KALASALINGAM
ACADEMY OF RESEARCH AND EDUCATION
(DEEMED TO BE UNIVERSITY)
Under sec. 3 of UGC Act 1956.
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SCHOOL OF ELECTRONICS, ELECTRICAL AND BIOMEDICAL TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SINCE 1993

Course Level Project Report

IOT-SENSORS AND DEVICES (211ECE1400)

Team Number	01
Project Title	BLUETOOTH GUIDED LINE FOLLOWER ROBOT
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BONAFIDE CERTIFICATE

Bonafide record of work done by MADIRE MANOJ KUMAR REDDY (9922005120), NARA CHANDANA SREE (9922005133), KUNCHEPU LOKESH (9922005045), N.VINAY BABU (9922005129), BATHRINATH P G (9922005033) of ECE Department during Odd semester in Academic Year 2023-24, as part of 211ECE1400 - IOT-Sensors and Devices Course level project.

Faculty In charge **Head of the Department**

Submitted for the evaluation of course level project of 211ECE1400 - IOT-Sensors and Devices course held on _______________

Internal Examiner **External Examiner**

Table of Contents

1.ABSTRACT

Bluetooth guided Line follower robots are autonomous systems designed to track and follow a designated path marked by a contrasting line on a surface and also controlled by Bluetooth connectivity. They find extensive applications in various fields such as industrial automation, warehouse logistics, and robotics education. This abstract provides an overview of the key components and functionality of a typical line follower robot.

The Bluetooth guided line follower robot consists of hardware components like microcontrollers, sensors, Bluetooth module actuators, and power systems. The microcontroller serves as the brain of the robot, processing sensory input and controlling the actuators based on the programmed instructions. Sensors, typically infrared or reflective optical sensors, are employed to detect the contrast between the line and the surface. These sensors generate electrical signals that are interpreted by the microcontroller to determine the robot's position relative to the line.

Actuators, such as motors or servo mechanisms, are responsible for the physical movement of the Bluetooth guided line follower robot. The microcontroller sends appropriate signals to the actuators to control the robot's speed and direction. By adjusting the motor speed differentially based on the position of the line under the sensors, the robot can follow curves, navigate intersections, and execute predefined maneuvers.

Power systems in Bluetooth guided line follower robots usually consist of batteries or rechargeable cells, providing the necessary electrical energy to run the microcontroller, sensors, and actuators. The power system should be designed to meet the requirements of the robot's operation time and performance.

In conclusion, Bluetooth guided line follower robots are versatile and cost-effective autonomous systems that can reliably track and follow lines.

Through the integration of microcontrollers, sensors, actuators, and intelligent control algorithms, these robots demonstrate the capability to execute precise movements and navigate predefined paths accurately.

2.INTRODUCTION

INTRODUCTION ABOUT BLUETOOTH GUIDED LINE FOLLOWER ROBOT

A Bluetooth guided line follower robot is a fascinating application of robotics that utilizes an Arduino microcontroller to autonomously navigate a predefined path by tracking lines on the ground. This ingenious creation is designed to mimic human abilities in following a path and is widely used in various industries, including manufacturing, logistics, and even as a fun educational project. In this introductory exploration, we will delve into the fundamental aspects of building and programming a Bluetooth guided line follower robot using an Arduino, highlighting the key components, principles, and the exciting possibilities this technology offers.

A Bluetooth guided line follower robot is an autonomous robotic system designed to follow a line or a track on the ground. It is a popular project in the field of robotics and serves as an excellent introduction to basic robotics concepts. The primary objective of a Bluetooth guided line follower robot is to detect and track a contrasting line using sensors and adjust its movement accordingly to stay on the desired path.

The concept behind a Bluetooth guided line follower robot is inspired by the way humans navigate by following visual cues. By utilizing sensors such as infrared sensors, the robot can detect the color or contrast difference between the line and the surrounding surface. This information is then processed by a microcontroller or a similar control system, which determines the robot's movements based on the sensor inputs.

Line follower robots can be programmed to follow different types of lines, such as thick or thin lines, straight or curved lines, or even complex patterns.

At the heart of this project lies the Arduino, a versatile and easily programmable microcontroller that serves as the brain of the line follower robot. The robot is equipped with sensors, typically infrared sensors, that detect the contrast between the dark line and the lighter surface. By strategically placing these sensors beneath the robot, it can make real-time decisions on whether to steer left or right, thus keeping it aligned with the path. The programming of the Arduino involves creating a set of instructions to interpret the sensor data and control the robot's motors accordingly. As the robot follows the line, it showcases the exciting world of robotics, demonstrating how automation and precision can be applied to solve real-world challenges and inspire budding engineers and hobbyists to explore the limitless potential of robotics and automation.

2.1 MOTIVATION

Educational: Developing a line follower robot with IR sensors and Bluetooth connectivity is an excellent educational opportunity. It allows enthusiasts, students, and aspiring engineers to gain hands-on experience in various domains, including electronics, robotics, and programming. This project facilitates learning about sensor technology, microcontroller programming (Arduino or similar), and wireless communication protocols, thereby enhancing technical skills and knowledge.

Problem-Solving Skills: Creating a line follower robot necessitates the application of problem-solving skills. Engineers and hobbyists must develop algorithms and control systems that enable the robot to follow a predefined path accurately. They need to fine-tune sensor readings, motor control, and Bluetooth communication to ensure seamless operation. This project challenges individuals to think critically and devise effective solutions.

Interactivity: The inclusion of a Bluetooth module introduces an element of interactivity. It enables users to control the robot remotely using a smartphone or computer, making the project engaging and entertaining. The ability to modify the robot's behavior through a mobile app or computer interface adds a layer of customization and fun, appealing to a wide range of users.

Real-World Applications: Bluetooth guided Line follower robots find practical applications in industries such as manufacturing and logistics, where they can be used for tasks like material handling and warehouse automation. By working on a project that combines IR sensors and Bluetooth connectivity, enthusiasts can explore the potential of these technologies in real-world automation scenarios.

Innovation and Creativity: This project encourages innovation and creativity. Users can experiment with various sensor configurations, control strategies, and Bluetooth functionalities to develop unique and advanced features. It's an opportunity to push the boundaries of what these technologies can achieve.

2.2 OBJECTIVE OF THE PROJECT

Remote Control: The Bluetooth module enables you to control the line follower robot remotely using a smartphone or a computer. This allows for greater flexibility in directing the robot's movements, making it adaptable to various scenarios and tasks.

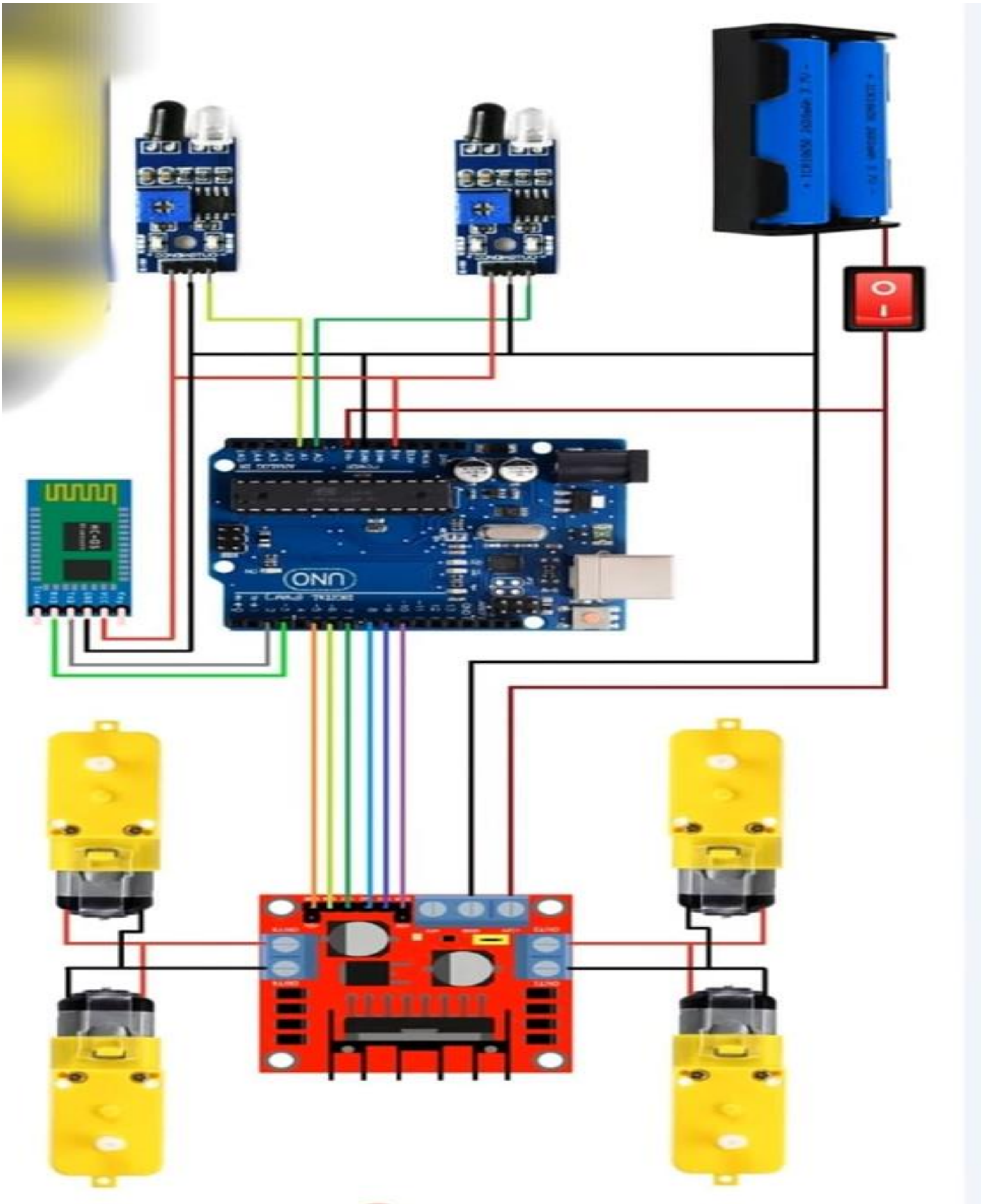
Wireless Interaction: With Bluetooth, the robot can send and receive data wirelessly, opening up possibilities for real-time monitoring, data logging, and interaction with other devices or systems. This is especially useful in applications where the robot needs to transmit sensor data or receive commands from a central control unit.

User Interface: You can create a user-friendly interface on the controlling device (e.g., a mobile app) to provide a more intuitive and visually appealing way to operate the robot. This enhances the user experience and makes it accessible to a wider range of users.

Automatic: While remote control is a key feature, Bluetooth can also be used to program the robot to operate autonomously with the ability to receive commands or updates wirelessly. This adds a layer of automation and adaptability to the robot's behavior.

Research: Line follower robots with Bluetooth modules serve as excellent educational tools for teaching programming, robotics, and electronics. They are also valuable in research applications for experimenting with different control strategies and communication protocols.

3.BLOCK DIAGRAM



3.1 COMPONENTS USED

ARDUINO UNO

Arduino is a crucial component in a Bluetooth guided line follower robot, serving as the brains behind its autonomous navigation. It processes sensor data from infrared or color sensors to detect lines on the ground and makes real-time decisions to follow the designated path. By interpreting sensor inputs and controlling the robot's motors, an Arduino microcontroller helps the robot maintain its course, making it an essential control unit for line-following robots. Its programmable nature allows for customization and adaptability, making it a versatile choice for creating efficient and precise line-following robots.

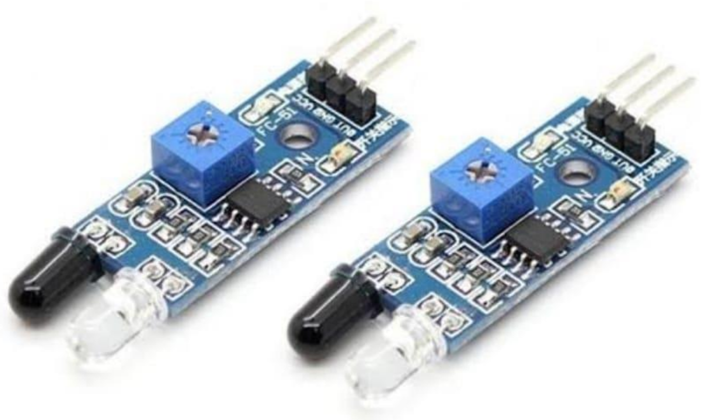
L298N MOTOR DRIVE

Dual H-Bridge Configuration: The L298N features a dual H-bridge configuration, which allows it to control two DC motors independently. Each H-bridge consists of two sets of transistors, enabling the driver to control the direction (forward or reverse) and speed of each motor. This makes the L298N suitable for applications where precise motor control is required.

High Current Handling: One of the notable features of the L298N is its ability to handle relatively high currents. This makes it suitable for driving motors with varying power requirements, including those used in heavy-duty applications like robotics, CNC machines, and other projects where strong torque and speed control are essential. Additionally, the L298N has built-in protection diodes to manage the back electromotive force (EMF) generated by the motors, enhancing its robustness and reliability in motor control scenarios.

IR SENSOR

In a Bluetooth guided line follower robot, an IR (Infrared) sensor is a crucial component that detects the contrast between a dark line on the surface and a lighter background, allowing the robot to make real-time decisions on its course by interpreting the reflected infrared light. These sensors are essential for providing feedback to the robot's control system, enabling it to stay on the desired path.



IR HW201 MODULE

Main chip: LM393

Detection Distance:2-30 cm

Detection Angle:35Degrees

Working Voltage: 3.3-5V

Board Size:31*14mm/1.22*0.55inches

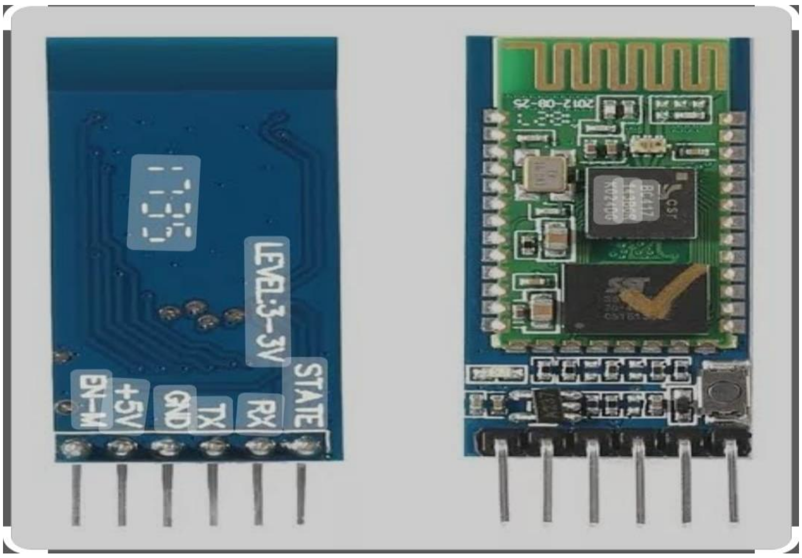
Board Weight(1pc):3g

20mA supply current

DC MOTOR

In a line follower robot, DC (Direct Current) motors are commonly used to drive the wheels. These motors provide precise speed and direction control, allowing the robot to make responsive movements to stay on course as it follows a line.

BLUETOOTH MODULE



A Bluetooth module in a line follower robot enables wireless communication with external devices, facilitating remote control, data exchange, and real-time monitoring, enhancing the robot's capabilities and versatility.

HC-05 BLUETOOTH MODULE is a Bluetooth SPP(Serial Port Protocol)module, designed for transparent wireless communication.

Features:

Low Power 1.8V Operation(1.8 to 3.6V I/O)

With integrated antenna , with edge connector

Transmit Power: Class 2(up to 4dBm)

Sensitivity: 80 dBm typical.

Frequency: 2.4 GHz ISM band.

Range: Approximately 10m (or 33 feet) in open air.

The other components which we used in our project :

- Glass plate
- LI- ION 18650 BATTERIES
- Bolts
- Connecting wires
- Soldering wires
- Plaster
- Switch
- Four tyres

PIN CONNECTIONS:

There are three pins in IR Sensor.

First pin of two IR sensors are connected to A0,A1 respectively.

Second pin is connected to ground.

Third pin is connected to 5V power supply.

Bluetooth module contains four pins.

First pin is connected to digital pin number 3.

Second pin is connected to digital pin number 2.

Third pin is connected to ground.

Fourth pin is connected to power supply.

4.PROTOTYPE AND IMPLEMENTATION

METHODOLOGY

Proposed Methodology

Designing a line follower robot involves several steps and considerations. Here's a methodology that you can follow to create a line follower robot:

Define the Objective: Clearly define the purpose of your line follower robot. Are you building it for a specific competition or task? This will help guide your design decisions.

Select the Platform: Choose a suitable hardware platform for your robot. This typically includes a microcontroller or a single-board computer like Arduino, Raspberry Pi, or similar devices.

Gather Components: Identify the necessary components for your line follower robot, such as motors, motor drivers, sensors, wheels, chassis, and power supply. Make sure they are compatible with your chosen platform.

Build the Chassis: Construct the physical structure or chassis of the robot. This may involve assembling or 3D printing a frame to house the components securely.

Motor Control: Connect the motors to the motor driver and then to the microcontroller. Implement the necessary software or code to control the motors for forward, backward, and turning movements.

Sensor Integration: Determine the type of sensor(s) you will use for line detection.
Common options include infrared (IR) sensors, reflective optical sensors, or even camera-based vision systems. Connect the sensors to the appropriate pins or ports on your microcontroller.

Refinement and Iteration: Analyze the performance of your line follower robot and identify areas for improvement. Make necessary adjustments to the hardware, software, or algorithm to enhance its performance.

Optional Features: If desired, you can add additional features to your line follower robot, such as obstacle detection and avoidance, wireless communication, or data logging capabilities.

Hardware Setup:

Assemble the line follower robot with motor drivers, line sensors, and an Arduino or microcontroller as its brain.

Connect a Bluetooth module HC-05 to the microcontroller, ensuring proper wiring and power supply.

Programming:

Write code for the microcontroller, utilizing a programming language like Arduino IDE or a compatible language.

Program the robot to read sensor data, make decisions based on line tracking, and send/receive data via the Bluetooth module.

Bluetooth Communication:

Pair the Bluetooth module with a smartphone or computer.

Develop a mobile app or software on the controlling device (smartphone or computer) to establish a Bluetooth connection and send control commands to the robot.

Control and Monitoring:

Use the mobile app or software to remotely control the robot's movements, set speed, or issue specific commands.

Implement feedback mechanisms for real-time monitoring, such as displaying sensor data or the robot's status on the controlling device.

Testing and Optimization:

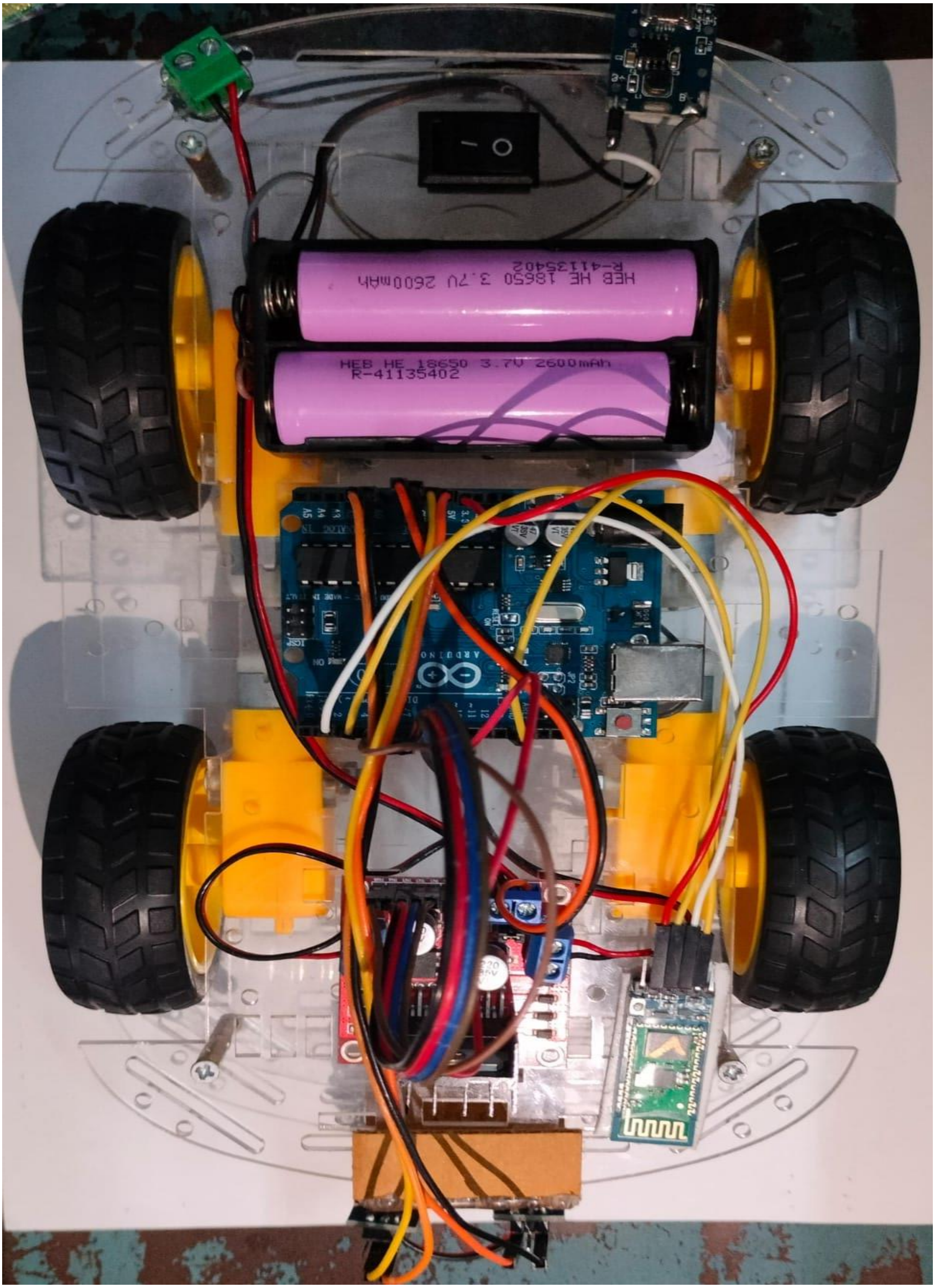
Test the robot's performance, making adjustments to the code, sensor placement, and control logic as needed.

Optimize the line follower's capabilities, ensuring it can effectively track lines and respond to remote commands.

Deployment and Application:

Deploy the robot in scenarios or applications where line following, remote control, and data exchange are required, such as in educational demonstrations or automation tasks

IMPLEMENTATION :



CONCLUSION

The Bluetooth-Guided Line Follower Robot represents a remarkable fusion of cutting-edge technology and robotics. This project has successfully demonstrated the power of Bluetooth communication in guiding an autonomous robot along a predefined path. As we conclude, several key takeaways emerge:

Innovative Technology Integration: The project showcases the seamless integration of Bluetooth technology with a line-following robot. This innovation opens doors to a wide range of applications in fields like automation, logistics, and industrial processes.

Precise Navigation: The robot's ability to follow a designated path with accuracy and efficiency highlights its potential for tasks that require precision and consistency.

User-Friendly Interface: The Bluetooth interface simplifies human-robot interaction, making it user-friendly. It allows for real-time control and adjustments, enhancing the robot's adaptability.

Scalability: The concept of Bluetooth-guided navigation can be scaled up or down to accommodate various environments and requirements, from factory floors to educational settings.

Challenges and Future Improvements: While the project is impressive, it is not without challenges. Battery life, obstacle detection, and adapting to dynamic environments are areas that require further refinement.

In conclusion, the Bluetooth-Guided Line Follower Robot exemplifies the marriage of technology and robotics. Its potential in real-world applications is vast, making it a remarkable milestone in the realm of automation and robotics. With ongoing advancements and refinements, it promises to be a game-changer in various industries.

REFERENCES

Title: "Bluetooth Based Line Follower Robot"

Author: Priyanka Sawant, Sagar Suryawanshi, Nikhil Kale

Source: International Journal of Engineering Research and General Science, Vol. 4, No. 2, March-April, 2016

Skynet robotics YouTube channel

Author: David Cook
Book Title: Line Follower Robots
Publication Year: 2017
Publisher: CreateSpace Independent Publishing

APPENDIX

A: Component List

List all the hardware components and electronic parts used in the robot, including sensors, microcontrollers, motors, Bluetooth modules, batteries, and more. Provide details such as model numbers and specifications.

B: Circuit Diagrams

Include detailed circuit diagrams or schematics of the robot's electronic connections. This can help readers understand how the components are wired together.

C: Source Code

If we are developed custom software or code for the robot's control and navigation, include the relevant code files. You can provide code snippets or the entire program, depending on your project's complexity.

Appendix D: Calibration and Setup

Explain in detail how the robot was calibrated and set up for the line-following task. This may include sensor calibration procedures and Bluetooth module configuration.

E: Test Results

Present any test data or results from your experiments, including the robot's performance on different types of tracks or under various conditions.

F: Images and Photos

Include high-resolution images and photographs of the robot, its components, and the project in different stages. Visual aids can be very informative.

G: User Manual

If your project is intended for others to replicate or use, provide a user manual that explains how to assemble, program, and operate the Bluetooth-Guided Line Follower Robot.

H: References

List all the sources, books, websites, and research papers that you referred to during your project for further reading.

This structure will make your appendix a comprehensive resource for anyone interested in your project, providing them with detailed information, code, and visuals to better understand and replicate your Bluetooth-Guided Line Follower Robot