SMART RESTAURANT MANAGEMENT SYSTEM

Amruta.V.Galabi[1], Ankita.N.Vaze[2], Anusha R[3], Chandana.S[4], Sushma K Sattigeri[5]

[1]amrutagalabi@gmail.com, [2]ankitavaze1@gmail.com,[3]anusharaghu01@gmail.com,[4]chandanas n768@gmail.com, [5]sushmacyber8@gmail.com, [1]Department of ECE, [2]Department of ECE, Department of ECE, [4] Department of ECE, [5] Global Academy of Technology,Bangalore, India

***Abstract*—In today's world, automation technology such as robotics and machine learning play an increasingly great role in everyday life. The proposed model is an internet of things based mobile robot. Now-a-days, restaurants have transitioned from offline to online platforms by developing their own websites and allowing customers to order food using restaurants' own website. The primary objective of this project is to automate the process of ordering food. Food can be ordered through the website of the restaurant. The robot delivers the food to the customers.**

Keywords—Path memorization, Obstacle detection, Mobile robot delivery, IOT, Online website

I. INTRODUCTION

We live in an era of rapid change whereby the dynamic, highly competitive business environment, along with ever-changing customer preferences, and the constant emergence of new technologies force organizations to continuously reorganize and reinvent themselves. Research suggests that service organizations are increasingly turning to technological innovations. Robotic technologies are coveted in many industries including restaurants.

In the proposed model, firstly the customers who enter the restaurant will have to scan the QR code which is placed on each table to access the website. The entire food menu will be available on the website and the customers can order the dishes they like. Once the dish is ordered based on the ordered food the same data is sent to kitchen and the chef prepares the ordered food.

Then the mobile robot will deliver the ordered food to the customer's respective table from the kitchen based on the path that is stored previously in esp32 microcontroller's temporary memory.

Once customers are done with their ordering, to make the payments, they must navigate to the payments page. This gives the customers a variety of options to pay the bill. They can pay the bill accordingly.

II. EASE OF USE

The proposed model aims to improve the ease of use for customers in a restaurant setting. By providing a QR code for customers to access the menu and order their food, the process is streamlined and eliminates the need for physical menus and traditional ordering methods. The use of a mobile robot to deliver the ordered food to the respective table also adds to the convenience and ease of use for customers. Additionally, the payment process is made easy and efficient by providing a variety of payment options through a single QR code. Overall, the proposed model prioritizes ease of use for customers in a restaurant setting.

III. REVIEW OF LITERATURE

[1] enables any restaurant to serve as a data-centric service provider for its customers and automate the process of ordering the food items. The user can use the app to place orders. The ordered food items will be displayed to the kitchen staff. Live video feed from the kitchen gives real-time updates to the user. The system can predict the kind of food each user might order and provide similar recommendations to the customers based on their tastes and choices. Thus, being able to predict the customer's orders beforehand and providing a recommendation to them to help them decide on their orders sooner will not only save time but also help the restaurant serve more customers in less time.

In [2] The customer will be given a hex keypad (with digits 0 to 9 and * and #). They must press the respective serial number of the item they want to order on this keypad by referring to the menu and press # to confirm the order. A wireless module transmits the order in encrypted format. The person on the system gets this message. Once the food is ready, then it is placed on the robot, which works on the principle of line following, and then the hex keypad (mounted on the robot) is pressed to make it deliver to that table. It stops for a brief amount of time if an obstacle is detected and once it is cleared, it moves.

In [3] an interactive website displaying the list of foods along with the images and price details. Has 'Add to cart functionality' before confirming the order. Orders are in the form of a queue. The table number specified helps the chefs to press the corresponding table number on the keypad present on the robot, for it to deliver the food to the table. Ordered menu is sent to billing counter to ensure convenient payment for the customers.

In [4] customers place the order through a website. The prepared food is loaded on the robot. The keypad present on the backside of the robot is used to select the table number and the robot goes to that table by recognizing the predefined path. Line follower mechanism is used. Arduino Mega 2560, battery, relay, motors, sensors, and buzzer are used.

In [9] the robot that is used identifies and tracks human presence in its surroundings using various sensors. The robot is designed to be used in a range of applications, including security, surveillance, and rescue operations.

The robot uses a combination of sensors, such as infrared, ultrasonic, and visual, to detect human presence. Once a human is detected, the robot tracks their movements and can send alerts to a central control system or the operator.

IV. PROJECT DESCRIPTION

4.1 BLOCK DIAGRAM

The block diagram in fig. 1 shows that the path storing for the tables is done using the serial monitor from Arduino IDE. This is stored in the temporary memory of Esp32. The QR code on the table, which in turn directs to a website when scanned, allows the customers to place their orders. The esp32 in the kitchen is connected to pushbuttons. If any of these buttons are pressed, then data is sent wirelessly using ESP-NOW protocol to the Esp32 on the robot. Depending on the table number that requested the order, the button is pressed by the chefs. The robot chassis consists of BO motors, L298N motor driver and 4 motors. The ultrasonic sensor and the buzzer help in obstacle detecting.

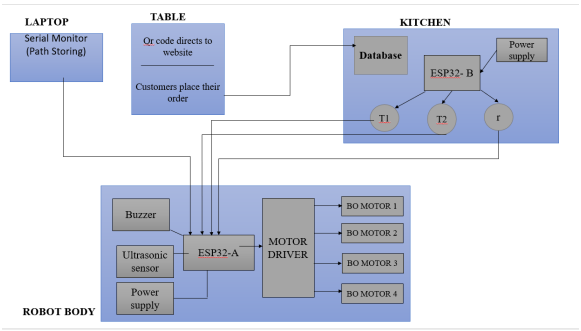

Fig. 1 Block diagram for the system

4.2 FLOWCHART

The flowchart for the hardware system is shown in fig 2.

The algorithm:

Step 1: Start

Step 2: Is order obtained in the database? If yes, then proceed. Else, return to step 2.

Step 3: Start preparing food in the kitchen.

Step 4: Food ready? If yes, proceed to step 5, else, return to step 4.

Step 5: Chef presses the button corresponding to the table number i.e., is in database.

Step 6: Robot collects it and moves to the table number mentioned.

Step 7: Is obstacle detected? If yes, proceed to step 8, else, go to step 9.

Step 8: Stops and alerts by buzzer till obstacle is cleared.

Step 9: Robot reached table? If yes, then go to step 10, else go to step 7.

Step 10: Robot waits for 5 sec and then goes back to kitchen.

Step 11: End

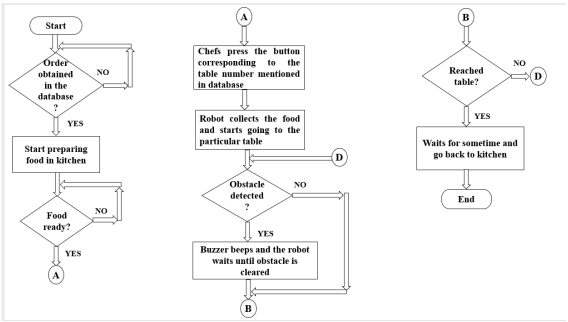

Fig. 2 Flow chart for hardware system

The algorithm for the software system

Step 1: Start.

Step 2: Ordered food? If yes, go to step 3, else go to step 2.

Step 3: Stores - table no, phone no, email id, quantity in the database.

Step 4: Total is calculated and displayed on the website.

Step 5: If Payment is initiated, go to step 6, else go to step 5.

Step 6: If payment is completed, then go to step 7, else go to step 6.

Step 7: If payment confirmed in Razor Pay go to step 8, else go to step 7

Step 8: Payment ID is sent to website and stored in database.

Step 9: End

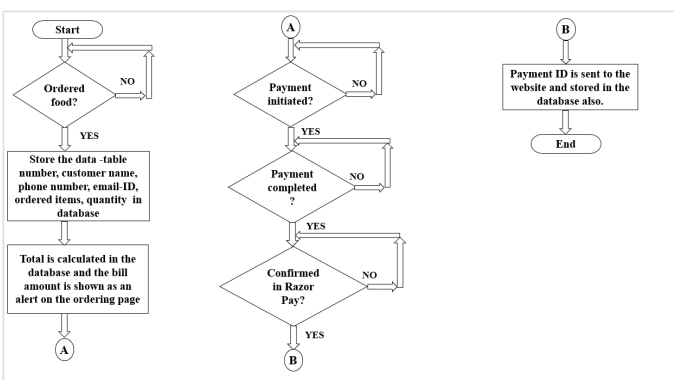

Fig. 3 Flow chart for software system

V. IMPLEMENTATION

STEP 1

The customers enter the restaurant and scan the Qr code present on the table. Qr code directs to the home page of the website. They can navigate to other pages like category, menu, and order.

STEP 2

Once the customers click on order button, they will be directed to this page. They must enter the details such as: Table number, name, email Id, items they wish to order, their quantity.

STEP 3

Once the customers click on "Place Order", the total amount is displayed.

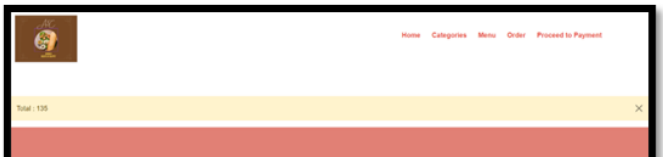

Fig. 4 Total is displayed once the order is placed.

The admin side of the website enables the admin to add or remove other people who can manage the account, he/she can manage the categories of foods, find out the total orders made and update the status of the orders of the customers. This enables them to find out the total revenue generated.

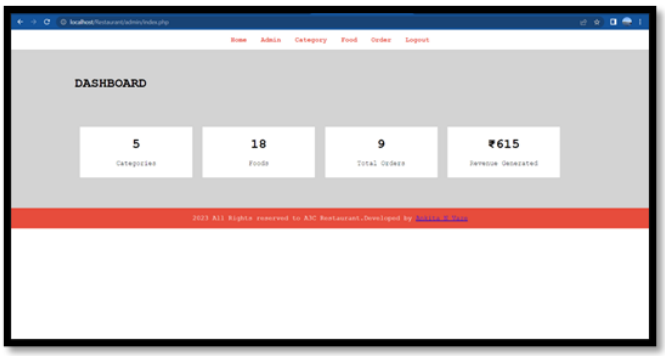

Fig. 5 Home page of admin side of website

STEP 4

Chefs start preparing the food. Once the dish is ready, they press the push button corresponding to the table number and then press the button 'r'.

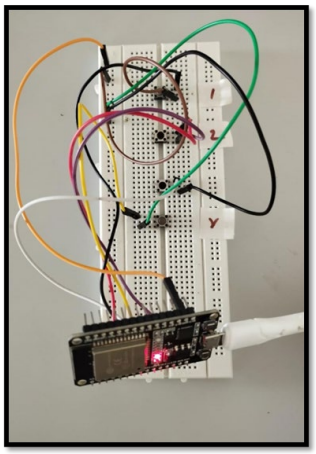

Fig. 6 Circuit for button press in kitchen.

STEP 5

ESP 32 in the kitchen communicates with the ESP 32 on the robot through Wi-Fi. Depending on the buttons pressed, it goes to a particular table and serve.

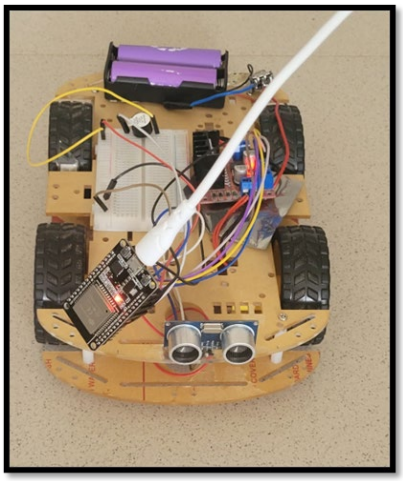

Fig. 7 Robot Assembly

STEP 6

For the payment, the customers must navigate to the "payment page" and enter the following details.

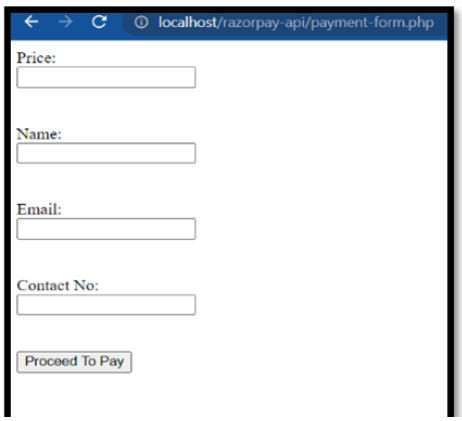

Fig. 8 Payment form page

STEP 7

On clicking the pay now button, the pop-up screen of Razor Pay will appear. This gives the customers a variety of options to pay the bill.

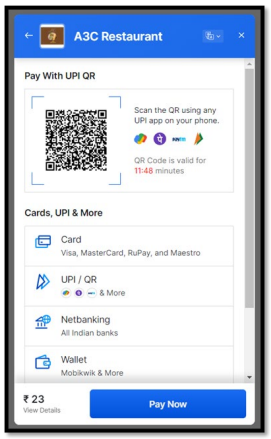

Fig. 9 Payment options shown by Razor Pay

STEP 8

Upon successful payment, the website shows the Payment ID.

VI. RESULTS

The button press message from the kitchen to the esp32 on the robot is successfully done with the serial monitor on the server side confirming the sending of data packet and the serial monitor on the client side confirming the delivery success. Depending on the table number obtained, the robot repeats the path stored in its temporary memory.

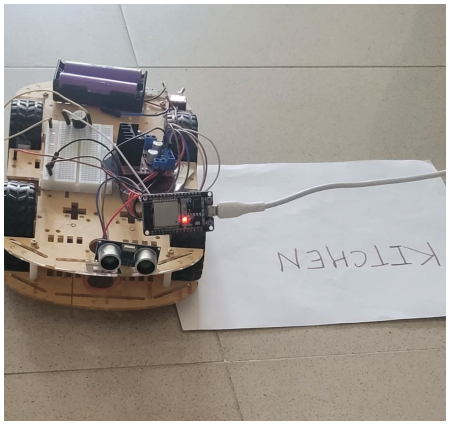

Fig. 10 Robot at kitchen

Fig. 11 Robot at table 1

The customer's information such as their name, phone number, their email-id, the items selected, their quantity, the cost of each item depending on their quantity and the total amount is available in the database. The status column is updated by the admin.

If the customers wish to cancel their order, then he updates the status to cancelled. If the payment is confirmed then, he updates the status to delivered.

Once the payment is successful, the order Id, razor payment ID, status, email ID and price are stored in the database.

The payment ID is then displayed on the website for the customers.

payment details inserted to db

Your payment was successful/Signature Verified

Payment ID: pay_LfdJCvA15AXNWu

Fig. 12 Website showing payment ID.

The admin can verify the payment made by the customers through his/her Razor Pay account.

A waiter robot can work continuously without breaks, leading to faster and more efficient service. A waiter robot can significantly reduce labour costs for a restaurant by eliminating the need for human waitstaff. This can lead to increased profitability and allow restaurants to offer competitive pricing. Promotes a safer and more hygienic environment by preventing the spread of illness and promoting customer confidence in the restaurant. The use of robot provides a unique experience to customers and hence enhances the restaurant's brand. This can lead to increased revenue and a stronger competitive position in the market.

The cost of purchasing and implementing a waiter robot can be significant, which may be a barrier for smaller restaurants or those with limited budgets. As with any

technological system, there is always the potential for technical difficulties or malfunctions. This can result in downtime and lost revenue for the restaurant. Waiter robots may be limited in their ability to adapt to changing restaurant environments, such as moving tables or accommodating special requests from customers.

VII. CONCLUSION AND FUTURE SCOPE

The proposed restaurant management system incorporating QR code technology, and a mobile robot represents a significant step forward in the automation and optimization of food service. The system has the potential to improve customer satisfaction, reduce wait times, and increase efficiency.

System can be used in restaurants instead of waiters. Also, in the isolation wards to serve the medicine or food to the affected person. Used in offices to deliver files from one room to another. Used in industries as a helping hand.

Moreover, this system is scalable and can be implemented in a variety of contexts beyond traditional restaurant settings, such as hospitals, nursing homes, and corporate canteens. As the world continues to grapple with the COVID-19 pandemic, contactless food service has become increasingly important, and this system has the potential to help meet that need.

Looking ahead, envisioning further improvements and extensions to the system, such as incorporating machine learning algorithms to personalize menu recommendations based on customer preferences and ordering history. With the continued advancement of technology, the possibilities for improving the restaurant industry through innovation and automation are virtually limitless.

Further the system can be developed more by introducing path planning using ROS (robot operating system). Further improvement can be made such that irrespective of the obstacle it takes alternate path to reach the destination. Can integrate camera for better navigation and feedback recognition from customers. The software can be further developed such that the bill amount is directly fetched from the database instead of the customer entering it.

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