International Journal of Science, Strategic Management and Technology
Volume **02** Issue **03** March-**2026** | ISSN: **3108-1762 (Online)** | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

Ultrasonic Radar System

| **Mashalkar Y.S.** | **Bharde Satyavijay** | **Barbole Omkar** | **Bomane Jayraj** | Senior lecture, Department of Electronics and Telecommunication Student Department of Electronics Electronics and Telecommunication. Vishweshwarayya Institute of Engineering Technology, Almala, India.

https://doi.org//10.55041/ijsmt.v2i3.413

Cite this Article: Y.S, M., Satyavijay, B., Omkar, B. & Jayraj, B. (2026). Ultrasonic Radar System. International Journal of Science, Strategic Management and Technology, *02*(03). https://doi.org/10.55041/ijsmt.v2i3.413

Abstract- This paper presents the design and implementation of an ultrasonic radar system for object detection and distance measurement. The system uses ultrasonic waves transmitted toward a target, and the reflected echo is received to calculate distance based on time of flight. A microcontroller processes the signal and displays the results on an output device. The system can also rotate to scan surrounding areas, providing radar-like functionality. It is low-cost, efficient, and suitable for robotics, security, and obstacle detection applications.

Keywords— Ultrasonic, Radar, Sensor, Distance, Detection, Microcontroller, Waves

I. INTRODUCTION

Ultrasonic radar system is a modern sensing technology used for detecting objects and measuring distance using ultrasonic sound waves. It works by transmitting high frequency sound signals toward an object and receiving the reflected echo. The time taken for the echo to return is used to calculate the distance accurately. This system is widely used in robotics, automation, security systems, and obstacle detection applications. Compared to traditional radar systems, ultrasonic radar is low cost, easy to design, and consumes less power. It is commonly implemented using microcontrollers such as Arduino for real time processing. Due to its simplicity and reliability, it is an effective solution for short range detection and navigation systems in various engineering applications.

II. LITERATURE REVIEW

i. **Ultrasonic Sensing Technology**: Ultrasonic radar systems are based on sound waves above human hearing range. Researchers have shown that these waves can effectively measure short distances by reflecting off objects and returning to the sensor.

ii. **Use of Microcontrollers (Arduino Uno)**: Many studies use Arduino Uno as the main controller because it is simple, low- cost, and easy to program for real-time ultrasonic signal processing.

iii. The working principle of ultrasonic radar is based on the transmission of ultrasonic waves and measurement of reflected echo time to calculate distance.

iv. **HC-SR04 Ultrasonic Sensor**: The HC-SR04 sensor is widely used in research due to its accuracy, affordability, and simple interfacing for distance measurement applications.

v. **Time-of-Flight Principle**: Literature explains that distance is calculated by measuring the time taken for ultrasonic waves to travel to an object and return as an echo.

III. NEEDS FOR AN ULTRASONIC RADAR SYSTEM

i. **Protection of Equipment and Infrastructure**: Automated rain detection systems are needed to protect outdoor electrical equipment, agricultural tools, and sensitive systems from rain damage by triggering timely alerts or actions.

ii. **Efficient Irrigation Control in Agriculture**: These systems help farmers automatically stop irrigation when rain is detected, saving water and improving crop management efficiency.

iii. **Real-Time Weather Monitoring**: Manual observation of rainfall is not always accurate or timely. Automated systems provide real-time detection and immediate response.

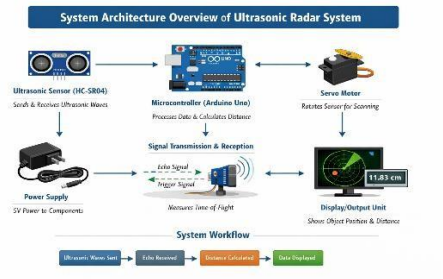
iv. **Reduction of Human Effort**: Traditional rainfall monitoring requires manual checking. Automated systems reduce human involvement and increase convenience.

v. **Low-Cost Smart Solutions**: With microcontrollers like Arduino Uno, rain detection systems can be developed at low cost, making them accessible for small-scale users and students.

vi. **Improved Safety and Automation**: Rain detection helps in activating safety measures such as closing windows, covering machines, or stopping outdoor operations automatically.

IV. SYSTEM ARCHITECTURE OVERVIEW

1. **Ultrasonic Sensor Unit (HC-SR04):** The ultrasonic sensor acts as the main input device. It transmits ultrasonic waves and receives the reflected echo from objects to measure distance.
2. **Microcontroller Unit (Arduino Uno):** The Arduino Uno is the central processing unit of the system. It calculates distance based on the time difference between transmitted .
3. **Power Supply Unit:** A regulated 5V power supply is used to power the Arduino and ultrasonic sensor for stable and continuous operation.
4. **Signal Transmission and Reception Block:** The transmitter sends ultrasonic waves toward an object, and the receiver captures the reflected waves. The time



FIG(A)SYSTEM ARCHITECTURE OVERVIEW

1.**Power Supply Unit The rain sensor module:** It provides regulated and stable DC power to all components of the ultrasonic radar system. It ensures that the microcontroller, sensor, and other modules work properly without voltage fluctuation.

The diagram shows the system architecture of an Automated Rain Detection System using Arduino Uno. Each block represents a component or stage of the system.

Fig (b) ULTRAONIC SENSOR MODULE

The ultrasonic sensor module is a device used to measure distance using sound waves. It works by sending high-frequency ultrasonic waves from the transmitter section. These waves hit an object and bounce back as an echo.

1. Arduino Uno (Signal Processing Unit)

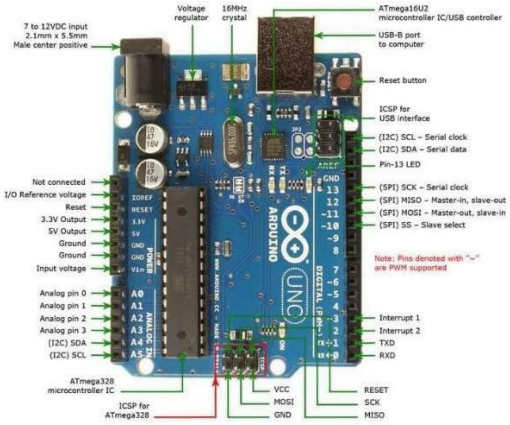


Fig (c) MICROCONTROLER

Ultrasonic Sensor → Arduino

- **VCC → Arduino 5V**

(Power supply to sensor)

- **GND → Arduino GND**

(Common ground)

- **TRIG → Arduino Digital Pin 9**

(Sends ultrasonic pulse signal)

- **ECHO → Arduino Digital Pin 10**

(Receives reflected signal)

ultrasonic radar system starts with a regulated power supply unit that provides stable voltage to all components and ensures smooth operation of the system. The microcontroller unit works as the central processing unit of the system and is responsible for controlling the transmitter, receiver, and overall distance calculation

2.Microcontroller unit

It acts as the brain of the system. It controls the ultrasonic sensor, processes the received signals, and calculates the distance of objects using time measurement.

3.Ultrasonic Sensor(Transmitter Section)

The ultrasonic radar system starts with a regulated power supply unit that provides stable voltage to all components and ensures smooth operation of the system. The microcontroller unit works as the central processing unit of the system and is responsible for controlling the transmitter, receiver, and overall distance calculation process.

Fig (d) O/P DEVICE

4.The **output stage** provides alerts when rain is detected

- **LED Indicator:** A light-emitting diode that glows when rain is detected. It provides a visual alert to the user.
- **Buzzer:**

A small electronic sound device that produces an audible alarm when rain occurs.
These outputs notify the user immediately and can also trigger automated systems such as irrigation control or window closing mechanisms.

5. Power Supply Unit

The **power supply unit** provides electrical energy to the entire system. In most Arduino projects, the system operates using

5V power supply provided through:

- USB connection from a computer
- External adapter
- Battery pack

V. ADVANTAGES

i. Low Cost

ii. Simple Design

iii. Fast Sensor Detection

iv. Low Power Consumption

v. Useful for Multiple Applications

VI. DISADVANTAGES

i. Limited Range

ii. Affected by obstacles

iii. Requires line of sight

iv. Slow for high-speed objects

VII. FUTURE ENHANCEMENTS

i. **IoT-Integration**
The system can be connected to the internet to monitor radar remotely using mobile or computer.

ii. **AI Implementation**
Artificial intelligence can help in identifying and classifying.

iii. Extended Detected Range
Sensor data can be stored in cloud databases for weather analysis and agricultural planning.

iv. **Wireless Communication**
The system can automatically close windows, control roofs, or activate drainage systems when rain is detected.

VIII. CONCLUSION

The ultrasonic radar system is an efficient and low-cost solution detecting objects and measuring distance in real time. ultrasonic waves for accurate short-range detection. That provide Stable Voltage to All Components.

IX. REFERENCES

[1]Arduino, "Arduino Uno Rev3 Documentation," Arduino Official Documentation. Available: https://docs.arduino.cc/hardware/uno-rev3

[2]Microchip Technology, "ATmega328P Datasheet," Microchip Inc. Available: https://www.microchip.com/en-us/product/ATmega328P

[3]MaxBotix Inc., "Ultrasonic Sensor Basics and Applications," MaxBotix Technical Resources. Available: https://maxbotix.com/pages/ultrasonic-sensor-education

[4]SparkFun Electronics, "Ultrasonic Sensor HC-SR04 Hookup Guide," SparkFun Learning Resources. Available: https://learn.sparkfun.com/tutorials/hc-sr04-ultrasonic-sensor-hookup-guide

[5]Last Minute Engineers, "Arduino Ultrasonic Sensor HC-SR04 Tutorial," Electronics Tutorial Resource. Available: https://lastminuteengineers.com/arduino-ultrasonic-sensor-hc-sr04/

[6]IEEE Xplore, "Radar and Ultrasonic Distance Measurement Systems," IEEE Research Papers. Available: https://ieeexplore.ieee.org