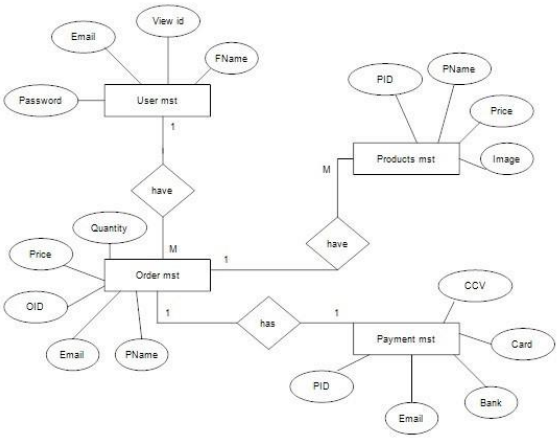


Fig 2: Entity Relationship Diagram

C. WEB ORDERING SYSTEM

Users of the web ordering system, namely restaurant customers, must be provided the following functionality:

- Navigate the restaurant's menu.
- Select an item from the menu.
- Add an item to their current order.
- Review their current order.
- The Web Ordering System Remove an item/remove all items from their current order.
- Provide delivery and payment details.
- Place an order.
    - Receive confirmation in the form of an order number or a pop up notification.
    - As the goal of the system is to make the process of placing an order as simple as possible for the customer as shown in fig 3.

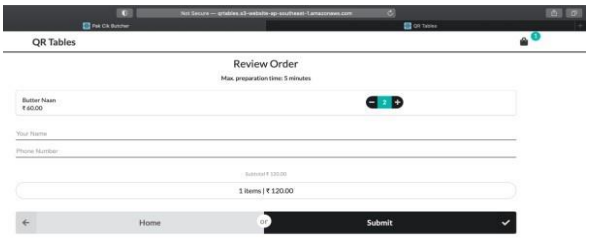


Fig 3: Order Submission by the customer

D. MENU MANAGEMENT SYSTEM

The menu management system will be available only to restaurant employees and only allow them to manage the menu that is displayed to users of the web ordering system.

The functions afforded by the menu management system provide user with the ability to, using a graphical interface, as shown in figures 4, 5 and 6:

- Add a new/update/delete food category to/from the menu.
- Add a new/update/delete food item to/from the menu.
- Update price for a given food item.
- Update default options for a given food item.
- Update additional information (description, photo, etc.) for a given food item,

Fig 5: Add new product

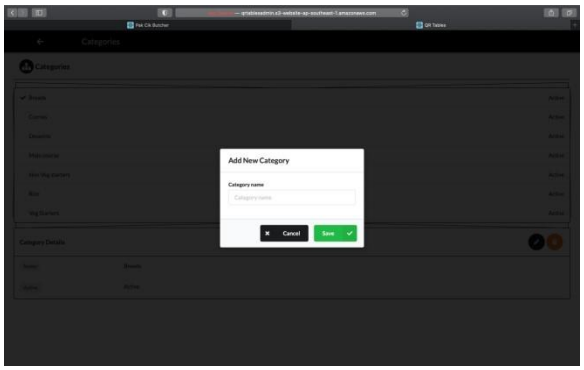
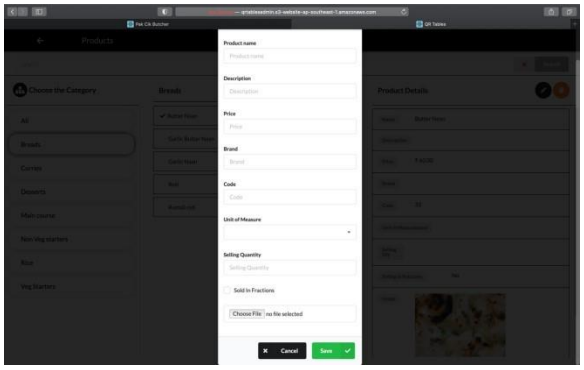


Fig 4: Add new category



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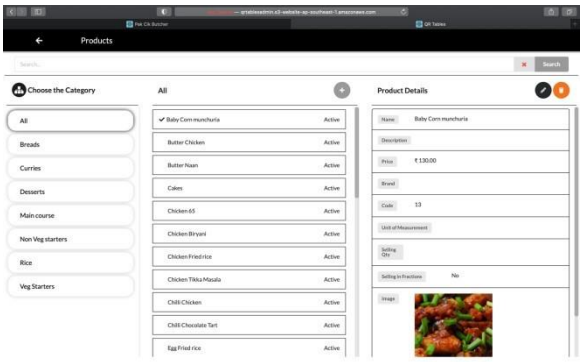

Fig 6: Update menu

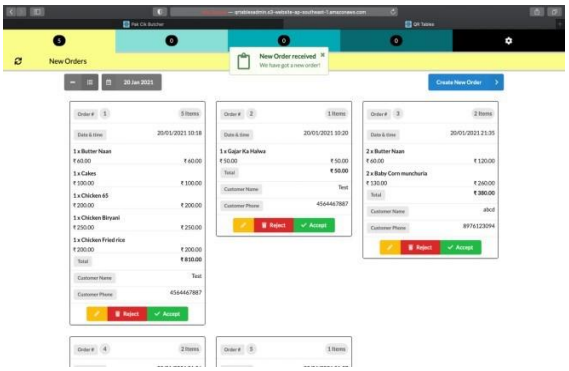

Fig 8: Processing of new orders

E. ORDER RETRIEVAL SYSTEM

Of the three components, the order retrieval system is functionally the simplest. Like the menu management system, it is designed to be used only by restaurant employees, and provides the following functions:

- Retrieve new orders from the database.
- Display the orders in an easily readable, graphical way.
- Update transition state of a particular order.
- Mark an order as having been processed and remove it from the list of active orders.

As shown in figures 7 and 8.

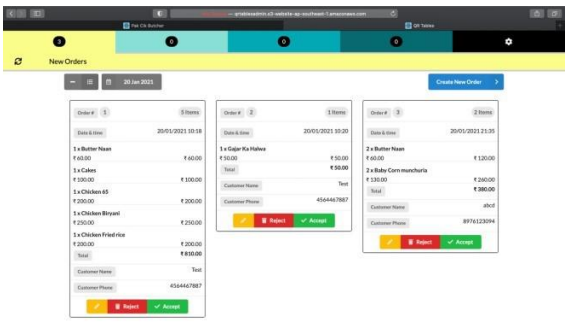

Fig 7: Current Orders

F. TASK ALLOCATION

After confirming the orders, a task will be allocated to the chefs and orders will be processed. The orders are placed directly and there won't be any misplacement of orders. Each chef can confirm their orders from the tokens received. After fulfilling their order preparation, they can complete the order by allowing the waiters to serve food for the relevant table. Factors, Usually, the orders are processed according to the time they were placed and more than one orders are placed and processed simultaneously, orders are sorted according to their priority and placed in an order que. Then kitchen staff can view the orders and continue preparing them without missing a single order.

G. NON-FUNCTION REQUIREMENT

These are constraints on the services or functions offered by the system. They include timing constraints, constraints on the development process and standards, etc. They often apply to the system as a whole. The Non-Functional Requirements are as follows:

DEPENTABLITY : is a property of the system that equates to its trustworthiness. Trustworthiness essentially means the degree

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of user confidence that the system will operate as they expect and that the system will not fail in normal use. **AVAILAIBLITY :** is the ability of the system to deliver services when requested and that the execution of the program is not interrupted by any error in the program.

RELAIBILTY : the ability of the system to deliver services as specified. The program is compatible with all types of operating system without any failure.

SAFETY : is the ability of the system to operate without catastrophic failure. This program is user friendly and it will never affect the system.

SECURITY : is the ability of the system to protect itself against accidental or deliberate intrusion.

H. SOFTWARE REQUIREEMENT

All of the application data is stored in a Mongo DB database, react JS and a Node JS server must also be installed on the host computer.

I. HARDWARE REQUIREMENT

The server hardware can be any computer capable of running both the web and database servers and handling the expected traffic. For a restaurant that is not expecting to see much web traffic, or possibly doing only a limited test run, an average personal computer may be appropriate. Once the site starts generating more hits, though, it will likely be necessary to upgrade to a dedicated host to ensure proper performance.

IV. RESULT

QR Tables System handles all the reservations properly as well as the orders. Because of the use of latest and the most relevant technologies the time wastage is reduced and the accuracy and confidentiality is maximized. The results consists of three main parts. First about the Front End implementation, second about the Back End part and the last part is all about the Hardware and its implementation part as pictured in figures 11 and 12.

FRONT END : With the help of Html, CSS, JavaScript, React JS, this part is completed. This part is both for customer and the admin. The front end part consists of two main pages. First the customer page and then the admin page. Customer page consists of 1- Menus, 2- Cart, 3- My
Orders. Admin page consists of 1- Login Page, 2- Dashboard page. The dashboard page is where the administration can manage (A) view new orders, (B) view orders in progress, (C) completed orders and (D) orders rejected. 2- The setting page. Here we have (A) The catalogue management (B) Sales report (C) User management (D) Change password (E) Logout.

BACK END : This is where the java script code is written to interact with the database. Here we have Graphs QL. Graphs QL allows front end to interact with the backend using queries and mutations. Graph QL resolves and executes both queries and mutations. Graphs QL is the core of the backend part. Here we also used the Mongoose, which basically acts as java script library to interact with the Mongo DB. The database has 1- categories 2- product 3- orders 4- users. First comes the category which consists of A- category id B- category name. Second we have the products where we have A- product id, B- product name. Third we have the orders which consist of A- order id, B- order date, C- order time, D- order status, E- order items. At last, we have the users which consists of A- user id, B- user name, C- user phone number, D- user password.

HARDWARE IMPLEMENTATION : This part consists of three main elements that are 1.

AWS Light Sail. 2. Raspberry Pi. 3. Epson TM-T82II Printer as in fig 10. AWS Light Sail is used to create a instance for running the cloud. Its installed in node JS in the machine. It is used to copy the files to a server from the local machine. Here an instance is created, that is the virtual machine with certain parameters such as ram, memory and operating system. RAM has 4GB, memory consists of 128GB, and the operating system is the Ubuntu. Once the instance has been created we need to create a static IP address to the machine. Process management library is present to make sure the java script application is always running even after rebooting or even after shutdown / automatically restart when crashed. Raspberry PI as in fig 9, is the second hardware part. It's a low cost, credit card sized computer that can be plugged in where ever related. A printer is connected with the raspberry pi4 where the operating system is installed on SD card with minimum size of 8gb. The operating system installed in it is the Raspbian. Installed node JS, then copy the files from local machine to the raspberry pi. Then we run the service that will be connected through internet connection using LAN as shown in fig 11.

Fig 12 shows us the working of the printer in the form of printed orders which are orders are being placed by the customer and are accepted by the admin and are being further processed by the chefs.

Fig 9: Raspberry Pi

Fig 10: Epson TM-T82II Printer

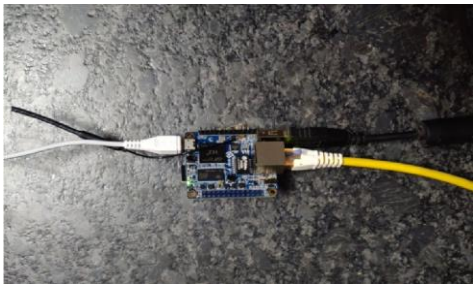

Fig 11: Power and LAN enabled Raspberry Pi

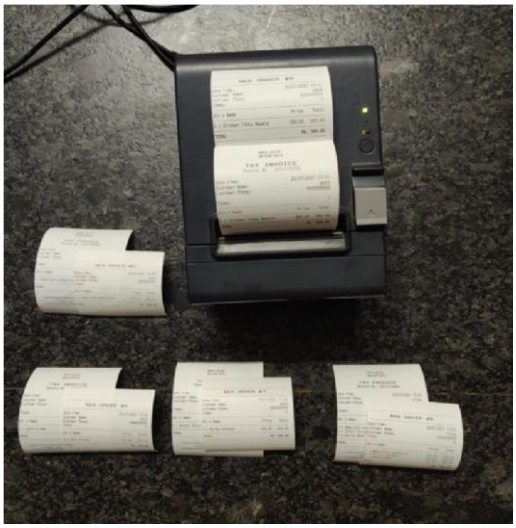

Fig 12: Printing of Ordered Tokens

V. CONCLUSION

This paper provides an insight to a suitable online restaurant management system for current society. QR tables stands unique from existing online restaurants that have mobile applications, since it provides an unique way of scan bar and brings all the possibility of ease for the customer in just one scan of QR code. The development of the online food ordering system involved many phases. This used a top-down approach concentrating on what and how and moving to successive levels of details. The first phase started with a detailed study of the problems and prospects of ordering at a restaurant. In the course, many problems were discovered to have hindered the effectiveness of the existing manual system. These problems, information needs and activities were documented and later used as the basis for system design, which immediately followed the first phase.

The design phase was concerned primarily with the specification of the system elements in manner that best met the organization's business needs. During this phase, strict adherence was made on proven software engineering principles and practices. To implement this design, a computer program was then written and tested. It is hoped that effective implementation of this software product would eliminate many problems discovered during systems investigation. This research work has been developed mainly to make day-to-day life of people, easier. Even though this research focuses on the IT industry, the research team will be focusing on reducing time wastage of customers.

Furthermore, it is expected that for any person who plans to build a similar system or any other real-time system, results of this research will be an aid and will provide insight on the performance, accuracy and reliability level that can be expected with the combination of tools, technologies and business requirements considered in this paper.

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