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SMART RESTAURANT USING E-MENU AND WAITER ROBOT

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Abstract: An electronic menu (e-Menu) and server robot system can potentially enhance the dining experience and improve the efficiency of a restaurant. The e-Menu which uses a LCD display with a 4X4 keypad provides customers with an interactive and visually appealing platform to browse and order dishes, including detailed information about ingredients and allergies. The server robot which uses line follower technique assists in taking orders and delivering food, allowing human staff to focus on other tasks such as cooking and customer service. The main aim is to automate and improve the ordering and billing processes in restaurants along with real time customer interaction and feedback.

Index Terms **- e-Menu, LCD display, 4X4 keypad, server robot, line follower.**

I. INTRODUCTION

Traditionally, restaurants have relied on paper menus and human waitstaff to facilitate the ordering and delivery of food and drinks. However, there are several drawbacks to this approach. Paper menus can be cumbersome and difficult to update, and waitstaff can be subject to human error or inconsistency in service quality. In addition, the increasing demand for convenience and personalization in the food service industry has led to the development of alternative solutions such as electronic menus and waiter robots.

The use of technology in the food service industry has increased significantly in recent years, with the introduction of electronic menus and waiter robots being among the most notable advancements. Electronic menus allow customers to browse and place orders using lcd module and a 4X4 keypad devices, while waiter robots are designed to deliver food and drinks to tables, as well as assist with tasks such as taking orders and making payments. In this paper, we present a smart restaurant concept that combines these two technologies to create a more efficient and convenient dining experience for customers.

Electronic menus allow customers to browse and place orders on LCD screen, which can be more convenient and easier to use than paper menus. They also enable restaurants to offer a wider range of options, as well as personalized recommendations based on past orders and customer preferences. Waiter robots, on the other hand, can assist with tasks such as delivering food and drinks to tables, taking orders, and making payments. They can also improve efficiency by reducing the workload of human staff and enabling restaurants to operate at higher capacity.

II. PROBLEM STATEMENT

Inefficient ordering and food delivery processes leads to long wait times and frustrated customers. Dependence on human staff to provide information and recommendations, which may be prone to error or bias. Difficulty in gathering customer feedback and data to improve operations. Difficulty in competing with other restaurants that offer more modern and convenient dining experiences.

III. LITERATURE SURVEY

Bankar et al. [1] have discussed in the present restaurant system, there is more reliance on humans for the complete process from ordering to serving food. In this proposed system the complete process is automated. The system uses modern methods/techniques like a multi-touch module for ordering & receiving bills, and an RF module for communication between the user and chef. A meal-serving robot is used for serving food that follows a designed path to provide a unique & completely automated dining experience. An android app PayPal is used for payment purposes.

Alam, Kazi Rabiul et al. [2] have discussed that the main aim is used to reduce the initial operating costs of smart restaurants. The most common method used in this kind of restaurant is to use a line follower robot for the delivery of food. This method has its drawbacks, like the initial cost of installation is very high and it consumes a lot of space as it needs a dedicated line for its working. Hence an overhead crane is used to overcome all these drawbacks. This overhead crane is capable of serving food directly from the Kitchen to the customer's table without any intervention in between. Mobile software is used to control this system, the frame is built which works in an overhead wheel system working on a relay system, and IR sensors for obstacle detection and Microcontroller PIC 16F72 for the recognition of the table the food has to be delivered from the Kitchen to the desired table.

Kapoor, Khushi et al. [3] have discussed that in today's restaurants, multi-touch menu cards & other digital methods are replacing old-fashioned services like waiters who take orders from customers and serve them. It provides a lot of flexibility in promoting meal and snack options. The automatic serving robot provides proper service to customers at the restaurant. The technologies used Arduino Mega, RF module, database management in modern restaurants to enhance the quality of service to enrich the customer dining experience. The customer needs to scan the QR code on the table, after scanning the code, the customer will encounter a mobile application on their mobile where they can order the food. As orders are displayed in the Kitchen, the cook will place the dishes on the robot and the task of the robot is to serve the customer.

Antony et al. [4] have studied that multiple robots working simultaneously can do a better job after tasks in an efficient & productive way than an individual robot fulfilling it. Many different strategies that can be centralized & decentralized approaches are used for the coordination of robots in applications such as firefights, disaster management, restaurant automation, etc. In a centralized system, synchronization among robots is done through communication between the central station and robots. Problems that a multi-robot system may face limitations in communication actuation, perception, and coordination in task management. In this paper a hybrid approach where a centralized system coordinates a team of automated robots implemented for the automation of food serving.

Akhund et al. [5] suggests that robots are handy in reducing human work. It can also be efficient in saving time and human energy. Robots nowadays are used in a wide variety of applications in the hospitality fields like restaurants. In this paper a line follower robot using IOT is built to reduce the cost & maintenance of the restaurants. The line follower Robot is used to avoid obstacles, it also uses RFID to recognize the table and serve the food. It can also, calculate the price of the orders. It connects to the customer's phone and also sends order details to the chef and manager. QR codes can be used to make online payments.

Gohil et al. [6] suggests that the main objective of this paper is to attract customers by making a modern and efficient smart restaurant by minimizing human interaction for ordering, billing and serving purposes. Here for the frontend work of the model, Arduino UNO is used for the backend work PHP, HTML and CSS has been used. PHP, HTML, and CSS is used for making a website for ordering food and to display the menu for customers on the phone. The current food orders/status of food can also be seen using this menu system. The orders which are prepared are communicated using a wireless medium at the cash counter laptop. The orders are also displayed on the laptop present in the kitchen according to the table number & priority of the orders. The food is delivered by a line follower Robot.

Huang et al. [7] suggests that the paper aims to build an automatic and intelligent restaurant by use of many robots which co-operate with each other. The system used here uses MATLAB software as a platform and uses Vision C# as a design tool to simulate the effect at the final. According to the no of guests, the system determines to assign a variety of robots & orders the robots which are nearest one task to perform according to the decision making. Particle Swarm Optimization is used to plan the path to obtain a faster convergence speed, and enhance the ability of global search so that the robots can achieve communication, co-ordination, and cooperation to execute the functions of automatic guest hosting, food delivery, table cleaning & many other features in the restaurants. This paper suggests a mechanism for an automated restaurant without any waiters by the use of multiple robots. The main contributions of the paper are integration of map contraction, optimal path planning & manipulation algorithms of multiple mobile robots.

Sheikh et al. [8] suggests that the paper suggests that there is rapid growth in the field of automation and robotics. Robots are used to improve the efficiency of work & reduce human errors. This proposed system provides a contactless system for ordering and delivering food. This project's main aim is to maximize the robot carrying capacity and improvise the delivery system. The food can be ordered online using the WIX website. This helps in accountancy, payments, ordering & order tracking. This system even has a special provision to make reservations and order takeaways. Arduino Mega 2560 has been used due to the availability of large flash memory. A line follower Robot is developed which is controlled with a PWM signal for the delivery of food.

Hamdany et al. [9] suggests that this project intends to provide a better customer experience by providing better & faster service for customers. The robot here is designed to respond to lighting sources and signals from any table to take orders from a particular table. The robot has an inbuilt Embedded E-menu system through which the customer can place their order. An LCD is used for the E-Menu the system, Bluetooth module is used for communication between the customer, cook, and reception. Orders are sent in a sequential manner using the same method and delivered accordingly using the help of a line follower robot.

Asif et al. [10] suggests that the robotics technology is replacing manual work at a fast pace throughout the world. In classical café, restaurants and hotels, the customers face a lot of problems due to congestion at peak hours, unavailability of waiters and due to manual order processing. These shortcomings can be handled by using a restaurant automation system where Waiter Robots are used for ordering food and beverages. A Bluetooth module is used for the wireless communication having the range of 10 meters in non-line of sight (NLOS) while 50 meters in line of sight (LOS). ATMEGA 328 microcontroller is used for managing all tasks for the motor driver as well as communication with the other sub-systems improved performance and better human machine interface (HMI) design..

IV. METHODOLOGY

The restaurant would have a E-MENU that is installed or placed on each and every table. The E-MENU would have a menu that the customers could browse through and select the items they want to order. The customer would select the items they want to order and add them to their cart. When the customer is ready to place the order, they would select the option to send the order to the kitchen via Bluetooth. The order can be sent to the kitchen via the E-MENU on the table by Bluetooth to send to the kitchen's computer or tablet. The kitchen staff would receive the order give a confirmation and start preparing it. When the order is ready, the kitchen staff would mark it as complete in the system. This system could be used to streamline the ordering process and reduce wait times for customers. It could also be used to reduce errors in orders and improve overall customer satisfaction. Additionally, the Bluetooth technology used to send the order from the customer's table to the kitchen's device could help to ensure that the order is secure and cannot be intercepted by unauthorized users.

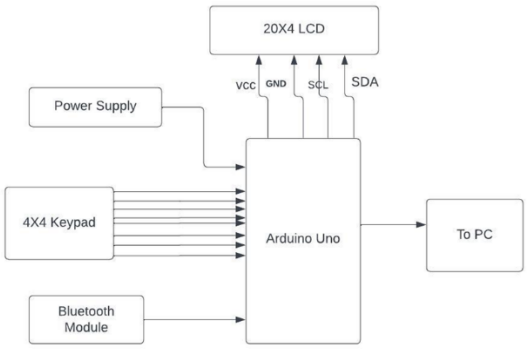

Fig: E-Menu Block Diagram

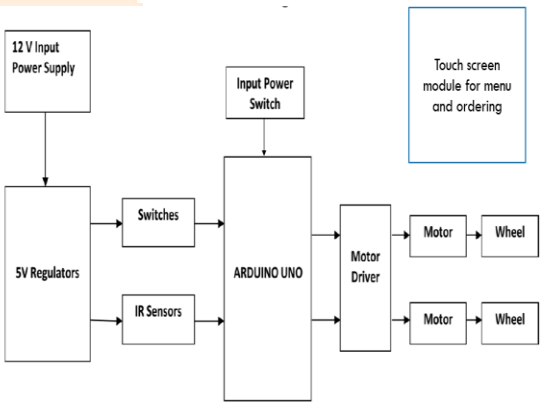

Fig: Waiter Robot Block Diagram

2) DELIVERY OF ORDER

The robot is used to serve food from the kitchen to the table. The robot makes use of line following method with the help of Infra-red sensors for navigation. In case of barriers within the way the IR sensor in the robot will detect them and stops the robot. A keypad is integrated within the robot to know which table to serve.

The robot is first positioned close to the kitchen (on the line). When the food is ready, the chef can place the items on the robot and click the table number on the keypad for delivery. The robot will start making its way to the table following the line. In case of obstacles within the path, the IR sensor will locate them and prevent the robot from moving. And additionally, while it detects the table it will give a buzzer indicating it has reached the designated table.

The directions for the table are already coded in the robot for smooth running. This smart robot has senses of holding for some fixed time delay at specific ordering table and after that completion of serving order it'll automatically return to the kitchen room to attend the subsequent order in queue.

AbbreviationsandAcronyms(Heading2)

Defineabbreviationsandacronymsthefirsttimetheyareusedinthetext,evenaftertheyhavebeendefinedintheabstract.Abbreviationssuc hasIEEEandSIdonothavetobedefined.Donotuseabbreviationsinthetitleorheadsunlesstheyareunavoidable.

V. RESULTS

Fig: 1) E- Menu for ordering

Fig :2) Press D to confirm order

Fig : 3)Delivery of food to designated table.

Fig: 4) Press B to generate Bill

Fig: 5) Give customer feedback (press 1 to 5)

Fig :6) After giving feedback.

V. CONCLUSION

The Smart Restaurant using E-Menu and Waiter Robot project is a great example of how technology can be used to improve the dining experience for customers. With the use of an E-Menu, customers can easily browse through the menu and place their order without the need for a physical menu or a waiter. The Waiter Robot also helps to reduce the workload of human waiters by delivering food and drinks to the customers' tables. The project has several benefits, including improving the efficiency of the restaurant, reducing wait times for customers, and providing a unique and innovative dining experience. It also helps to reduce human contact, which is especially important during times of pandemics or other health crises. However, it is important to note that while technology can certainly improve the restaurant experience, it should not replace the human element entirely. There should still be human staff present to interact with customers and provide a personal touch to the dining experience. Overall, the Smart Restaurant using E-Menu and Waiter Robot project is an excellent example of how technology can be used to improve the efficiency and customer experience of restaurants while still maintaining the importance of human interaction.

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