Line Follower Obstacle Avoiding Robot

Dr. NARENDAR SINGH[1], *Dr. CHAUDHURI MANOJ KUMAR*[2], *L. SHRAVANI*[3], *D. SAI TEJA*[4], *CH. SIRI CHANDANA*[5], *D. VAISHNAVI*[6], *AYESHA MISBA*[7]
[1,2,3,4,5,6,7] *Department of ECE, School of Engineering, ANURAG University, Hyderabad*

***Abstract*—The project demonstrates the development of an IoT-enhanced line follower robot, combining traditional line following capabilities with modern IoT technologies. The robot uses infrared sensors to detect line patterns and connects to the internet via Wi-Fi, enabling real-time monitoring, remote control, and data logging. The hardware architecture includes a microcontroller, infrared sensors, motor drivers, and wireless communication modules. The system shows potential applications in educational environments, industrial automation, warehouse logistics, and autonomous navigation systems.**

I. INTRODUCTION

In this fascinating project, we'll investigate the use of an Arduino and an L298 Motor Driver to create a Line Follower Robot that can avoid obstacles. Robots that follow lines are extensively employed in several sectors for activities like moving objects and engaging in entertaining events like robotic racing. This project constructs a dynamic and adaptable robot through the integration of the obstacle-avoiding intelligence with line following precision. Through the Arduino IDE and some range of components, you are able to construct a smart robot capable of navigating complex environments.The fast pace of technological development has resulted in the spread of innovative projects in robotics and the Internet of Things (IoT). One such interesting project is the Line Follower Obstacle Avoiding Robot, which integrates the features of autonomous navigation and obstacle avoidance. The project utilizes the strength of the Arduino microcontroller and the L298 motor driver to develop a flexible and smart robotic system [9].

Fundamentally, this robot is programmed to track a pre-designed path along a line on the ground and detect and bypass obstacles ahead. The most important parts of this project are,In combining these parts, the robot can navigate around its space on its own, making instant decisions to stay on the line and avoid obstacles.

This project not only exhibits basic concepts of robotics and IoT but also delivers hands-on training in programming, electronics, and sensor integration. It is an ideal teaching resource for students and hobbyists that exhibits the useful applications of technology in solving actual problems [10].

This project can be scaled up and modified for different applications, including warehouse automation, delivery robots, and intelligent transportation systems. The skills and knowledge developed from constructing and learning about this robot can serve as a foundation for more complex IoT and robotics projects.

II. LITERATURE SURVEY

Robot Guard: An Automated Line Follower Robot for Smart Industry Pollution Monitoring and Warning System Using IoT

This study discusses a line follower robot equipped with IR sensors to detect and follow lines, designed for industrial applications. The robot integrates IoT capabilities to monitor environmental pollution levels in real-time, providing warnings when thresholds are exceeded.[1]

Design of Autonomous Line Follower Robot with Obstacle Avoidance - This paper discusses the design and implementation of a line-following robot capable of selecting desired lines among black and white paths. It also explores the robot's ability to detect obstacles and choose alternative paths to reach its target. [2]

An Ultrasonic Line Follower Robot to Detect Obstacles and Edges - This research presents a line-following robot equipped with ultrasonic sensors to detect obstacles and edges, enabling it to navigate predefined paths while avoiding collisions. [3].

Line Follower Robot with Obstacle Avoiding -This study provides a comprehensive survey of existing approaches, algorithms, and technologies used in line-following and obstacle detection for robots [4]. It examines various sensor technologies such as infrared, ultrasonic, and lidar, along with computer vision techniques for object detection.

IARJSET.COM. [5]
Obstacle Avoidance and Line Following 2WD Robot - This project utilizes proximity sensors to detect obstacles and infrared sensors to follow predefined paths. The robot is controlled by an Arduino UNO, which processes sensor data to navigate effectively. [6]
Line Follower Robot & Obstacle Detection Using PID Controller - This paper discusses the use of a PID controller in designing a line-following robot [7]. An array of multiple sensors detects the black surface, and obstacle detection is performed by an ultrasonic sensor.[8]

III. METHODOLOGY

The creation of a robot is achieved by choosing the appropriate parts, including the Arduino Uno microcontroller, L298 motor driver, infrared (IR) sensors, and ultrasonic sensors. A chassis is constructed to accommodate all parts safely, and a good power supply is provided. The assembly and design of the circuit section is where the DC motors are connected to the L298 motor driver, which controls the speed and direction of the motors using signals from Arduino. The Arduino comes with a software that can create line following and obstacle avoidance algorithms. Sensor calibration is also done to set up the IR and ultrasonic sensors, and initial experiments are undertaken to test the ability of the robot. The last integration and optimization step entails thorough testing to confirm the robot's functionality integrates smoothly. Field testing is performed to test the reliability and strength of the robot. Documentation and presentation are essential steps, such as circuit diagrams, code, calibration methods, and test data. The main achievements and conclusions are tabulated in a report.

IV. ARCHITECTURE

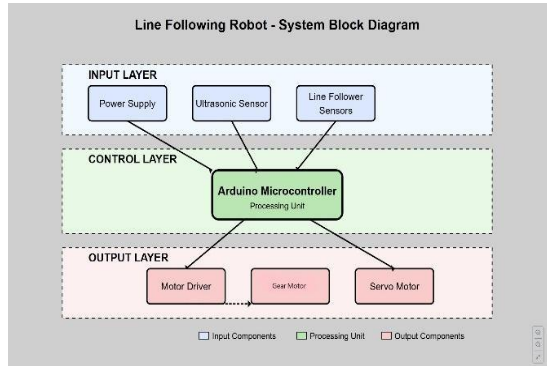

Fig 4.1: - Block Diagram

V. RESULT

the line follower robot with obstacle detection has proved consistent performance on different testing parameters. The outcomes confirm the validity of integrating infrared line sensors and ultrasonic obstacle detection with PID algorithm for navigation. Enhancements in the future may be to improve the capability of the robot to work with variable line widths and using advanced path planning algorithms for challenging environments. As robotics technology keeps improving, these findings offer significant information regarding the creation of more efficient autonomous navigation systems

VI. OUTPUTS

Fig 6.1: - Proposed Model

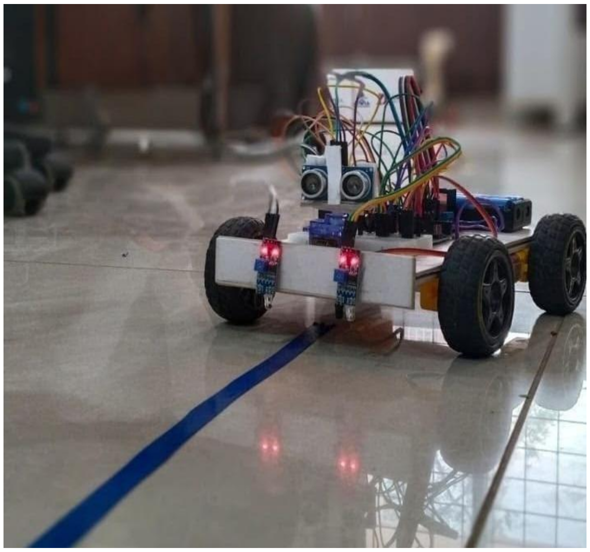

Fig 6.2: - Robot moving in a predefined path

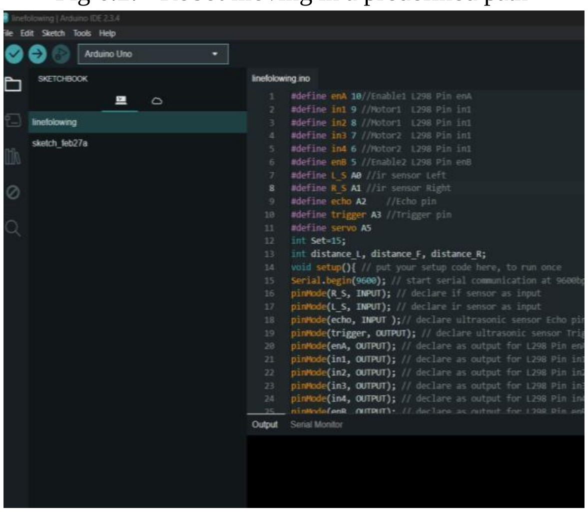

Fig 6.3: - Arduino IDE Software

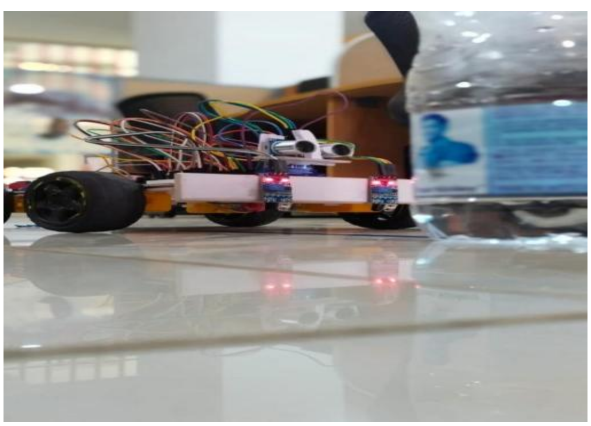

Fig 6.4: - Robo detecting Obstacle

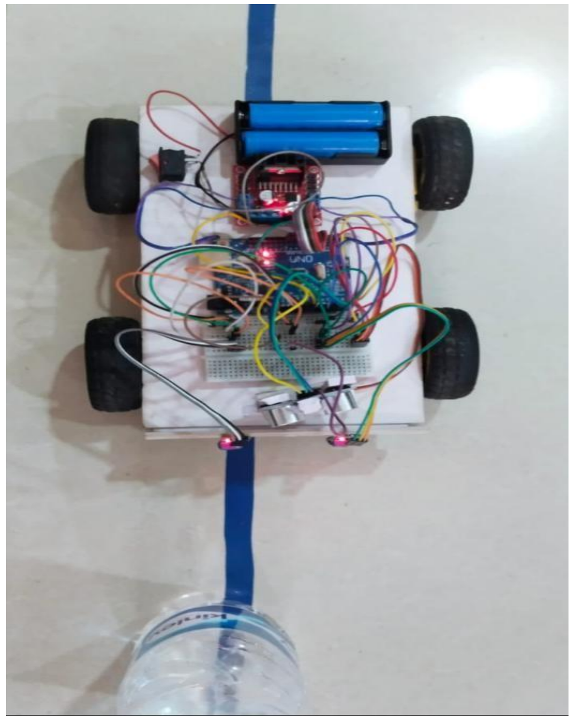

Fig 6.5: - Proposed Prototype

VII. CONCLUSION

This project illustrates the development of a line follower robot that is capable of avoiding obstacles. It was achieved through Arduino and the L298 Motor Driver. Different components, including infrared and ultrasonic sensors, have been integrated to develop a robot that is capable of following lines and avoiding obstacles with intelligence. Aside from providing informative information about robotics and Arduino programming, this project is fun and practical for students, hobbyists, and robot enthusiasts. The Line Follower Obstacle Avoiding Robot using Arduino and L298 Motor Driver achieved its objectives of autonomous navigation and obstacle avoidance. The project provided valuable hands-on experience with robotics, programming, and sensor integration. The results demonstrated the effectiveness of the chosen components and algorithms in creating a versatile and reliable robotic system.

REFERENCE

[1] (Kabilan S, Arunmaran E) "Line Follower Robotics Using IoT" (2019).
[2] (Rohit Tripathi et al) “Design and Development of

IoT-Based Smart Library Using Line Follower Robot". (2020).
[3] (A. A. Masoud et al.) "A Fuzzy Rule-Based Control System for Fast Line-Following Robots" (2020).
[4] (Quazi Taif Sadat et al) "Design and Implementation of Line Follower Robot Using Arduino Microcontroller" (2020).
[5] (Beatriz Arruda Asfora) "Embedded Computer Vision System Applied to a Four-Legged Line Follower Robot" (2021).
[6] (S. S. Manivannan et al) "A Novel Design of Sensor-Based Line Follower Robot with Obstacle Detection and Bluetooth Control" (2021).
[7] (Prof. Vallabh Shinde et al.)"Line Following Robot using IoT Arduino" (2022).
[8] (Mr. Pradeep Samal et al) "Line Follower Robot" (2023).
[9] Singh, D. N., B. Pavitra, R. Nagaswetha, G. Anil Kumar, and G. Ashwini. "An Intelligent Virtual Assistant using Raspberry Pi." Math. Stat. Eng. Appl. 71, no. 3 (2022): 1261-1270.
[10] Singh, D. N., Murugamani, C., Kshirsagar, P. R., Tirth, V., Islam, S., Qaiyum, S. & Waji, Y. A. (2022). IOT Based Smart Wastewater Treatment Model for Industry 4.0 Using Artificial Intelligence. Scientific Programming, 2022.