INDIAN INSTITUTE OF TECHNOLOGY MANDI

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A Report on

LINE FOLLOWING ROBOT

(INTERSECTING LINES)

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ABSTRACT

A line follower robot with an intersecting line follower feature is a type of autonomous robot that can navigate through complex paths and intersections using an Arduino Uno microcontroller board.

To build a line follower robot with an intersecting line follower feature, the robot is typically equipped with an array of sensors that detect the lines and intersections and send signals to the microcontroller. The microcontroller processes the signals and sends commands to the motors to move the robot in the desired direction.

One of the significant advantages of using Arduino Uno in a line follower robot with an intersecting line follower feature is its easy-to-use software platform and a vast online community that provides support and resources for programming and troubleshooting.

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1. INTRODUCTION

A line follower robot using an Arduino Uno is a project in robotics that uses sensors to detect and follow a line on the ground. The robot typically uses infrared sensors to detect the line and an Arduino Uno board as the microcontroller to control the movement of the robot.

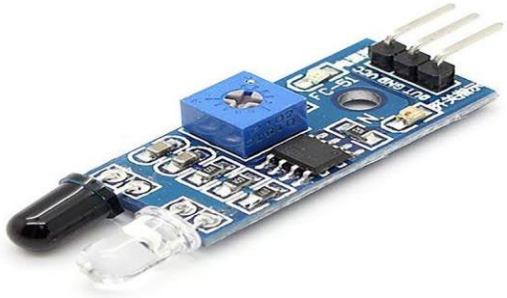
To handle intersecting lines in its path, the robot needs to be programmed to detect the intersection and determine the appropriate action to take. There are several approaches to achieving this, including using multiple sensors, advanced algorithms, or machine learning techniques.

One common method is to use a sensor array that can detect multiple lines at once. When the robot encounters an intersection, it can determine the direction to follow based on the readings from the sensors. Another approach is to use machine learning algorithms to train the robot to recognize different line patterns and intersections.

2. COMPONENTS

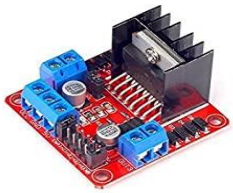
- Arduino Uno Board
- Acrylic Sheet 5mm (2x2 feet)
- 2 Geared-Encoder Motor 60 RPM
- 2 Rubber wheels(75mm)
- 1 Castor wheel
- 2 IR Sensor
- 1 LIPO 12V Battery
- 1 Motor driver L298
- Aluminium Profile (20x20mm)
- Allen Bolts and Screws
- Jumper Wires

Arduino UNO Board



IR Sensor

Geared-Encoder Motor 60 RPM

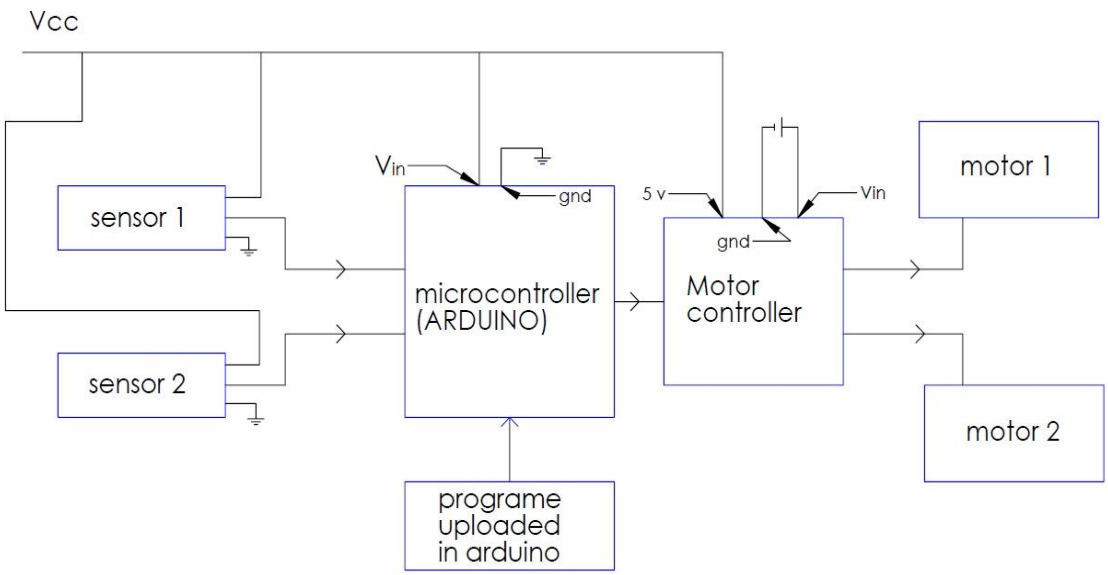


L298N Motor Driver

Castor Wheel

12V LIPO Rechargeable Battery

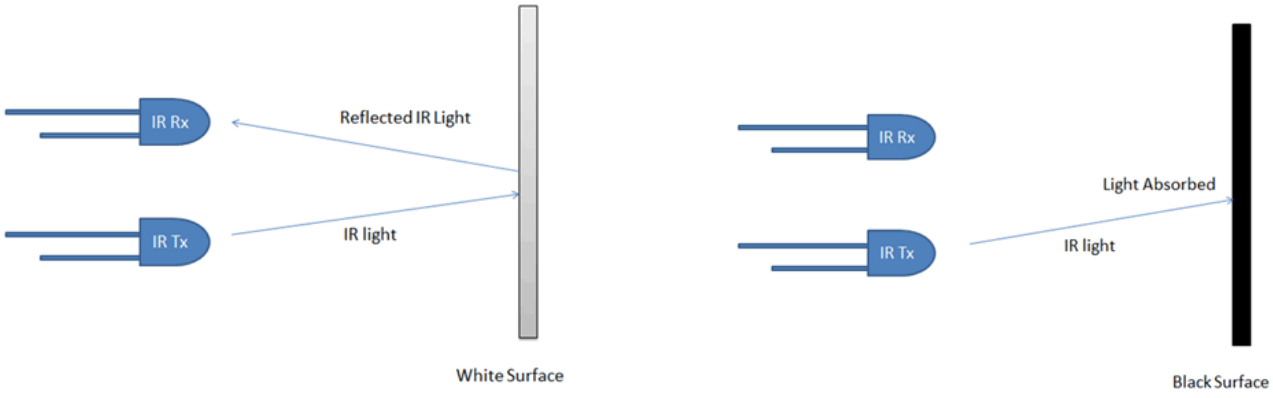
3. BLOCK DIAGRAM



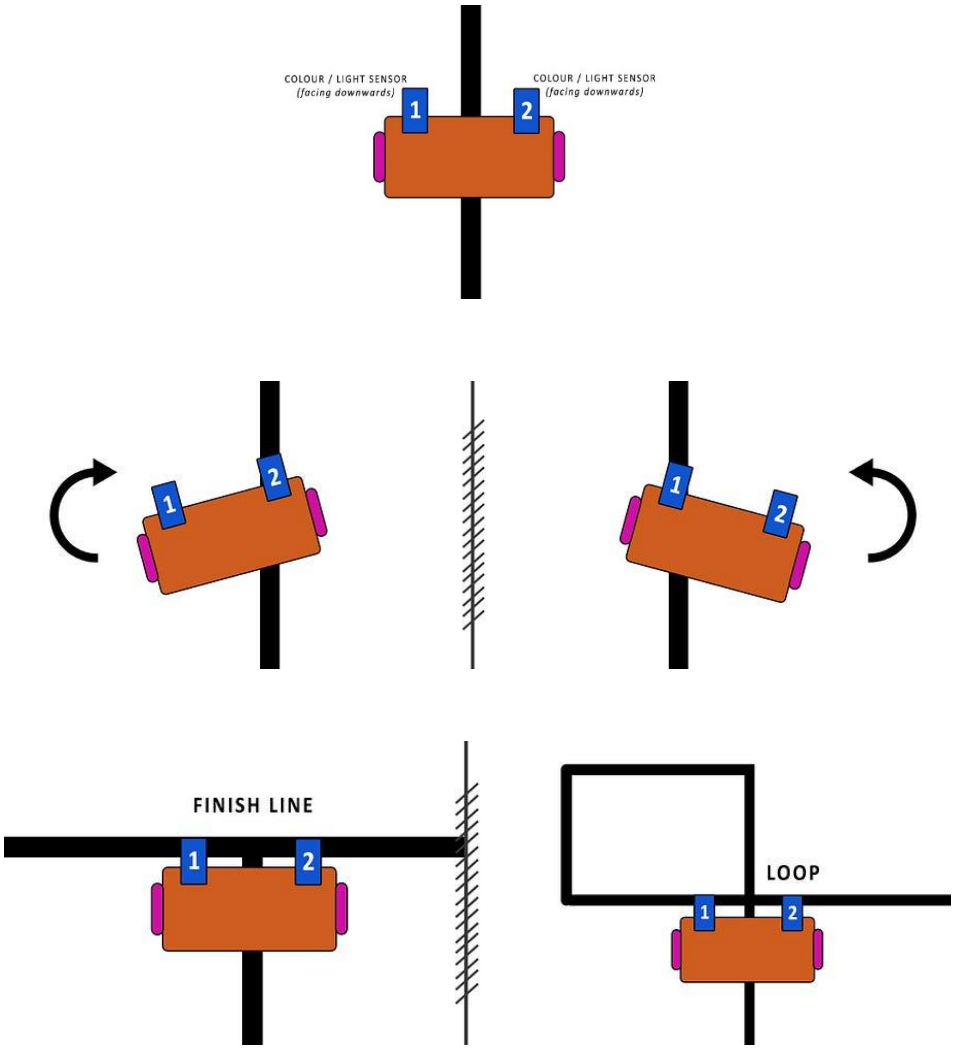
Block diagram displaying component connections

4. METHODOLOGY

The line follower robot is a kind of robot that detects and follows a line drawn on the floor. In order to detect the line which is to be followed sensors can be employed. For the line follower robot, when the sensor
senses the line the signal is sent to the microcontroller and then the wheels of the robot are controlled and moved through the help of programming.
The basic principle of the line follower robot is to capture the line position by making use of optical sensors mounted at the front end of the robot. To
accomplish this successfully Infrared sensors are used. When the sensor senses the path, analog signal is given to the operational amplifier to produce 0s and 1s which are then fed to the microcontroller, the microcontroller then decides the next move according to the program. When the both sensors are indicating low (0) the robot starts to move on the black path, but if the both sensors indicate high (1) then the robot starts
to move along the white path. The microcontroller used is the Arduino UNO which is a board based on the ATmega328P.



Working of IR Sensors



Working of Line Follower (Intersecting Lines)

5. CHASSIS DESIGN APPROACH

The choice of chassis for a line follower robot using Arduino Uno with intersecting line handling is an important consideration. The chassis is the structural framework of the robot that holds all the components, including the motors, sensors, and microcontroller.

There are several chassis approaches to consider, such as:

- Two-Wheeled Chassis: A two-wheeled chassis is a popular choice for line follower robots. It consists of two motors and wheels that provide excellent mobility and maneuverability. The chassis can easily turn and navigate around corners, making it ideal for navigating intersections.

- Four-Wheeled Chassis: A four-wheeled chassis offers greater stability and load capacity than a two-wheeled chassis. However, it may be more challenging to navigate tight turns and intersections.

- Tracked Chassis: A tracked chassis uses tracks instead of wheels to provide better traction and maneuverability on rough terrain. However, it may not be as efficient on smooth surfaces like a line follower robot.

The choice of chassis ultimately depends on the specific requirements of the robot. However, a two-wheeled chassis is often the most suitable choice for a line follower robot as it provides the necessary mobility and maneuverability to navigate through intersections with ease.

Additionally, a two-wheeled chassis is relatively simple and easy to build, which makes it an ideal choice for students who are new to robotics. The chassis can be customized with additional features like a battery holder, sensor mounts, and other components as per the specific requirements of the robot.

A two-wheeled chassis is a structural framework used for robots that is designed to be supported by two wheels. It is a popular choice for line follower robots, as it provides excellent mobility, stability, and maneuverability.

The two-wheeled chassis typically consists of two motors, wheels, and a central body or platform that houses the microcontroller, battery, and other necessary

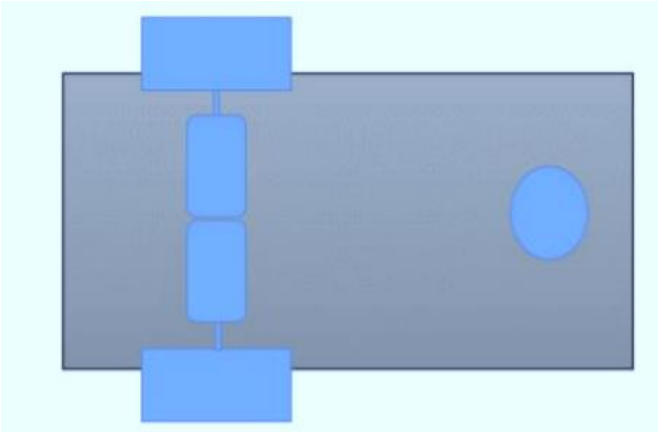
components. The wheels are connected to the motors through gears or belts, and the motors are controlled by the microcontroller.

The chassis can turn by varying the speed of the wheels on each side, allowing it to navigate around corners and curves. The chassis's stability is provided by the central body or platform, which distributes the weight of the robot evenly over the two wheels.

The two-wheeled chassis can be customized to meet specific requirements, such as adding sensors, cameras, and other components. The chassis's size and shape can also be adjusted to accommodate the size and weight of the components.

One advantage of the two-wheeled chassis is its simplicity and ease of construction. It can be built using simple materials like wood, acrylic, or plastic, making it an ideal choice.

Overall, the two-wheeled chassis is a versatile and efficient design for line follower robots, providing excellent mobility, stability, and maneuverability, and can be easily customized to meet specific requirements.



Example - Two Wheeled Chassis

6. CAD APPROACH

Using a CAD (Computer-Aided Design) software for designing the chassis and components of a line follower robot using Arduino Uno with intersecting line handling is a useful approach to visualize and optimize the design before actual construction.

The CAD software provides a 3D model of the robot, which can help in identifying design issues and potential interferences between the components. It

also allows for easy modification and iteration of the design until the desired outcome is achieved.

The CAD approach can be used to design and simulate the following components of the line follower robot:

- Chassis: The chassis is the framework of the robot that holds all the components together. The CAD approach can be used to design the shape, size, and location of the chassis and the mounting points for the motors, sensors, and other components.

- Wheels: The wheels are a critical component of the robot that provides mobility and maneuverability. The CAD approach can be used to design the size, shape, and material of the wheels and to simulate their movement and interaction with the surface.

- Motors: The motors are responsible for driving the wheels and providing the necessary torque for movement. The CAD approach can be used to design the motor mounts, gears, and belts, and to simulate their movement and interaction with the wheels.

- Sensors: The sensors are a crucial component of the robot that detects the line and navigates through intersections. The CAD approach can be used to design the sensor mounts and simulate their interaction with the surface.

- Microcontroller and Battery: The microcontroller and battery are essential components that power and control the robot. The CAD approach can be used to design the mounting points for the microcontroller and battery and to simulate their interaction with the other components.

Overall, the CAD approach for designing a line follower robot using Arduino Uno with intersecting line handling can help in visualizing and optimizing the design, improving the efficiency of the robot, and reducing the chances of errors during the construction phase.

7. APPLICATIONS OF THE PROTOTYPE

- Low Cost: Arduino Uno is an inexpensive microcontroller board that can be used to build a cost-effective line follower robot.

- Easy to Program: The Arduino Uno is user-friendly, and its programming language is based on C++, which is easy to learn.

- Customizable: The robot can be easily customized to meet specific requirements. The code can be modified to add more features or to optimize the performance.

- Educational: Building a line follower robot is an excellent project for students who are interested in robotics and programming. It can help them learn about sensors, microcontrollers, and coding.

- Efficiency: The robot can follow a line accurately and efficiently, and it can navigate through intersections with ease.

8. LIMITATIONS OF THE PROTOTYPE

- Limited Range: The robot's movement is limited to the line it is programmed to follow, which means it cannot operate beyond the line's boundaries.

- Sensitivity: The robot's sensors are sensitive to the surface it operates on. The robot may not function correctly if the surface is too reflective or too dark.

- Complex Intersections: The robot may struggle to navigate through complex intersections with multiple lines. The robot may require advanced algorithms or machine learning techniques to handle such intersections.

- Environmental Factors: The robot may be affected by environmental factors such as lighting conditions, dust, and other obstacles on the line.

- Limited Load Capacity: The robot is typically designed for lightweight loads and may not be able to carry heavy objects.

REFERENCES

- Advance Line Follower Robt | playwithrobots
  http://playwithrobots.com/advance-line-follower-robot/
- Line Following Robot Algorithm | Gupta Jay | medium
  https://medium.com/@gupta.jay/line-follower-robot-algorithm-optimizations-for-better-line-following-64297aeed17e
- Line Following Robot | IEEE
  https://ieeexplore.ieee.org/document/9197968
- How to Make Line Follower Robot | maker
  https://maker.pro/arduino/projects/make-line-follower-robot
- Line Follower Robot Using Microcontroller | electronicshub
  https://www.electronicshub.org/line-follower-robot-using-microcontroller/
- Arduino UNO | docs.arduino
  https://docs.arduino.cc/hardware/uno-rev3
- IS Mini Project Line Follower | Tejas Yogesh Pawar | studocu
  https://www.studocu.com/in/document/dr-d-y-patil-vidyapeeth-pune/computer-engineering/line-following-robot-project-report/18183710
- Line Follower Robot Using Arduino | Saddam | scribd
  https://www.scribd.com/document/314569026/Line-Follower-Robot-Using-Arduino
- A line follower robot from design to implementation | academia
  https://www.academia.edu/972274/A_line_follower_robot_from_design_to_implementation_Technical_issues_and_problems
- Line Following Robot | Siddhant Pathak | IJIREEICE
  https://ijireeice.com/wp-content/uploads/2021/06/IJIREEICE.2021.9542.pdf