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RESEARCH ARTICLE OPEN ACCESS

Air Defense System Using Arduino

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Abstract
In recent years, there has been growing interest in developing low-cost monitoring systems using embedded technology. This paper presents a simple aerial object detection and alert system built using Arduino. The system uses an ultrasonic sensor to detect nearby objects and a servo motor to scan different directions. When an object is detected within a certain range, an alert is generated using a buzzer and LED. The main aim of this project is to design an affordable and easy-to-understand prototype that demonstrates basic detection and alert functionality. The results show that the system works effectively within a short range and can be useful for basic monitoring applications.

INTRODUCTION
Nowadays, embedded systems are widely used in many fields like automation, security, and monitoring. Many detection systems used in industries are expensive and complicated. Because of this, there is a need for simple and low-cost alternatives, especially for students and small applications.
In this project, an Arduino-based system is developed to detect objects in its surroundings. The idea is to create a basic model that can sense objects and give alerts. Even though it is a simple prototype, it helps in understanding how real-time detection systems work.

EXISTING SYSTEM
Most of the existing detection systems use advanced technologies like radar and image processing. These systems are highly accurate but come with certain drawbacks.
Drawbacks of existing systems:
- High cost of implementation
- Complex hardware and software
- Requires skilled operation
- Not suitable for small-scale use

PROPOSED SYSTEM
To overcome these issues, a simple system is proposed using Arduino and basic components. The system is designed to detect objects and provide alerts in real time.

Main components used:
- Arduino Uno
- Ultrasonic Sensor (HC-SR04)
- Servo Motor
- LED
- Buzzer

The ultrasonic sensor is used for distance measurement, while the servo motor helps in scanning different directions. Arduino acts as the main controller.

SYSTEM WORKING
- The ultrasonic sensor sends sound waves
- These waves reflect back after hitting an object
- Arduino calculates the distance using the time taken
- The servo motor rotates to cover a wider area
- If the object is detected within a fixed range:
- LED turns ON
- Buzzer gives alert sound

METHODOLOGY
The system is designed step by step:
- Interfacing ultrasonic sensor with Arduino
- Programming distance calculation
- Connecting servo motor for scanning
- Adding alert system (LED + buzzer)
- Testing the system under different conditions
  The scanning range is controlled by the servo motor, and detection depends on distance threshold.

RESULT

After testing, the system was able to detect objects successfully within a short distance range (around 2 cm to 100 cm). The servo motor helped in improving the coverage area.

Observations:

- Detection is accurate at close range
- Response time is quick
- System works continuously without interruption

APPLICATIONS

- Basic Security System
- Obstacle Detection
- Educational Demonstrations

LIMITATIONS

- Limited detection range
- Cannot detect very fast-moving objects
- Performance may vary due to environmental conditions

FUTURE SCOPE

The system can be improved further by:

- Adding IoT for remote monitoring
- Using camera modules for better detection
- Increasing range using advanced sensors
- Implementing AI-based tracking

CONCLUSION

This paper presents a simple and effective object detection and alert system using Arduino. The system is easy to design and works well for short-range detection. It is mainly useful for learning and basic applications. With some improvements, it can be extended for more advanced uses.

REFERENCES

- Arduino official website
- HC-SR04 datasheet
- Basic electronics textbooks
- Embedded systems study materials

