e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

OBSTACLE AVOIDING ROBOTIC VEHICLE USING ARDUINO

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ABSTRACT

This research paper presents the development of an obstacle-avoiding robot car using Arduino, designed to autonomously navigate by detecting and responding to obstacles in its path. The robot employs an Arduino microcontroller as its primary control unit, interfaced with a servo motor, motor driver, and SR (ultrasonic) sensor. The servo motor assists in adjusting the robot's direction, while the SR sensor detects nearby obstacles, enabling real-time adjustments to the vehicle's trajectory. The motor driver facilitates precise control over the DC motors that power the wheels. The programming, executed in the Arduino IDE, integrates libraries that streamline communication between the Arduino, motor driver, and sensor modules. This obstacle avoidance system can direct itself by altering its course upon detecting obstacles, showcasing fundamental autonomous behaviour. The project serves as a prototype for potential future applications in autonomous vehicle navigation and robotics, where efficient and safe obstacle avoidance is critical.

I. INTRODUCTION

With advancements in robotics and automation, obstacle-avoiding technology has become essential for autonomous navigation systems, particularly in robotics and self-driving vehicles. This paper discusses the design and implementation of an obstacle-avoiding robot car that uses Arduino as its core controller to autonomously detect and steer away from obstacles. The system integrates several hardware components, including a servo motor for directional control, a motor driver for managing motor functions, and an SR (ultrasonic) sensor to detect nearby obstacles. This setup allows the robot to monitor its surroundings and make instant adjustments to its path.

The project's primary objective is to build a vehicle capable of autonomously navigating around obstacles using real-time data. The coding for this system is performed in Arduino IDE, utilizing libraries to manage communication between components efficiently. This technology showcases foundational capabilities that could be applied in larger autonomous systems, providing insights into the mechanics of obstacle detection and response, which are critical for safe autonomous navigation in both robotics and future autonomous vehicles.

II. LITERATURE REVIEW

Obstacle-avoiding robots have become vital in autonomous navigation, using ultrasonic sensors and Arduino-based microcontrollers to detect and evade obstacles. Ultrasonic sensors, such as the HC-SR04, provide accurate, real-time detection over a short range, enabling responsive maneuvers. Arduino microcontrollers, commonly with ATmega328P, interpret these sensor inputs and drive DC motors through H-bridge modules like the L293D, allowing directional adjustments. Basic algorithms enable robots to steer away from obstacles by reversing or rotating, enhancing their adaptability in complex environments. These robots serve diverse applications, from household automation to hazardous area exploration, and future developments aim to improve multi-sensor integration and algorithmic sophistication for more versatile, intelligent autonomous systems.

III. METHODOLOGY

- **Obstacle Detection**: The ultrasonic sensor emits pulses; if an object is detected within a predefined threshold distance, the sensor sends this information to the Arduino.

- **Motor Control**: The Arduino signals the motor driver to control the DC motors based on the sensor's data. If no obstacles are detected, the vehicle moves forward. When an obstacle is detected, the vehicle stops and changes direction.
- **Directional Adjustment**: The servo motor adjusts the sensor's orientation to scan the surrounding environment, determining the best path forward.

IV. RESULT

The obstacle-avoiding robotic vehicle successfully demonstrated autonomous navigation in a controlled environment. The system accurately detected obstacles within the sensor's range and adjusted its direction to avoid collisions. This simple, cost-effective robotic platform achieved smooth and reliable movement, making it suitable for various applications, including education and research.

V. CONCLUSION

This research demonstrates the successful design and development of an Arduino-based obstacle-avoiding robotic vehicle. The project provides a hands-on understanding of robotics fundamentals, including sensor integration and motor control, and lays the groundwork for more advanced autonomous systems. As sensor and processing technologies evolve, this project can be expanded into various fields, such as autonomous vehicles, smart mobility solutions, and industrial automation.

VI. REFERENCES

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