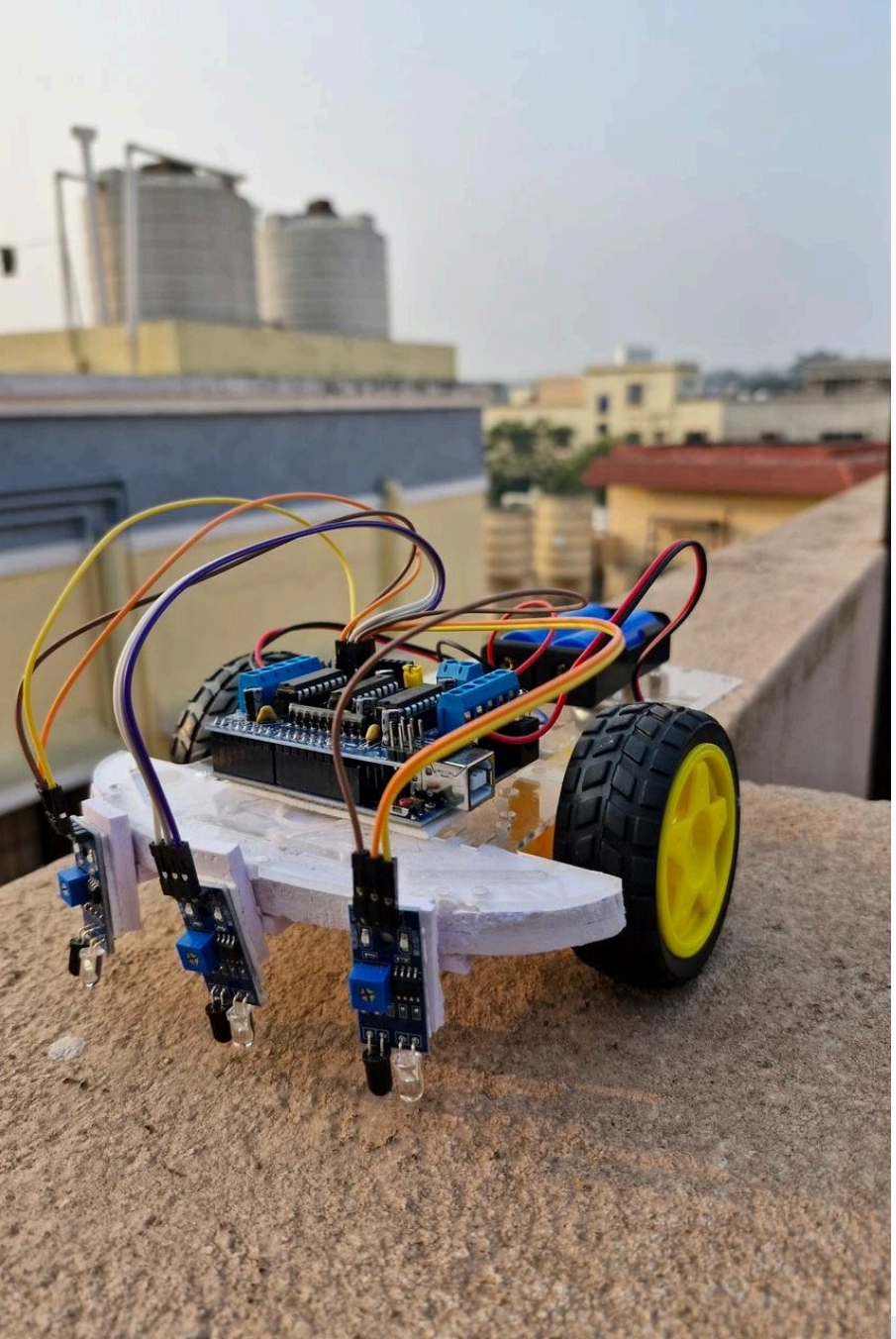


MAZE SOLVING ROBOT:

Navigating withArduinoUNO and the Left Hand Rule Algorithm

SECTION : 2241031

BRANCH : CSE

GROUP MEMBERS :

ANSHUMAN PATTANAYAK(2241016334)

MUGDHAA PATTANAYAK(2241016337)

SANJEEB KUMAR PUSTI(2241016499)

SHREETI BISWAL(2241002217)

SURYAKANTA NISHANK(2241014157)

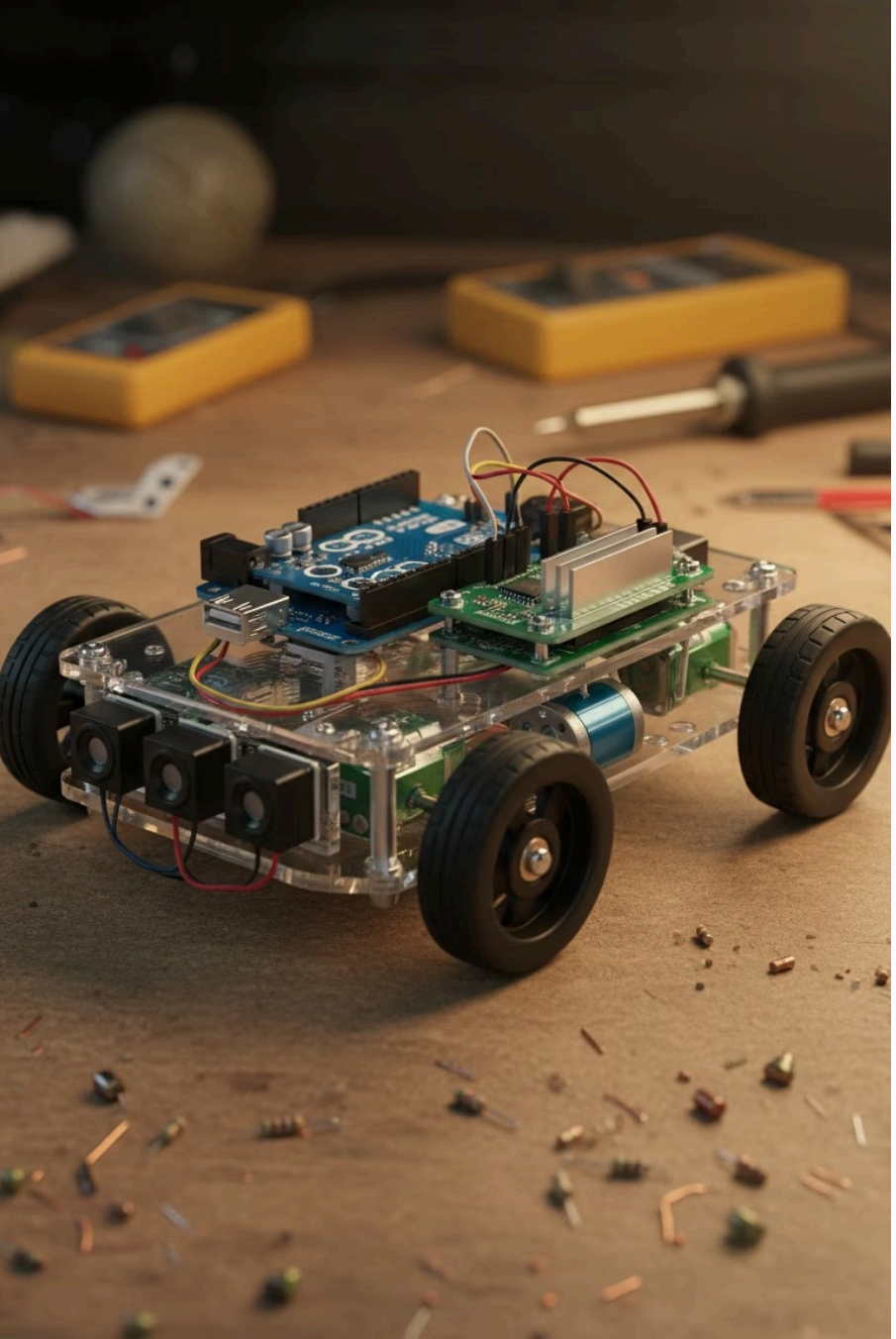
TANAYA DASH(2241004201)

SUPERVISOR'S NAME : DR. BHABASIS MOHAPATRA

Introduction: Navigating the Labyrinth

Thisprojectpresentsan autonomousrobotdesignedtonavigateandsolve mazes.Itworks independently, finding the correct path without any human intervention or pre-loaded map of the maze.

The robot uses a set of sensors and a microcontroller to detect its surroundings and make decisions about which way to turn.
Its key components include an Arduino UNO as the main controller, three Infrared (IR) sensors to detect paths, an L293D motor driver to control the motors, and two DC motors for movement. The robot's decision-making is guided by the **Left-Hand Rule algorithm**, a simple strategy for consistently following the left wall to navigate the maze.
Based on the inputs from its sensors, the robot determines whether to move forward, turn left, or turn right, successfully solving the labyrinth.



Objective :

Cost-Effective Design

Toconstructa reliableandeconomical robot capable of efficient maze navigation.

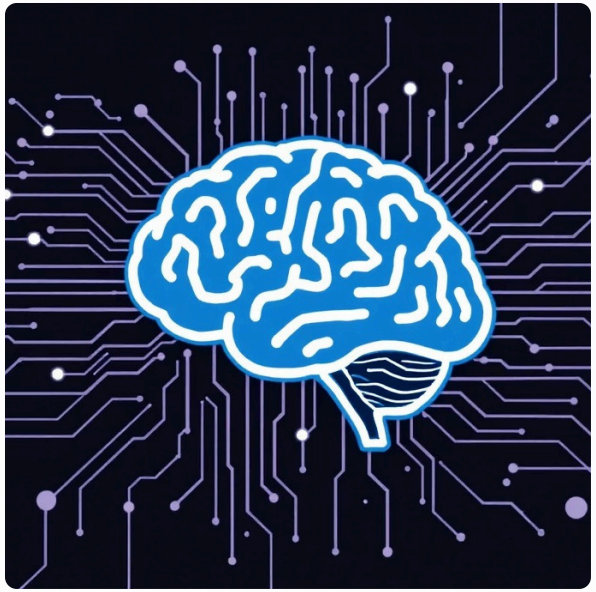
Algorithm Implementation

Toaccuratelyimplementthe LeftHand Rule algorithm for intelligent decision-making at maze intersections.

Hardware Integration

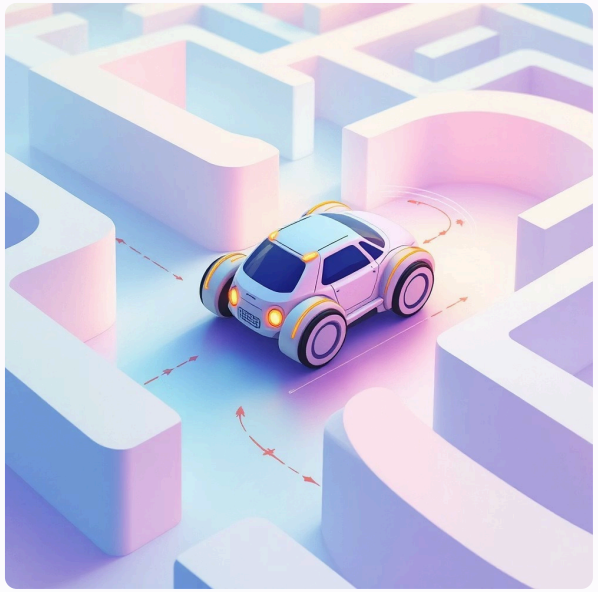
Todemonstratethepracticaland seamless integration of various components, including sensors, motor drivers, and the microcontroller.

Motivation:



Knowledge Enhancement

Deepenunderstandingofroboticsprinciples, sensor technology, and embedded programming techniques.



Real-World Application

Applycomplexalgorithmiclogic tosolvepractical autonomous navigation challenges.

Inspire Innovation

Foster creativity in robotics usingreadily available components and a DIY project approach.

Essential Components: The Robot's Building Blocks

Arduino UNO Microcontroller

Thebrain ofourrobot,processingsensordata and executing navigation logic.

L293D Motor Driver Board

AdualH-bridgethatcontrolsthespeed and direction of the DC motors.

Power Supply

A8vbatterypackwith regulators for consistent power delivery.

3 Infrared (IR) Sensors

Usedfordetectingwallsorlines,crucial for environmental awareness.

2 DC Geared Motors with Wheels

Providetherobot'smobilityandpropulsionthrough the maze.

Chassis & Wiring

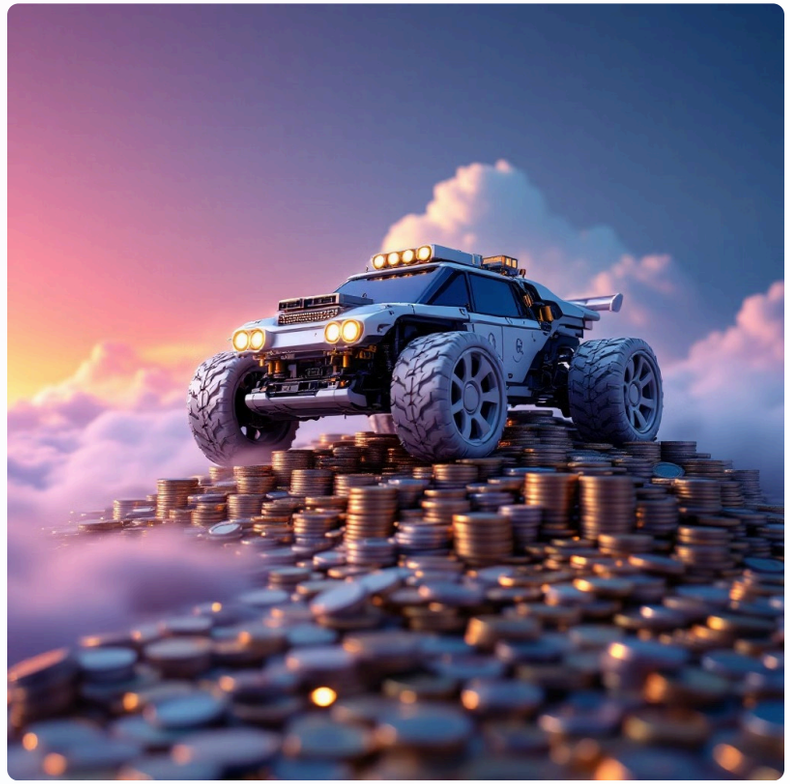
Thestructuralframeandnecessary electrical connections for assembly.

BUDGET

Project Cost Analysis: An Affordable Endeavor

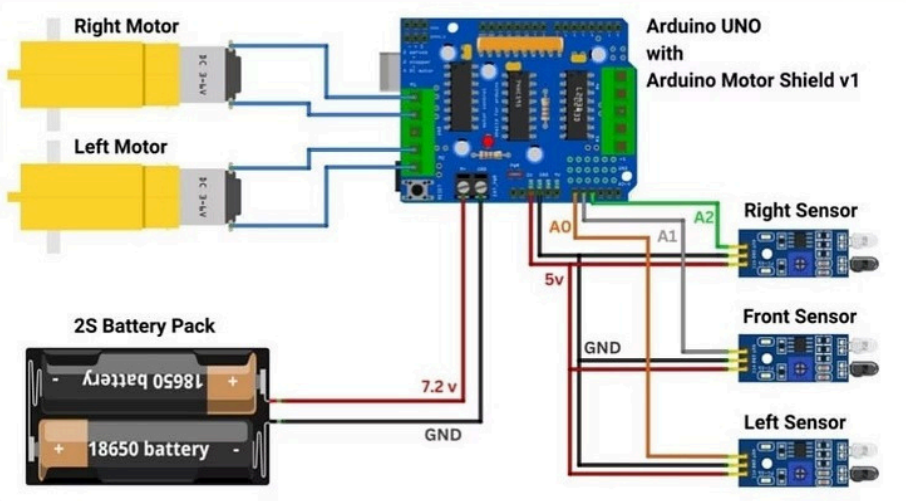
Component	Cost (Rs)
Arduino UNO	460/-
IR Sensors (3 units)	30 X 3 = 90/-
L293D Motor Driver Module	190/-
DC Motors (2 units)	170/-
Battery pack & regulators	200/-
Chassis & wheels	180/-
Miscellaneous	380/-
Total Estimated Cost	**1670/-**

Thetotal estimated cost for this maze-solving robot project is remarkably affordable, making it an excellent choice for educational purposes and hobbyists alike. The selection of readily available and cost-effective components ensures that the barrier to entry for building such a robot remains low, while still delivering a robust and functional device.



Circuit Diagram: The Robot's Nervous System

- The Arduino UNO acts as the central processingunit,receiving inputs from the **three IR sensors** connected to its analog pins A0, A1, and A2.
- These sensors are strategically positioned to detect walls on the left, front, and right of the robot, providing crucial navigational data.
- The **L293D motor driver** serves as the interface between the Arduino and the **two DC motors**.
- Digital pins on the Arduino are used to send control signals to the L293D, dictating the speed and direction of each motor.
- This setup ensures that the robot can execute precise movements, including turning and moving forward.
- A regulated power supply is critical; 5V powers the Arduino and sensors, while 12V drives the more power-hungry motors.
- This careful power distribution, along with clear wiring paths, guarantees stable operation and smooth control throughout the maze-solving process.



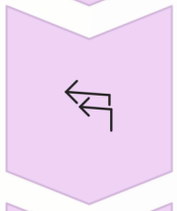
LOGIC

Working Procedure: The Left-Hand Rule in Action

Therobot'snavigationhingesonreal-timedatafromitsIRsensorsandthedeterministiclogicoftheLeft-HandRule algorithm.

Sensor Data Acquisition

The **IR sensors continuously scan the surroundings** to detect the presence or absence of maze lines. This information is processed by the Arduino to determine available paths.

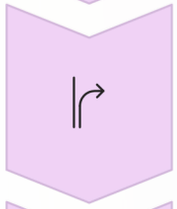


Apply Left-Hand Rule

The algorithm dictates the next move: if a left path is detected, the robot **prioritizes turning left** to maintain contact with the left line.

Go Straight

If no left path is available but the forward path is clear, the robot **moves straight ahead**.



Turn Right

Should both left and forward paths be blocked, the robot **attempts a right turn** to find an open route.

U-Turn at Dead End

If all paths (left, forward, right) are obstructed, it signifies a **dead end**, prompting the robot to execute a **U-turn** to backtrack and explore other options.

Diverse Applications: Beyond the Maze

Educational Tool

An excellent platformforteachingrobotics, programming, and algorithmic thinking in schools and workshops.

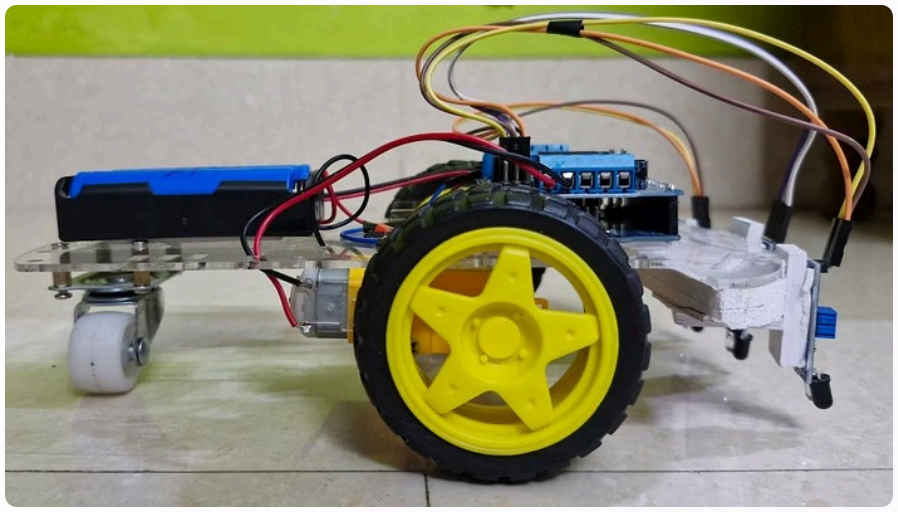
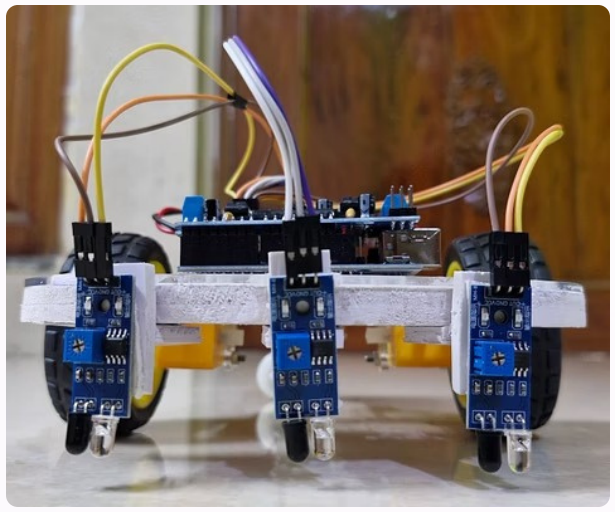
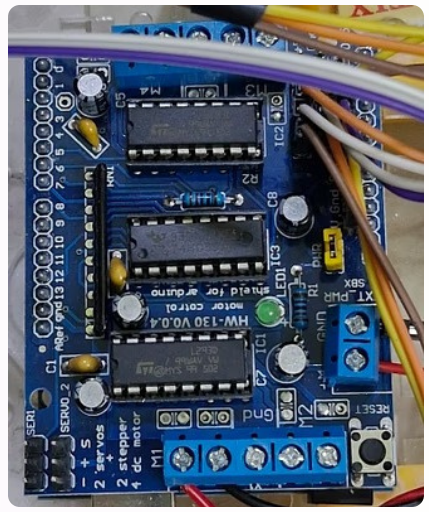
Autonomous Navigation

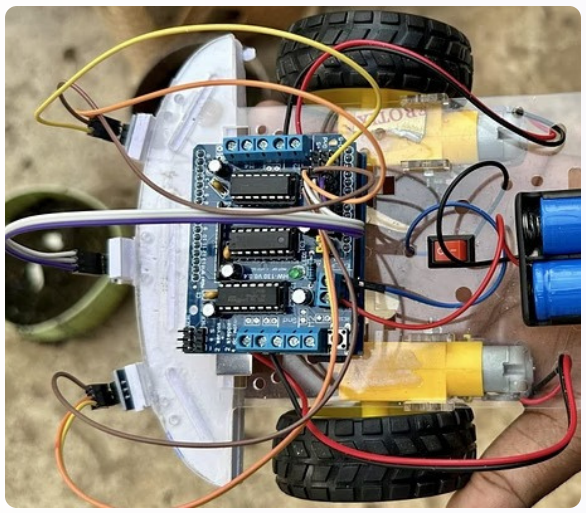
Servesas a foundationalprototypeforlarger autonomous systems in logistics, exploration, and smart environments.

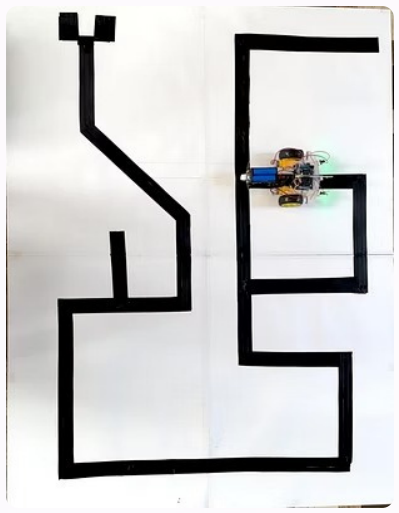
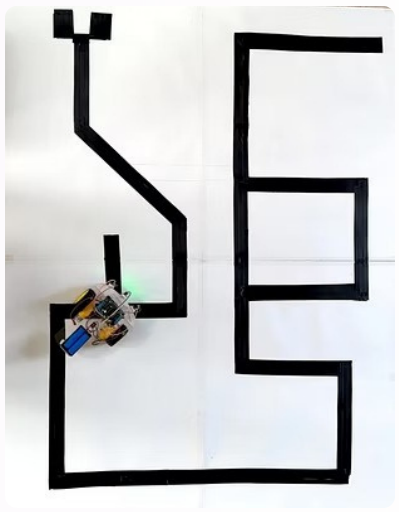
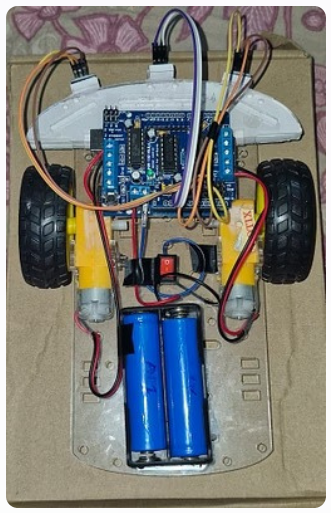
Search & Rescue

Adaptable forscenarios requiring exploration of hazardous or inaccessible areas to locate survivors or assess damage.

Project in Action: Visual Evidence



1. These images provide a step-by-step look at the robot's construction and operation. The 1st photo showcases the **sturdy chassis** with integrated motors, forming the mechanical base.
2. The 2nd highlights the **precise placement of the IR sensors**4one on each side and one in front4crucial for accurate maze detection.
3. The 3rd, 4th and 5th image offers a clear view of the **electronic heart of the robot**, detailing the connections between the Arduino UNO, L293D motor driver, and the IR sensors, emphasizing the meticulous wiring.
4. Finally, the 6th photo captures the robot actively **navigating a test maze**, demonstrating the Left-Hand Rule algorithm in practice as it gracefully follows the left wall towards the exit.

Project Video :

Yo uTu b e

MAZE SOLVER ROBOT

In this video, we present our Maze Solving Robot built using Arduino Uno. The robot uses IR sensors to detect the path and automatically find the correct route through the maze without&

SUMMARY

Conclusion & References

Key Takeaways

- Successfully developed a cost-effective maze-solving robot.
- Achieved autonomous navigation using the Left-Hand Rule algorithm.
- Gained practical experience in embedded systems, sensor integration, and motor control.
- The project demonstrates the potential for basic robotics to solve practical problems.
- Enhanced problem-solving abilities through iterative design and debugging of robot behavior.Demonstrated practical application of sensor integration for environmental perception.

References for Further Reading

Forthose interested inexploringsimilar projects ordiving deeper into the technical details, the following resources proved invaluable during the development of this robot:

- **https://projecthub.arduino.cc/me%20rk/arduino-maze-solving-robot-e69923**
- **https://www.arduino.cc/**
- **https://www.hackster.io/Varun2905/maze-solving-robot-3-ir-sensors-9ada3b**
- **https://www.youtube.com/watch?v=kDwNHIAzxfM&t=9s**

Presented By :

Sanjeeb Kumar Pusti
2241016499

Mugdhaa Pattanayak
2241016337

Suryakanta Nishank
2241014157

Anshuman Pattanayak
2241016334

Tanaya Dash
2241004201

Shreeti Biswal
2241002217

Thank You!

Your attention is greatly appreciated.Pleasefeelfree to ask any questions.