TEPIAN Vol. 7 No. 2 (June 2026) 84-91 p-ISSN 2721-5350 e-ISSN 2721-5369
https://doi.org/10.51967/tepian.v7i2.3510 © 2026 Tepian Politeknik Pertanian Negeri Samarinda

Fire Detection Alarm and Electric Circuit Breaker based on SIM800L Arduino

Kadek Reda Setiawan Suda*
Electronic Engineering, National Polytechnic, Denpasar, 80239, Indonesia
reda@polnas.ac.id
**Corresponding author*

Abdillah Aziz Muntashir
Mechatronics, Astra Polytechnic, Cikarang, 17530, Indonesia
abdillah.muntashir@polytechnic.astra.ac.id

I Komang Gede Sukawijana
Electrical Engineering Education, Ganesha University of Education, Singaraja, 81116, Indonesia
gede.sukawijana@undiksha.ac.id

Muhdalifah Muhtar
Electrical Engineering, Ujung Panjang State Polytechnic, Makassar, 90221, Indonesia
muhdalifahmuhtar@poliupg.ac.id

Ida Bagus Putu Widja
Electronic Engineering, National Polytechnic, Denpasar, 80239, Indonesia
ibpwidja@gmail.com

I Wayan Nova Eka Ariana
Electronic Engineering, National Polytechnic, Denpasar, 80239, Indonesia
kayannova23@gmail.com

Submitted: 2025-10-03; Accepted: 2026-04-15; Published: 2026-06-01

***Abstract*—**The danger of fire can have fatal consequences such as loss of property and even loss of life. Preventive action is necessary to avoid, prevent and minimize the occurrence of fire disasters. This research aims to design and build a smoke and fire detection system based on sensors, microcontrollers, which can be used to detect potential fire hazards in certain houses or buildings. The research method in designing this system refers to the prototyping model. The components used are MQ-02 sensors, KY-026 sensors, microcontrollers, alarm buzzers, and SMS notification senders and GSM calls using the SIM800L module. The results of the research are a fire detection alarm system and electricity circuit breaker, which functions to provide early warning of potential fires through buzzer alarms and SMS notifications and GSM calls. This system can be used to help detect and avoid potential fire hazards.

***Keywords*—** Alarm, Detection, Fire, Notification, SIM800L

I. INTRODUCTION

Disaster is an event that is detrimental to human life. One of them is a fire disaster. According to the Great Dictionary of the Indonesian Language, fire is defined as "the event of something burning (house, forest and so on)" (Waworundeng, 2020). Fire disasters can occur due to unknown sources of fire, for example cigarettes, electrical short circuits, gas leaks, and others (Tarigan, 2020). The main cause of fire disasters is fire while smoke is an additional result of fire disasters. Every house or building is likely or has the potential to experience fire, which is caused by many factors, either from the negligence of the owner or intentionally by irresponsible people. From these possibilities, a fire detection device is needed that will notify the building owner so that it can be handled early so that fire incidents can be minimized (Mulyono et al., 2021). The detection equipment that is already in circulation also varies, from cheap to very expensive.

In the modern era like today, technology is developing very rapidly, as well as communication systems, the communication in question is not only human-to-human communication but also human-to-device communication or device-to-human communication. This research is intended to create an early detection device for fire based on SIM800L (GSM) with the title of Fire Detection Alarm and Power Circuit Breaker based on SIM800L using Arduino Microcontroller (ATmega 328p). This tool uses two sensors, namely, MQ-02 as a smoke and gas detector, KY-026 Sensor to detect fire (Putri et al., 2020). Fire notifications are sent via SMS and GSM calls, as an actuator in the early detection system for fire is a buzzer that functions as a signal for detecting smoke or fire (Waworundeng, 2020), a relay that functions as a power circuit breaker if fire is detected for early anticipation to prevent continuous electrical short circuits that can cause large-scale fires.

Fires in residential areas have a detrimental impact on the joints of life, the real impact of fire disasters are: loss of property that cannot be saved, burns to loss of life due to fires and can cause deep trauma for someone who has experienced the event. The occurrence of fires at night is indeed very worrying because it is out of our control. Fires in the house are sometimes not always visible from the outside due to minimal ventilation or windows.

From the Great Dictionary of the Indonesian Language, detection is "an effort to find and determine the existence, assumption or reality" (Pedagogos et al., 2021). When the KY-026 sensor detects a fire, the relay will give a signal to the contactor to cut off the electricity and will immediately make a GSM call to provide a warning that a fire has occurred. Even though the electricity has been cut off or turned off, this tool continues to work because it has a battery backup to continue communicating (Sudarmin,

2019). To return the system to its initial condition, a system reset must be carried out by pressing the system reset button on the Arduino board and this detection tool will work normally, the electricity will turn on automatically. From the negative impact of a fire in this Fire Detector Alarm project, it is hoped that it can minimize casualties and losses at night or when not at home.

II. METHODS

Research methods are scientific procedures, steps, or procedures in obtaining data for research purposes that have certain goals and uses. As expressed by Sugiyono who explains that research methods are a scientific way of obtaining data for certain goals and uses (Yendri et al., 2017).

The method used in this research is the Trial and Error Period. Trial and Error is in this period people compile knowledge by trying repeatedly until a solution to the problem is found that is considered satisfactory (Santiyadnya et al., 2023).

Research entitled "Fire Detection Alarm and Circuit Breaker Based on SIM800L Arduino" with this research, it is expected that the formulation of the fire problem can be minimized. This section will explain the methodology and flow of the final assignment (Suda et al., 2025). This methodology description will be useful as a guideline during the final assignment which can be seen in Figure 2 research methodology flowchart.

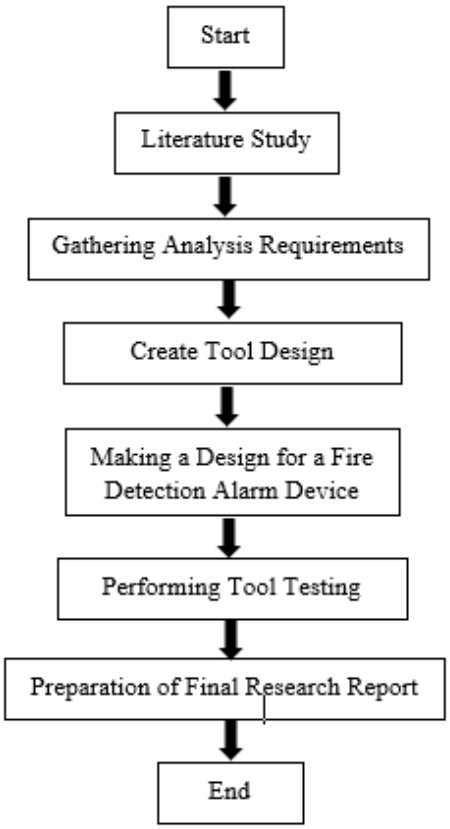


Figure 2. Research Methodology Flowchart

The explanation of the research methodology flowchart is presented comprehensively to provide a clear and systematic understanding of each stage involved in this study. A well-structured methodology is essential to ensure that the research process is carried out in a logical sequence, starting from problem identification to the final reporting of results. Each stage in the flowchart represents a crucial step that contributes to the successful development of the fire detection alarm and electric circuit breaker system.

The literature study stage serves as a fundamental basis for this research, where relevant theories, previous studies, and technological developments are systematically reviewed to support the design and implementation of the proposed system. At this stage, various sources such as scientific journals, conference proceedings, and technical reports are analyzed to obtain a comprehensive understanding of fire detection systems, sensor technologies, embedded systems, and wireless communication using GSM modules (Komang et al., 2024).

Fire detection systems based on microcontrollers, particularly Arduino, have been widely developed due to their cost-effectiveness, flexibility, and ease of implementation. For instance, research on Arduino-based fire detection and control systems demonstrates that integrating sensors, microcontrollers, and GSM communication modules enables automatic detection of fire hazards, activation of alarms, and remote notification through SMS alerts. These systems are capable of monitoring environmental conditions continuously and responding quickly by triggering alarms and cutting off electrical power to prevent further damage (Dauda & Toro, 2020). However, some existing systems are still considered complex and require regular maintenance, which may increase operational costs.

The integration of gas and fire detection systems to enhance safety mechanisms. For example, LPG detection systems utilize gas sensors, microcontrollers, and GSM modules to detect leakage and automatically trigger preventive actions such as shutting off valves, cutting electrical power, and sending alert messages to users. These systems highlight the importance of early detection and automatic response in reducing the risk of fire and explosion incidents (Moovendan et al., 2021). This approach reinforces the need for integrating multiple safety mechanisms within a single system.

The use of GSM-based fire alert systems that combine flame and smoke sensors with real-time communication features. These systems are designed to provide immediate notifications through SMS or phone calls, enabling users to respond quickly even when they are not physically present at the location. The integration of Arduino and GSM technology has proven to be reliable, easy to install, and suitable for various environments such as homes, offices, and industrial areas (Bandgar & SVB, 2025).

Fire detection technology have also introduced IoT-based and intelligent systems capable of remote monitoring and automated fire suppression. Some studies propose systems that integrate GSM communication with

IoT platforms or autonomous devices to improve detection accuracy and response time. These systems are able to overcome the limitations of traditional fire detection methods, which often rely on passive alarms and lack real-time communication capabilities (Muhammad et al., 2024). More advanced approaches incorporate artificial intelligence and computer vision to detect fire more accurately and reduce false alarms, demonstrating the rapid evolution of fire safety technologies (Tan et al., 2025).

An effective fire detection system should not only be capable of detecting fire or smoke but also provide rapid response mechanisms such as alarm activation, automatic power disconnection, and real-time communication with users. However, many existing systems still face challenges such as high complexity, dependency on network infrastructure, or limited integration between detection and response mechanisms. This research aims to develop a more integrated, efficient, and reliable fire detection system by combining sensor-based detection, Arduino microcontroller processing, and GSM communication using the SIM800L module to provide early warning and preventive actions in real-time.

The second stage is requirements analysis, which focuses on identifying and defining the system requirements in detail. This stage involves determining both functional requirements, such as the ability to detect smoke and fire, send SMS notifications, trigger alarms, and disconnect electrical circuits, as well as non-functional requirements, including system reliability, response time, and operational stability (Rohayani, 2020). Furthermore, this phase also includes planning the testing procedures that will be used to evaluate the performance and reliability of the system. By clearly defining these requirements, the development process can be carried out more effectively and systematically.

The next stage is the tool design phase, where the conceptual model of the system is translated into a detailed technical design. This includes designing the system architecture, selecting appropriate hardware components, and determining how each component will interact within the system (Firmansyah, 2023). The design process involves integrating input components such as MQ-02 and KY-026 sensors, processing units such as the Arduino microcontroller, and output components including buzzers, relays, LCD displays, and the SIM800L communication module. This stage ensures that all components are properly configured to work together efficiently and meet the predefined system requirements.

After completing the design phase, the development stage is carried out by implementing the system design into a functional prototype. At this stage, all hardware components are assembled and programmed according to the designed specifications. The system is configured to continuously monitor environmental conditions, detect the presence of smoke or fire, and respond automatically. When smoke is detected, the system sends an SMS notification to the user, while fire detection triggers a buzzer alarm, initiates a GSM call, and activates the relay to cut off the electrical power supply. This stage is critical as it transforms theoretical design into a real, working system.

The following stage is system testing, which aims to evaluate the functionality, performance, and usability of the developed system. Various testing scenarios are conducted to ensure that the system operates correctly under different environmental conditions and levels of smoke or flame exposure (Maulana et al., 2023). The results of these tests are analyzed to determine whether the system meets the expected performance criteria. If any issues or limitations are identified, improvements and adjustments are made to enhance system performance. In this study, the testing results are not only used to validate the system but also serve as valuable input for future development and refinement (Setiyani, 2020).

The final stage is the preparation of the research report, which involves documenting all stages of the research process, including methodology, system design, implementation, testing, and results. This documentation is essential to provide evidence of the research conducted and to ensure transparency and reproducibility. The findings of the study are then compiled into a scientific article for publication, allowing the research to contribute to the broader academic and technological community (Sahroni, 2023).

The block diagram is a series of components and sensors in the system to be created. Figure 3 is a system block diagram of the tool.

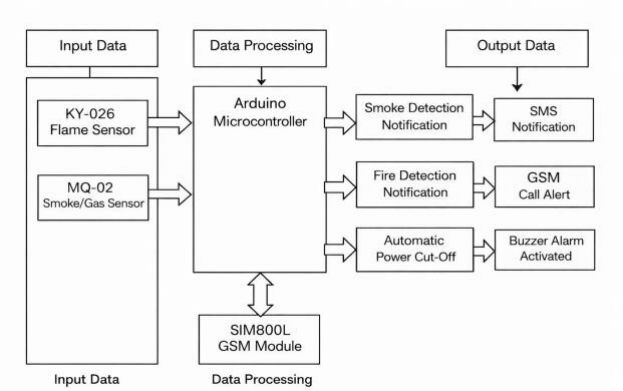


Figure 3. System Block Diagram

The following figure 4 below is a flowchart of the series of tools created. Figure 4 is a flow diagram of the tool circuit created. The description based on the System Workflow Diagram in Figure 4 is that first, initialization is carried out to prepare the tool in its initial position on a tool. Second, the MQ-02 sensor reading the MQ-02 sensor carries out the process of reading analog and digital data and the data will be sent to the Arduino (Erawati, 2019). Next, the KY-026 sensor reading to carry out the process of reading analog and digital data and the data will be sent to the Arduino. The final stage when smoke is detected, the tool will send an SMS, but if the KY-026 sensor detects fire, the tool will make a cellular call to the intended number and the power supply will be cut off and if both sensors do not detect smoke or fire, it will return to the sensor reading process (Fadly, 2020).

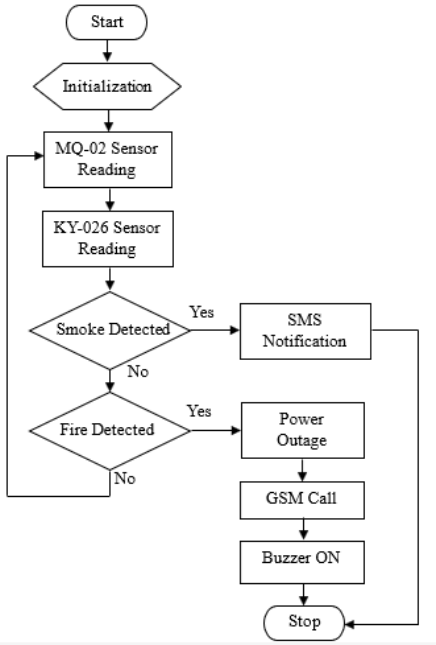


Figure 4. System Workflow Flowchart

Figure 5 is a schematic diagram of a SIM800L Arduino-based Fire Alarm and Circuit Breaker. This circuit uses Eagle software. From the schematic diagram above, the relay and buzzer function as outputs, while the MQ-02 and KY-026 sensors function as inputs to detect smoke or fire and send notifications to the designated mobile phone number. Arduino and SIM800L function as data processors, control centers, and notification data senders.

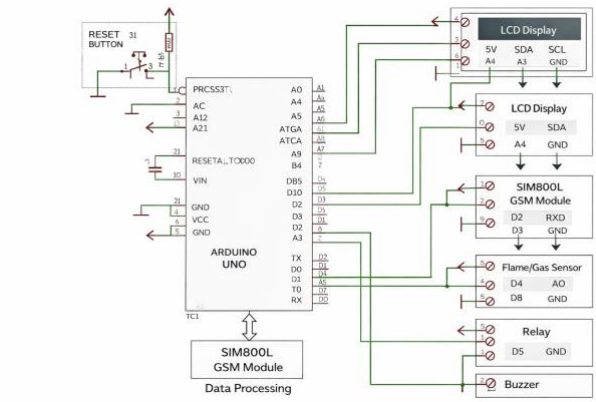


Figure 5. Schematic Diagram in General

A. PCB Design

This Custom Arduino PCB Schematic is made using eagle software (Toruan, 2023; Kurniasari, 2025). This stage aims to create an initial design for making a PCB by declaring the pins that will be used and connecting the component pins with the components that will be connected. Figure 6 is a custom Arduino PCB schematic (Kurniasari, 2025).

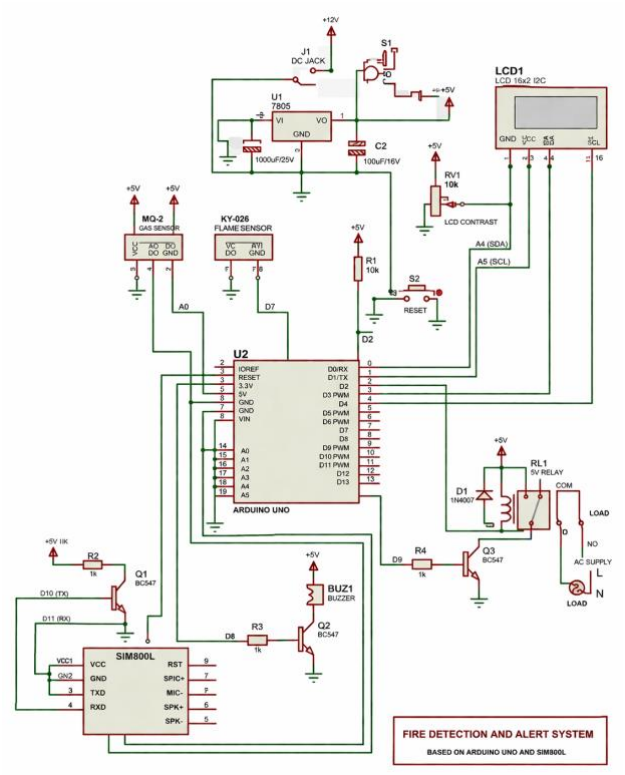
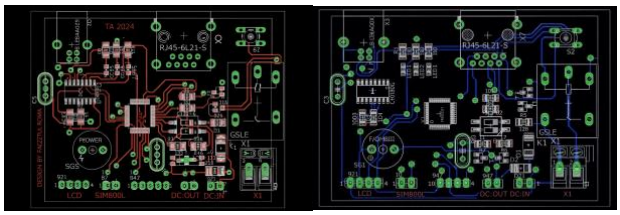


Figure 6. Custom Arduino PCB Schematic

B. PCB Layout

Figure 7a is the creation of the upper PCB layout, where the upper layers are designed for the placement of Surface Mounted Device (SMD) components such as ATmega ICs, resistors, transistors and LEDs (Uin, 2018). Furthermore, in Figure 7b is the creation of the lower PCB layout, where the lower layers are designed for the placement of Dual In Line (DIL) type components or types of components that penetrate from the upper and lower layers such as relays, buzzers, terminals, crystal oscillators and data connectors.



(a) (b)

Figure 7. PCB Layout (a) Layout Bottom Layers, (b) Layout Top Layers

III. RESULT AND DISCUSSION

System implementation is a series of activities to implement a system idea or plan developed well in advance. System implementation is not limited to implementation actions alone, but also includes activities planned well in advance to achieve specific goals. System implementation also refers to specific rules that support the work process. At this stage, the researcher implemented the developed tool to be implemented as a fire detection alarm and circuit breaker based on the SIM800L Arduino. Hardware implementation is the process of installing the

assembled tool and using it as a fire detection alarm and circuit breaker based on the SIM800L Arduino. Figure 8 shows the assembly of the fire detection device, which includes several components, including a fire sensor and a smoke sensor.

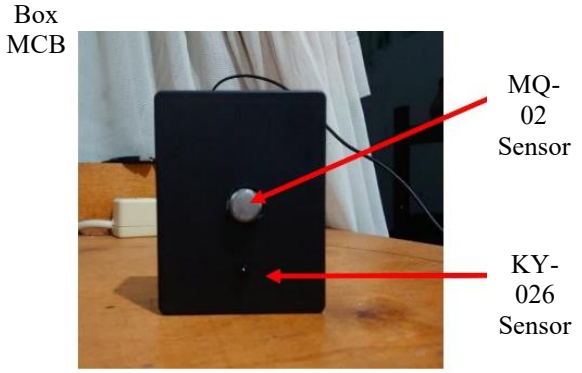


Figure 8. Fire Sensor and Smoke Sensor

Assembly also does not focus solely on the sensor; without the control device, the sensor will not function properly. Figure 9 shows the assembly of the fire alarm and main control to perform control activities and process data received from the sensor.

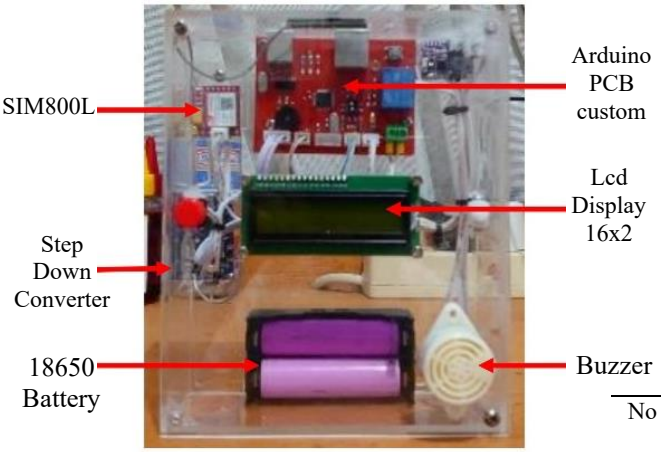


Figure 9. Fire Alarm Main Control

From the division of these three assemblies, the desired device can be assembled into a single unit that will function according to the design. The hardware required to meet the implementation needs in the actual environment is Arduino Custom PCB, SIM800L, Buzzer, LCD Display, Step Down Converter, 18650 Battery, KY-026 Sensor, MQ-02 Sensor, Contactor, Connecting cable, GSM Antenna. Figure 10 is the result of designing a fire detection alarm and electric circuit breaker based on SIM800L Arduino.

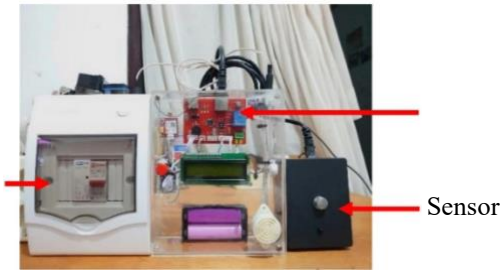


Figure 10. Fire Alarm

The working system of the SIM800L Arduino-based Fire Alarm and Circuit Breaker is that the first time this device is turned on, Arduino will start data processing then the SIM800L module will prepare for signal scanning, after the SIM800L gets a signal, this device will send an SMS with the contents "Normal System" as well as the LCD display. The MQ-02 sensor and KY-026 sensor will start the process of monitoring smoke and fire objects. If the MQ-02 sensor detects smoke, this device will provide a notification in the form of an SMS with the contents "Smoke Detected". If the KY-026 sensor detects fire, the electric current will be cut off then this device will provide a notification in the form of a GSM call to the specified telephone number. The electric current will not be reconnected until the system reset button is pressed.

System Test Results

Testing of this device aims to verify that all hardware elements are as expected. The test results indicate that the Arduino SIM800L-based fire alarm and circuit breaker functioned properly. The Arduino SIM800L-based fire alarm and circuit breaker will send SMS notifications and emergency calls, and cut off the power supply in the event of a fire. Table 1 shows the results of testing the SIM800L in a real-world environment.

Table 1. SIM800L Testing

No	Testing Place	Signal Search Duration	SMS Delivery Duration	Call Process Duration	Call Duration
1	Belimbing Village	30 seconds	50 seconds	30 seconds	30 seconds
2	Kerobokan Village	50 seconds	60 seconds	40 seconds	30 seconds
3	Pupuan Village	60 seconds	90 seconds	50 seconds	30 seconds

From table 1 the SIM800L test can be explained in detail to understand the results obtained.

1. SIM800L testing in Belimbing Village. In this test from the beginning this device was turned on SIM800L needed 30 seconds to get a signal with a distance of 20 meters from the transmitter tower, needed 50 seconds to send SMS, needed 30 seconds to make a GSM call with 30 seconds of the call taking place.
2. SIM800L testing in Kerobokan Village In this test from the beginning this device was turned on SIM800L needed 50 seconds to get a signal with a distance of 2 km from the transmitter tower, needed 1 minute to send

SMS, needed 40 seconds to make a GSM call with 30 seconds of the call taking place.

3. SIM800L Testing in Pupuan Village In this test, from the beginning of the device being turned on, the SIM800L took 1 minute to get a signal at a distance of 7 km from the transmitter tower, took 90 seconds to send an SMS, took 50 seconds to make a GSM call with 30 seconds of the call taking place.

A. LCD Testing

Table 2 shows the results of the LCD testing. LCD testing is crucial because it ensures that the program embedded in the microcontroller is working properly and that the LCD display matches the design.

Table 2. LCD Testing

No	Characters to be displayed	Tool Test Results	Appearance According to Program
1	Normal System		Yes
2	Smoke Detected		Yes
3	Fire Detected		Yes
4	Power Outage		Yes

The results of the LCD testing can be explained in detail to make it easier for readers to understand what was tested on the device being made.

1. In the LCD test with the text character "Normal System" it is in accordance with the character written in the Arduino coding.
2. In the LCD test with the text character "Smoke Detected" it is in accordance with the character written in the Arduino coding.
3. In the LCD test with the text character "Fire Detected" it is in accordance with the character written in the Arduino coding.

In the LCD test with the text character "Electricity Disconnected" it is in accordance with the character written in the Arduino coding.

B. KY-026 Sensor Testing

Figure 11 shows a test of the KY-026 sensor. The KY-026 Sensor test was conducted with the aim of measuring the maximum range or sensitivity of the sensor to medium fire objects. In this test, the maximum distance that the KY-026 Sensor can detect from the fire object is 180 cm. If the test is carried out closer than 180 cm, the sensitivity of the KY026 Sensor will increase. When the sensor detects a fire, the power supply will be cut off, a notification in the form of a GSM call will be given, and the buzzer will turn on.

Figure 11. KY-026 Sensor Testing

If the KY-026 sensor detects a fire, a call notification automatically appears on the user's smartphone. The automatic call notification indicates that the KY-026 sensor sensitivity test was successful and feasible for implementation in a real-world environment. Figure 12 shows a screenshot of the fire call notification from the device.

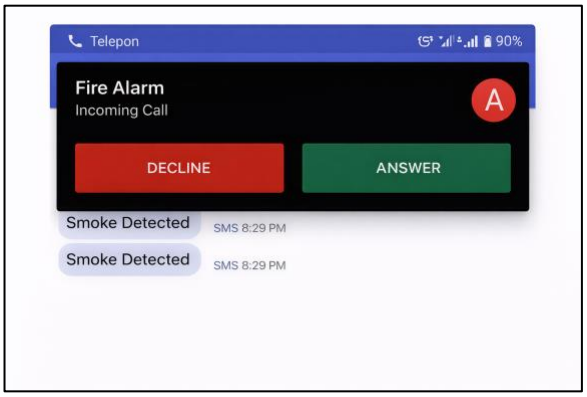


Figure 12. GSM Call Notification

MQ-02 Sensor Testing

Figure 13 shows the results of the MQ-02 sensor test. The MQ-02 sensor test was conducted to measure the sensor's maximum range or sensitivity to smoke objects. In this test, the maximum distance that the MQ-02 sensor can detect from a fire object is 40 cm. If the test is carried out closer than 40 cm, the MQ-02 sensor's sensitivity will increase. When the sensor detects smoke, an SMS notification will be sent to the user.

Figure 13. MQ-02 Sensor Testing

The MQ-02 sensor test is considered successful if the smoke detected is within 40 cm. Upon smoke detection, the user of the device will automatically receive an SMS notification on their smartphone, which aims to anticipate a larger fire. Figure 14 is a screenshot of the smartphone's automatic SMS notification sent by the device.

Figure 14. SMS Notification

IV. CONCLUSION

The KY-026 flame sensor and the MQ-02 smoke sensor have demonstrated reliable performance during testing using fire and smoke scenarios. The KY-026 sensor was able to detect fire effectively at a maximum distance of 180 cm when positioned parallel to the fire source, indicating its suitability for medium-range flame detection. Meanwhile, the MQ-02 sensor showed optimal performance in detecting smoke at a maximum distance of 40 cm from the source, which suggests that it is more appropriate for close-range smoke monitoring. These results indicate that both sensors complement each other in detecting different fire-related conditions, thereby enhancing the overall effectiveness of the system.

The electric circuit breaker mechanism integrated into the system has operated as expected. When the KY-026 sensor detects the presence of fire, the system successfully activates the relay to automatically cut off the electrical power supply, which is a critical feature for preventing the spread of fire and minimizing potential damage. In addition to this safety mechanism, the system also provides real-time notifications to users. When smoke is detected, the system sends an SMS notification via the SIM800L module, while fire detection triggers both a buzzer alarm and a GSM call alert. This multi-layered notification system ensures that users receive timely warnings through different communication channels, even when they are not physically present at the location.

The developed system demonstrates a good level of functionality, responsiveness, and integration between hardware and communication components. The combination of sensors, microcontroller processing, and GSM-based communication provides an effective early warning system for fire hazards. However, despite its promising performance, several limitations were identified, particularly in terms of detection range variability, sensitivity to environmental conditions such as airflow and temperature, and the dependency on GSM network availability for communication.

Several improvements can be considered to enhance the system's performance and scalability. First, the integration of additional sensors, such as temperature or infrared sensors, could improve detection accuracy and reduce false alarms. Second, the system can be further developed by incorporating Internet of Things (IoT) technology, enabling real-time monitoring through mobile applications or web-based dashboards. Third, optimizing sensor calibration and implementing intelligent algorithms, such as machine learning or fuzzy logic, may help improve decision-making and system reliability. Additionally, future studies may explore the use of alternative communication technologies, such as Wi-Fi or LoRa, to overcome limitations related to GSM network dependency. Finally, expanding the system to support multi-node deployment in larger environments, such as industrial or residential buildings, would significantly increase its practical applicability.

REFERENCES

Bandgar, S. S., & SVB, L. (2025). Smart fire alert system using Arduino and GSM for real time safety. *International Journal of Engineering Development and Research, 13*(4), 416–420.

Dauda, M. S., & Toro, U. S. (2020). Arduino based fire detection and control system. *International Journal of Engineering Applied Sciences and Technology, 4*(11), 447–453.

Erawati, W. (2019). Perancangan Sistem Informasi Penjualan Dengan Pendekatan Metode Waterfall. *Jurnal Media Informatika Budidarma*, *3*(1), 1. Doi: 10.30865/Mib.V3i1.987

Fadly, M., Ros Muryana, D., & Thyo Priandika, A. (2020). Sistem Monitoring Penjualan Bahan Bangunan Menggunakan Pendekatan Key Perfomance

Indicator. *Journal Of Social And Technology For Community Service (Jstcs)*, *1*(1), 15–20.

Firmansyah, T., Riyandika, R., Saraswati, I., Supriyanto, S., Wildan, Muh., Supriyanto, T., & Alam, S. (2023). Rancang Bangun Doppler X-Band Speed Detector Untuk Kendaraan Roda Dua Pada Jalan Kelas Iiic. *Elkomika: Jurnal Teknik Energi Elektrik, Teknik Telekomunikasi, & Teknik Elektronika*, *11*(2), 271. Doi: 10.26760/Elkomika.V11i2.271

Komang, I., Sukawijana, G., Santiyadnya, N., Reda, K., Suda, S., & Teknologi, J. (2024). *Pelatihan Penggunaan Alat Penetas Telur Berbasis Kontrol Logika Terprogram Bagi Kelompok Ternak Buana Sari* (Vol. 9).

Kurniasari, A. A., Puspitasari, P. S. D., Perdanasari, L., Yuana, D. B. M., & Jumiatun, J. (2025). An Intelligent Fuzzy Logic-Controlled IoT System for Efficient Hydroponic Plant Monitoring and Automation. Jurnal ELTIKOM: Jurnal Teknik Elektro, Teknologi Informasi dan Komputer, 9(1), 47-56. https://doi.org/10.31961/eltikom.v9i1.1475

Maulana, R., & Ikasari, I. H. (2023). *Literature Review: Implementasi Perancangan Sistem Informasi Perpustakaan Sekolah Berbasis Web Dengan Pendekatan Metode Waterfall*. Retrieved From Https://Journal.Mediapublikasi.Id/Index.Php/Jriin

Moovendan, M., Hoque, N., & Dey, A. (2021). LPG detection and prevention using SVL technology. *Turkish Journal of Physiotherapy and Rehabilitation, 32*(3), 1296–1305.

Muhammad, S. A. G., Suranegara, G. M., & Setyowati, E. (2024). Design of monitoring and fire extinguishing system based on the Internet of Things in unmanned vehicles. *Jurnal Sistem Cerdas, 7*(3), 248–259.

Mulyono, J., & Apriaskar, E. (2021). *Simulasi Alarm Kebakaran Menggunakan Sensor Mq-2, Falme Sensor Berbasis Mikrokontroler Arduino*. *14*(1), 16–25. Retrieved From Http://Journal.Stekom.Ac.Id/Index.Php/Elkom■Page16

Pedagogos, J., Pendidikan, J., Bima, S., Indriani, D., Subhan, M., Rahmawati, E., Fisika, P., Tendean, J., Mande, K., & Bima-Ntb, K. (2021). *Sistem Alarm Kebakaran Berbasis Arduino Menggunakan Flame Detector Dan Sensor Mq-2*. Doi: 10.33627/Gg.V3i2.509

Putri Noor Qadhariyah Fitriyanti, Jits., Rivi Hendardi, A., Nurmayadi, D., Noor Qadhariyah Fitriyanti, P., & Rivi, A. H. (2020). *Evaluasi Sistem Proteksi Kebakaran Pada Bangunan Gedung Hotel Bertingkat*.

Rohayani, Y., Penulis, I., & Bina Sarana Informatika, U. (2020). Penerapan Metode Waterfall Dalam Perancangan Sistem Informasi Akuntansi Pengiriman Barang. In Jurnal Sistem Informasi Akuntansi (Vol. 01, Issue 01). Retrieved From Https://Ejournal.Bsi.Ac.Id/Ejurnal/Index.Php/Justian

Sahroni, A., & Sofyan, P. R. (2023). Time Segment Analysis Of Heart Rate Variability To Evaluate Daily Stress Using Wearable Device Technology. *Jurnal Eltikom*, *7*(2), 104–115. Doi: 10.31961/Eltikom.V7i2.747

Santiyadnya, N., & Setiawan Suda, K. R. (2023). "Tec-House" Webcam-Based Remote Sensing System For Home And Building Security Using The Haar Cascade Method. *Jurnal Nasional Teknik Elektro*. Doi: 10.25077/Jnte.V12n2.1059.2023

Setiyani, L., Abdul Haris, J., & Tjandra, E. (2020). Rancang Bangun Papan Informasi Digital (Digital Signage) Berbasis Web Menggunakan Sistem Operasi Linux Dengan Server Nginx Pada Stmi Rosma Karawang. *Metik*, *4*(2), 83–91.

Suda, K. R. S., Suteja, I. W. A., Antara, M. A. S., Putra, I. G. E. W., & Wija, I. B. P. (2025). Automatic Temperature And Humidity Regulation System Design For Oyster Mushroom Growth. *Tepian*, *6*(2), 127–132. Doi: 10.51967/Tepian.V6i2.3251

Sudarmin, S., Zahro, L., Pujiastuti, S. E., Asyhar, R., Zaenuri, Z., & Rosita, A. (2019). The Development Of Pbl-Based Worksheets Integrated With Green Chemistry And Ethnoscience To Improve Students' Thinking Skills. *Jurnal Pendidikan Ipa Indonesia*, *8*(4), 492–499. Doi: 10.15294/Jpii.V8i4.17546

Tan, E. T. W. R., Nasir, F. F. M., Rahman, K. A. A., & Noor, A. Z. M. (2025). Autonomous Blazebot: A real-time fire detection and SMS alert system using AI and GSM technology. Jurnal Kejuruteraan, 37(6), 3063–3074. https://doi.org/10.17576/jkukm-2025-37(6)-40

Tarigan, J. G. U., Prayogo, D. N., & Juniati, N. (2020). Perancangan Zero Waste Collection S/S 2021 Dengan Inspirasi Emosi Akibat Kabut Asap. *Keluwih: Jurnal Sains Dan Teknologi*, *1*(2), 119–123. Doi: 10.24123/Saintek.V1i2.2949

Toruan, F. L., & Galina, M. (2023). Internet Of Things-Based Automatic Feeder And Monitoring Of Water Temperature, Ph, And Salinity For Litopenaeus Vannamei Shrimp. *Jurnal Eltikom*, *7*(1), 9–20. Doi: 10.31961/Eltikom.V7i1.658

Uin, A. R., & Banjarmasin, A. (2018). Analisis Data Kualitatif. *Jurnal Alhadharah*, *17*(33), 81–95.

Waworundeng, J. M. S. (2020). Desain Sistem Deteksi Asap Dan Api Berbasis Sensor, Mikrokontroler Dan Iot Design Of Smoke And Flame Detection Systems Based On Sensors, Microcontrollers And Iot. *Cogito Smart Journal* |, *6*(1).

Yendri, D., Wildian, & Tiffany, A. (2017). Perancangan Sistem Pendeteksi Kebakaran Rumah Penduduk Pada Daerah Perkotaan Berbasis Mikrokontroler. *Jurnal Umj*.