

Smart Robot for Restaurant Food Delivery

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Abstract

This paper describes the design and development of a waiter robot which is considered as a possible solution to restaurant automation. The robotics technology is replacing manual work at a fast pace throughout the world. In classical café, restaurants and hotels, the customers face a lot of problems due to congestion at peak hours, unavailability of waiters and due to manual order processing. These shortcomings can be handled by using a restaurant automation system where, Waiter Robots, are used for delivering food and beverages. Our model aims to deliver automatically from the kitchen to the customer table. The chef at the kitchen places the food on the robot and scans the barcode. The robot understands to which table the food is to be delivered and starts moving from kitchen to dining area in the designated path. The robot is designed to stop near the respective table, wherein the customer pickup the food (or) the assigned waiter serves the food from the robot. After the customer receives the order the robot heads back to the kitchen for the next order to be delivered. The entire movement of the robot is tracked by the lane following mechanism

Keywords - Arduino, IR Sensor, LDR, Restaurant delivery Robot.

I.

INTRODUCTION

Robots are used to serve humanity. The branch of robotics that plays such a vital role is called “social robotics” Social robots in today’s scenario are now communicating with human, interacting and relating to society in all aspect and are capable of understanding social terms. Due to the modernization in robotic technologies, many new designs and mechanisms are being implemented which are able to read human thoughts and understand actions. Such robots find vast applications in assistive robotics e.g. To help out injured, sick and elder people. Theses robots are adaptive, i.e. They can be used in multi- mode as per scenario. So far, the robots are those who learn from us, but that time will not be so far when the teacher will then be learner. There is an ever rising trend in using robots in restaurants for automation.

These robots can welcome guests, take orders, serve food to customers. Designing such robots can be effective to learn advance concepts in human-robot interaction, develop new models and protocols for communication as well as use new architectures for real time path planning, guidance and control

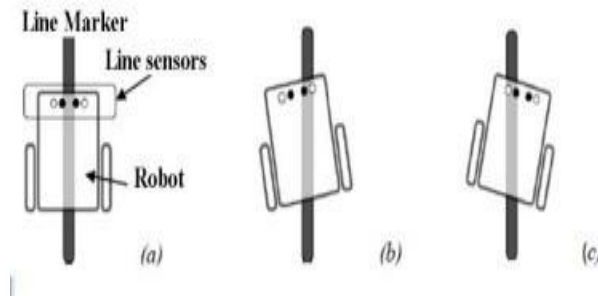


Figure1: Line controller in robot

The movement of the robot (a) straight, (b) left offset, (c)

right offset Robots have appeared in a number of restaurants in Japan, China or advanced countries around the world as chefs or waitresses. In Vietnam, the first robot which is made by composite structure and put on a wheeled base structure was developed with a purpose of serving as a waiter in a coffee shop in 2017.

For consumer application, wheeled mobile robot is often chosen for its advantages such as simple structure, availability of robot's parts, cost in manufacturing, easy to operate and so on. Thus, the author comes up with an idea of using wheeled mobile robot as waiter serving robot in a restaurant. The controller to drive the robot speed is very important because if it is accelerated or decelerated too fast, the food or drink putting on it may have spilled out. Traditional line following robot uses the ON / OFF method which means the robot switches off one of the motor if it moves off the path.

This is a very simple robot control method that helps the robot return to the target path. However, the limitation of this method is the robot always vibrates to the right or to the left of the path. This affects the movement speed of the robot, the stability is not very high, and much energy is lost. Another method that applies the pulse with modulation technique to control the rotational speed of the motor based on the average value of the pulse output signal of the controller. This method overcomes the oscillation of the robotic movement, but the limitation of this method is the identification of PWM values to control the speed of the two motors while keeping it following the target line and discussion. Then, the manuscript focuses on the controller configuration of the controller system and the implementation of the line following technique for the movement of the restaurant serving robot. The conclusion sums up whatever the author has achieved so far and proposes the direction for improvement of the system in the near future.

II. PROPOSED METHODOLOGY

The below diagram depicts the travelling path of the restaurant. At first the robot stays idle in the kitchen waiting to be deliver food to the tables. Each table is named with unique barcodes. Also near each table there is a light source which gets activated when the food is delivered to that table. The chef scans the unique barcode by keeping the food which has to be delivered to the specific table on the robot, upon the scanning the corresponding light near the table is switched ON, and the robot starts to travel

along its path, when it reaches the table it stops the movement and the vertical motors gets activated making it easier for the customers to pick up food from the robot, after the food is picked up by the customer, the robot waits for around 5-10 secs to check if there is any other food plates left on its arms. Later the robot again activates the vertical motor to reset the position, starts to move along its path to reach the kitchen and waits for another order to be picked up the robot. Robot wait time at each table is 10 secs. Time taken for the vertical robotic movement is 30 secs (15 secs for downward and upward movement).

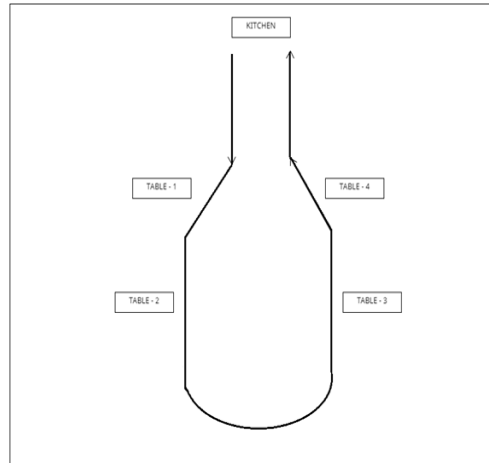


Figure2:Proposeddiagram

III. REQUIREMENTS

A. Software Requirements

Arduino IDE

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. The Arduino Integrated Development Environment or Arduino Software (IDE) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs. It connects to the Arduino and hardware to upload programs and communicate with them.



Figure3:Arduino IDE

B. Hardware Requirements

The components used for this project include:

A. Arduino MEGA

The microcontroller board like “Arduino Mega” depends on the ATmega2560 microcontroller. It includes digital input/output pins-54, where 16 pins are analog inputs, 14 are used like PWM outputs hardware serial ports (UARTs) – 4, a crystal oscillator-16 MHz, an ICSP header, a power jack, a USB connection, as well as an RST button. This board mainly includes everything which is essential for supporting the microcontroller. So, the power supply of this board can be done by connecting it to a PC using a USB cable, or battery or an AC-DC adapter. This board can be protected from the unexpected electrical discharge by placing a base plate.

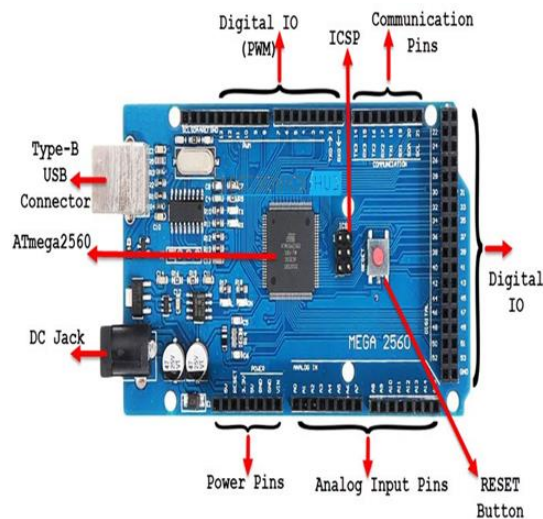


Figure4: Arduino MEGA

B. Barcode Scanner

Barcode scanners can be connected to a computer through a serial port , keyboard port , or an interface device called a wedge . A barcode reader works by directing a beam of light across the bar code and measuring the amount of light that is reflected back. But here with our Arduino we use bar code scanner connected not directly to the microcontroller nut interfaced with USB host shield.



Figure5:Barcode Scanner

C. *Arduino L293D motor driver shield*

The Arduino L293D motor driver shield guide is a robotics project that involves driving various types of motors. The most common types used for robotic applications include DC, servo, and stepper motors.

However, these motors typically cannot be driven directly by Arduino or another microcontroller. This is because of their higher current and power ratings, so motor shields or driver ICs are used instead. These shields or ICs isolate a motor's power supply and use control logic from the micro controller circuitry.

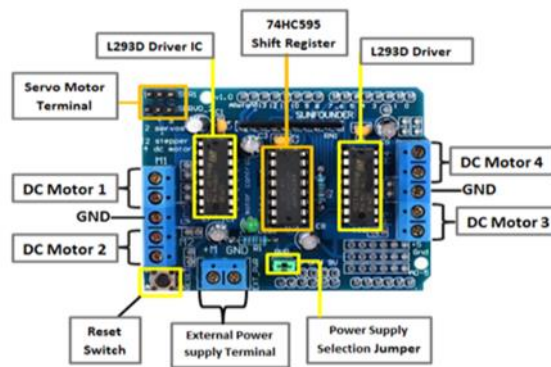


Figure 6: Motor Driver Shield

D. *LDR SENSOR*

Barcode scanners can be connected to a computer through a serial port, keyboard port, or an interface device called a wedge. A barcode reader works by directing a beam of light across the bar code and measuring the amount of light that is reflected back. But here with our Arduino we use bar code scanner connected not directly to the microcontroller but interfaced with USB host shield.

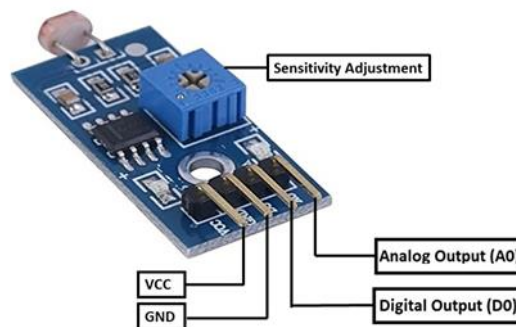


Figure 7: LDR Sensor

An electronic component like LDR or light-dependent resistor is responsive to light. Once light rays drop on it, then immediately the resistance will be changed. The resistance values of an LDR may change over several orders of magnitude. The resistance value will be

dropped when the light level increases.

The resistance values of LDR in darkness are several megaohms whereas in bright light it will be dropped to hundred ohms. So due to this change in resistance, these resistors are extremely used in different applications. The LDR sensitivity also changes through the incident light's wavelength.

IV. METHODOLOGY

There is a counter at which the order given by the customer is received through manual entries. There may be several tables which are arranged in a specific way. After the preparation of food, order will be placed on the robot which will serve the food on the table from which the order is been placed. After serving it will again return to the starting position . When the robot comes to deliver the food from the kitchen, correspondingly the LED light at the table will be ON, this will set high by the chef by scanning the barcode of the table. The robot has an intelligent feature to stop the movement whenever it receives light near the table. By this the customer will also get to know that the food will be delivered to his table only

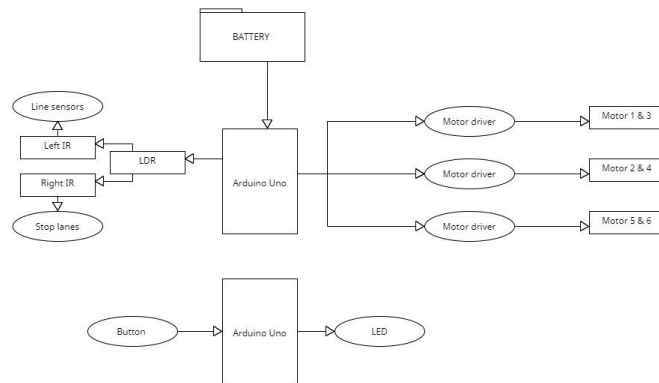


Figure8:Block Diagram

V. CONCLUSION

Robots are used to serve humanity. The branch of robotics that plays such a vital role is called “social robotics” . Social robots in today's scenario are now communicating with human, interacting and relating to society in all aspect and are capable of understanding social terms. Due to the modernization in robotic technologies, many new designs and mechanisms are being implemented which are able to read human thoughts and understand actions. Such robots find vast applications in assistive robotics e.g. to help out injured, sick and elder people. These robots are adaptive, i.e. they can be used in multi-mode as per scenario. So far, the robots are those who learn from us, but that time will not be so far when the teacher will then be learner. There is an ever rising trend in using robots in restaurants for automation. These robots can welcome guests, take orders, serve food to customers. Designing such robots can be effective to learn advance concepts in human-robot interaction, develop new models and protocols for communication as well as use new architectures for real time path planning, guidance and control. The delivery robot presented in this paper is a part of restaurant automation system. The system is found to perform well in a mock-up restaurant as demonstrated. Multiple customer tables were placed for stop-over, and delivery

from the kitchen. More experiments are to be planned for improved performance and better human machine interface (HMI) design.

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