Drip Irrigation Robot

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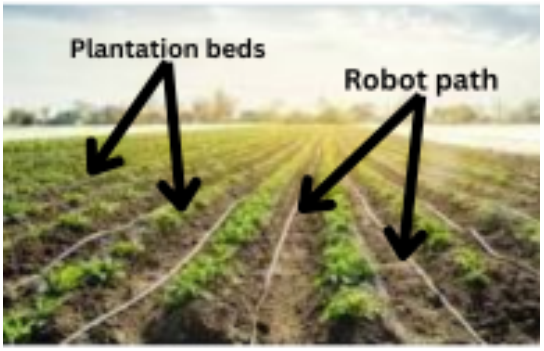
***Abstract*—Our main aim for the ES116 project has been-making human lives easier. We use the concept of a 'line following robot'. This is achieved by integrating IR sensor into the model. This is the key element used to control the model.**

I. Introduction

A. Our motivation:

We developed our project on the lines of 'Line Following Robot'. Through this, we aim to automate the process of drip irrigation.



As seen here the plantations are in a **line,** and the gaps between the plantations are where we aim to run our robot. So the robot runs on a path, which is a line. Hence, our line robot comes in handy.

B. What are its advantages?

We observed that conventional sprinklers waste a lot of water by blindly sprinkling in the open fields. By using the **Drip Irrigation Robot** we can safely save a lot of water.

II. Theory

A. Where will the robot go next?:

1) IR Sensors: We used two IR sensors. IR sensors send IR rays, these rays are either reflected, or absorbed or partially reflected or partially absorbed. In case of reflected rays, the receiver may or may not pick up all the reflected signals. But in case of absorbed rays, the receiver receives back nothing which is easier to account for. Hence we used black tape.

2) Arduino UNO: Arduino takes the output given by the IR sensors. The sensors and Arduino UNO are a single unit which direct the robot, across the black tape path. Arduino UNO output is processed on the computer using code.

B. How will the robot move?

1) Motor Shield L293D: The Motor Shield L293D has a switch which it uses to power up the motor. The motor is connected to 2 BO motors, using jumper wires. It is the one which takes power from batteries and drives the BO motors.

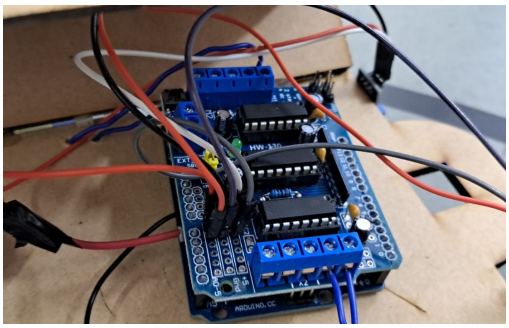


Fig. 1. Dual H bridge motor

2) BO motors, and wheels: The BO motors are the ones which drive the wheels, these move at a specified fixed RPM which drive the wheels and ultimately the robot.

Fig. 2. BO motors and wheels

3) Roller: The roller is a fairly important component. This plays a role in performing arbitrary movements with the robot. When the robot wants to change direction, the roller is in use.

C. How will it sprinkle water?

1) Servo Motor: A pipe is fixed to the servo motor. The servo motor continuously moves in an angle of 120 and the pipe moves along with it. We will provide a continuous supply of water to the pipe so that it can spray the water.

III. Instruments Required

Materials

Arduino UNO, Batteries 9V (2), Motor Shield L293D, BO Motor (4) , IR sensor (2) , Wheels (4), Jumper wires, Breadboard, Black Tape, Roller, Servo Motor

Challenges faced/ improvisations

We had the option of using Raspberry Pi, and **Arduino UNO**, since we were already proficient in using Arduino, we continued with that.

The **IR sensors** were the principal components in making our robot follow a line. They work on the principle of 'Sending and receiving IR signals'. When IR sends signals to the **black tape**, it does not receive anything back, this directs the robot to stay on the line. hence we brought black tape

We were unable to find a battery case, so we used batteries of 9V and stuck them directly to the cardboard.

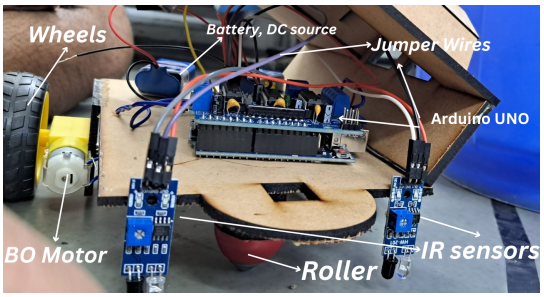
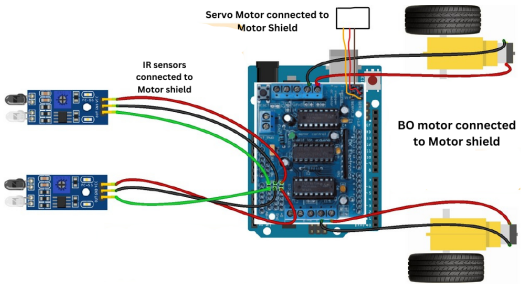


Fig. 3. Labelled diagram of our internal circuits

IV. Procedure

Circuitry:



This is the circuitry involved in making the drip irrigation robot. The IR sensors are connected to the motor shield using jumper wires. The servo-motor is connected to the motor shield using jumper wires and the BO-motor is connected to the motor shield using jumper wires.

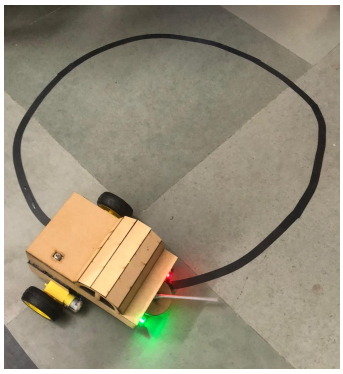
Code:

ARDUINO_LINE_FOLLOWING_CAR.ino

```
  motor4.run(RELEASE);


 }
 for(servo_position = 120; servo_position >= 0; servo_position-=2){
  Serial.println(analogRead(lefts));
  Serial.println(analogRead(rights));
  if(analogRead(lefts)<=350 && analogRead(rights)<=350){
   //forward
   motor1.run(FORWARD);
   motor2.run(FORWARD);
   motor3.run(FORWARD);
   motor4.run(FORWARD);
  }
  //line detected by left sensor
  else if(analogRead(lefts)<=350 && !analogRead(rights)<=350){
   //turn left
   motor1.run(FORWARD);
   motor2.run(FORWARD);
   motor3.run(BACKWARD);
   motor4.run(BACKWARD);

  }
  //line detected by right sensor
  else if(!analogRead(lefts)<=350 && analogRead(rights)<=350){
   //turn right
   motor1.run(BACKWARD);
   motor2.run(BACKWARD);
   motor3.run(FORWARD);
   motor4.run(FORWARD);

  }
  //line detected by both
```

First we have defined A0 as lefts and A1 as rights. Then we have initialized motor1, motor2, motor3, motor4 and servo and then setting the speed of the motor to 18V. Then the value is taken from A0 and A1 and serial monitor is opened and the sensor values are taken from A0 and A1. Then we have put 4 conditions to move it forward, left, right and stop it by moving wheels forward, backward and releasing it. The servo motor is also moving simultaneously from 0 to 120 degrees and 120 to 0 degrees.

V. Results



We covered the circuitry for a more presentable appeal. Finally the product looks like this. We chose a circular path to demonstrate the *line following principle* . Here, we have achieved another feat: *The fields need not be in a line*, they can be **circular** which is space efficient, and our robot will irrigate accordingly.

What we achieved?

We were able to make a fully functional robot which moves on line placed in any arbitrary way. The pipe attached to the servo motor continuously moves with the robot. The pipe will serve to be the principle water dispenser which will irrigate the fields.

VI. Future Scope

Agricultural Scope

This product can be scaled up to sow seeds. Thus it will be a fully equipped agriculture robot.

Fire Fighters:

It can also be used by fire fighters. The chasis can be made of fire resistant material, and the robot can be magnified in size. This will save the lives of many, by just using a simple principle.

Patrolling:

The robot moves in a line. The front can be used to scan by fitting a camera on it. This will greatly help the police in risky areas.

VII. References

- How to make a Line Follower Robot Car Using Arduino L293d and IR sensors (HELP/SUPPORT Provided), www.youtube.com. https://youtu.be/Jmbxb0Yq6Cg?si=4WI2l8wOIl67-gF (accessed Apr. 16, 2024).
- A. KS, "Basics of IR Sensor — IR LED Pin Diagram & Working," Electronics For You, Nov. 03, 2020. https://www.electronicsforu.com/technology-trends/learn-electronics/ir-led-infrared-sensor-basics

VIII. Discussions

It was very challenging to bring the IR sensors close to ground, because if it was above the ground at a greater height, then there would be loss of IR sensor rays. The servo motor was integrated in the system we already built. Hence it was challenging to integrate it in an already built system.

IX. Acknowledgement

We **Dhruv Jalan, Dhruv Goel and Dhruv Choudhary** thank our **TAs** and **course instructor, Mr Arup Chakroborty** for giving us a chance, and the resources to exercise our skills and build something resourceful. Special thanks to our **TA, Ms. Shruti** for her unwavering support throughout the project, and the course ES116.