HANIF
Journal of Information Systems
https://journal.ilmubersama.com/index.php/hanif

Internet of Things (IoT)

Design of Fire Detector with Water Sprinkler Based on Internet of Things (IoT)

Deal Alfi Juliaz [1], *Halim Maulana* [2]

[1] *Department of Information Technology, Faculty of Computer Science and Information Technology, Universitas Muhammadiyah Sumatera Utara, Medan, 20238, North Sumatra, Indonesia*
[2] *Department of Information System, Faculty of Computer Science and Information Technology, Universitas Muhammadiyah Sumatera Utara, Medan, 20238, North Sumatra, Indonesia*

ARTICLE INFORMATION

Received: October 14, 2025
Revised: February 14, 2025
Available Online: February 20, 2025

KEYWORDS

Water Sprinklers
Fire Systems
Internet of Things

CORRESPONDENCE

Phone: (+62) 822-7303-1040
E-mail: dealalfi7@gmail.com

A B S T R A C T

Fire detectors with smoke and fire sensors integrated with Internet of Things (IoT)-based sprinkler systems are an important innovation in modern fire safety systems. The system combines sensor technology to detect smoke and fire in real-time, as well as an automatic mechanism to respond to danger by spraying water through sprinklers connected to the IoT network. By utilizing IoT, the system can send alerts to mobile devices and control centers directly when a fire is detected, enabling quick response and efficient coordination. This research discusses the design, implementation, and evaluation of this fire detector system, as well as its benefits in improving safety and reducing fire damage. Evaluations were conducted with simulated fires to test the detection accuracy and response effectiveness of the system, demonstrating significant potential in fire risk mitigation and property protection. Hardware design of fire monitoring equipment with water sprinklers based on the Internet of Things (IoT) using NodeMCU ESP8266, Liquid Crystal Display (LCD), Relay, and water sprinklers. The design of the hardware work stages can be seen in the following block diagram.

INTRODUCTION

Technology today has developed very rapidly and almost covers all aspects of human life. One form of technological development is the automation system. Basically, the automation system works without human intervention, so that the system can complete all work independently. Existing technology can be connected to each other via the internet network so that it can channel or receive data automatically. The Internet of Things (IOT) can support automated systems by providing real-time information so that users can monitor the performance of the automated system [1,2,3].

Internet of Things (IoT) is a structure where objects, people are provided with exclusive identities and the ability to move data over a network without requiring two-way human-to-human interaction, namely source to destination or human-to-computer interaction. The Internet of Things is a very promising scientific development to optimize life based on smart sensors and smart devices that work together through the internet network [4,5,6].

In this context, the concept of the Internet of Things (IoT) allows integration between fire detection devices and sprinkler systems, providing a fast and effective response in dealing with fires. This study aims to design a fire detector system connected to the IoT, using sensitive sensors, automatic control systems, and internet connections to enable remote monitoring and control. When the sensor detects a fire, the system will automatically activate the sprinkler to extinguish the fire and provide an alert to the homeowner or firefighters through a special application connected to the IoT. In addition, this system can also provide reports and analysis related to fire incidents to assist in future investigations and improvements [7,8].

https://doi.org/10.56211/hanif.v2i2.38

This is reinforced by the opinion of [9,10] who aims to design and build the development of this fire detector to describe Internet of Things (IoT)-based fires in all areas in a crowded place. This tool implements a design system using the C# programming language. The use of sensors in this detector system uses an integrated smoke sensor and a flame sensor integrated in the Wireless Network Sensors Fire Preparedness. Data collection techniques are carried out by observation with data analysis techniques using descriptive analysis of trial data acquisition and evaluation of Fire Detector tools and other tool components.

Building safety and security are top priorities in modern infrastructure management. Fire is a serious threat that can cause huge losses. In this context, developing responsive solutions to detect and deal with fires is very important. In recent years, the Internet of Things (IoT) has emerged as a new paradigm in utilizing connectivity and automation to improve system efficiency and effectiveness. Applying this concept to fire detectors with water sprinklers allows for high-tech integration in order to improve fire detection and response capabilities [11,12].

Based on this, a fire detector system with a water sprinkler will be developed. This system utilizes IoT Internet of Things as a monitoring medium between users and devices, so that users can perform remote monitoring. This design uses NodeMCU ESP8266 as a communication device between the device and the database. This tool uses an android application on a smartphone that functions as a real-time fire monitoring tool.

NodeMCU is the choice because it is equipped with an ESP8266 WiFi module in it. NodeMCU can be considered as an Arduino board integrated with ESP8266, eliminating the need for two separate devices as done in the research of IoT-based automatic water flow and watering monitoring systems with the ESP8266 module. By using NodeMCU, users can save costs because they do not need to buy two separate devices such as an Arduino board and an ESP8266 module. This also simplifies the integration and development of fire detector systems connected to IoT [13,14].

METHOD

Type of Research

The type of research used in this study is the design of a fire detector with a water sprinkler by testing on a prototype of a smoke and fire monitoring device used in an automatic water sprinkler using NodeMCU ESP8266. By using Internet of Things (IoT) technology for remote detectors, this study is expected to produce data that shows smoke and fire values in real-time.

Research Procedure

The research on the design of a fire detector with a water sprinkler based on the Internet of Things (IoT) using NodeMCU includes several stages, namely as shown in the following flow diagram.

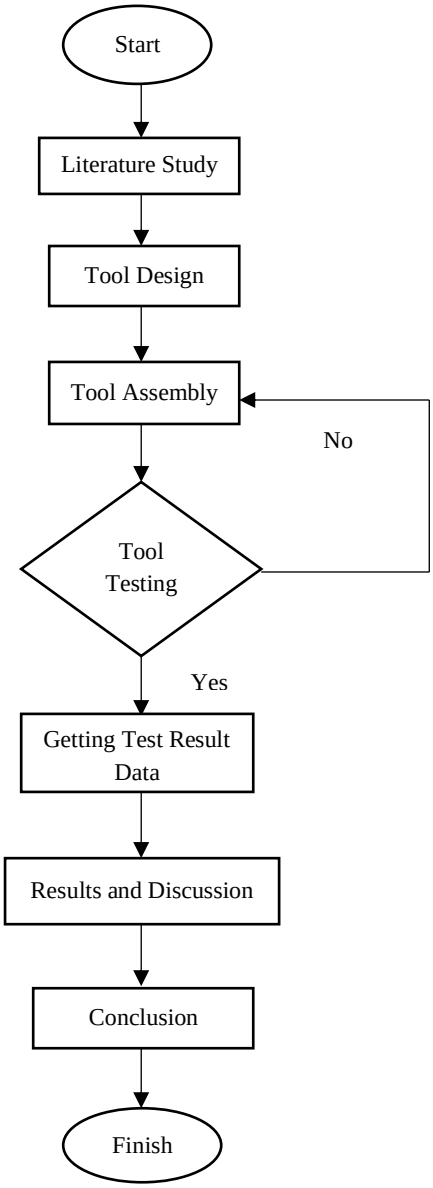

Figure 1. Research Procedure

Hardware Design

Hardware design of fire monitoring equipment with water sprinklers based on the Internet of Things (IoT) using NodeMCU ESP8266, Liquid Crystal Display (LCD), Relay, and water sprinklers. The design of the hardware work stages can be seen in the following block diagram.

 https://doi.org/10.56211/hanif.v2i2.38

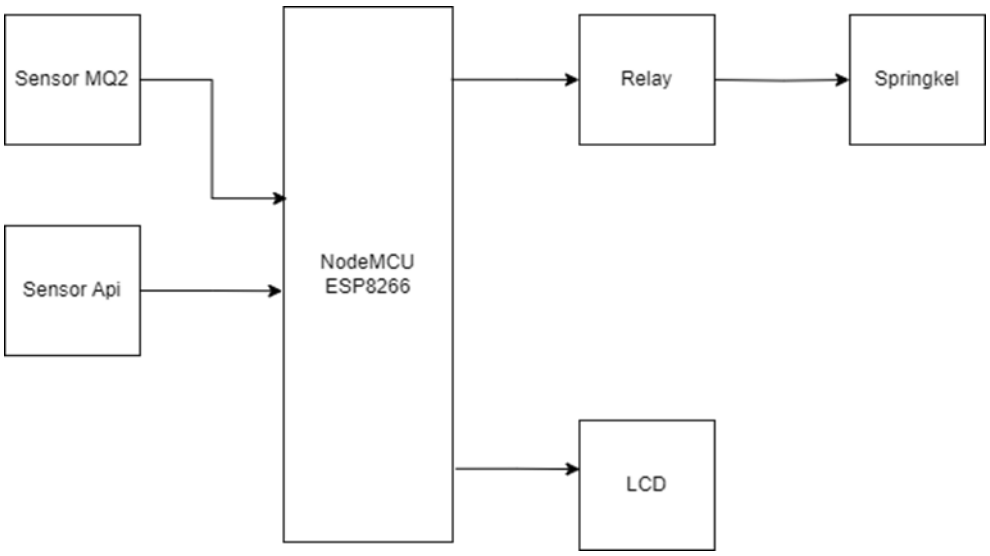

Figure 2. Block Diagram

In the image above there are several system diagram blocks, each of which functions to form a coordination to achieve the desired goal, namely input, process, and output can be explained as follows:

1. Input on NodeMCU;
    a. Fire and Smoke Sensor, this sensor functions as a detector of fire and smoke.
2. Output on NodeMCU
    a. Relay, as an electric switch that functions to connect and disconnect the flow of electricity.
    b. LCD 16x2, functions to display Smoke and Fire data
    c. Smartphone, on a Smartphone that has installed the blynk application, it functions as an output, namely to display the presence of Smoke and Fire.

Circuit Component Design

Circuit Component Design of fire monitoring tool with water sprinkler based on Internet of Things (IoT) using NodeMCU ESP8266, Liquid Crystal Display (LCD), Relay, and water sprinkler. The design of the hardware work stages can be seen in the following image.

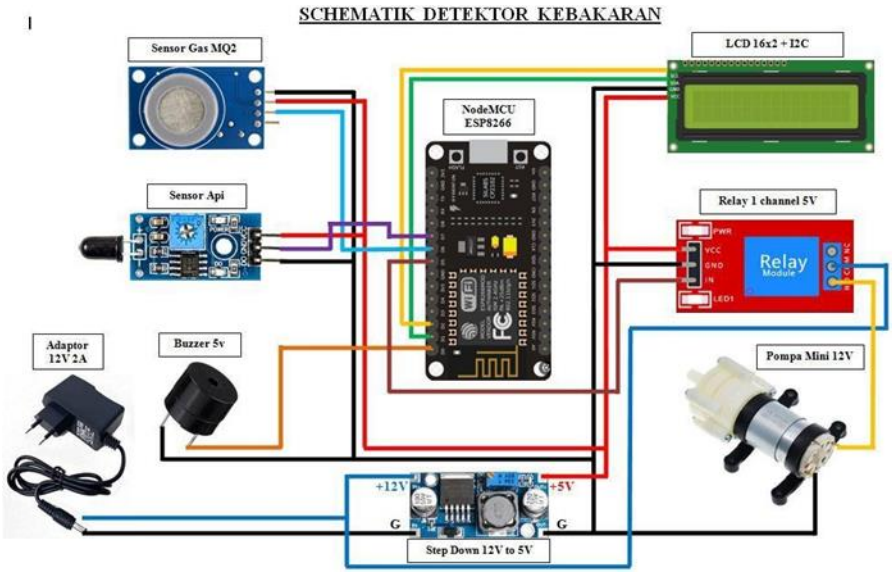

Figure 3. Circuit Components Series

RESULTS AND DISCUSSION

Tool Design Results

The prototype design of a fire detector with a water sprinkler based on the internet of things with an ESP8266 microcontroller. This circuit is connected using jumper cables and an adapter as a current connector.

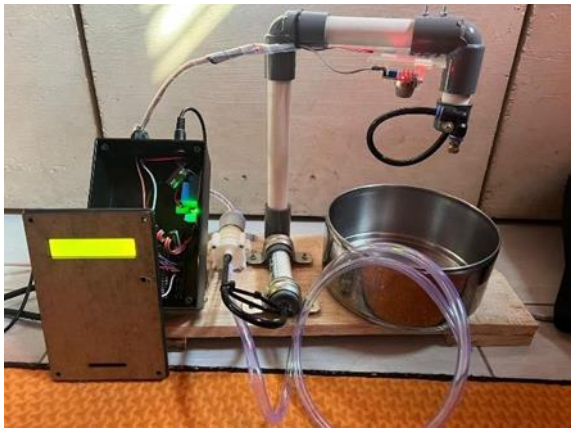

Figure 4. Tool Prototype

The image above is a series of all the tools that have been designed and started to be tested to see if the tool works according to design so that it can be identified if there are any problems that occur when the tool starts to operate.

System Test Results

The following is a display of the Blynk system as a monitoring media and remote control on this fire detector system that has been designed.

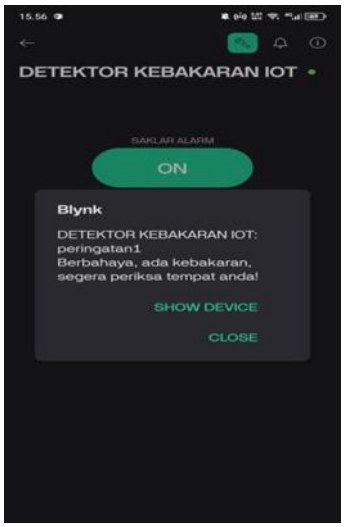

Figure 5. Blynk View

In the image above, remote monitoring of the fire detector system that has been designed can be done. In this blynk application, users can control their devices that detect fire. If the user turns on the alarm switch and a fire occurs through smoke and fire detection, the blynk application automatically provides notification to the user via the blynk application and email.

 https://doi.org/10.56211/hanif.v2i2.38

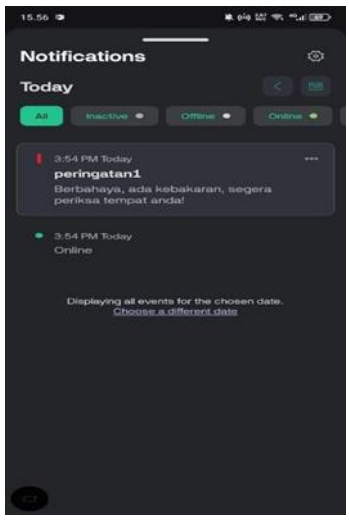

Figure 6. Blynk Notification View

The image above shows that when a fire occurs, the Blynk application will provide a notification to the user.

Figure 7. Email Notification View

The image above shows that when a fire occurs, the user's email will also be notified as in the Blynk application.

Figure 8. Fire Detector LCD

In the picture above, this tool is a fire detector LCD that provides status and pump information. If the LCD status is safe, it shows that smoke and fire are no longer present and if the LCD status says dangerous, it shows that smoke and fire are detected in the area.

CONCLUSION

Based on the design process, and testing on the fire detector design tool with water sprinkler based on the internet of things (IoT), it can be concluded that: The design and development of the fire detector design with water sprinkler based on the internet of things (IoT) can be a tool and can be run according to the function of each sensor. This system can be accessed in real-time and controlled remotely. By integrating fire sensors, automatic water sprinklers, and IoT technology, this system is able to improve safety, response speed, and efficiency in handling fires. This system has the potential to be an innovative solution in fire monitoring and prevention, both for household, commercial, and industrial buildings.

REFERENCES

Book: Single Author

[1] Indah Purnama Sari. Algoritma dan Pemrograman. Medan: UMSU Press, 2023, pp. 290.
[2] Indah Purnama Sari. Buku Ajar Pemrograman Internet Dasar. Medan: UMSU Press, 2022, pp. 300.
[3] Indah Purnama Sari. Buku Ajar Rekayasa Perangkat Lunak. Medan: UMSU Press, 2021, pp. 228.

Book: Two or More Authors

[4] Janner Simarmata Arsan Kumala Jaya, Syarifah Fitrah Ramadhani, Niel Ananto, Abdul Karim, Betrisandi, Muhammad Ilham Alhari, Cucut Susanto, Suardinata, Indah Purnama Sari, Edson Yahuda Putra. Komputer dan Masyarakat. Medan: Yayasan Kita Menulis, 2024, pp.162.
[5] Mahdianta Pandia, Indah Purnama Sari, Alexander Wirapraja Fergie Joanda Kaunang, Syarifah Fitrah Ramadhani Stenly Richard Pungus, Sudirman, Suardinata Jimmy Herawan Moedjahedy, Elly Warni, Debby Erce Sondakh. Pengantar Bahasa Pemrograman Python. Medan : Yayasan Kita Menulis, 2024, pp.180
[6] Zelvi Gustiana Arif Dwinanto, Indah Purnama Sari, Janner Simarmata Mahdianta Pandia, Supriadi Syam, Semmy Wellem Taju Fitrah Eka Susilawati, Asmah Akhriana, Rolly Junius Lontaan Fergie Joanda Kaunang. Perkembangan Teknologi Informatika. Medan: Yayasan Kita Menulis, 2024, pp.158
[7] Muharman Lubis Ilham Firman Ashari, Debby Erce Sondakh, Rahmawati Rolly Junius Lontaan, Mustarum Musaruddin Indah Purnama Sari, Muh. Nadzirin Anshari Nur, Hanalde Andre Muh. Rais, Janner Simarmata. Internet of Things (IoT) Dan Multimedia: Integrasi Dan Aplikasi. Medan: Yayasan Kita Menulis, 2024, pp.182

Journal Article from the Internet

[8] Sari, I.P., Al-Khowarizmi,A.K., Apdilah, D., Manurung, A.A., & Basri, M. (2023). Perancangan Sistem Pengaturan Suhu Ruangan Otomatis Berbasis Hardware Mikrokontroler Berbasis AVR. sudo Jurnal Teknik Informatika 2 (3), 131-142
[9] Wardani., S, & Dewantoro., RW. (2024). Internet of Things: Home Security System based on Raspberry Pi and Telegram Messenger. Indonesian Journal of Applied Technology, Computer and Science 1 (1), 7-13
[10] Sari, I.P., Al-Khowarizmi, A.K., Hariani, P.P., Perdana, A., & Manurung, A.A. (2023). Implementation And Design of Security System On Motorcycle Vehicles Using Raspberry Pi3-Based GPS Tracker And Facedetection. Sinkron: jurnal dan penelitian teknik informatika 8 (3), 2003-2007
[11] Y.Efendi, "Internet of Things (IoT) Light Control System Using Mobile-Based Raspberry Pi", Scientific Journal of Computer Science, Vol. 4, no. 1, April 2018.
[12] Sari, I.P., Basri, M., Ramadhani, F., & Manurung, A.A. (2023). Penerapan Palang Pintu Otomatis Jarak Jauh Berbasis RFID di Perumahan. Blend Sains Jurnal Teknik 2 (1), 16-25
[13] SJ Sokop et.al, "Peripheral Interface Trainer Based on Arduino Uno Microcontroller", E-Journal of Electrical and Computer Engineering vol.5 no.3 (2016).
[14] Sari, I.P., & Batubara, I.H. (2020). Aplikasi Berbasis Teknologi Raspberry Pi Dalam Manajemen Kehadiran Siswa Berbasis Pengenalan Wajah. JMP-DMT 1 (4), 6
[15] M. Saleh and M. Haryanti, "Design of a Home Security System Using Relays", Journal of Electrical Technology, Mercu Buana University, Vol. 8 No. May 2, 2017

[16] Sari, I.P., Batubara, I.H., & Basri, M. (2022). Implementasi Internet of Things Berbasis Website dalam Pemesanan Jasa Rumah Service Teknisi Komputer dan Jaringan Komputer. Blend Sains Jurnal Teknik 1 (2), 157-163

[17] Matondang, M.H.A., Asadel, A., Fauzan, D., & Setiawan, A.R. (2024). Smart Helmet for Motorcycle Safety Internet of Things Based. Tsabit Journal of Computer Science 1 (1), 35-39

[18] Sari, I.P., Novita, A., Al-Khowarizmi, A., Ramadhani, F., & Satria, A. (2024). Pemanfaatan Internet of Things (IoT) pada Bidang Pertanian Menggunakan Arduino UnoR3. Blend Sains Jurnal Teknik 2 (4), 337-343

[19] Husaini, A., & Sari, I.P. (2023). Konfigurasi dan Implementasi RB750Gr3 sebagai RT-RW Net pada Dusun V Suka Damai Desa Sei Meran. sudo Jurnal Teknik Informatika 2 (4), 151-158