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Smart Restaurant: From Order to Delivery, and Security

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Abstract*—"Automation is everywhere", it is present in all kinds of modern businesses. Conventional restaurant system doesn't employ any kind of technology for work. Whereas in this modern system customers can use their smartphones to order food from a digital menu available in the website. Orders are displayed to chef in the kitchen where he can prepare the food according to the queue. After the preparation a waiter robot will deliver the food to the respective table. Using a digital menu to take an order and a robot to serve the food reduces human error. It also helps in reducing the employability costs and increases profit margin. Some security measures are also implemented to prevent theft and an alert system in case of an emergency.*

Keywords—digital menu, Waiter robot, alert system

1. Introduction

We are living in a world where everything is becoming smarter, from smart phone to smart home. Modern technologies are helping many businesses to make their operation more convenient and effective. In a conventional restaurant system orders are taken by waiters after which the food is prepared in kitchen and served tom the customer by a waiter. This system relies on manpower to handle customer reservation, ordering food, placing order on table, and collecting the bill. This system is prone to human errors. There are some situations where waiters are busy to attend.

To customers and serving of food is delayed or it is not served on first come first serve basis. To avoid these problems we propose a smart restaurant system in which most of the tasks are automated. This system consists of three modules

Module 1: The first module deals with ordering of food. Here customers order food from a website using their smart phone where they specify the food and their table number.

Module 2: Second module deals with serving of food. Here the prepared food is delivered to the customer using a waiter robot.

Module 3: This is a safety and security module. This module is used to alert people in case of an emergency and detects theft.

2. Literature Survey

We have gone through some research papers and got to know the following inferences which will be helpful in our paper

Md Younus, Pooja Gadekar , Adiraj Walse [1] explained the basic working of Line Follower Robot which follows the path using IR sensors ,DC Motors and driver module.

Mehran Pakdaman and M.Mehdi Sanatiyaan [2] explained about Line Follower Robot and how they used

CNY70 sensor, L298N, Atmel's AVR microcontroller and actuators.

Neeti Malik, Neetu Rani, Alpana Singh ,Pratibha ,Srishti Pragya[3] proposed a work on Server Robot with object detection where it uses LDR sensor and LED lights to detect the table and IR sensor for object detection in it.

Prejitha.CT, Vikram Raj.N, Harshavardhan Vibhandik, Gayatri Wadyalkar, Pushpak Tiple, Khushi Kapoor, Sai Prajna Manduri, Ankush Oswal, Manasi Sanjivan Kulkarni[4] from different branches of enginnering formed a group and developed a Design of Restaurant Service Robot where it comprises of various sensors, speakers, buzzers and motors. They have also created a contactless food carrying cabins within the robot so that there won't be any dust accumulation on it.

This group also created an online website where all the menu details and price details of each item will be available in it and customer can order food items through that website.

Tuhin Ghosh,Shubham Bhoir,Prashant Patel,Nikhil Mehta,Samruta Mhatre[5] has created an website and application for Smart Restaurant where website works on connecting with wi-fi within the restaurant and it involves three modules named Tablet module ,Server module and Kitchen module . Here customer can order food item within the premises of the restaurant or they can also opt home delivery.

3. Proposed Work

3.1 Smart Ordering system:

Smart Ordering system, This module involves the replacement of old traditional food ordering process using menu cards on table and servers with the usage of online

web page to display and order food items within in the mobiles of the customers.

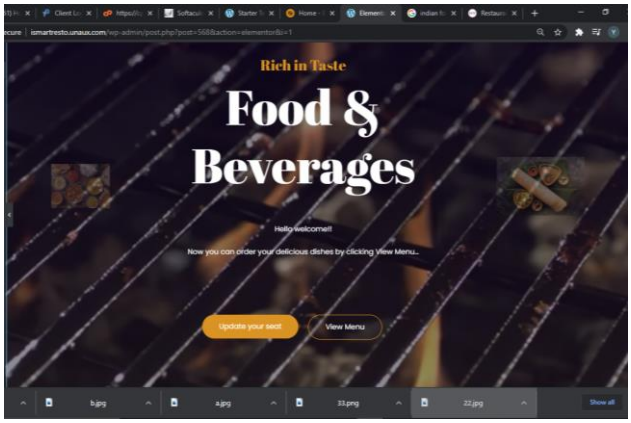

Figure 1: Interface

In this paper we have explained the whole process of Smart Ordering system from the display of food items on the customer's mobile to the billing process .This complete process of ordering to billing have three segments in it User Segment, Chef Segment, Billing Segment. Whenever the user selects the required food items and entered required fields like Table number and Mobile Number the order will be saved with that particular table number and will be sent to both Chef's Segment and Billing Segment. In the Chef's segment the order will be queued as per the previous orders and in the billing segment the order will be showed with the table number so that the user can pay directly at the billing counter.

Figure 1 gives us the view of the interface of our web application.

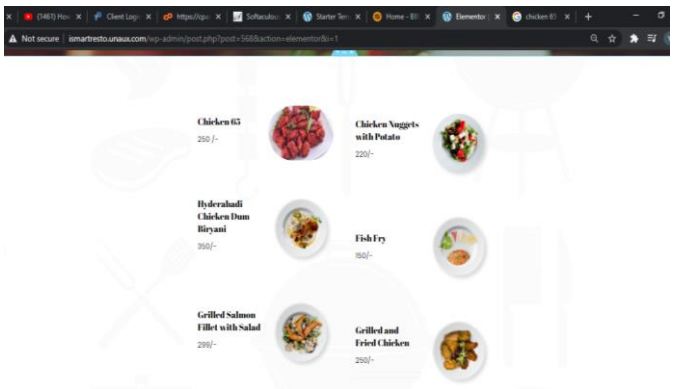

Figure 2 Menu Details

As an User interface our web application displays a welcome message to the customer and then it will take them to the list of food items along with images and price details. Customer can add as many items he wants to order and add them to cart and he need to enter table number so that order will be saved with that table number so that server robot can deliver the food easily. We gave two more segments where the item list will be sent to that two segments as soon the customer submit their food items.

Figure 2 gives us the view of menu which appears in our online website so that customer can choose the required item.

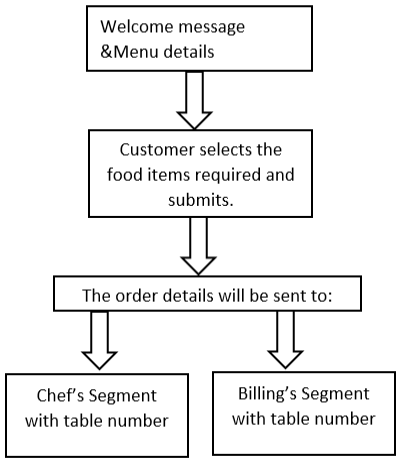

Figure 3: Flow Chart for ordering system

Figure 3 gives us an idea of Smart ordering system in the step wise from the welcome interface of the customer to the chef and billing segment.

3.2 Server Robot:

Second module completely deals with serving of the food. In this module a robot is employed to deliver the food. Employment of robot helps in reducing the human errors. The robot is able to move form kitchen counter to the respective table and returns to the kitchen counter after delivering the food. The layout of the restaurant looks like the Figure 2.

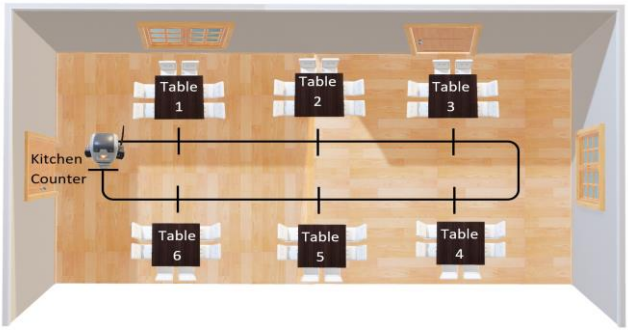

Figure 4: Layout of the restaurant

Layout can be customised in other ways with sufficient space for robot to move. The design of the robot is not similar to the humanoid robots. It is of convenient height and has more space to carry food and beverages inside it. It has racks to place food and beverages inside it. It also contains pockets for spoons and forks.

Figure 4 is the Layout of the restaurant and the path arranged for the server robot to serve the food ordered by the customer.

Line Follower: The robot is path follower. It follows the path layed on the floor with the help of IR sensors. A black path is layed on the floor which is sensed by the IR sensors. The values given by IR sensors helps in determining the direction of movement of the robot. Every table has a horizontal black line near it. It is used to sense the position of the table.

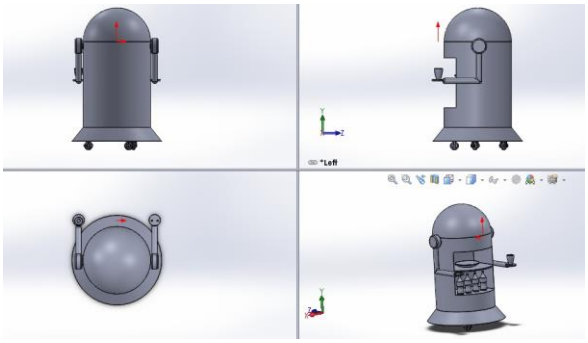

Figure 5: Back, Side, Top and front view of robot

Obstacle Sensing: The robot is equipped with ultrasonic sensors to detect obstacles. Ultrasonic sensor continuously monitors the distance between the obstacle and the robot. When the distance measured by the sensor is below a specified limit it alerts the person standing in front of it to clear the path using a buzzer. In this way the robot is able to move through the path avoiding the obstacles

Figure 5 gives the four dimensional mechanical view of the server robot.

Input: The robot uses a keypad to take input. Input given to the robot is the table number. Chef enters the table number using the keypad after placing the food inside the robot. The robot then follows the path and reaches the specified table.

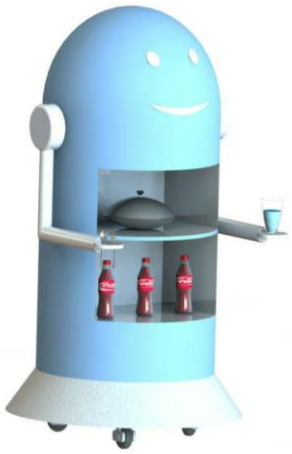

Figure 6: Clear View of Server Robot

Figure 6 is the clear image of the server robot where it have shelves inside to keep the food so that no dust and germs accumulate on it and we have given some extra holders to carry spoons, forks etc to our robot.

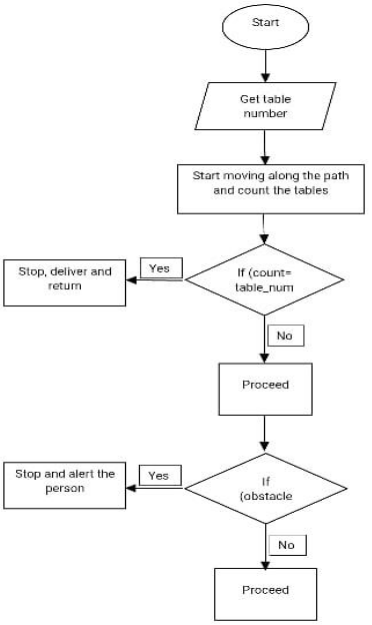

Figure 7: Flow chart of Server Robot

Figure 7 is the Working Mechanism of our waiter robot in the form of flow and also explained about the obstacle detection.

3.3 Safety and Security System:

Restaurant is the place where customer comes to eat food they want and pay according to that. Now the only way to attract the customers to visit or revisit the restaurant to build up the trust in their mind. Where trust can be build on the basis of three aspects Taste, Ambiance and Security. As taste depends on the chef and each restaurant have its own type of

tastes and styles. Ambiance involves the atmosphere, how attractive we are creating our surroundings and the third one involves safety and security systems which works on all security measures taken in the whole restaurant area in order to prevent any damages before they take place.

As Safety and Security plays a key role in any area, Our project involves Safety and Security System in restaurant where we used some sensors to detect different parameters within the premises of restaurant and either send them to the management or sends command to some actuators to react immediately .The sensors and actuators we used in our project are as follows:

3.3.1 Motion Detection:

PIR Sensor: Passive Infra Red sensor is a sensor which detects the ir radiation of any animals or human which are in motion. It will be helpful for us in the detection of any theft during night. As our sensor is embedded with lights and alarms, whenever it detects human motion near windows or doors it turns all the lights on and rings the alarm so that the theft won't take place.

Ultrasonic Sensor: This sensor helps us in two ways one is to detect any motion near windows or doors and the other one is to drive the small animals away as they may not be detected by the PIR sensor but those animals can hear the ultrasonic sounds and run away.

3.3.2 Fire Prevention:

It involves the detection of any fire or its related gases and taking accurate action to prevent it.

Smoke Detector: It is the sensor which is used to detect any smoke or fire within the premises near the sensor and sends the data to the management or the appropriate actuators to work on to control the issue .Here we use sprinkler to control the fire automatically when fire catches.

Carbon Monoxide Detector: Carbon Monoxide is a toxic gas which releases when carbon fuel burns .Carbon Monoxide detector detects such gases when any leakage of cylinder within the kitchen area and sends command to the management along with the buzzing sounds.

In addition to all these sensors and actuators, as a project of smart restaurant system we also worked on hand sanitization where we install the sanitizer which sprinkles on hand of the customer when he keeps hand infront of it.

This sanitizer will be kept at the entry of the restaurant so that customer will enter with hygiene hands. We used IR sensor to detect the hands of the customer and it allows sanitizer to open its lid when detected.

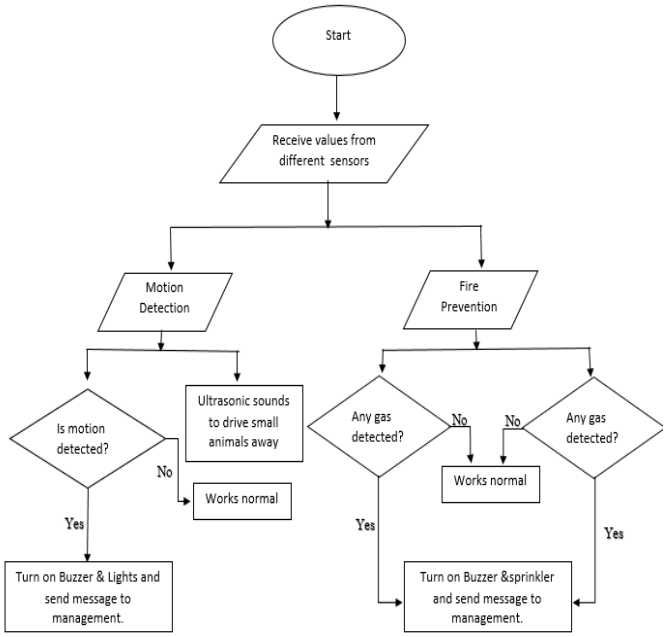

Figure 8: Flowchart of Safety &Security System

Figure 8 is the flow of complete work done by different sensors and actuators under the safety and security system within the restaurant.

4. Result and Analysis:

We have created a virtual environment of Restaurant and applied safety and security system by using some sensors and actuators in it as shown in figure9.

Figure 9 : view of security system in restaurant

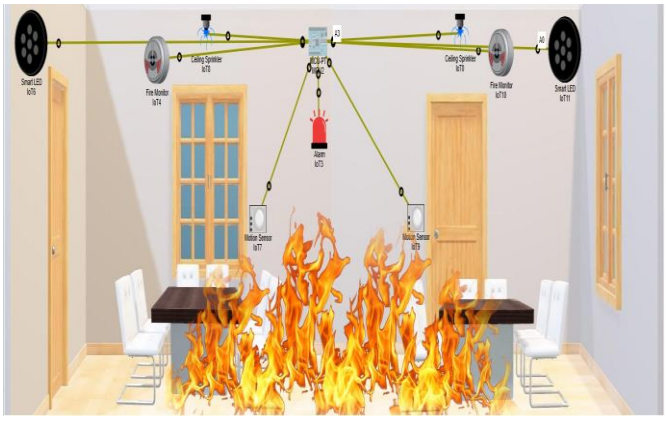

Figure 10: Sprinkling of water and Buzzer ON when detected fire.

When fire or any gas is detected by gas sensors in the restaurant then there will be immediate response from the sprinklers by turning ON and sprinklers water on it and cools down down the temperature in the restaurant. We can witness the working of sprinklers as there is blue colored liquid near the sensors in the figure 10.

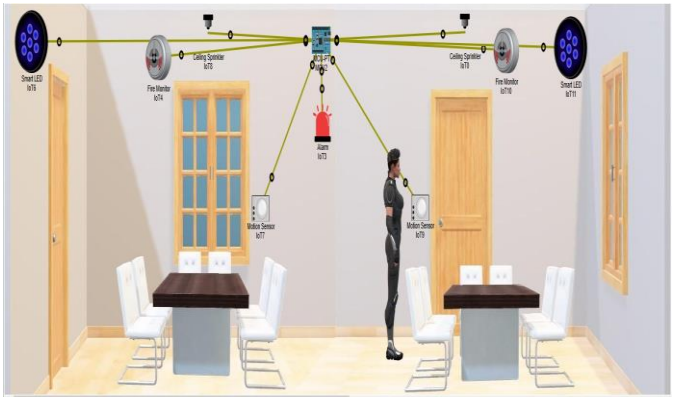

Figure 11: Lights ON when motion detected

Motion Sensors are used in this project to detect any theft or unwanted movement of any person within the restaurant especially in the night time .So whenever the sensor any human or animal motion in front it ,it will turn all the lights on as shown in figure 11.

5. Future Scope:

This robot can also be involved in room service also so that it can carry all the basic items which are required by the customer.

This waiter robot can also be customized with some changes in hardware and software so that it can be installed in hospitals to carry medicines, in libraries to carry books and also used by elder people for house service.

6. Conclusion:

This paper has explained about the Complete Smart Restaurant System where it involves Smart Ordering System to the Smart Security System. We can order food through online website. The ordered menu will be sent to the chef to cook as per the queue and also sent to the billing counter so that customer can pay the amount directly without wasting the time. Food will be delivered by the waiter robot. Seperate chambers were created for the server robot and closed with a glass lid so that the germs and dust cannot be accumulated on the food. Security system involves various sensors which prevent the risks and takes appropriates actions if anything happens. As robots are involving in our daily works this system will be more effective and attractive and less prone to errors.

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