# *Design and Test Android-Based* Early *Fire Detection* Tools

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**ABSTRACT**

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The impact of global change causes people's lives to become more vulnerable to fire problems. Fire hazards have severe impacts, such as the loss of property and even casualties. Preventive measures are necessary to avoid, prevent, and minimize the occurrence of fire disasters. The research aims to design and build sensor-based gas, fire, and temperature detection systems, microcontrollers, and IoT devices, which can be used to detect potential hazards. Fire inside a particular house or building. This research method uses experimental methods in prototyping models. Components used are gas sensors, fire sensors, temperature sensors, microcontrollers, LEDs, and alarm buzzers, which are integrated with the Blynk IoT platform. The results of the study are in the form of an IoT-based gas, fire, and temperature detection system, which serves to provide early warning of \fire emissions through alarms and message notifications. Text on a smartphone. This system can be used to help detect and avoid potential fire hazards.

**Key Words**: Sensors, Detection, Alarm, Systems

## INTRODUCTION

A fire disaster is a catastrophic event where a structure or environment becomes engulfed in flames, resulting in severe material losses and casualties across various locations such as factories, buildings, markets, residential areas, and fuel stations [1]. Fire incidents can occur unexpectedly, often triggered by short circuits, gas leaks, or ignition sources such as cigarette sparks [2]. A significant contributing factor to the escalation of fire damage is the community's lack of awareness and slow response in contacting emergency services, compounded by inaccurate location information during reports [3].

Technological innovation has revolutionized many fields, including fire safety, through automation and remote sensing technologies that minimize the need for direct human intervention [4]. The integration of the Internet of Things (IoT) has introduced smart home and industrial fire detection systems capable of monitoring and controlling environmental parameters in real time [5]. Such systems not only provide faster detection but also improve situational awareness and decision-making during emergencies [6]. IoT-based monitoring systems, when combined with wireless communication modules such as ESP8266 and cloud-based platforms, allow data exchange between sensors and mobile devices, offering real-time alerts and enhancing community preparedness [7], [8].

In many fire incidents, emergency response units arrive when the fire has already spread significantly due to delays in reporting and distance constraints [9]. Therefore, research and innovation are shifting toward developing autonomous and Android-integrated fire detection systems that leverage Wi-Fi communication and mobile applications for instant notifications [10]. These systems utilize sensor networks, including flame, smoke, and temperature sensors, coupled with microcontrollers to transmit early warnings through IoT platforms such as Blynk or Firebase [11], [12].

Preventive actions are essential to mitigate the consequences of fires, emphasizing the need for advanced detection technologies integrated with IoT infrastructure [13]. This research aims to design a smoke and fire monitoring system that employs microcontrollers and sensors connected to a mobile-based IoT platform to notify users immediately when potential fire hazards are detected [14], [15]. Such systems represent a practical innovation toward achieving resilient and adaptive fire prevention mechanisms in smart environments.

## MATERIALS AND METHODS

This research is carried out by experimental methods by developing existing research; it is hoped that this research can provide better benefits. Based on the analysis of Android-based early fire detection tools that have been carried out independently from several parts, including the sender/transmitter circuit, receiver/receiversoftware, monitoring display / Human Machine Interfacing. Sender Circuit (Transmitter) In the working system of Android-based early fire detection devices that implement wireless systems, there must be a sending part (transmitter) and a receiver circuit (receiver). The sender circuit or transmitter circuit (Figure 1) is a series consisting of several parts, including a gas sensor (MQ-5), Wifi Module ESP8266, a Buzzer, circuit in the transmitter. It can be seen in Figure 1.

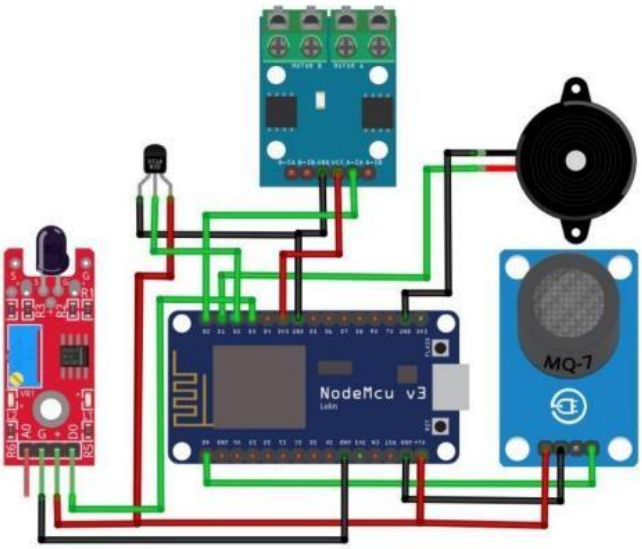


**Figure 1.** Transmitter Circuit

The sender circuit (transmitter) serves as a circuit that sends data to applications on smartphones and also to receivers. In addition to being a data sender, the sending circuit (transmitter) also contains sensors for gas readings, an LCD, and a buzzer as indicators and interfaces for air conditions.

This research was conducted based on important stages that were carried out with a success indicator in connecting the NodeMCU ESP8266 module and other devices so that they could be used to complete the success indicator in connecting the NodeMCU ESP8266 module and other devices so that they could be used to complete the completion of multiobjective problems.

The following is the design of a fire alarm detection system presented in the form of aflowchart.

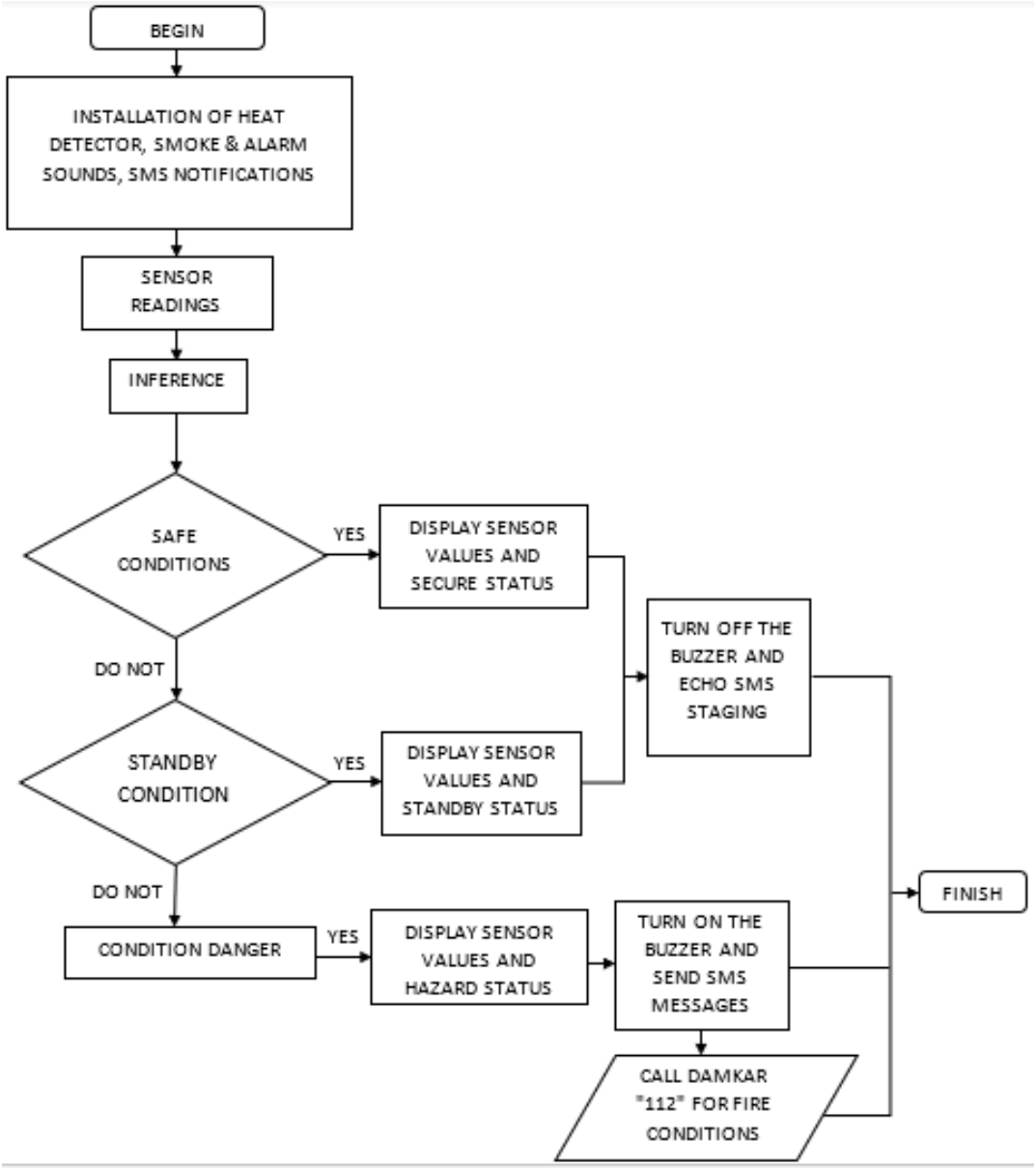


**Figure 2.** Flowchart Fire Safety Alarm System

Figure 2 presents the flow of the alarm system works first of all by installing gas, fire,and temperature detectors. The next step is for the detector sensor to perform readings and draw conclusions about the environmental conditions reached.

If the condition is safe, the detector will display the sensor value and safe status, and then disable the buzzer and send sms messages. When the alert condition is met, the detector will display the sensor value and alert status, and then disable the buzzer and send sms messages. If the danger condition occurs, the detector will display the sensor value and danger status, and the buzzer will be on, and send an sms message to make an emergency fire department call, which is 112, after it's done.

## RESULTS AND DISCUSSION

The hardware that was successfully made in this study is an early fire prevention automation system through coordination using notifications that will be sent over the internet on mobile phones connected to the internet. Blynik software.

With the gas leak detection system, fire sensor detection system, and temperature sensor in accordance with ISO 7240-5 of 2014, the Gas sensor (MQ2), fire sensor, and temperature sensor can detect leaks. Gas, temperature rise, and fire so directly send data to the Blynk application. The test results showed the insertion of this sensor for class A1 according to the ISO 7240-5 standard.

How the tool works when there is a gas leak and a fire sensor is detected, then notifies by sendinga message to the ESP8266 Module and proceeds to the Blynk application on the HP display that there is a gas leak and fire. Then the Buzzer (alarm) sounded. Discussion of the test and the results obtained is presented as follows.

### MQ-2 Sensor Testing (Gas Sensor)

This test is done using a portable gas stove that is open. The goal is to find out the level and concentration of gas by the MQ2 sensor used to detect carbon monoxide gas in the room.

**Figure 3.** MQ-2 Gas Sensor Testing Results

| Distance | Picture | Result |
|---|---|---|
| 50 cm |  |  |



Figure 3 shows the first test is to detect monoxide gas directed at the MQ2 sensor, which detects the smell of gas, and the sensor directly detects and sends data to Bylnk that the gas has been detected.

### Fire Sensor Testing

The purpose of the infrared sensor is to detect the presence of a fire that ignites towards the sensor. Testing is carried out by means of measurement with input devices with wood materials.

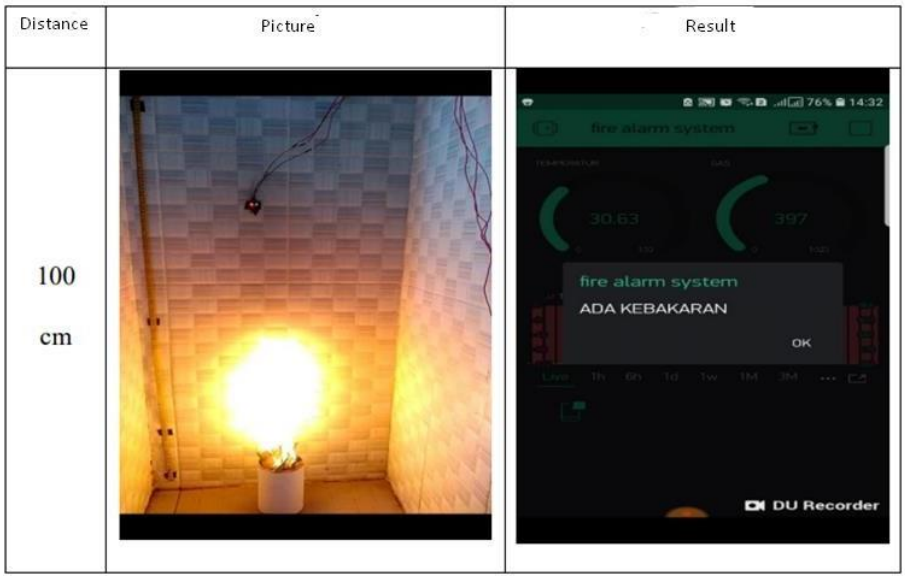


**Figure 4.** Fire Sensor Testing Results

The second test detects fire and temperature, from Figure 4. It states that the fire sensor works well when the fire that is burning the sensor detects the presence of fire and directly sends data to Bylnk that fire and temperature are detected.

**Temperature Sensor Testing**

This sensor helps the fire sensor so that there is no alarm in a fire event. Temperature sensor testing uses a portable gas stove that ignites the fire in order to determine the speed of propagation of the temperature sensor.

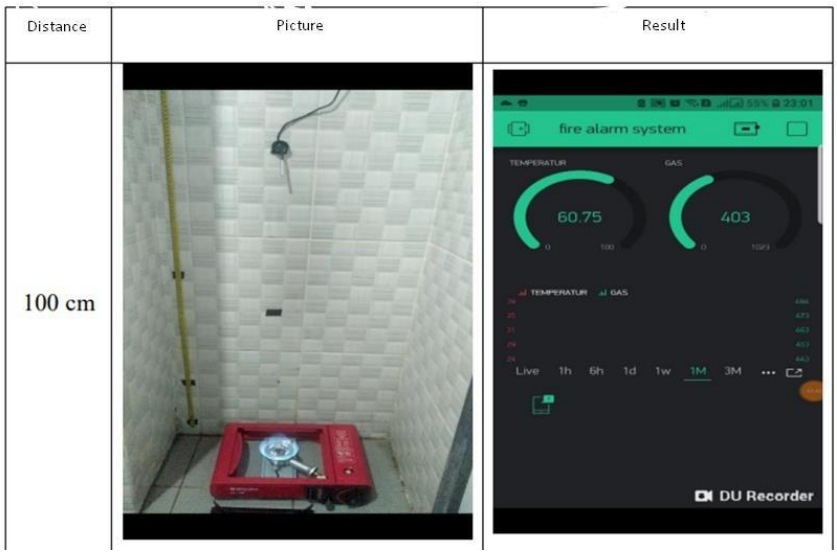


**Figure 5.** Temperature Sensor Test Results

Figure 5 shows the results of temperature sensor testing, with sensor data working well and in accordance with ISO 7240-5 standards. Temperature sensor testing is carried out at a room temperature of 30 °C.

## CONCLUSION

From the results of the research can be concluded, among others, that the prototype of anandroid-based fire prevention early detection system can monitor the potential for fire by the presence of fire. This system is able to provide remote information on the condition of the presence of fire and gas in real time through the Blynk application on Android smartphones. The results of this study are expected to be used to help detect and avoid potential fire hazards.

Even if this Android-based early fire detection device has been successfully made, it is recommended to remain careful to pay more attention to the use of gas cylinders and put combustible materials in a safe place.

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