

# AUTONOMOUS ACCIDENT AVOIDING SMART ROBOT

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## ABSTRACT

*In today's rapidly advancing technological world, robotics has become an important field contributing to automation and intelligent systems. The Autonomous Accident Avoiding Smart Robot developed in this project is designed to navigate unknown environments while detecting obstacles and preventing collisions without human intervention. The system uses ultrasonic sensors to continuously measure the distance between the robot and surrounding objects. Based on real-time sensor data, the Arduino microcontroller processes inputs and controls the speed of DC motors through a motor driver circuit. When an obstacle is detected within a critical range, the system automatically reduces speed and applies emergency braking to avoid accidents. An LCD display is used to show real-time information such as distance, movement*

*status, and warning messages, while a buzzer provides audible alerts during*

*emergency conditions. The Arduino platform is selected due to its simplicity, reliability, and ease of programming using the Arduino IDE. The integration of hardware components such as ultrasonic sensors, motor driver, DC gear motors, LCD module, and buzzer ensures smooth and efficient operation. This autonomous robot is capable of real-time decision-making, making it suitable for applications in smart transportation and safety systems.*

**KEYWORDS:** *Autonomous Robot, Accident Avoidance, Arduino Microcontroller, Automatic Speed Control, Automatic Braking, Ultrasonic Sensor, Motor Driver, LCD Display, Buzzer Alert, Robot*

## INTRODUCTION

The rapid advancement of autonomous systems and intelligent transportation technologies has increased the demand for safer and more reliable robotic platforms. A major challenge in robotic and vehicular systems is the delayed response to dynamic obstacles, improper speed regulation, and dependence on human control, which can lead to accidents. To overcome these issues, the proposed Autonomous Accident-Avoiding Smart Robot is designed to ensure real-time perception, decision-making, and automatic response.

The system uses ultrasonic or infrared sensors to continuously measure the distance between the robot and surrounding objects. The collected sensor data is processed by a microcontroller, which evaluates potential collision risks based on predefined threshold values. A closed-loop control mechanism is implemented to dynamically adjust motor speed and maintain safe operation. When an obstacle is detected within a critical range, the system activates an automatic braking function to prevent collisions. This integration of sensing, processing, and control enhances safety, reliability, and autonomous navigation capability.

## RELATED WORK

Several studies have focused on the development of autonomous obstacle

avoidance systems using microcontroller-based platforms. Researchers have implemented Arduino-based robots integrated with ultrasonic and infrared sensors for real-time distance measurement and navigation control. These systems enable robots to detect obstacles and adjust their movement accordingly to prevent collisions. Many works also utilize motor driver ICs such as L293D to control DC motors efficiently, ensuring smooth directional changes and speed regulation. Review of literature shows that combining multiple sensors improves detection accuracy and reduces false readings in dynamic environments. Some advanced approaches incorporate real-time processing algorithms that allow quick decision-making for safe navigation. Overall, existing research highlights that low-cost embedded systems with sensor integration provide reliable solutions for autonomous movement, making them suitable for applications in robotics, industrial automation, and intelligent transportation systems.

## LITERATURE REVIEW

The literature survey on autonomous accident-avoiding robots highlights significant advancements in sensor-based navigation and real-time control systems. Researchers have widely used ultrasonic

and infrared sensors with Arduino-based controllers for effective obstacle detection and avoidance. Studies also show that multi-sensor fusion improves accuracy and reliability in dynamic environments compared to single-sensor systems. Several works introduce adaptive speed control and automatic braking mechanisms to enhance safety during navigation. IoT integration enables remote monitoring and real-time data access, while LCD displays improve user interaction by providing system status updates. Overall, existing research emphasizes low-cost, efficient, and intelligent robotic systems capable of real-time decision-making for safe autonomous movement and collision prevention.

## EXISTING METHOD

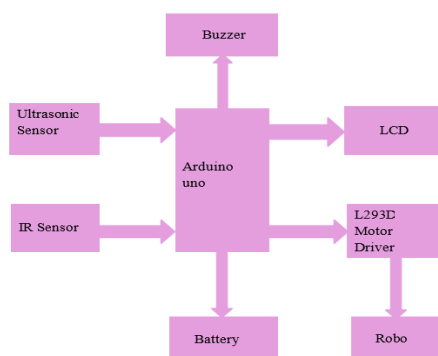
The existing system consists of fixed-speed robots that operate without any obstacle detection or environmental awareness. These systems move at a constant speed based on pre-programmed instructions and do not incorporate sensors such as ultrasonic or infrared for real-time monitoring. Since there is no feedback mechanism, the robot cannot detect or respond to unexpected obstacles, often leading to collisions and mechanical damage. The absence of speed control and automatic braking further limits their safety and adaptability in dynamic environments.

Although these robots are simple, low-cost, and easy to implement, their functionality is restricted to controlled or predefined conditions, making them unsuitable for real-world autonomous navigation applications.

## PROPOSED METHOD

The proposed system, Autonomous Accident Avoiding Smart Robot, introduces an intelligent and real-time obstacle detection and avoidance mechanism using ultrasonic sensors. The system continuously measures the distance between the robot and surrounding objects and sends the data to an Arduino controller for processing. Based on predefined safety thresholds, the controller dynamically adjusts motor speed and activates automatic braking when obstacles are detected within a critical range, ensuring collision-free movement. Motor driver circuits enable precise control of DC motors for smooth navigation. An LCD display provides real-time status updates such as distance and warnings, while a buzzer generates alerts during emergency conditions.

## SYSTEM ARCHITECTURE



**Fig 1: Block Diagram**

## METHODOLOGY DESCRIPTION

### Sensing Unit

The ultrasonic sensor continuously measures the distance between the robot and nearby obstacles. The IR sensor assists in detecting nearby objects and supports stable path tracking in dynamic environments.

### Control Unit

The Arduino Uno acts as the central processing unit of the system. It receives real-time sensor inputs and processes them using programmed logic for decision-making.

### Alert System

The buzzer is used to generate an audible warning whenever an obstacle is detected within the safety range. This ensures immediate attention and helps prevent collisions during robot movement.

### Display Interface

The LCD display shows real-time information such as distance values, sensor status, and warning messages. It improves system transparency by providing clear feedback to the user.

### Motion Control Unit

The L293D motor driver controls the direction and speed of the DC motors based on Arduino signals. This enables smooth movement of the robot in forward, backward, and turning directions.

## SOFTWARE AND HARDWARE REQUIREMENTS

### HARDWARE REQUIREMENTS

#### Arduino Uno



**Fig 2: Arduino Uno**

Arduino Uno is the central controller of the system based on the ATmega328P microcontroller. It processes all sensor inputs and generates control signals for motors, LCD, and buzzer.

#### IR Sensor



**Fig 3: IR Sensor**

The IR sensor is used for detecting nearby obstacles or object presence. It provides quick response signals to help in short-range detection and path tracking.

**Ultrasonic Sensor**



**Fig 4: Ultrasonic Sensor**

The ultrasonic sensor measures distance using sound wave reflection technique. It continuously detects obstacles and sends real-time distance data to the Arduino.

**LCD Display**



**Fig 5: LCD Display**

The LCD display is used to show system status and sensor readings. It provides

visual output such as distance, warnings, and robot movement status.

**Buzzer**



**Fig 6: Buzzer**

The buzzer is an alert device used to generate sound warnings. It activates when an obstacle is detected or when immediate attention is required.

**L293D Motor Driver**



**Fig 7: L293D Motor Driver**

The L293D motor driver controls the direction and speed of DC motors. It acts as an interface between Arduino and motors for safe high-current operation.

**DC Motors**



**Fig 8: DC Motors**

DC motors are used to provide movement to the robot. They rotate forward or reverse based on signals from the motor driver.

### **Robot Chassis**

The robot chassis is the mechanical frame that holds all components. It provides structural support and ensures proper alignment of the system.

### **Wheels and Caster**

Wheels are attached to DC motors for movement of the robot. The caster wheel provides balance and smooth turning support.

### **Breadboard and Jumper Wires**

Breadboard is used for temporary circuit connections without soldering. Jumper wires connect sensors, Arduino, and other components securely.

### **Power Barrel Jack**

The power barrel jack is used to supply external power to the system. It ensures

stable voltage input for Arduino and connected modules.

### **External Power Supply**

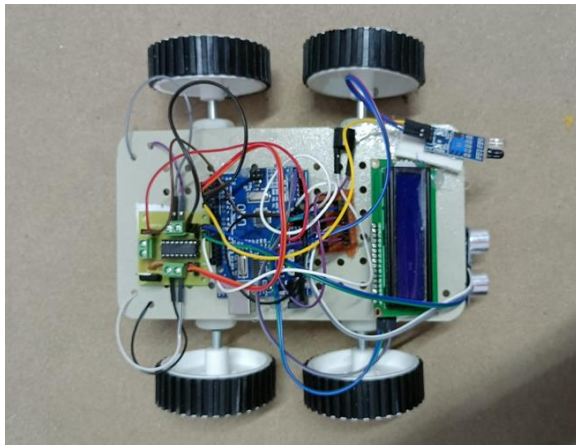
External power supply provides required energy for system operation. It ensures continuous and stable power for motors and sensors.

## **SOFTWARE REQUIREMENTS**

**Arduino IDE:** Arduino IDE is the main software used for writing and uploading code to Arduino Uno. It provides a simple interface for programming, compiling, and debugging embedded systems. The IDE supports real-time serial monitoring for testing sensor outputs. It also includes built-in libraries for easy hardware interfacing and control.

## **RESULTS AND DISCUSSION**

The image shows an Arduino-based autonomous robot that uses ultrasonic and IR sensors to detect obstacles and control DC motors via a motor driver for real-time navigation with LCD status display.



**Fig 9: Autonomous Accident Avoiding Smart Robot**

The “FORWARD – NO OBJECT DETECT” status indicates a clear path ahead, allowing the robot to move smoothly at normal speed without any obstacle-triggered interruption or braking.



**Fig 10: Output of Forward No Object Detected**

The image shows real-time LCD output where the IR sensor detects no obstacle (IR value 0) and the ultrasonic sensor measures about 29 cm, confirming proper sensor operation and continuous environmental monitoring.



**Fig 11: Output of IR Sensor Distance**

The image shows the robot detecting an obstacle, displaying “STOPPED OBJECT DETECTED” on the LCD and immediately halting motors to ensure safe autonomous navigation.



**Fig 12: Output of Object Detected**

## CONCLUSION

The Autonomous Accident Avoiding Smart Robot successfully integrates sensors, Arduino control, and motor drivers to achieve reliable autonomous navigation. It effectively detects obstacles in real time and responds with appropriate speed control and braking actions. Overall, the system demonstrates a cost-effective and efficient solution for improving safety in robotic movement.

## FUTURE SCOPE

The system can be enhanced using advanced sensors like LIDAR and camera-based vision for better accuracy. Integration of AI and IoT will enable smart decision-making and remote monitoring capabilities. It can also be extended for applications in autonomous vehicles, industrial automation, and smart delivery systems.

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