School of Electrical Engineering
Department of Electrical and Computer Science Engineering

Project Title

THE ULTRA SONIC SENSOR OBSTACLE FINDING ROBOT

A MINI PROJECT REPORT

Submitted by

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BECS201L- SEMICONDUCTOR DEVICES AND CIRCUITS

Submitted to

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ABSTRACT

A brief summary of your project that gives readers a quick overview of the essential points within 200words

The ultrasonic sensor-based obstacle-avoiding robot is an autonomous robot designed to navigate its environment by detecting and avoiding obstacles using ultrasonic sensors. These sensors emit sound waves and measure the time it takes for the waves to bounce back from nearby objects, allowing the robot to calculate the distance to obstacles in its path.

The robot's core components include ultrasonic sensors, a microcontroller (such as Arduino or Raspberry Pi), motors for movement, and a power supply. The microcontroller processes sensor data, and based on the distance readings, it determines if there are obstacles ahead. If an obstacle is detected within a certain range, the robot takes action, such as stopping, reversing, or turning, to avoid a collision.

This type of robot is ideal for applications like autonomous navigation, warehouse robots, or educational projects. It offers a simple and effective solution for basic obstacle detection and navigation, making it popular in robotics learning environments. The system's ability to react in real-time to environmental changes ensures smooth movement and efficient pathfinding, even in cluttered or dynamic spaces.

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CHAPTER-1

INTRODUCTION

Introduction:

This project focuses on the development of an eco-friendly line follower obstacle avoider robot. The main goal is to design and implement an autonomous robot that can follow a predefined path while efficiently detecting and avoiding obstacles in its way. An ultrasonic sensor obstacle-avoiding robot is an autonomous robot designed to navigate its environment without human intervention by detecting and avoiding obstacles using ultrasonic technology.

These robots are typically equipped with ultrasonic sensors that emit sound waves and measure the time it takes for the sound to bounce back after hitting an obstacle. This data is then processed by a microcontroller, allowing the robot to determine the distance to any nearby objects in its path.

When the robot detects an obstacle within a predefined distance, it takes actions to avoid collision, such as stopping, reversing, or changing direction. The robot's movements are powered by motors controlled by the microcontroller, which adjusts the robot's speed and direction based on sensor feedback.

The robot's control system is built around an Arduino UNO microcontroller, which processes the data from the sensors and controls the motors to navigate the robot accordingly.

Objectives:

- Implement obstacle avoidance functionality using an ultrasonic sensor.
- Develop a control algorithm for line following and obstacle avoidance.
- To integrate ultrasonic sensors with a microcontroller (such as Arduino or Raspberry Pi), allowing the robot to process sensor data and control the motors for movement.

- To optimize the robot's performance in terms of speed, responsiveness, and accuracy in obstacle detection and avoidance, ensuring reliable operation in different environments.

Significance:

The development of an eco-friendly line follower obstacle avoider robot has significant implications for sustainability and automation, this project is significant not only for its technical and educational value but also for its real-world implications in the fields of automation, robotics, and intelligent systems. It helps bridge the gap between theoretical knowledge and practical application, making it an important tool for developing foundational skills in modern technology.

Project Scope:

The ultrasonic sensor obstacle-avoiding robot project covers the creation of a basic autonomous robot that detects and avoids obstacles using ultrasonic sensors. It includes sensor integration, movement control, decision-making algorithms, and practical testing. The scope also includes educational, prototyping, and real-world application potential, with room for future development into more advanced systems. This project serves as a foundation for understanding robotics, automation, and autonomous navigation, and it can be expanded in various directions based on specific goals or industry needs.

LITRATURE REVIEW:

1)Xing tang He, Hongpeng Ji, Yuanyuan Song, Genxin Song, Hangyi Cai, Yang Mi, Member, IEEE Shanghai University of Electric Power, Shanghai 200090, Voltage Stability Control for DC Microgrid with Energy Storage.

- In order to maintain the bus voltage stability of isolated DC microgrid, it is necessary to configure the energy storage system to realize the balance of energy supply and demand.
- The demand side power is distributed automatically by renewable energy source according to its maximum output power, which can assure the bus voltage stability.

2)S. Augustine, M. K. Mishra, and N. Lakshminarasamma, "A unified control scheme for a standalone solar-PV LVDC microgrid system with HESS," IEEE Journal of Eme. and Sele. Topics in Power Elect., pp. 1–1, 2019.

- The paper proposes an adaptive droop-based load sharing, MPP tracking and energy management of photovoltaic (PV) based DC microgrid system. A proportional droop index (PDI) algorithm is introduced, which is a function of normalized current sharing difference and voltage deviation in the output side of the converter.
- The given method eliminates poor voltage regulation issues of the conventional droop method. The control of hybrid energy storage system (HESS) with battery and super-capacitor (SC) is also discussed to stabilize the DC grid voltage and energy management of the DC microgrid.

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METHODOLOGY

The **Ultrasonic Sensor Obstacle Avoiding Robot with IR Sensor** is a type of autonomous robot designed to navigate its environment while avoiding obstacles.

- Sensor Placement:

  - **Ultrasonic Sensor**: Mount the ultrasonic sensor at the front of the robot to detect obstacles in the robot's path. It should be placed at a height that allows it to detect obstacles in the typical range (about 20 cm to 4 meters).
  - **IR Sensors**: These are typically placed at the front or along the sides of the robot to detect lines or boundaries. Some robots use IR sensors to detect edges (for edge-avoiding) or to follow lines on the ground.

- Sensor Working Principle:

  - **Ultrasonic Sensor**: It works by emitting ultrasonic waves and measuring the time it takes for the waves to bounce back from an object. The distance to the object is calculated based on the time delay.
  - Formula: Distance=Time×Speed of Sound/2
  - **IR Sensors**: These work by emitting infrared light and detecting the reflection of the light from nearby objects. The sensor detects changes in the reflected light intensity to determine proximity.

3. Obstacle Detection and Avoidance Logic:

  - **Distance Measurement**: The ultrasonic sensor continuously measures the distance to objects in front of the robot. If the distance falls below a predefined threshold (say 20 cm), it indicates that an obstacle is too close, and the robot must take action.
  - **IR Sensor Functionality**: The IR sensors are used to detect additional obstacles or lines on the ground. For example, an IR sensor might be placed at the rear of the robot to prevent it from backing into obstacles, or it might be used for a line-following application.

- Control Algorithm :

The control logic to avoid obstacles typically involves these steps:

- **If no obstacle is detected** (i.e., distance > 20 cm): The robot moves forward.
- **If an obstacle is detected** (i.e., distance < 20 cm):
    - The robot should stop or reverse.
    - The robot may also perform a turn (left or right) to navigate around the obstacle. The direction of the turn can be chosen based on additional IR sensor readings or a pre-defined turning logic.
- The robot continues to make decisions in real-time based on continuous sensor inputs.

➢ Motion Control:

- The DC motors are controlled by the microcontroller via a motor driver, which adjusts the speed and direction of the motors. The robot can move forward, reverse, and turn based on the sensor inputs.
- **Turning Strategy**: When the robot detects an obstacle, it may:
    - Reverse for a short distance.
    - Turn in a specific direction (left or right) to find a clear path.
    - Continue straight if there is no obstruction after the turn.

➢ IR Sensors for Line Following:

In some obstacle-avoiding robots, IR sensors are used for line following or boundary detection. These sensors detect the contrast between the floor (light or dark) and follow a predefined path.

- **Line following algorithm**: If the robot detects the line (usually the difference in infrared reflection), it adjusts its motors to stay on track.

➢ System Integration and Testing:

- Once all sensors and components are connected to the microcontroller, test the system in a controlled environment (e.g., a room or track with obstacles) to fine-tune the behavior.
- Adjust the threshold distances for obstacle detection based on real-world tests.

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RESULT AND DISCUSSION

CHAPTER-3

3.1 EXPERIMENTAL ANALYSIS:

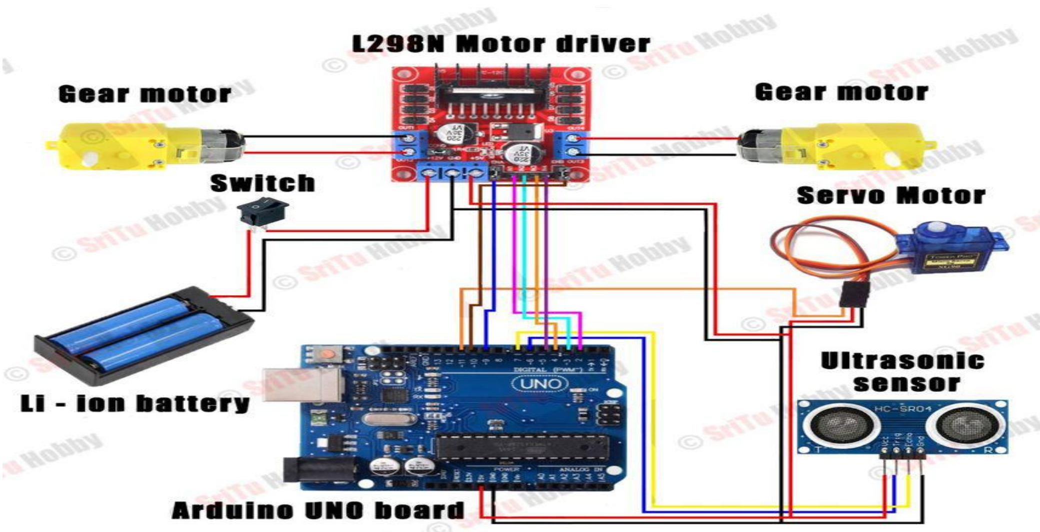
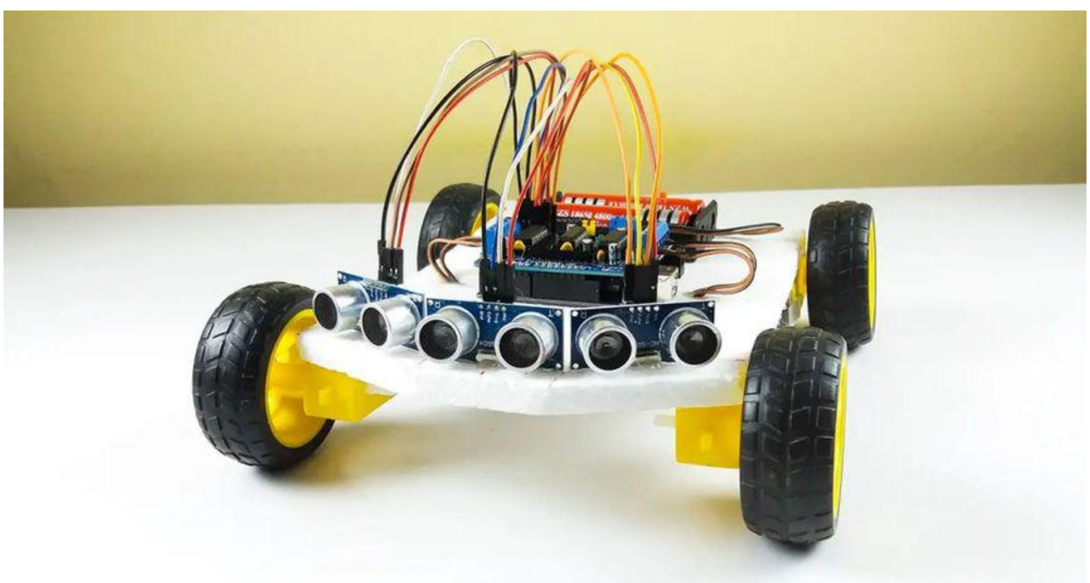


Photo of the Project:



CONCLUSION:

This project successfully demonstrates the design and implementation of an eco-friendly line follower obstacle avoider robot. Ultrasonic sensor-based obstacle-avoiding robots represent a significant area of research and development in robotics, offering cost-effective, reliable, and simple solutions for autonomous navigation. While ultrasonic sensors have some limitations, such as range and accuracy, their affordability and ease of integration make them ideal for basic obstacle detection and avoidance tasks. The future of these robots lies in improving sensor accuracy, integrating multiple sensors, and applying advanced algorithms to create more efficient and adaptable systems..

Future Work:

By improving sensor fusion, navigation algorithms, and mobility, these robots can become more versatile, reliable, and intelligent. As these robots evolve, they will not only become more effective in complex real-world applications but will also play a key role in shaping the future of autonomous systems. Whether it's for industrial use, educational purposes, or home automation, there are endless possibilities for the expansion of this technology..

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