CSE299

JUNIOR DESIGN
PIZZA ROBOT
- FROM TEAM BLACKLINE

TEAM MEMBERS -

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Table of Contents :

Abstract —----------03

Introduction —----------03

Necessity —----------04

Methodology —----------04

Materials —----------05

Procedure —----------05

Pictures —----------06

Code Snippets —----------07

Mechanism —----------09

Challenges —----------10

Solving Problems —----------10

Conclusion —----------11

Reference —----------11

Abstract :

The Pizza Robot is an automated pizza serving system that uses line following and human detection technologies. It is designed to simplify the process of serving pizza slices in meetings and conferences. The Pizza Robot is made up of a number of components, including an Arduino microcontroller, a line following sensor, a human detection sensor, two 18650 Li-ion batteries, and a mount. The Pizza Robot works by following a black line that is drawn around the table. When the human detection sensor detects a human, the robot will stop and the person can take a pizza slice from the plate on top of the robot. The Pizza Robot is a unique and innovative project that has the potential to revolutionize the way pizza is served in large gatherings.

Introduction :

The Pizza Robot is an innovative project that combines the use of line following robot technology with human detecting systems to serve pizza slices to guests. Built using an Arduino microcontroller, this system has the ability to detect and follow black lines. The Pizza Robot is designed to simplify the process of serving pizza slices in meetings and conferences. It is equipped with a line following sensor that enables it to navigate its way through a predefined path on the large table. By following the black line, the Pizza Robot can efficiently deliver pizza slices to guests without the need for human intervention. In addition to the line following system, the Pizza Robot is also equipped with a human detection sensor. This sensor allows the robot to detect the presence of humans and approach them for serving pizza. The Pizza Robot is a unique project that showcases the potential of combining different technologies to create an efficient and automated pizza serving system

Necessity of PIZZA ROBOT :

The Pizza Robot project is a practical solution for large meetings and conferences where multiple people are seated together. By automating the pizza delivery process, the Pizza Robot can serve pizza slices to a table of 12-15 people efficiently and without the need for human intervention. This improves the speed and accuracy of pizza delivery, allowing guests to enjoy their food without any delays or mistakes. Overall, the Pizza Robot project provides an innovative solution for serving pizza slices in large gatherings, improving efficiency and customer satisfaction

Methodology :

1. System Design:
    - Analyzed requirements and designed the Pizza Robot system architecture.
    - Acquired necessary components and materials.
2. Assembly and Wiring:
    - Analyzed requirements and designed the Pizza Robot system architecture.
    - Acquired necessary components and materials.
3. Line Following Functionality:
    - Programmed the Arduino to utilize line following sensors and follow the black line on the table.
4. Human Detection Functionality:
    - Integrated the ultrasonic sensor to detect humans or objects.

    - Programmed the Arduino to pause the robot when a human is detected, allowing them to retrieve their pizza slice.
5. Testing and Refinement:
    - Conducted extensive testing, refining code and addressing issues.
    - Made hardware and wiring adjustments as needed.
6. Evaluation and Performance Analysis:
    - Evaluated the Pizza Robot's performance in line following, human detection, and pizza delivery.
    - Collected data on speed, successful serving, and user satisfaction.
    - Analyzed the data to assess the effectiveness of the system.

This methodology guided the design, implementation, and evaluation of the Pizza Robot project, resulting in an efficient automated pizza serving system that follows a predefined path, interacts safely with humans, and improves pizza delivery in various settings.

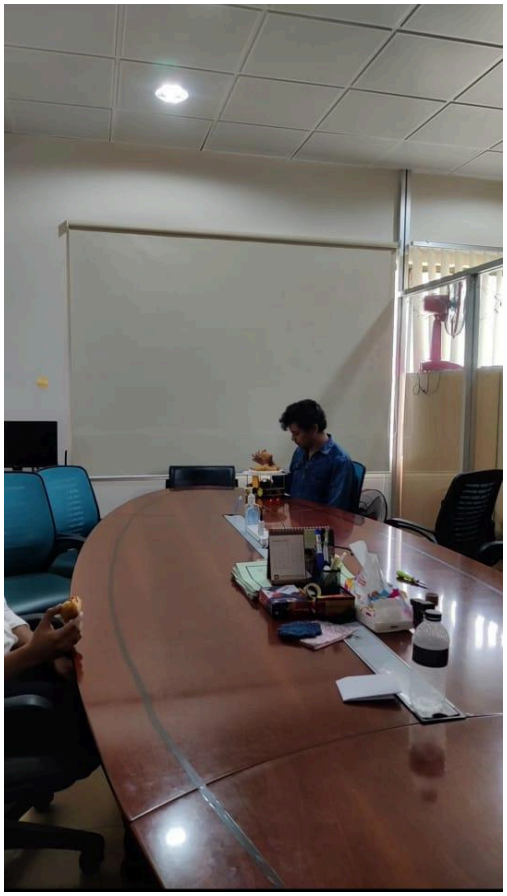
Materials :

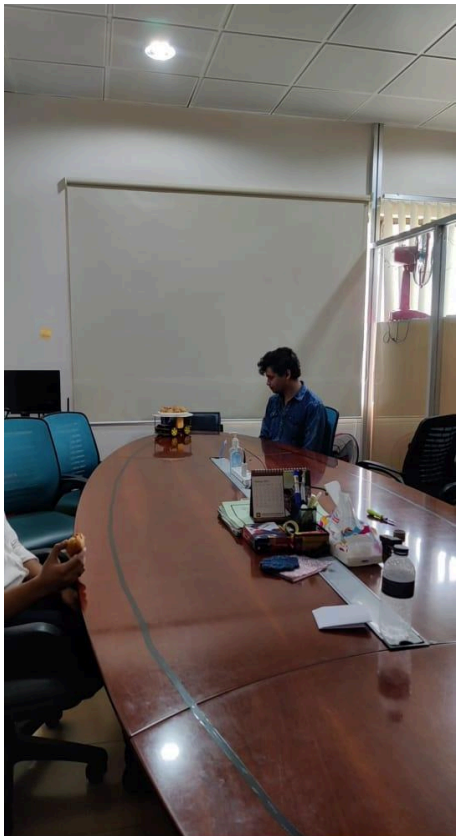
1. Arduino UNO R3
2. L293D Motor Driver
3. Chassis for Arduino board
4. 2x 18650 Li-ion Batteries
5. 2x IR sensors
6. Ultrasonic Sensor
7. 18650 Battery Case
8. Binding Tape
9. Jumper Wires
10. Mount
11. Pizza base

Procedure :

1. To make the robot we had to configure its body. Attached 4 dc gear motors with the robot base and then soldered wire to the motor.
2. After that we had to place 2 infrared sensors at the bottom of our robot. We have chosen the bottom to avoid direct contact with ambient lights because we know that the infrared sensor doesn't work properly under extreme lighting conditions.
3. After that we attached our arduino board which is configurable UNO R3 board and after that we have added a motor shield.
4. Then after connecting the motor shield we have configured all the pin connections and attached the analog pins to the sensors
5. Then we added an Ultrasonic sensor to detect human or nearby objects then connected all of its pins to the motor shield.
6. After mounting everything we have attached two lithium ion batteries to power up the whole system.
7. Lastly we have uploaded our code segment to the board and then added an extra killer switch so that we can cut the power whenever we need.

Pictures of PIZZA ROBOT :





Code Snippets:

```
//line detected by both
 else if(digitalRead(left)==0 && digitalRead(right)==0){
   //Forward
   motor1.run(FORWARD);
   motor1.setSpeed(100);
   motor2.run(FORWARD);
   motor2.setSpeed(100);
   motor3.run(FORWARD);
   motor3.setSpeed(100);
   motor4.run(FORWARD);
   motor4.setSpeed(100);
 }
```

```
//line detected by left sensor
else if(digitalRead(left)==0 && !digitalRead(right)==0){
  //turn left
  motor1.run(FORWARD);
  motor1.setSpeed(200);
  motor2.run(FORWARD);
  motor2.setSpeed(200);
  motor3.run(BACKWARD);
  motor3.setSpeed(200);
  motor4.run(BACKWARD);
  motor4.setSpeed(200);

}


//line detected by right sensor
else if(!digitalRead(left)==0 && digitalRead(right)==0){
  //turn right
  motor1.run(BACKWARD);
  motor1.setSpeed(200);
  motor2.run(BACKWARD);
  motor2.setSpeed(200);
  motor3.run(FORWARD);
  motor3.setSpeed(200);
  motor4.run(FORWARD);
  motor4.setSpeed(200);

}


//line detected by none
else if(!digitalRead(left)==0 && !digitalRead(right)==0){
  //stop
  motor1.run(RELEASE);
  motor1.setSpeed(0);
  motor2.run(RELEASE);
  motor2.setSpeed(0);
  motor3.run(RELEASE);
  motor3.setSpeed(0);
  motor4.run(RELEASE);
  motor4.setSpeed(0);

}
```

```
//Ultrasonic sensor
  if (distance <= 15 && distance != 0)
  {
    motor1.run(RELEASE);
    motor1.setSpeed(0);
    motor2.run(RELEASE);
    motor2.setSpeed(0);
    motor3.run(RELEASE);
    motor3.setSpeed(0);
    motor4.run(RELEASE);
    motor4.setSpeed(0);
    Serial.println("Stop");
    delay(6000);
  }
```

Mechanism:

Pizza robot is an Arduino based robot that will serve pizza slices around a table following a black line. We used many parts which we will be describing in the materials section. This pizza robot looks like a monster track. We attached a strong plate at the top of the car. This plate or base will be used to carry pizza slices. The robot will follow the line around a table. We used a black tape to give a double layer around the table. Without the black line the robot will not get any direction. Placing it over the black line we can start the robot and it will start moving following the line. We placed a sensor at the side of the car to detect humans or any subject. The person who wants a pizza slice will show his hand at the side of the car to stop the robot. We used ultrasonic sensors to detect humans or any objects . Recognizing a subject around the sensor the car will stop for (1 min) and meanwhile the person can take his/her pizza slice. After 1 min the car will again start moving following the black lines and people around the table can take pizza slices one by one by lifting their hands.

Challenges:

What obstacles we have faced during the process

1. At the time of fixing all the parts we were a little bit confused and made some connection problems which is normal.
2. Every time we carried the robot some connection problems occur
3. At testing time when we give one layer of tape around the table the robot shows us some problem to turn around the table curve.
4. At first our waiting duration of the pizza robot was 15 seconds which was very less time to take a pizza slice.
5. The base part was not hard to take the weight of any kind of fast food.

Problem-solving approaches:

What obstacles we have faced during the process

1. During the connection problem we used some guidelines from our team member ABIR and also tried patiently to handle it.
2. We fixed the problem by connecting the wire.
3. At testing time when tape problems occur we double the layer of black tape. Then the robot follows the curve properly.
4. We update the duration time from 15 seconds to 1 minute.
5. We changed the base into a hard board that can hold all types of fast food.

Conclusion :

The Pizza Robot project successfully automated pizza slice delivery in large gatherings. By combining line-following robot technology with human detection systems, the Pizza Robot improved efficiency and accuracy in pizza serving. It precisely followed a predefined path using line following sensors and paused when detecting humans or objects with an ultrasonic sensor.

This project demonstrates the potential of automation in the food service industry, particularly in large gatherings like meetings and conferences. It highlights the adaptability of line following and human detection technologies in various scenarios that require precise navigation and interaction with humans.

In conclusion, the Pizza Robot project provides an innovative and efficient solution for pizza serving. It showcases the integration of different technologies and sets the stage for further advancements in automated systems.

References :

We have used Arduino IDE

And for products we have used https://www.electronics.com.bd