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Autonomous Robot for Delivering The Orders in Restaurants By using Raspberry Pi

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Abstract— In today's era most of the people prefer dinner in the restaurant. The use of robots as waiters in restaurants is an increasing trend in the service industry. The Waiter-robot is an exceptional autonomous robot which has the ability to follow a designated path by measuring the distance and reach its intended destination. It reducing effort, time, error, etc and increasing quality, capacity and efficiency in the delivering the food. This robotic application using a Raspberry-pi based kit mounted with ultrasonic sensors for mapping and localization of destination table.

Keywords : Raspberry-pi, Ultrasonic sensors, DC motors, push button, LCD etc.

I. INTRODUCTION

The use of robots as waiter Robot in restaurants is on a currently increasing trend in the service industry. It is a robot used to help restaurant staffs to deliver order to particular tables in the restaurant. Our robot is able to get instructions from a controller and calculate its path to the destination and navigate its way there. The controller is connected to the display that will show the table that is currently being served. Robot can get directions from Processor and figure its way to the goal and explore its defeat. The Processor is associated with the showcase that will show the table number. This made the consistency, working capacity, quality while conveying the nourishment.

Sensor gives a huge part in mechanical technology. This robot is controlled by the user as it follows a path by a unique identification of table. For that we have connected switches to the input of raspberry pi depending upon number of tables.

Mechanical technology applies to machines that have human like structure. Apply autonomy is a multidisciplinary subject which manages mix of mechanical and electrical frameworks to make machines that are planned to decrease human burden. Because of modernization in mechanical advances, numerous new plans and systems are being executed which can peruse human considerations and comprehend the activity.

Fig.1 shows the constructional or working model of Robot.

Advantages:

- Reducing effort, time and error.
- Increases quality of service and efficiency.
- Robots are much cheaper than humans and their cost is now decreasing.
- Robots are more precise and consistent than human workers.
- Increases productivity.

Fig 1. Constructional diagram of waiter Robot

II. LITERATURE SURVEY

Sayali N Joshi, Vaishnavi K Patki, Priyanka S Dixit, Husain K Bhaldar (2019) they use raspberry pi and pi camera for human following trolley which captures the tag using pi camera & follows particular human [1].

Fatima R. Ali (2018) 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 [2].

Garcia-Haro, J. M (2018)implemets Waiter Robot Application: Balance Control for Transporting Objects in which they increases the stability of motion using zero moment point stability criteria. They implement this project by using control system[3].

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 [4].

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Md. Kamruzzaman and Md. Tareq (2017) tells design of microcontroller based robot which works effectively in a restaurant and office environment by using the Bluetooth device and the motor. In this system the receive order-request through android apps. So they develop Design and implementation of a robotic technique based waiter [5].
J.S.Tan, V.Teh, H.M.Teck, Z.H.Lim, C.Manoharen (2016) design Future farming robotic delivery system Jackbot Mark 1 in which they uses microcontroller-Raspberry Pi 2 to increase the speed of delivery and it carry the high load as compare to traditional delivery system[6].
Akshay A. Mane (2015) presented that use of IR sensor for mapping and localization of unknown area which is calculated by using the Kalman filter. So he designs Robotics Based Simultaneous Localization and Mapping of an Unknown Environment using Kalman Filtering which if the mathematical area detection technique [7].
Sandeep Bhat, M. M. (2015)using Microcontroller based Embedded System. They uses IR sensor for pathway planning for food delivery and also to carry the baggage[8].
M. Asif (2015)persented the system which transmit the order through the wireless network to the kitchen and the waiter robot deliver the order to the perticular table using bluetooth module.So she has proposed Waiter Robot –Solution to Restaurant Automation [9].
YongChai Tan, B. L (2016) implement New Automated Food Delivery System Using Autonomous Track Guided Centre-Wheel Drive Robot which line or path follower technology to place the order to the perticular robot[10].
The author Mehran Pakdaman (2009) said that as the robot is line follower robot it follows the predefined path which is visible like black path and this line is sensed by the IR sensor and each to the particular destination for that he proposed Design and Implementation of Line Follower Robot [11].

III. WORKING METHODOLOGY

Fig.2 shows the block diagram of Autonomous Robot for delivering orders in Restaurants by using Raspberry pi. Robot having two wheels and one freewheel is mounted along with different sensors and module i.e. ultrasonic sensors and switches. This robot is controlled by predefined path as it follows a path by a unique identification of table. For that we have connected switches to the input of raspberry pi depending upon number of tables we assign the particular directions and path for every table.
We can give input manually to the robot through switch. The number of switches equals to the number of tables present in the restaurants. Press the switch from which table order comes. We use LCD display to display whether the key is pressed or not.

Ultrasonic sensors are used to detect the obstacles in the path. It transmits the signal continuously if any obstacle come then the transmitted signal get disturb and the reflected signal known as echo which is received by the ultrasonic receiver.
If the obstacle is detected in between 20cm to 5cm robot will stop else it will follows the given path & the distance is calculated by using Eq.(1) & Eq.(2)

$$\text{Distance}=17150*\text{Time} \quad \ldots.(1)$$

$$\text{Distance}=\text{Pulse Duration}*17150 \quad \ldots.(2)$$

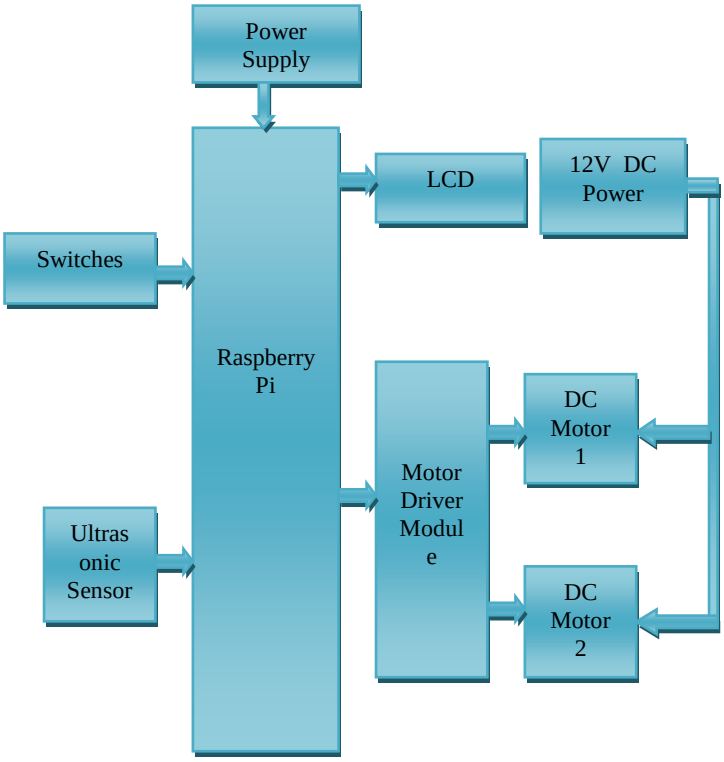

Fig 2: Block Diagram of Proposed work

Raspberry pi itself is a mini-computer. It is used for learning and experimental purpose. It operates on 3.3V power supply. In this project we use Raspberry pi as a main processor to control Robot motion. It takes the input from switches and ultrasonic sensors and after processing it, it sends the data to the driver module to control the motors.

Motor driver module is used for boosting the current of Raspberry pi. The average current capacity of GPIO is 50mA but for controlling the motor we require 2A current. We can interface two DC motors and one stepper motor to the motor driver module.

DC motors are used to convert current electrical energy into mechanical energy. It is used for controlling the wheels of Robot. It operates on 12V power supply. DC motor has higher starting torque. It is easy and cost effective to control. In Robot we uses two wheels for taking right and left moves and one free wheel for taking turn smoothly.
In that we have connected switches to the input of raspberry-pi. Depending on the number of tables we connect the number of switches. If user presses any switch then Robot starts moving towards the destination according to instructions from Raspberry pi.
Fig.3 shows the flow chart of our system which describes the working of robot. Firstly it checks the status of ultrasonic sensors. If both the Ultrasonic sensors output are low then it indicates the robot is on correct track, then Robot moves in forward direction and reach at the destination.
But if any of the sensor having high output that means if right ultrasonic sensor's output is high then it stops left motor and moves the Robot in right direction, similarly if the left sensor's output is high then it stops right motor and moves the robot in left direction.
Then again it checks whether the robot is on correct track or not.

According to that it will reach to the given destination and deliver the order to the correct table. After delivering the order the robot moves to its original location.

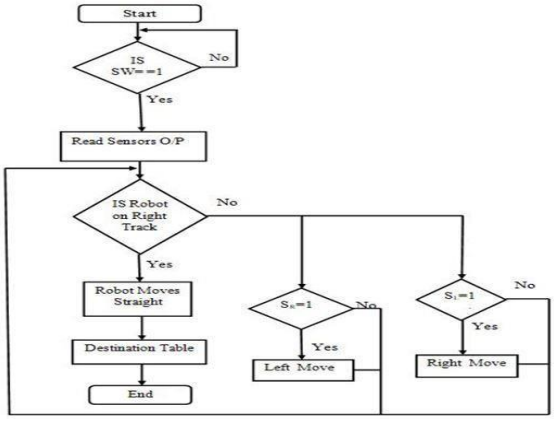

Fig 3:-Flow chart

IV. RESULT & DISCUSSION

Table no:1

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

Depending upon the trial & error method system calculates the delay to reach to the destination table.

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.

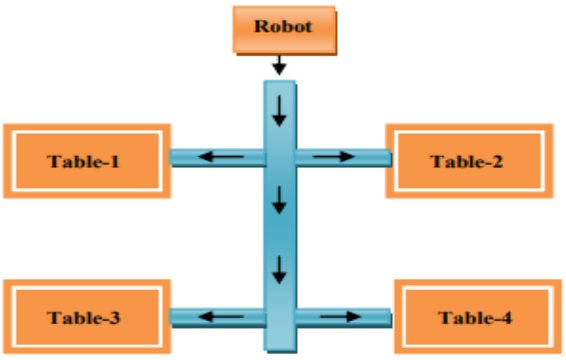

Fig 3:-Restaurant arrangement

V. CONCLUSION

In traditional serving system waiter will deliver the orders so that its time consuming & produces human errors. So we proposed this system to overcome these drawbacks.

This paper is effectively experimented & implemented for the restaurants to deliver the order to the particular table and robot follows the particular path. So this robot is cost-effective, and it reduces human efforts. Also, this robot is utilized for various places like malls, cafes, hotels etc.

Robot is designed to deliver the order to the particular table. It can improve the quality of service. When we press any key the Robot will follow the pre defined path and reach to the desired path to deliver the order.

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