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Waiter robot with billing system

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Abstract: Robots are replacing manual work at a fast pace throughout the world in all fields. In hotel industry the customers face a lot of problems due to congestion at peak hours. This can be avoided by using robots that can take orders from customers, serve the ordered food and also with a billing system. The system consists of a table unit and a serving unit. The table unit is a mobile application made using MIT app inventor. The app is designed to list the menu, and gets the choice of food from the customers. The ordered food is sent to the head chef through the app. The food is then loaded on the robot, which forms the serving unit. The robot is controlled using an Arduino. The robot reaches the correct table to which the food is to be served using Flood fill algorithm and an obstacle detection system. when the robot reaches the table, the customer takes the food. After the food is ordered the total amount to be paid is generated using the mobile app, the customer pays the bill at the bill counter. This system can be used in cafes, restaurants and hotels to reduce the cost of hiring manual power in hotel industry , the chances of misplacing the orders and also it can work for long hours than the human waiters.

Keywords-Robots, Flood fill algorithm, obstacle detection.

I. INTRODUCTION

The shortage and inefficiency of manpower has become a huge conundrum for business owners these days, especially in the food and beverage industry. Even with the deployment of good chefs and experienced managers, restaurants tend to run into chaos with inefficient servers. Therefore, usage of robots has been proposed and is currently deployed in various countries to cut market cost and increase efficiency.

ROBOTS

Robots can be divided in two main types. The first one deals with the teleoperated robots while the second one is autonomous robots. Teleoperated robot is remotely controlled and guided by a human operator who views and senses the environment through the robot sensors. Whereas, the autonomous robot has multiple sensors to detect events and measure state information which is then used to apply control logic

II. EXISTING SYSTEM

China and Japan are continually doing inventions in robotic sector, they are using robots in every field to facilitate the public. India is not technologically forward especially in terms of Robotics .Number of researches are on going in order to automate the industries of India. It is aimed to make the restaurants and hotels automated in order to facilitate the public by robotic technology along with the smart ordering system and to give them a fine dining experience with robots.

In China, Harbin, Heilongjiang province a restaurant named "Robo Restaurant" have robots to serve the tables. These robots are can travel around a designated path via sensors and are

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capable of serving 30 different dishes and has a

s. The implementation of robots in commercial industries and many other firms has proven itself in providing a very promising future of advanced robotics. We can understand its influence in the industrial market just by seeing how much effort and financial support a particular company gives in making robots such as the waiter-bot.

III. PROPOSED SYSTEM

The proposed system consists of an ultrasonic sensor mounted on a servo motor to check for obstacles. The robot travels to the specified table using a dynamic algorithm called flood fill algorithm. It is enabled with a mobile application for the ease of the customers. The mobile application is designed to display the menu and to get the orders from the customers.

IV. MERITS

1)Employers do not have to worry about hiring, sick time, vacations or human error.

2)It will offer a consistent branded experience, with an unique attraction to customers

3)Labor costs can be reduced with robot waiters.

Robots can also be used for cooking or food preparation

IV. BLOCK DIAGRAM

The system consists of a serving unit and a table unit.The serving unit consist of the robot. The block diagram of the robot is shown below

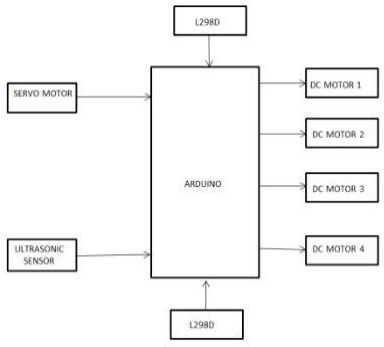

Fig. 1 Block diagram

battery life of four to five hour **V. WORKING PRINCIPLE**

In proposed system uses Arduino to implement this project, and ultrasonic sensor and a servo motor to locate the obstacles. The robot is directed using four DC motors. The motors are controlled using a L298D motor driver. The robot is fed with the total area available for it's movement. The robot decides the path to reach the table using flood fill algorithm. Each table is provided with a mobile application through which the customer selects the food item. The selected food and the table number corresponding to that order is sent to the kitchen via the application.

VI. COMPONENTS USED

Arduino

The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

L298 Motor drive

The motor drivers will acts as interfacing devices between microcontroller and motors. Motor drivers will act as current amplifiers since they take a low current control signal and provide a high current signal. This high current signal is used to drive the motors. Using L298D chip is the easy way for controlling the motor

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using microcontroller. It contains two H-bridge driver circuits internally.

This chip is designed to control two motors. L298D has two sets of arrangements where 1 set has input 1, input 2, output1,output 2, with enable pin while other set has input 3, input 4, output 3, output 4 with other enable pin.

ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object . It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package.

Its operation is not affected by sunlight or black material like sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal,

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2,

SERVO MOTOR

A servo motor is an electrical device which can push or rotate an object with great precision. An object can be rotated at some specific angles or distance using servo motor. It is made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor.

DC MOTOR

DC motors are electric motors that are powered by direct current (DC), such as from a battery or DC power supply. Their commutation can be brushed or brushless. The speed of a brushed DC motor can be controlled by changing the voltage alone. By contrast, an AC motor is powered by alternating current (AC) which is defined by both a voltage and a frequency. Consequently, motors that are powered by AC require a change in frequency to change speed, involving more complex and costly speed control. This makes DC motors better suited for equipment ranging from 12V DC systems in automobiles to conveyor motors, both which require fine speed control for a range of speeds above and below the rated speeds.

VII. FLOOD FILL ALGORITHM

Choosing an algorithm for the robot is critical in making the robot reach the specified table. Flood-fill algorithm was chosen due to its balance in efficiency and complexity. There are four main steps in the algorithm: Mapping, Flooding, Updating and Turning.

Mapping

For the robot to be able to reach the table, it has to know how big the area is and virtually divides them into certain number of cells that can be used later in calculating the shortest path to the destination. In this project, a maze of 6×6 cells is used. The boundries of the area is marked as obstacle . The initial position of the robot and the destination , that is the table is also defined during the mapping process.

Updating the wall data

Before the robot decides where it wants to move to, it has to check if it is surrounded by any walls in any of the three directions: right, left and front. The robot reads the distance of any obstacle at each direction and check if the distance in each is more than 20 cm. The ones that exceed 20 cm are updated as “wall” on their respective side.

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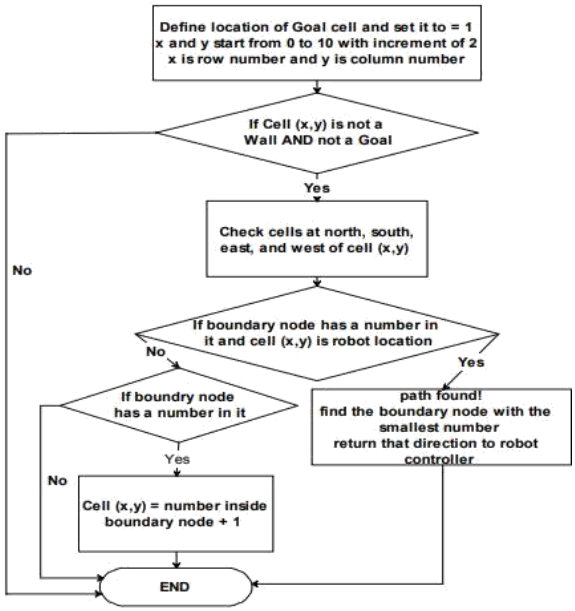

Fig. 2 Updating wall data

For the robot to update the correct wall data, it has to know first which direction it is facing. There are four orientations for the robot to be facing: north, south, east or west. Initial orientation was set at start and the robot keeps tracking of any changes.

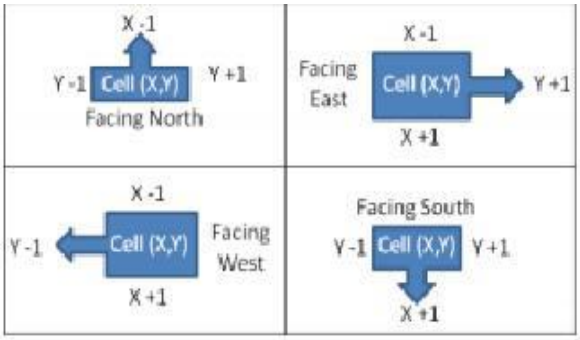

Fig. 3 Change in array locations to update the wall based on robot orientation

Flooding the area

After updating the wall information for the current cell, the robot starts to flood the matrix to find the shortest path to the goal . The robot floods the matrix and makes decision by checking one cell at a time. It does the same for all the cells and keeps repeating for several times until a path between the robot and the goal is found. The algorithm assigns a value to each cell based on how far it is from the destination cell. Based on that, the goal cell gets a value of 1. If the robot is standing on a cell with a value of 4, it means it will take the robot 3 steps (3 cells) to reach the destination cell. The algorithm assumes that the robot can't move diagonally and it only can make 90 degree turn

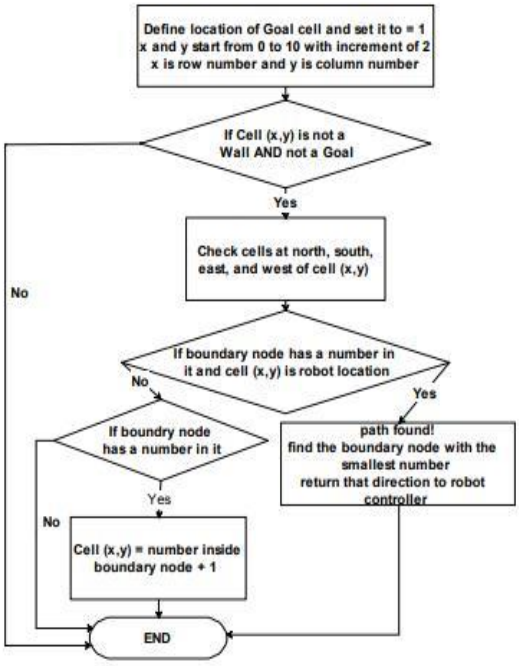

Fig. 4 Flowchart for flooding the area

Checking for turns

After the robot has decided which direction it will go next, it returns the amount of degrees it needs to turn in order to go to the cell intended . After turning the robot, the algorithm updates the new orientation of the robot, i.e. facing north, south, east or west.

VIII. CONCLUSION

There are few restaurants in India that are replacing human with robots but still these robots require a human to place the plates on the table and removing those plates.

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In this system robot serves food to the table which reduces time making it highly efficient. This tends to avoid the manual errors and time lags.This project can be further extended by making automation in cleaning of tables , placing the plates and picking them**.** The mobile application can be updated by allowing the user to customize the menu and music to their taste .

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