
ARDUINO OBSTACLE AVOIDING ROBOT

Ms. Aishwarya V^{*1}, Mr. Kamal Kannan R^{*2}, Sree Vishnu G^{*3}, Suraj P^{*4},

Suresh Kumarb^{*5}, Thirumal Selvan K^{*6}, Veerapandi S^{*7}

^{*1}Assistant Professor, Anna University, Department Of Electronics And Communication Engineering, SNS College Of Engineering, Coimbatore, Tamil Nadu, India.

^{*2}Assistant Professor, Anna University, Department Of Computer Science And Engineering (Internet Of Things), SNS College Of Engineering, Coimbatore, Tamil Nadu, India.

^{*3,4,5,6,7}Student, Anna University, Department Of Mechanical And Mechatronics Engineering (Additive Manufacturing), SNS College Of Engineering, Coimbatore, Tamil Nadu, India.

ABSTRACT

This project presents the design and implementation of an Obstacle Avoiding Robot, focusing on cost-effectiveness and simplicity. The robot is powered by an Arduino microcontroller and features a single ultrasonic sensor for obstacle detection and a servo motor for precise maneuvering. Controlled movement is achieved using a motor driver and four geared motors with wheels. Seamless integration of components is facilitated by jumper wires, resulting in a compact and efficient obstacle avoidance system. The robot autonomously navigates unfamiliar environments, demonstrating a practical and affordable solution for mobile robotics.

Keywords: Arduino, Obstacle Avoiding Robot, Ultrasonic Sensor, Servo Motor, Motor Driver, Autonomous Navigation, Mobile Robotics, Cost-Effective Design.

I. INTRODUCTION

Recently, the subject of robotics has grown significantly, partly because microcontroller platforms like as Arduino are becoming more widely available. This paper describes the design and development of an Arduino microcontroller-based autonomous obstacle-avoiding robot. This project's main objective is to create an economical, effective robot that can independently navigate challenging settings. Applications for autonomous robots are numerous and include home help, industrial automation, and exploration of dangerous areas. These robots need to be able to avoid obstacles in order to function properly and securely in dynamic environments. Using the ease of use and flexibility of the Arduino platform, this project seeks to offer a useful demonstration of obstacle avoidance technology as well as an instructional resource. The robot created for this project moves using DC motors and detects obstacles using an ultrasonic sensor. The key processing unit is the Arduino microcontroller, which interprets sensor data and runs navigation algorithms. Because of this integration, the robot can dynamically modify its course to avoid accidents, providing a clear and concrete example of the fundamentals of autonomous robotics. This paper intends to be a useful resource for academics, educators, and hobbyists interested in utilizing Arduino to construct autonomous robotic systems by offering a thorough overview of the design and implementation process.

II. METHODOLOGY

1. System Activation Startup Initialization:

- The robot's system is triggered as soon as it is powered on, making sure that it is always prepared to recognize and avoid impediments.

2. Function of Ultrasonic Sensor

- **Sensor Positioning:** To identify impediments in its route, the robot has an ultrasonic proximity sensor installed in front of it.
- **Wave Emission and Reception:** Ultrasonic waves are continuously emitted by the sensor. When these waves come into contact with an object, such as a wall or another object, they return to the sensor.

3. Measurement of Distance

- **Time Calculation:** The ultrasonic waves' return time is measured by the Arduino microcontroller.
 - **Distance Conversion:** The speed of sound is used to translate this time into a distance measurement.
-

4. Comparison of Thresholds

- **Distance Threshold:** An established threshold distance is used to identify obstacles.
- **Proximity Alert:** This alert tells that the robot is getting too close to the obstacle if the identified object is within this threshold.

5. Activation of Obstacle Avoidance

- **Motor Control for Avoidance:** The Arduino stops the robot's forward motion when it detects an object inside the threshold. After that, the robot performs a preprogrammed avoidance action (such as halting, reversing direction, or turning) in order to avoid the obstruction.
- **Continuous Movement:** The robot keeps going ahead if there are no obstacles inside the threshold.

6. Constant Surveillance

- **Real-Time Updates:** The robot updates the distance measurements in real time by continually observing its surroundings.
- **Normal operating:** The robot continues its normal operating pattern, which consists of continuous forward movement, when no impediment is identified inside the threshold.

7. Sturdiness of the Environment

- **Adaptability:** The system is made to work consistently in a range of environmental circumstances, such as dimly lit areas and uneven terrain, guaranteeing obstacle avoidance and identification.

8. Energy Source Power Supply:

- A rechargeable battery pack powers the entire system. The Arduino and any associated sensors will operate steadily if the power is properly regulated

III. MODELING AND ANALYSIS

1. Hardware Setup:

- **Arduino Microcontroller:** The main control module, handling sensor data and regulating motor outputs.
- **Ultrasonic sensor:** The robot's front-mounted Ultrasonic Proximity Sensor measures the separation between obstacles in its route.
- **Servo motor:** Turns the ultrasonic sensor in different directions to search for impediments.
- **LED Indicators:** Offer graphical feedback for troubleshooting and testing.
- **Battery Pack:** Provides power to the complete system, guaranteeing the Arduino and its related components operate steadily

2. Software and Logic:

- **Logic Distance Calculation:** The Arduino uses the speed of sound to compute the distance, while the ultrasonic sensor counts the amount of time it takes for ultrasonic pulses to return after encountering an obstruction.
- **Threshold Detection:** When an item is identified within a predetermined range, such as 20 cm the obstacle avoidance behaviour is triggered.
- **Obstacle Avoidance Mechanism:** When the threshold is crossed, this mechanism activates the robot's motor control to halt, reverse, or change course in order to avoid obstacles.

Real-Life Implementation Steps:

- **Sensor Mounting:** To guarantee precise distance measurement, the ultrasonic sensor is firmly attached to the front of the robot chassis.
- **Motor Attachment:** To enable movement, the DC motors is mounted on the chassis and wired them to the wheels.
- **Installation of the Servo:** To enable directional scanning, the servo motor is mounted and fasten the ultrasonic sensor to it.
- **Placement of the LEDs and Battery:** For a reliable power supply, the battery is packed firmly against the chassis and align the LEDs for maximum visibility during testing.

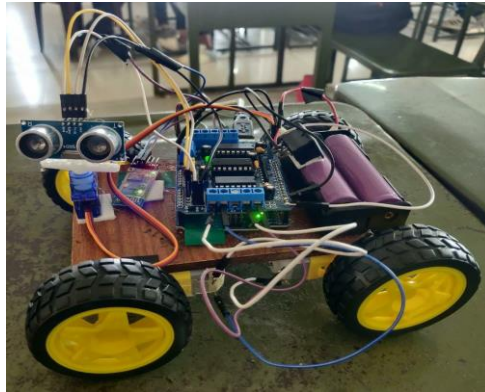


Figure 1: Prototype project.

Testing and Calibration:

- To make sure it functions basic, test the robot on a level area free of obstructions.
- Check to see if the ultrasonic sensor detects distance appropriately.
- **Identifying and Avoiding Obstacles:** Position impediments at different separations and track the robot's reaction. As necessary, fine-tune the avoidance movements and adjust the threshold distance.
- **Testing in the Environment:** To guarantee consistent performance, test the robot on various surfaces and under various lighting situations. Check the system's resistance to small vibrations and impacts.

IV. RESULTS AND DISCUSSION

The Arduino obstacle-avoiding robot's purpose was to identify and avoid impediments in its path so that it could travel on its own. The robot is powered by DC motors for movement, ultrasonic sensors for measuring distance, and an Arduino microcontroller. The project's outcomes emphasize the robot's potential uses in a variety of robotic and automation settings by showcasing its efficiency in real-time obstacle recognition and avoidance.

V. CONCLUSION

The completion of the obstacle-avoiding robot project signals the arrival of a functional and commercially feasible autonomous system that can navigate a variety of terrains while slyly avoiding impediments. This robot, which combines a servo motor, geared motors, Arduino microcontroller, and ultrasonic sensor, is a prime example of how robotics may be used in everyday life. Because of its scalability, instructional value, and intrinsic flexibility, it is the ideal project for both extensive replication and educational study. The thorough documentation that includes code implementations, circuit schematics, and iterative testing modifications is a great resource for troubleshooting and a guide for future work in the field. This study makes a substantial contribution to the rapidly developing field of robotics by skillfully fusing hardware and software paradigms to accomplish efficient obstacle avoidance.

VI. REFERENCES

- [1] Arduino. (2015). Arduino Software (IDE). (Arduino) Retrieved December 27, 2015, from <https://www.arduino.cc/en/Guide/Environment>
- [2] Arduino. (2015). Introduction. (Arduino) Retrieved December 12, 2015, from <https://www.arduino.cc/en/Guide/Introduction>
- [3] Duino-Robotics. (2013). Obstacle Avoidance Tutorial. (Duino-Robotics) Retrieved November 23, 2015, from <http://www.duino-robotics.com/obstacleavoidance.html>
- [4] Gray, K. W. (2000). Obstacle Detection and Avoidance for an Autonomous Farm Tractor. Utah State University.
- [5] Heidarsson, H. K., & Sukhatme, G. S. (2011). Obstacle Detection and Avoidance for an Autonomous Surface Vehicle using a Profiling Sonar. 2011 IEEE International Conference on Robotics and Automation. Shanghai.
- [6] Ryther, C. A., & Madsen, O. B. (2009). Obstacle Detection and Avoidance for Mobile Robots. Technical University of Denmark.