

# IoT Based Smoke and Metal Detection System for Military Use

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**Abstract:** *This paper presents an IoT- based smoke and metal detection system designed for military safety and surveillance. In risk areas such as borders and defense zones, early detection of fire hazards and hidden metallic threats is essential. The Proposed system integrates a smoke sensor and a metal detector with microcontroller to continuously monitor environmental conditions. When smoke or metal is detected above the set of limit, the system immediately activates an alert using a buzzer and also sends notifications using IoT technologies such as Wi-Fi or GSM. This helps in continuous monitoring and allows faster response in emergency situations. The system is designed to be simple, affordable, and reliable for use in remote areas. The testing results show that the system works effectively, providing accurate detection with fast response time, and reducing the need for manual monitoring.*

**Keywords:** IoT, Smoke Detection, Metal Detection, Arduino, Military Security, Sensors

## I. INTRODUCTION

The need for better security systems in military applications is increasing day by day. In high-risk areas like border areas and defense zones, it is very important to detect dangers such as fire and hidden weapons at an early stage. Traditional monitoring systems mostly depend on human observation, which can be slow and may not work in emergency situations. Because of this, there is a need for automatic systems that can quick and accurate results. With the development of the Internet of Things (IoT), it is now possible to connect sensors and devices for real-time monitoring and communication. IoT-based systems are already used in many areas such as smart homes, industrial safety, and environmental monitoring. Recently, many researchers have worked on system that detect smoke, harmful gases, and metal objects, and these systems have helped in improving safety. However, most of these systems focus on only one type of detection and do not combine multiple feature.

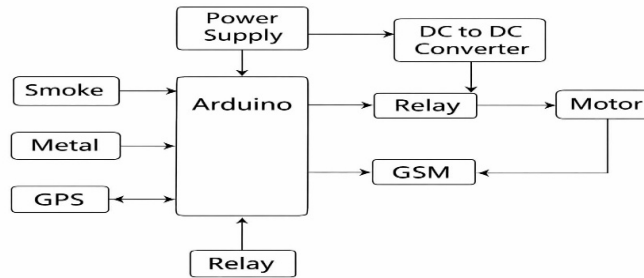
## II. METHODOLOGY

The proposed IoT-based smoke and metal detection system for military use is developed to continuously monitor the environment and provide quick alerts when any danger is detected. The system uses different sensors connected to a microcontroller to detect smoke and metal objects. When any abnormal condition is found the system sends alerts and helps in taking immediate action. The overall working of the system is based on sensing, processing, and communication, which ensure proper performance and reliability.

### System Architecture

The system consists of three main units: sensing unit, processing unit, and alert unit. The sensing unit includes a smoke sensor and a metal detector that continuously monitor environmental conditions. The processing unit, which is a microcontroller such as Arduino MCU, receives input signals from the sensors and analyzes them. The alert unit includes a buzzer and IoT communication module that notifies the user when a threat is detected.





**Figure 1:** Block Diagram of Smoke and Metal Detection System

### Working Principle

The system works by constantly collecting and analyzing data from different sensors. A smoke sensor checks for smoke or harmful gases, while a metal detector is used to find nearby objects. When the readings exceed the set limits, the microcontroller processes the information and generates an alerts. This alert can either be a buzzer sound or a message sent through IoT technologies like Wi-fi or GSM.

### Data Analysis

The system looks at the sensor data based on threshold values set during calibration. If the smoke level crosses a certain limit, it is taken as fire risk. In a Similar way, if metallic objects are detected within a certain range, it may point to a possible threat. The system's accuracy and response time depend on how fast and how well it can detect these conditions.

### III. MODELING AND ANALYSIS

The following table lists the main components used in the proposed system along with their functions. These components work together to achieve efficient detection and monitoring.

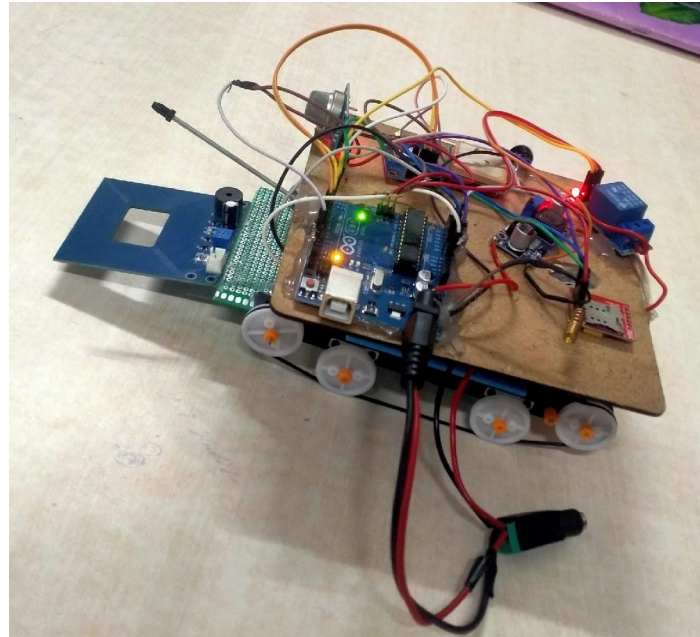
Sr. No.	Component Name	Description
1	Microcontroller	Arduino / NodeMCU used for processing
2	Smoke Sensor (MQ-2)	Detects smoke and harmful gases
3	Metal Detector	Detects metallic objects
4	Buzzer	Provides alert sound
5	LED	Visual indication of detection
6	IoT Module	Wi-Fi/GSM for sending alerts
7	Power Supply	Provides required power to the system

### IV. RESULTS AND DISCUSSION

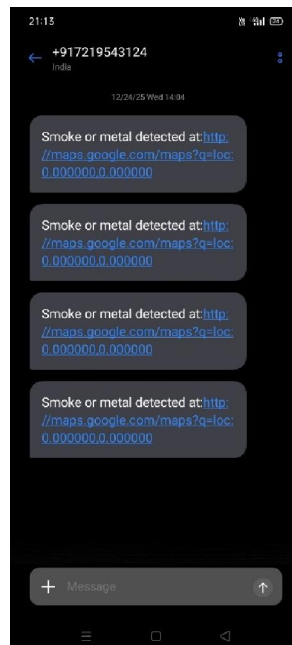
The system was tested under different conditions to check its performance. The smoke sensor was able to detect smoke accurately and alerts in a short time. In the same way, the metal detector identified metallic objects placed near the sensor. The system showed quick response time, which makes it suitable for real-time use. The use of IoT also made remote monitoring possible, which is helpful in military areas where direct human access is limited.

Overall, the system well and showed reliable detection.





**Figure 2:** Prototype of IoT Based Smoke and Metal Detection System.



**Figure 3:** SMS Alert Received for Smoke and Metal Detection.

## V. CONCLUSION

The IoT-based smoke and metal detection system improves safety and security in military areas. By combining smoke and metal detection into a one system, it reduces the need for multiple devices and increases efficiency. The system is easy to implement, cost-effective, and provides real-time alerts. It helps prevent fire hazards and quickly detect



potential threats. In the future, it can be improved by adding features like GPS tracking, mobile app integration, and advanced sensors for better accuracy and performance.

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