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Virtual Path Following Smart Waiter-Bot

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ABSTRACT

The Waiter-Bot is an exceptional autonomous robot which has the ability to follow a designated path like a pathfinder with the help of IR sensor arrays and reach its intended destination. It is an Arduino based robotic design implemented to seek out and detect its required destination and perform its deliberate tasks with precision and accuracy. The Waiter-Bot consists of simple mechanical design which has simple mechanism with which performing the necessary tasks becomes easier. Due to its design parameters, it also requires less power and draws less current which allows us to work with the robot safely. Moreover, it also adds to the safety to its environment and the people around it. Its light weight builds up allows us to assemble the parts without having the difficulty to carry it anywhere. Once assembled, the entire robot still remains light in its weight and can easily be moved around if necessary. Based on its complete set-up and overall parameters, the waiter-bot stands out on its own to become an important aspect to the solution of this paper.

Keywords : Arduino, Motor driver, IR, LCD.

I. INTRODUCTION

Restaurants like Spyce are leading the way with robots that cook complex meals on-demand. Companies such as OTG reimagined the restaurant airport experience and replaced servers who take customer orders with self-ordering tablets. A study by the Center for an Urban Future found that the automation potential for waiters and waitresses is 77%. That figure increases to 87% when you factor in workers that prep food. This doesn't mean all these jobs will be automated, but it is a stark reminder that automation has and will continue to reshape the workforce in ways that impact workers and change the customer experience.

The type of experience a business wants to provide its customers, combined with forces like labor and real estate costs, will influence the rate at which automation replaces humans and disrupts the traditional workflow. For example, technology is available to automatically pull espresso shots and make cappuccinos. But the number of coffee shops employing baristas appears to have grown. This seems counterintuitive, but is influenced by the consumers' desire to enjoy an authentic coffee shop experience that includes a handcrafted espresso drink with a touch of human interaction. But operational

efficiencies for businesses, consumers' desire for convenience, and their evolving purchasing habits could turn your bearded barista into an endangered species. Increasing labor costs, no tip credit or the potential loss of it for full service restaurants, and greater efficiencies have already been cited by restaurateurs as a reason they've digitized some of their workforce.

Although some restaurants have replaced servers or counter staff with self-ordering tablets, they still rely on humans to bring the food to your table or pack your food to go. Companies like Bear Robotics could change that, just read their tagline 'Reshaping the Restaurant with Robotics & AI.' The robot they've developed can be seen on their website delivering cuisine to diners' tables. And while the robot may not provide the same human hospitality as a person, they can create an futuristic experience. With further advances in technology, these robots will be able to deliver aspects of hospitality like being courteous and helpful, just without the actual human touch.

Restaurant delivery personnel aren't safe from technology if you live in a city. Imagine if you ordered a pizza from your local pizzeria and instead of a delivery person standing at your door with pizza in hand, a small car-like vehicle appears, its top pops open and you take your pizza out. Companies like Marble have built sidewalk delivery robots, which they are developing to become fully autonomous in dense urban environments where they'll navigate people and all the obstructions found on city streets and sidewalks. It's not far-fetched to imagine that instead of a high school student delivering your pizza in the suburbs, a self-driving car will pull down your driveway, a little robot will get out and bring the food up to your front door. And while customers may not crave human interaction from restaurant delivery, there's a different expectation when it comes to seeing your barkeep at the local pub.

Suggesting that your beloved bartender can be digitized is sacrilegious to many people, but it's not out of the question. Products like Smartender pour over 600 different drinks from a touch screen machine that syncs up with a bar's point of sale system and existing equipment. And while this self-pouring cocktail machine in a bar could never inspire a show like Cheers, there are businesses where the efficiency of this technology outweighs the need for a personal pour. If you prefer a little more flair with an element of humanity, consider the Tipsy Robot, which uses two robotic arms mimicking a human bartender that will mix your drink, muddle your mojito, and even garnish your libation for a little extra pizzazz.

If ordering your dinner on a tablet, having a robot serve your food, and touch screen technology pour your beer is too much for you to stomach, you can adjust your tip when paying for the meal from an app on your cell phone. Ultimately, restaurants, consumers and technology companies will determine what technology is here to stay and what is novelty. Either way, society must do a better job planning for the future of the workforce in the age of technology. The Waiter-Bot is an exceptional autonomous robot which has the ability to follow a designated path like a pathfinder with the help of IR sensor arrays and reach its intended destination. It is an Arduino based robotic design implemented to seek out and detect its required destination and perform its deliberate tasks with precision and accuracy. The Waiter-Bot consists of simple mechanical design which has simple mechanism with which performing the necessary tasks becomes easier. Due to its design parameters, it also requires less power and draws less current which allows us to work with the robot safely. Moreover, it also adds to the safety to its environment and the people around it.

II. BASIC IDEA

The Waiter-Bot is an exceptional autonomous robot which has the ability to follow a designated path like a pathfinder with the help of IR sensor arrays and

reach its intended destination. It is an Arduino based robotic design implemented to seek out and detect its required destination and perform its deliberate tasks with precision and accuracy. The Waiter-Bot consists of simple mechanical design which has simple mechanism with which performing the necessary tasks becomes easier. Due to its design parameters, it also requires less power and draws less current which allows us to work with the robot safely. Moreover, it also adds to the safety to its environment and the people around it.Smart restaurant concept will have two major part, first is ordering system and second is delivering system.

First: Proposed design will have a mobile robot which will be used to deliver foods to the guest/customer in the restaurant. It will deliver food to the table having different identity as a serial number.

Second: In our system we are going to design food ordering as well as delivering system. There will be a device to order food having different menu list on the table with serial number. User will get a matrix keypad interface to order food by pressing respective key.

2.1 Block diagram of system

We have two systems block one is on transmitter side and another is on waiter bot side.

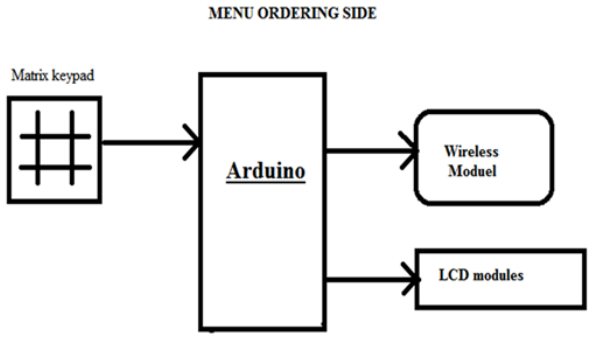


Figure 2.1 Basic Block Diagram of menu ordering side.

On this side we will have a matrix keypad with 0 to 9 number keys along with * and # keys. By pressing different number, we could order the different menu referring to different food items. LCD display will be there to show which items we are ordering. We will have wireless module to transmit encrypted data of the ordered food. Similarly, on receiver side we will have wireless receiver with LCD to show which items to be delivered to which table.

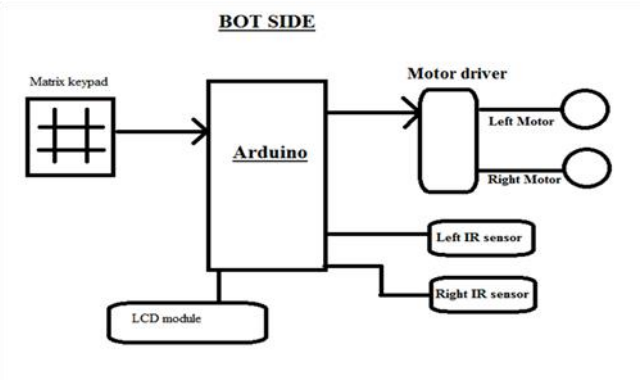


Figure 2.2 Basic Block Diagram of Bot side.

On bot side we will have Line follower section which will follow line drawn as a path on floor. There will be keypad which will give command to bot for the different location of the table. LCD module will be there to show pressed key of table number.

2.2 WORKING OF PROJECT

Proposed system will used in hotels/restaurants as a waterbed. At first side we will have a menu ordering device which will have a matrix keypad with different keys. We will have to press respective key of menu to be ordered. On pressing key, we will get dish name on LCD just to confirm the dish name. Once the selection of menu is final, we will have to press # key on keypad to send order details to hotel. On receiver side the person on system will get the order number along with the table number from which the order is confirmed. Cook will prepare food and place it on tray attached to water bot and press the key of table number.

Both will automatically go to that particular table by following line and the algorithm developed for the

table position. This is how the waiter bot will be smart solutions to hotels/restaurants.

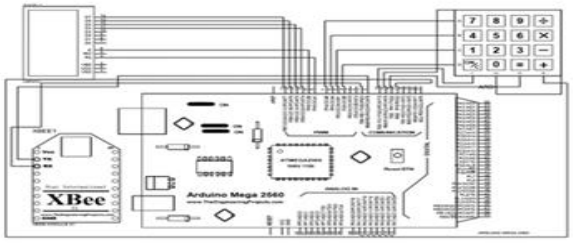


Fig. Circuit Diagram Of Customer Table

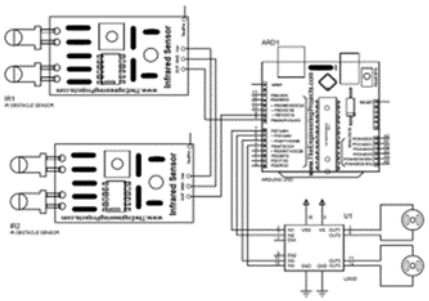


Fig 2 . Circuit Diagram Of Robot

2.3 COMPARATIVE STUDY OF DIFFERENT METHODS

Sr.No	Parameters	Existing Serving Robot	Our Purposed Serving Robot
1.	Navigation	Using Sound Sensor, Using Line Follower, Remote Control	Using IR Sensor With Virtual Path
2.	Serving	Does Not Serve On Table	Can Serve On Table
3.	Ordering System	Generally Using A Touch Screen Or Bell To Call The Robot.	A Web Based Application Of The Communication Between The Customer Table And The Order Receiving Station , With 4x4 Keypad Matrix And LCD Module For Display
4	Balancing	No Need Just Because This Robot Is Moving Along The Path	Gyor Is Used To Use To Balance The Tray At The Tilt Floor And During Serving Food On Table.
5.	Communication	Existing Robot Can Only Serve Packed Food, Towel And Soup Etc.	Our Robot Can Serve Indian Food And Other Dishes Available On The Restaurant Menu Card.(Drinks, Snacks, Daal, Chapatti , Dessert, Etc.)

Table 1. Comparison Between Existing Serving Robot With Our Purposed Solution.

III. LITERATURE SURVEY

[1]Neeti Malik, Neetu Rani, Alpana Singh, Pratibha, Srishti Pragya , "Review paper on- Serving Robot New Generation Electronic Waiter" : IJIRST – International Journal for Innovative Research in Science & Technology| Volume 2 | Issue 11 | April 2016 ISSN (online): 2349-6010 in this paper Serving Robot is designed to reduce the work load of waiter and to increase the efficiency. This system provides an online menu ordering and reservation-making process, and also personal menu recommendation service. With the help of RFID-based membership cards, waiters can immediately identify help of Arduino. LEDs will be place on the path of robots customers according to their consumption records. The waiter uses a PDA to take orders from the customer and with the use of WLAN order is send to the kitchen. Then chefs prepare the menu and waiter can deliver it to customer. When the customer has finished the meal, the cashier uses RFID-based PDA to identify the membership ID to calculate the bill.

[2] Neelima Mishra, Dr. Dinesh Goyal, Dr. Ashish Dutt Sharma , "Automation in Restaurants: Ordering to Robots in Restaurant via Smart Ordering System" : Suresh Gyan Vihar University, Jaipur International Journal of Converging Technologies and Management (IJCTM) Volume 4, Issue 1, 2018 ISSN: 2455 – 7528. The proposal of a fully automated menu ordering system in which the paper based menu is replaced by a user friendly Touchscreen based menu card. The system has PIC microcontroller which is interfaced with the input and output modules. The input module is the touchscreen sensor which is placed on GLCD (Graphical Liquid Crystal Display) to have a graphic image display, which takes the input from the user and provides the same information to the microcontroller. The output module is a Zigbee module which is used for communication between system at the table and system for receiving section. Microcontroller also displays the menu items on the GLCD. At the receiving end the selected items will be displayed on the LCD and by using the conveyer belt the received will send to the particular table.

[3] Anjali M. Yelasange, Husain K. Bhaldar, Kirti A. More, Anjali P. Katkar , "Autonomous Robot for Delivering The Orders in Restaurants By using Raspberry Pi" : International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-6, March 2020. They makes the use of static system in which the robot moves on static lines by using Digital differential algorithm and dynamic system in which the arrangement of the following lines is changed accordingly using Bezier curve algorithm . Author Shivraj P. (2018) tells that they are uses the collaborative operation. It has ability to solve many difficult issues in automation of a system using MATLAB which is act as line follower robot. So that Author proposed the Food Delivery Automation in Restaurants Using Collaborative Robotics.

3.1 History of Robotics

We may think of robotic waitstaff as something that belongs to the future, but the truth is that robots have been serving people at restaurants since the 1980s. How well have these robot servers worked out? Here is a brief history of robot waiters over the last 30 years.

Tambo R-1 and Tambo R-2, two robots built in Japan, used in Two Panda Deli, a Chinese fast-food restaurant in Pasadena, California, between 1983 and 1986. If there weren't any police radios operating nearby (the robots spun in circles and dropped food when any of them were nearby), R-1 and R-2 could deliver food and be nice in three languages (English, Japanese and Spanish). After three years of work both of them were sold to a restaurant in Modesto, where their career ended few months later.

Ken, a robot waiter, moves at a snail's pace to deliver a bottle of wine and glasses to customers' table at a restaurant in Tokyo on Nov. 24, 1985. The four-foot tall Ken, a prototype for a new type of robot to be used in ships and restaurants, is actually operated by Mitsugu Watarai, left, manager of the restaurant. He can't take order or open a wine bottle to serve, but now is a well-known waiter in Roppongi, Tokyo's nightlife district. The manager says some people come in and order a cup of coffee or tea just to see the robot.

The Suzumo Sushi Robot at the National Restaurant Association convention in Chicago, May 18, 1987. It was capable of rolling the rice ball for sushi dishes, while the attendant placed the fish filets on top.

Boris, the dishwasher robot, built in Birmingham University, England, controlled by three computers in 2014.

IV. FLOWCHARTS

Fig 3. Flowchart of How Robot Will Follow The Process

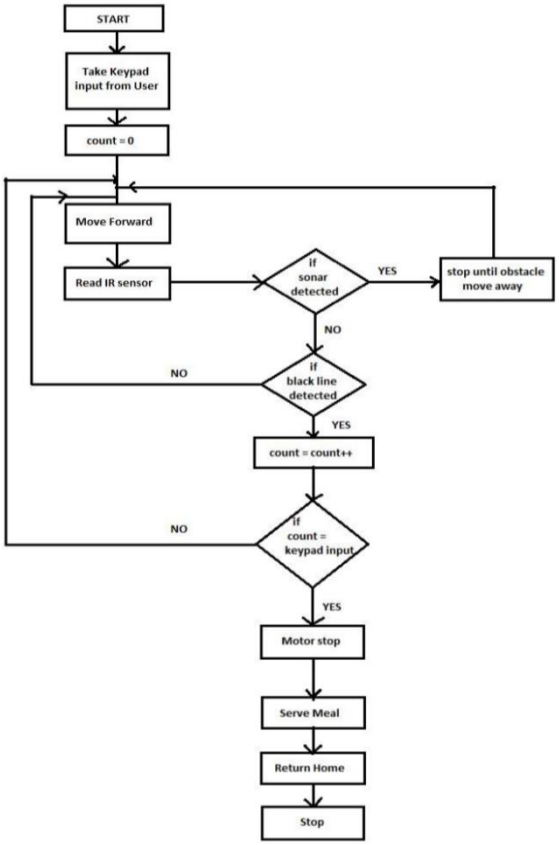


Fig 4. Flowchart of Algorithm

V. RESULT & DISCUSSION

Sr. No.	Switch	Table No.	Time required (sec)
1.	1	Table – 1	20
2.	2	Table – 2	20
3.	3	Table – 3	30
4.	4	Table – 4	30

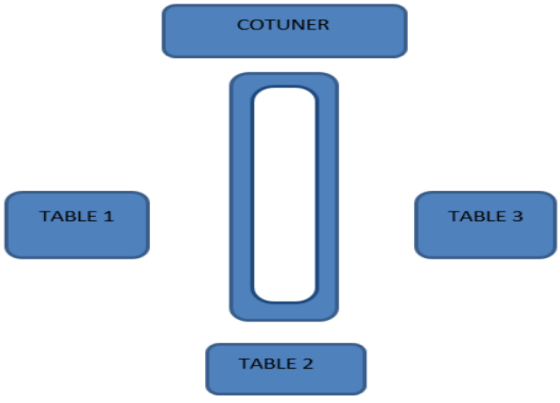


Fig 5. Restaurant functional correlation

If we press the key 1 then robot will follow the path given for Table – 1. Robot will go forward for 10 sec then it will take left turn for 3sec and move forward for 7sec. If obstacle is detected in between Robot will stop, after removing of obstacle robot will follow the destined path. Similarly it will work for the Table – 2. If we press the key 3 then robot will follow the path given for Table – 3. Robot will go forward for 20 sec then it will take left turn for 3sec and move forward for 7sec. If obstacle is detected in between Robot will stop, after removing of obstacle robot will follow the destined path. Similarly it will work for the Table – 4.il prices and interest rate are normally distributed.

5.1 PHOTOGRAPHS OF CIRCUIT BULID

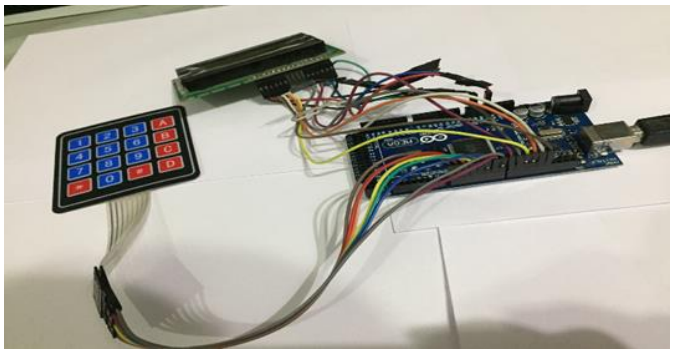


Fig.(a)

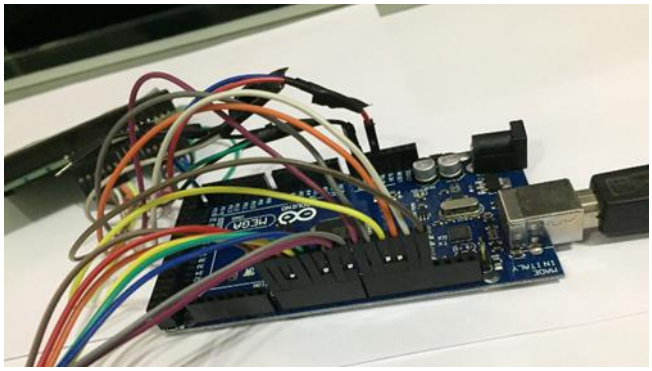


Fig.(b)

Fig(a) & Fig.(b) Module of Menu Table

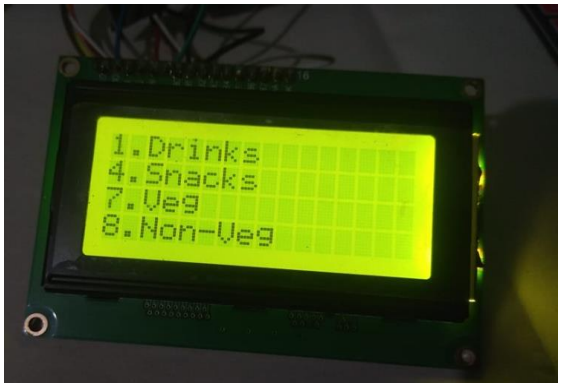
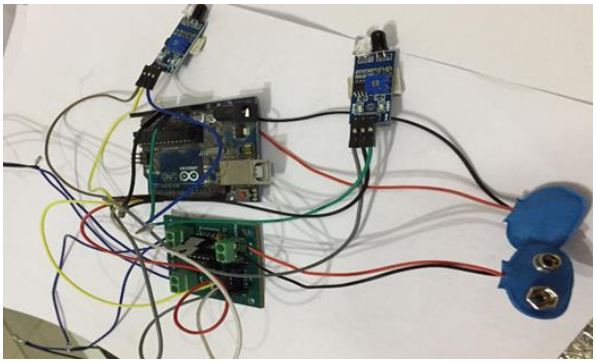
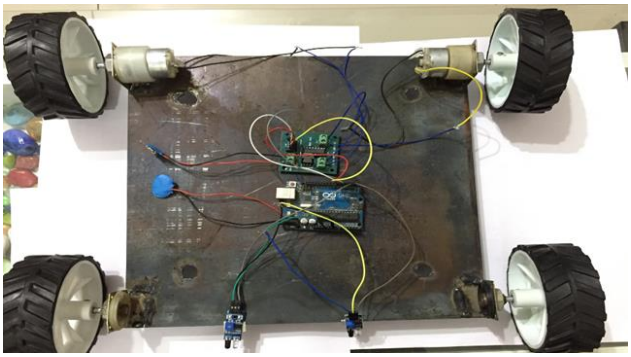


Fig (c) After Pressing the keys Menu Card is display.



Fig(d) Circuit Of Robot



Fig(e) Module Of Robot With Chassis

Fig(f) Final Model Of Waiter Robot

Fig (g) Performance result of Robot Chassis

VI. CONCLUSION

FEATURES

In this Project The robotic waiter system is a design concept that integrates autonomous omnidirectional mobile robots with an eco-system which provides knowledge of the environment in which the robots operate. This allows for a quicker translation from research to the industry. The robots are designed to be productive and efficient replacement where there is a shortage of human labour which does mundane and repetitive work such as carrying food to the tables. In addition, the ability to carry more than one order in the robot significantly helped in reducing the workload of a waiter during peak periods. Tests with the prototype and full scale robot in the restaurant have shown that the design is able to provide assistance in the restaurant, and therefore the next challenge is to have multiple robots in the restaurant. With a one off development of the smart eco-system, the cost of additional autonomous robots will increase the total cost significantly as compared with using multiple state of the art AI waiter robots with human skills and abilities.

- Waiter bot will deliver food without any loss.
- It will be smooth drive bot.
- It will say hello to customer while delivering the food.
- It will improve hospitality of the restaurants/hotels.

APPLICATIONS

- As it is a dedicated application waiter bot will be used in hotels, restaurants, hospitals, or any other table food or medicine delivering services.
- Hotel Robo is used for delivering food, drinks, to the respective tables and rooms.
- It is also used for room service.
- It reduces the customers waiting time.

ADVANTAGES

- This waiter-bot can also be used in Pandemic situations like “CORONA-VIRUS ” to sever medication to the suspected patient’s.
- This robot can even be used in situations where human can’t reach.
- Reduces customer waiting time.

- These types of robot movement are usually automatic.
- It is relatively cheap.
- They can also be used for long distance.
- This type of robot are simple to build.
- One time investment in the system.
- Work can be faster and may reduce the cost of labouring.
- As customers place their own orders, waiter's staff numbers can be reduced.
- Applications are performed with precision and high repeatability.

DISADVANTAGES

- Cost of maintenance is high for robots.
- Failure of robot may fail whole system.
- Robot need the precised values to work in the environment.

FUTURE SCOPE

- In future ,it can implemented for cooking in restaurants.
- Carrying luggage from one place to another of customers of restaurants.
- Implemented as staff in hospitals.
- Bill printing can be provided with in the waiter-bot.
- Debit/Credit card enabled payment acceptance machine could be connect to Robot.
- In future the robot can understand the customer language and can communicate with them in there languages using artificial intelligences . They can communicate in different languages such as English, Hindi, Marathi, Tamil, Telgue , French, German and so on.

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