REPORT

Bachelor of Technology

in

Electronics and Instrumentation Engineering

Project done at

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

by

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Wireless Distance Alert System using Arduino UNO with Ultrasonic Sensor and Buzzer Feedback

0.1 Introduction

In many real-life applications, detecting the presence and distance of an object is crucial such as in vehicle parking systems, obstacle detection robots, and security systems. This project implements a Wireless Distance Alert System using an Arduino UNO, Ultrasonic Sensor, Buzzer, and LED indicators.

The ultrasonic sensor acts as the primary sensing element by transmitting sound waves and receiving the echo from nearby objects. The Arduino UNO processes the received signal, calculates the distance, and provides audio (buzzer) and visual (LED/LCD) alerts. The system behaves like a simple RADAR to warn users of obstacles within a certain range.

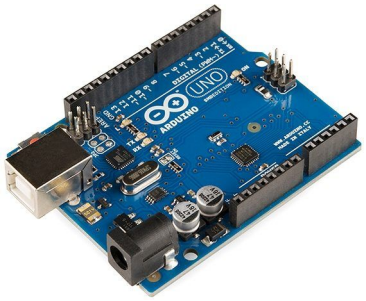
0.2 Objectives

- To design a distance monitoring system using Arduino UNO.
- To implement an obstacle detection mechanism using an ultrasonic sensor.
- To provide real-time alert signals through a buzzer and LED when objects approach within a threshold distance.
- To display measured distance on an LCD screen for better monitoring.

0.3 Components Required

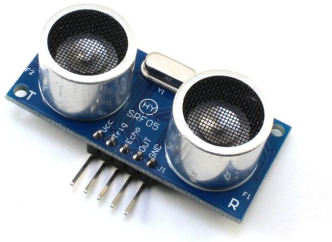
1. Arduino Uno

- Acts as the brain of the project.
- Takes input signals (from the ultrasonic sensor), processes them, and controls output devices (servo, buzzer, LED, LCD).



2. Ultrasonic Sensor (HC-SR04)

- Purpose: Measures distance by sending ultrasonic waves and receiving the echo.
- Role in project: Detects how far an object is from the sensor.
- Trigger pin $\rightarrow$ sends sound pulse.
- Echo pin $\rightarrow$ receives reflected pulse to calculate distance.



3. Servo Motor

- Purpose: Provides controlled angular motion ($0^\circ - 180^\circ$).
- Role in project: Likely rotates to point towards detected objects or perform an action (like opening/closing a barrier).

4. Buzzer

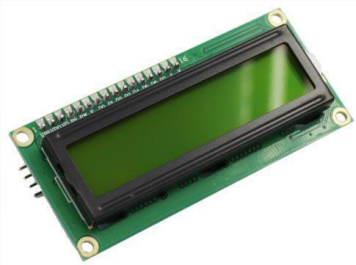
- Purpose: Produces a sound alert.
- Role in project: Gives warning/alarm when the sensor detects something at a certain distance.

5. LED

- Purpose: Visual indicator (ON/OFF light).
- Role in project: Lights up when an object is detected or when a condition is met (like too close).

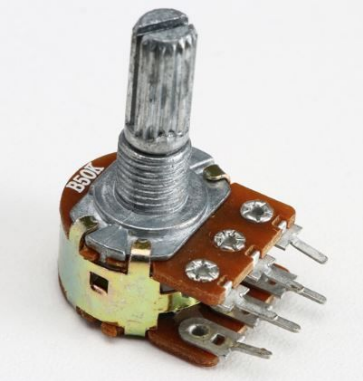
6. 16x2 LCD Display

- Purpose: Shows text/numeric data.
- Role in project: Displays measured distance or system messages (like "Object detected" or "Safe distance").



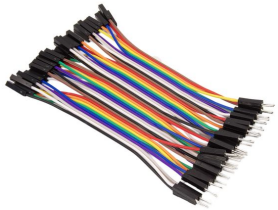
7. Potentiometer

- Purpose: Variable resistor.
- Role in project: Adjusts the contrast of the LCD display so that characters are visible clearly.



8. Jumper wires

- Purpose: For connections.



0.4 Circuit Connections

Ultrasonic Sensor

VCC	$\rightarrow 5$ V
GND	$\rightarrow$ GND
$Echo$	$\rightarrow Pin6$
$Trigger$	$\rightarrow Pin7$

Buzzer

$Out \rightarrow Pin8$
$GND \rightarrow$ GND

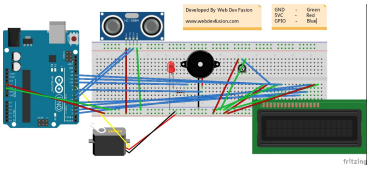
LED

$Positive \rightarrow Pin10$
$Negative \rightarrow$ GND

LCD (16x2)

- RS $\rightarrow Pin12$
- E $\rightarrow Pin11$
- D4 $\rightarrow Pin5$
- D5 $\rightarrow Pin4$
- D6 $\rightarrow Pin3$
- D7 $\rightarrow Pin2$
- $VDD \rightarrow 5$ V
- $VSS\&RW \rightarrow$ GND
- $VO \rightarrow Potentiometer$

0.5 Circuit Diagram



0.6 Working Principle

1. The ultrasonic sensor sends out sound waves through its trigger pin.
2. These waves reflect back when they strike an object and are captured by the echo pin.
3. The Arduino UNO calculates the time difference between transmitted and received waves, then converts it into distance using the formula:

$$DISTANCE = \frac{TIME \times SPEEDOFSOUND}{2}$$

4. If the measured distance is less than a predefined threshold (e.g., 30 cm), the buzzer and LED are activated as warning signals.
5. The LCD display continuously shows the measured distance in centimeters.

0.7 Applications

- Vehicle parking assistance systems.
- Obstacle detection for robots.
- Blind-spot detection in vehicles.
- Security systems for detecting intruders.
- Distance measuring instruments.

0.8 Advantages

- Low cost and easy to implement.
- Accurate for short to medium ranges.
- Provides both visual and audio alerts.
- Portable and power-efficient.

0.9 Limitations

- Limited range (2 cm − 400 cm for HC-SR04).
- Performance affected by surface type (soft surfaces absorb sound).
- Works best in short-distance applications.

0.10 Conclusion

The project successfully demonstrates a Wireless Distance Alert System using Arduino UNO, ultrasonic sensor, and buzzer feedback. The system measures distance effectively and provides timely alerts when obstacles are within a dangerous range. With simple modifications, this setup can be used in smart vehicles, robotics, and security systems, making it highly practical in real-world scenarios.

0.11 Future Enhancements

- Integration with Bluetooth/Wi-Fi module for wireless monitoring on smartphones.
- Addition of multiple ultrasonic sensors for 360° RADAR-like coverage.
- Use of a servo motor to rotate the sensor, displaying obstacles on a RADAR screen.
- Integration with IoT platforms for remote distance monitoring.