



Autonomous Serving Drone for Intelligent Restaurant System

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ABSTRACT: In today's world the use of robot is going on increasing. Robots are able to carry out every work more effectively and efficiently than a man can do. This paper demonstrates the idea of "Autonomous serving robot". There are many areas of research that could be done for a serving robot. The main concept of this paper is to deliver the food from the main counter to the customer's table by using a robot in a restaurant. A line following robot can be designed using sensor operated motors to reach the correct table and to provide proper service to customer in restaurant. If a person wants to give an order then he can use the android tablet on his table. The ordered or selected food list will be displayed in the kitchen tab to the corresponding table number. The person at the kitchen checks the order, prepare it and put it on the robot serving tray. The total cost for each orders placed will be calculated and displayed to the main counter. The robot uses an 'Arduino Uno' to run the program of line following module and obstacle detecting module. The robot will move to the respective table based on the information given from the main counter. The robot movement is stable and logical.

KEYWORDS: Line following robot, obstacle sensor, Wi-Fi module

I.INTRODUCTION

The world is becoming smart, interaction between robots and humans is becoming stronger as they have become an indispensable tool in ensuring the quality at present. Robots play a key role in making our daily lives easier and better. They are used in diverse areas better than even before, the recent advancements in the field of robotics are astonishing. This paper deals with a food serving robot based on Aurdino Uno. This food serving robot is a combination of recent technologies like line following, obstacle sensing etc. Aurdino serves as the heart of the robot, it plays the key role in directing and controlling every moves of the robot. Wi-Fi module, driver circuit and sensors are the other major components.

This robot is basically a line following robot, with the help of two IR sensors. Obstacle detection is another feature and is done using ultrasonic sensors. Android tab provided on each table and the robot is connected to the common Wi-Fi network. The customer can use the android tablet for ordering food items. The ordered or selected food list will be displayed in the kitchen tab to the corresponding table number. The person at the kitchen checks the order and put it on the robot serving tray to deliver the food to corresponding table. The person at the counter initiates the movement of the robot to reach respective table. In case of any obstacle the robot will stop within a range programmed by the programmer and produce a beep sound to give warning. It will take left turn or right turn or straight to the next junction as per the instructions providing.

The most important feature of the robot is the hygiene. Several advantages can be pointed out regarding the robot. Robot will be much efficient and cost effective when compared to a waiter. The basic objective of the Serving Robot is to serve the customer effectively.

II.SYSTEM BLOCK DIAGRAM AND WORKING

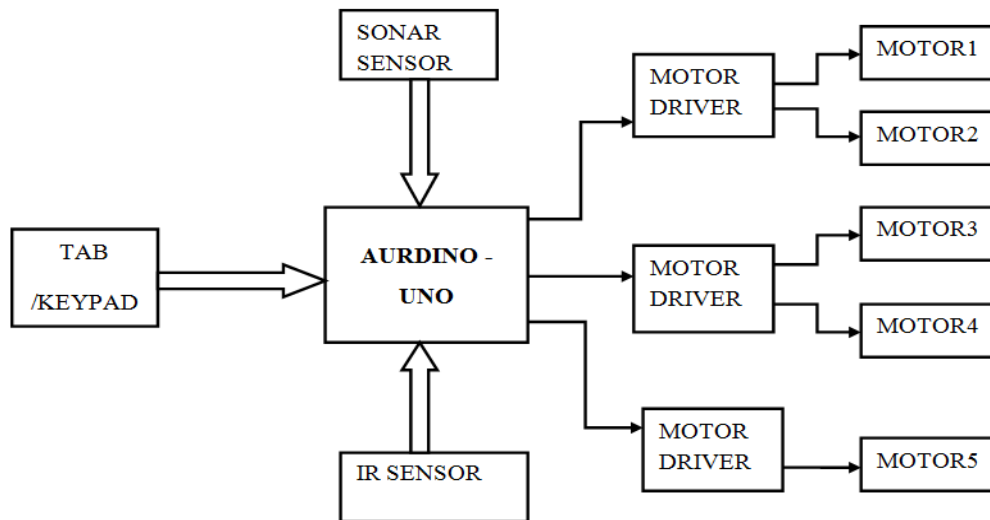


Fig.No:1 Block Diagram

The basic block diagram is shown above.

Ardino uno serve as the main block for the robot functioning where the entire program is loaded. The full system is connected to a common Wi-Fi module (ESP8266). The order from the customer through the tab is send over this Wi-Fi to the kitchen /main counter corresponding table number. Whenever the food is ready to serve to the customer, by providing the table the robot will deliver the food. When the command is provided the robot will start following the black line by IR sensor along with detecting for obstacle using ultra sonic sensor (HC SR04). If any obstacle is detected the robot will stop moving with giving a buzzer sound as the warning. The selected binary coded inputs are given to Arduino uno and it checks the corresponding binary number of the output. This programmed ardino uno actually compares the output data and some early inputted data. And then it's output is given to the motor driver circuit which drives the motors accordingly. According to the command the motor driver, drove motor to forward or backward or left or right.

The arena will be consisting of the black lines and tables with android tablets. When the customer comes he/she can use the tab instead of the menu card to order the food. As the tab provide provision to order all types of food items available in the restaurant. The ordered or selected food list will be displayed in the kitchen tab according to the table number. The person at the kitchen checks the order, prepare it and put it on the robot serving tray. As the kitchen user will provide the command of the table number for the robot to serve the food. A priority order is set for delivering order. Then the robot will initiate its program to follow black line. The robot will start following black line and provides proper service to respective person or table automatically. After serving it will again follow the returning black line path and come to the starting position. The model consists of the following segments:

a. **LINE FOLLOWER:** A line follower robot is used to follow the black line within the restaurant. Mainly Infrared (IR) sensor (STL015V1.0) is used for line following. When sensor sense black colour, the robot will move forward through the line and it can also self adjust the robot to maintain movement within the given path. Whenever the value of sensor changes it is time to take decision by the robot to deviate from the current status.

b. **OBSTACLE DETECTOR :** An obstacle detector is an intelligent feature of the robot, which can automatically sense obstacles on its path. It is designed by using Ultrasonic sensor (HC SR04). The principle behind it is that whenever an obstacle comes in front of the Ultrasonic sensor there will be a change in output of sensor and this change will be

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detected by Aurdino uno. And hence the obstacle is detected and the Aurdino sends a signal to buzzer and the beep of the buzzer indicates the presence of the obstacle in the path. The range of the sensor can chooses according to the requirement, in reference to the sensor standard range.

c. WIRELESS TECHNOLOGY : Wi-Fi is a technology that uses radio waves to provide network connectivity for entire restaurant to smart function. A Wi-Fi connection is established using a Wi-Fi module (ESP8266) to create hotspot for the communication between robot and different users and also between the tabs. The wireless technology (RF technology) is used to get the order to the counter section and kitchen. The whole control of the robot is also done by making use of this technology.

d . POSITION DETECTION : The tab placed on the each table is used to service the customer who wants to order the food. When the customer place the order using the tab , the same list of data is copied and send to the counter. The person at the counter checks the order, prepare it and put it on the robot and robot again provides proper service to respective person automatically. In IDE programming language , detection of the correct position/table following the path is programmed.

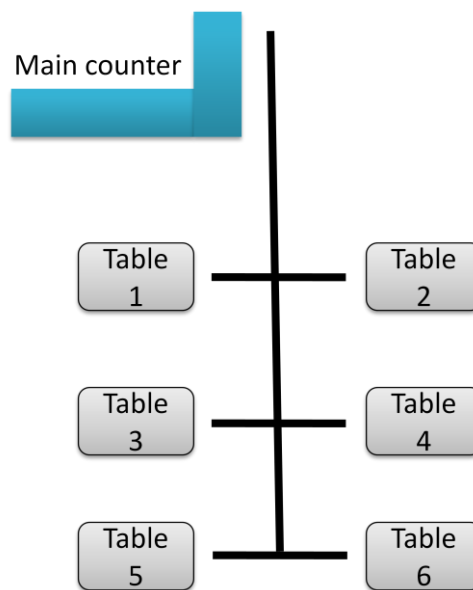


Fig.No:2 Working Arena

The working arena is shown in fig.1. There is a counter at which the order is given by the customer is received. There may be several tables which are arranged in this patten n. This is done to provide a specified path to the robot. This is a track which is of black colour, sensed by the robot for the entire movement. The arrangement of a particular restaurant is as shown in the figure , there can be any other arrangement. It should consist of a main counter, robot and the arranged tables.

III.RESULT AND DISCUSSION

Modelling of the proposed design is done in proteus 8.1.The food serving robot consist of hardware components like aurdino uno, ESP8266 Wi-Fi module, ultrasonic sensor (HC SR-04), motor driver (L298) and 12v DC Motor. Simulation in proteus was done for partial circuit only due to few limitations in it. The simulation circuit consist of a aurdino board connected to motor driver where the 4 motors are connected and to ultrasonic sensor.

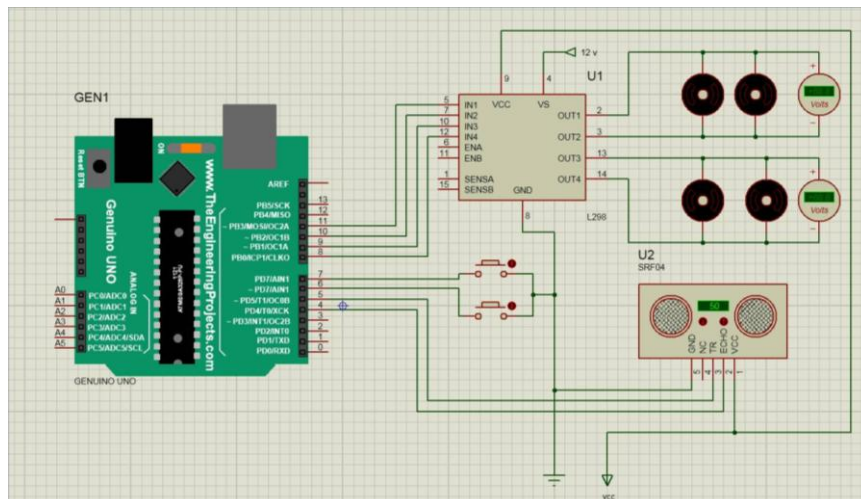


Fig.No:3 Simulation diagram for motor movements

As the implementation of the food serving robots to the intelligent restaurant system will brought a drastic development in the food sector. These robots can reduce the customers waiting time. One time investment is much enough, that it does not requires frequent maintenance. Mainly the robots can do the work faster and also appointing robots may reduce the cost of labouring. The most vital advantages is applications are performed with precision and high repeatability.

IV.CONCLUSION

Robots are increasingly becoming the part of the new generation. The idea of delivering food using a robot is not a new yet there are several technical difficulties to overcome. First it would be the cost involved in the manufacture. To convince that this automated food delivery system is workable, it comes to a point that people will realistically compare the cost of hiring a worker and buying a robot. Thus it is essential to keep the cost down. The stability of the robot cannot be compromised, this leads to the determination of the optimum operating speed. This particular system allows customers to order food by android app which is programmed by embedded c, which is wirelessly connected to the counter via Wi-Fi module. A line following robot is used to carry meal from counter to customer. An automated food delivery system using a robot is yet to be popular in the food and beverage industry. However, once the technical difficulties can be overcome and improvements are made, the automated food delivery system using a robot is a possible solution to the issues faced by thousand of restaurant owners.

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