

A Review on Object Detection Radar Systems Using Arduino Uno

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Abstract: This project presents an Object Detection Radar System based on the Arduino Uno, designed to detect and visualize the position and distance of objects within a specified range using ultrasonic sensors and servo motor rotation. The system provides a cost-effective solution for detecting obstacles or intrusions by mimicking radar functionality. Using an HC-SR04 ultrasonic sensor, the system measures the distance to nearby objects by transmitting and receiving ultrasonic waves. A servo motor rotates the sensor to scan the area in front of it, while Arduino Uno processes the data and transmits it to a computer or Android device for visualization through Processing software or a mobile interface. This real-time radar visualization enhances awareness of surrounding objects and can be applied in areas such as robotics, surveillance, and autonomous vehicles. The proposed system demonstrates how low-cost embedded components can be used to replicate the principles of radar for educational, security, and automation purposes.

Keywords: Arduino Uno, Ultrasonic Sensor, Radar System, Object Detection, Automation, Embedded System

I. INTRODUCTION

Automation and sensing technologies play a crucial role in modern systems where environmental awareness is required, such as robotics, automotive safety, and security monitoring. One of the essential sensing techniques is object detection, which helps devices identify nearby obstacles and make decisions based on their distance and position. Traditional radar systems rely on electromagnetic waves and expensive sensors, but recent advancements in microcontrollers and ultrasonic sensors have enabled cost-effective solutions for small-scale applications.

The Object Detection Radar using Arduino Uno replicates radar functionality using ultrasonic waves. The system rotates an ultrasonic sensor mounted on a servo motor, scans the surrounding area, and determines the distance of objects. The data is processed by the Arduino Uno and visualized on a graphical interface that resembles a radar screen. This system is particularly useful for robotics, where autonomous robots must detect and avoid obstacles, as well as in home automation, surveillance, and defense applications. Its modular design allows for integration with IoT platforms, Android applications, and AI-based object classification systems for future enhancements.

In this study, a low-cost, real-time, and accurate radar prototype is designed and implemented using affordable components like Arduino Uno, HC-SR04 ultrasonic sensor, and servo motor, providing both educational and practical value.

II. LITERATURE SURVEY

Paper / Project	System Architecture	Cost	Ease of Implementation	Performance	User Experience	Limitations
Khan et al.	Ultrasonic-based obstacle	Low (<\$30)	Easy setup	Accurate in short range	Simple distance	Limited detection



	detection using Arduino				display	angle.
Rahman et al.	Radar prototype using Arduino and Processing	Low (<\$35)	Moderate	Real-time visualization	Interactive radar interface	Servo Delay Affects precision.
Sharma et al.	IoT-based obstacle detection using NodeMCU	Moderate (<\$50)	Moderate	Remote monitoring	Mobile-based alerts	Requires Wi-Fi connectivity.
Joshi et al.	Smart vehicle collision avoidance using sensors	Moderate	Complex	High accuracy	Improved road safety	High processing demand
Mehta & Singh	Ultrasonic radar using Raspberry Pi High	High (>₹4000)	Moderate	Fast image processing	GUI-based visualization	Costly hardware.
Ali et al.	Arduino-controlled security radar system	Low (<\$40)	Easy	Stable detection	Useful for security	Short detection range.
Ali et al.	Object detection with Bluetooth alert	Low (<\$25)	Easy	Fast response	Fast response	No visualization interface.
Kumar & Das	Sonar-based distance measuring system	Low	Moderate	Accurate readings	Simple display	No rotation mechanism.

III. PROPOSED METHODOLOGY

The proposed Object Detection Radar System is designed using Arduino Uno as the core processing unit, interfaced with a HC-SR04 ultrasonic sensor, SG90 servo motor, and computer or Android device for radar visualization.



Object Detection Radar System

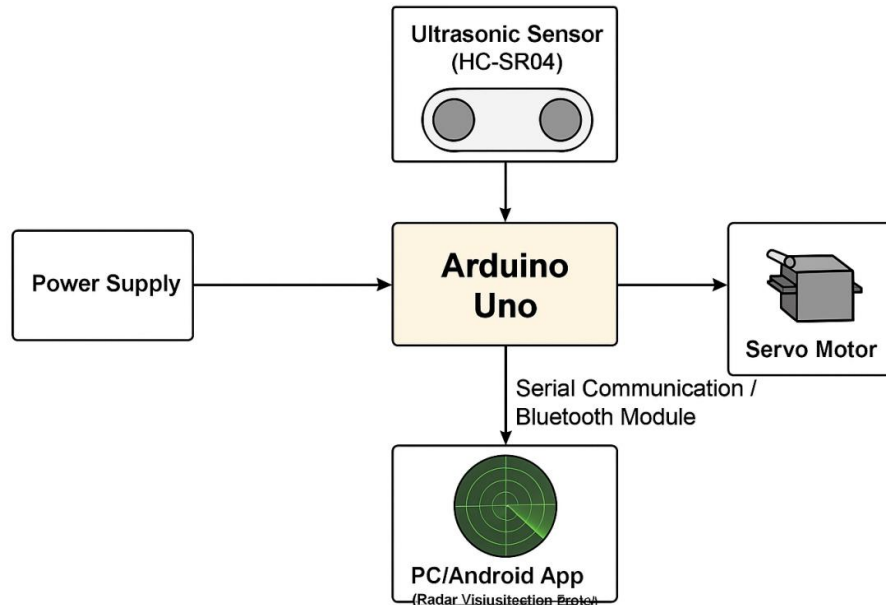


Figure1: Block Diagram of Proposed System

IV. CONCLUSION

The Object Detection Radar using Arduino Uno successfully demonstrates a simple yet effective method of real-time object detection and visualization. The system efficiently measures the distance of nearby objects and presents them on a radar-style display, providing valuable insights into spatial awareness. By combining low-cost hardware with simple software logic, this project serves as an ideal prototype for educational, research, and security applications. Future developments may include integrating IoT for cloud monitoring, AI-based object classification, or GPS integration for autonomous navigation systems. Thus, this system highlights how affordable embedded technology can replicate complex radar systems for practical and scalable solutions.

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