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Design and Construction of Fire Detection Equipment on Electrical Panels Automatically Using IOT

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Abstract

Fires in electrical panels are a common problem experienced when electrical shorts occur. This research was carried out to identify and overcome the electrical panel fire problem. Therefore, the researchers automatically made a fire detection device on electrical panels based on the Internet of Things. This study uses NodeMCU ESP8266 Wifi Module as a microcontroller and DHT11 and MQ-2 as sensors. When a fire is demonstrated, or there is smoke and gas to detect a fire hazard on the electrical panel. In this fire detection device, a test of the DHT11 and MQ-2 sensors is carried out, which will turn on the fire alarm system in the form of a buzzer through the NodeMCU ESP8266 microcontroller command, and the results of the test of the tool will be displayed in a real-time database on the firebase. Testing the fire detection device on the electrical panel automatically uses a match tool and sensor readings to read the presence of a fire in the electrical panel. This measurement difference raises the value of the percentage error in the measurement tool.

Keywords: Electrical panel, NodeMCU ESP8266, real time database, DHT11, MQ-2

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1. Introduction

The danger of fire is a danger that is likely to occur at all levels of society. Fires result in many losses, both moral and material losses. Fires can happen anywhere, such as in buildings or ships; fires can even occur in electrical equipment, such as electrical panels. Generally, a fire is only discovered after much fire or smoke. The electrical panel is one of the devices in the cabinet, which is a tool for dividing and distributing electric current used in electricity sources such as lights and other electronic devices. We can predict signs of an electrical panel fire from the hot temperature inside the panel. Fires can be controlled, and damage can be minimized if we know the fire signs early on. A safety device or sensor is one way to prevent unexpected fires in electrical panels. This automatic fire detection system can make

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decisions accurately and quickly to prevent fires before they become big. The current development of communication technology has given birth to the Internet of Things, making it easier for people to communicate information using internet media. This research was carried out based on the problems described, then "DESIGN AND BUILDING OF FIRE DETECTION EQUIPMENT ON ELECTRICAL PANEL AUTOMATICALLY USING IOT" will be created. This tool is made with an MQ-2 smoke detector and a DHT11 temperature sensor using a NodeMCU ESP8266 microcontroller with a Buzzer output as a warning and Firebase as a means of information to notify officers to handle a fire in the electrical panel immediately.

2. Research Method

The research method used is the R&D (Research and Development) method. Research and development methods, or in English, Research and Development, are used to produce specific products and test the effectiveness of these products. At this stage, researchers are looking for data about the meaning of each component in making "Design of a Fire Detection Device on Electrical Panels Automatically Using IoT" in the form of DHT11 sensors and MQ-2 sensors to find solutions to problems that arise. In the literature study, learning was carried out on the use of fire sensors and temperature sensors to read the presence or absence of fire using the NodeMCU ESP8266.

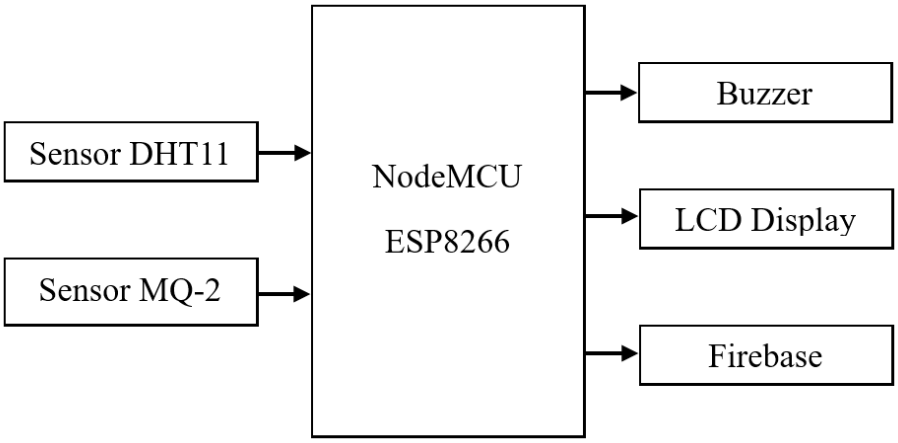

Figure 1 Diagram Block

Component description in block diagram:

1. The DHT11 sensor is a single-wire digital primary temperature and humidity sensor that sequentially provides temperature and humidity values .
2. The MQ-2 sensor is a tool that can detect the concentration of smoke and flammable gas, and the output is read as an analog voltage.
3. NodeMCU is an open-source IoT firmware platform for controlling devices over a Wi-Fi network or other collection of devices.
4. The buzzer is an electrical component that converts electrical vibrations into sound vibrations.
5. Firebase is a backend platform as a service (BaaS) provided by Google for data storage for mobile application development.
6. LCD (Liquid Crystal Display) is an electronic component that displays numbers, letters, or other symbols

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3. Results And Discussion

Tool testing is carried out to determine whether the tool's working system is functioning correctly, with the aim that, in the end, the tool can work according to the design of the fire detection tool on the electrical panel automatically using IoT. The results of testing the design of a fire detection device on an electrical panel automatically using IoT using a DHT11 sensor, MQ-2 sensor, NodeMCU ESP8266, using a buzzer as an alarm when a fire occurs and monitored using an LCD and using the Firebase real-time database.

3.1. MQ-2 Sensor Testing

The author tested the MQ-2 sensor by producing smoke from burning paper so that it entered a box measuring 19cm long, 19cm wide, and 14cm high, then placing the MQ-2 sensor near the smoke source so that the NodeMCU could receive the smoke value. This test aims to determine how many seconds the smoke sensor will detect the presence of smoke and how many seconds it will take for the smoke level reading to be 80%.

Figure 2. MQ-2 Sensor Testing

Table 1. MQ-2 Sensor Test Result

No	Time	Smoke Level (%)	Alarm Indicator	Buzzer	*Firebase*
1	00.00.00	30	OFF	OFF	*Real-Time*
2	00.16.73	50	ON	ON	*Real-Time*
3	02.55.63	80	ON	ON	*Real-Time*

3.2. DHT11 Sensor Testing

Test the DHT11 sensor by bringing the DHT11 temperature sensor closer to a heat source, namely fire. The author has set the system when the temperature reaches 40 degrees Celsius and how fast the sensor reading is to read the fire danger due to hot temperatures. This tool is tested by bringing the candle's flame closer to a distance of approximately 2cm from the DHT11 sensor so that the system will provide an alarm notification on the LCD and sound the buzzer as a sign of a fire.

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Figure 3. DHT11 Sensor Testing

Table 2. DHT11 sensor test data

No	Time	Temperature (°C)	Alarm	Firebase
1	00.00.00	32,30	OFF	Real-Time
2	00.27.28	35.70	OFF	Real-Time
3	00.51.67	38.50	OFF	Real-Time
4	01.07.79	40.00	ON	Real-Time

3.3. Firebase real-time database testing

The author will also test Firebase by retrieving output data from the LCD and the Firebase real-time database.

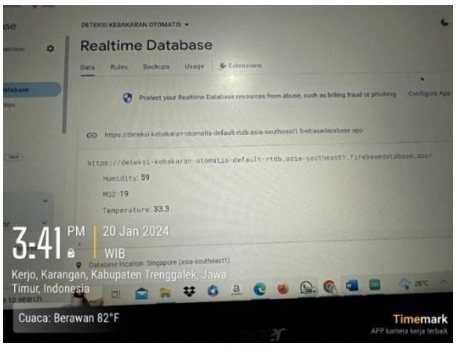

Figure 4. Firebase real-time database testing

The MQ-2 smoke and gas sensor functions very well in reading the presence of smoke with a minimum smoke level alarm setting of 50% with a time of 16 seconds. In testing the DHT11

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temperature sensor using fire, it functioned well in reading hot temperatures with a temperature alarm setting of 40℃, which took 1 minute and 07 seconds. The data displayed on the LCD and firebase is based on the electrical panel's temperature, humidity, and smoke conditions.

4. Conclusion

Based on the tool design process and the results of tool testing that the author has carried out, conclusions can be drawn, namely: Design a fire detection device on an electrical panel automatically using IoT with the NodeMCU ESP8266 microcontroller by utilizing two sensors, namely the DHT11 sensor, as well as the MQ-2 sensor with buzzer output, 16x2 LCD, and Firebase real-time database, in the design of an automatic fire detection tool using IoT utilizing the DHT11 sensor and MQ-2 sensor. Both sensors can carry out their respective functions, but the two sensors are not connected, so if damage occurs to one of the sensors, the device can still function properly. This fire detection system uses a 16x2 LCD screen, which functions as local monitoring on the electrical panel, and a Firebase real-time database, which is used to monitor humidity, temperature, smoke, and gas on the electrical panel so that users of this tool can monitor the condition of the electrical panel. Therefore, if conditions are abnormal in real time, they can be handled immediately. Furthermore, this fire detection system is equipped with a buzzer that can sound to alert the device owner if a fire hazard occurs. The output values from these two sensors can be seen via the Firebase real-time database so that users of this device can easily monitor this fire detection tool at any time.

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References

[1] Basino, et al. (2022). Design and Construction of an Electrical Panel Fire Detector Based on an Atmega 328 Microcontroller on a Fishing Vessel. Journal of Nonformal Education Science, Vol. 08.

[2] Beetrona. (2020). Understanding ESP8266 Complete Wifi Module. Available: https://beetrona.com/pengertian-esp8266-modul-wifi-complete/. Accessed on June 28 2022 at 10.00 WIB.

[3] Internal Coding. (2020). What is Firebase? Definition, Types and Functions. Available: https://www.dicoding.com/blog/apa-itu-firebase-pengertian-jen-jen-dan-function-kegunaannya/. Accessed on 01 July 2022 at 09.30 WIB

[4] Rachman, N. F., Sunardi, S., Aghastya, A., Wirawan, W. A., & Putri, N. D. O. (2023, May). Simulation of early warning system in landslides and flooding with IoT. In AIP Conference Proceedings (Vol. 2592, No. 1). AIP Publishing.

[5] Faiz, Azhari M. (2019). Design of LPG Gas Leak Detection and Control Tools Using IoT-Based MQ 2 Sensors. Faculty of Engineering, University of North Sumatra Medan.

[6] Firlianto, Eko and Dini Anjelina. 2021. IoT-Based Sensor Data Monitoring and Building Control System for Fire Hazards. Bangka Belitung State Manufacturing Polytechnic.

[7] Mambang. (2021). Textbook Of Internet Communications Technology (Internet of Things). Banyumas: CV. Persada Pen.

[8] Sunardi, S., Arifianto, T., Hartisa, A. L., Darmawan, A., & Wirawan, W. A. (2020). Perancangan Sistem Peringatan Longsor dan Deteksi Pergeseran Tanah Menggunakan Metode Telemetri. Jurnal Penelitian Transportasi Darat, 22(2), 123-130.

[9] Marselinus, M. (2016). Fire Alarm System Using Infrared and Temperature Sensors based on Arduino Uno. Department of Physics, Faculty of Science and Engineering, Nusa Cendana University.

DOI: https://doi.org/10.71225/jstn.v1i1.42

[10] Mulyati, Sri and Sumardi. (2018). Internet of Things (IoT) on Gas Leak Detector Prototype Based on MQ-2 and SIM800L. Engineering Journal: Muhammadiyah University of Tangerang, Vol. 7, no. 2.
[11] Sadewo, D. N., & Wirawan, W. A. (2023, March). Maximum Power Tracking Photovoltaic Polycristalin and Monocrystalline Optimized with Algorithm Dual Axis Solar Tracking Using Four LDR Comparator Sensor. In International Conference on Railway and Transportation (ICORT 2022) (pp. 285-293). Atlantis Press.
[12] Sasmoko, Dani. (2021). Arduino and Sensors in DIY Arduino Projects. Semarang: Prima Agus Teknik Foundation.
[13] Sugiyono. (2019). Quantitative, Qualitative, and R&D Research Methods. Bandung: Alphabet.
[14] Sukmadinata, Nana Syaodih. (2009). Educational Research Methods. Bandung: Rosdakarya Youth.

DOI: https://doi.org/10.71225/jstn.v1i1.42