POLLUTION DETECTION SYSTEM DESIGN USING MQ2 SENSOR AND TELEGRAM BASED ON NODEMCU ESP8266 AT BANJARAN DISTRICT OFFICE

Roni Surahman, Lukmanulhakim Almamalik, Wanda C. P. Batubara
Computer Engineering Study Program, Politeknik Piksi Ganesha, Bandung

Abstract

This study aims to design a pollution detection system based on NodeMCU ESP8266 using the telegram application and the MQ2 sensor and provide information about pollution levels in the air. This research method uses qualitative methods with observational and descriptive approaches. How to obtain the data used by direct observation at the Banjaran District Office, as well as by searching online data on the internet related to the problem. The problem in the research being conducted is regarding a pollution detection system based on NodeMCU ESP8266 using the MQ2 sensor as a pollution detector, a red LED as an indicator, a buzzer as an alarm, a 16x2 LCD to display air pollution levels, and a telegram will send notifications in the form of warnings about pollution levels. The air quality value (PPM) is determined based on the parameters Good (0-50), Moderate (51-100), and Danger (>100). The test results show that the detector is successful in detecting pollution in the form of smoke with different PPM values. The buzzer and LED are active when the PPM value is in the dangerous category.

Keywords: Air Pollution, MQ2 Sensor, Smog, Telegram App, NodeMCU ESP8266

Introduction

Air is an important component for living things. Air quality must be maintained so that it can be used optimally. However, the air quality is currently deteriorating due to air pollution. As a result, air quality decreases and decreases in quality when used.

Sources of air pollution can come from various activities such as transportation, offices and industry. This activity is the biggest contribution in contributing to air pollution. In addition, air pollution can also be caused by natural activities such as forest fires, volcanic eruptions and others. The resulting impact causes a decrease in air quality and has a negative impact on the health of living things.

The absence of an air pollution monitoring system makes air pollution difficult to control so that an air pollution monitoring system is urgently needed in the Banjaran District Office. Air pollution that is so felt is cigarette smoke. Cigarette smoke makes the surrounding temperature hot and also has a negative impact on health. One of the harmful compounds in cigarette smoke is carbon monoxide. So that this air pollution needs to be monitored for dirty air levels so that it does not become a health risk for humans.

In making this detector, researchers developed from previous research, namely using a Gas Sensor. This type of research is observational and descriptive with a qualitative approach method. The MQ2 sensor is a sensor that is sensitive to cigarette smoke so it can be used to detect air pollution. Telegram is a free, non-profit, cloud-based multi-platform instant messaging application.

Literature Review

2.1 Air Pollution

Air pollution is one of the environmental damages, namely in the form of decreased air quality due to the entry of harmful elements into the air or the earth's atmosphere. The elements that enter the atmosphere can be carbon monoxide (CO), nitrogen dioxide (NO2) and other dangerous elements. These elements are also known as pollutants or types of air pollutants.

There are two factors that cause air pollution, namely natural factors and human factors. The causes of natural factors are volcanic activity, forest fires and microorganism activities. From these activities the pollutants produced are in the form of smoke, dust and gas.

2.2 MCU nodes

NodeMCU is an open source IoT platform. It consists of hardware in the form of the ESP8266 System on Chip from ESP8266 made by Expressive System, as well as the firmware used, which uses the Lua scripting programming language. The term NodeMCU by default actually refers to the firmware used rather than the development kit hardware.

NodeMCU can be analogous to the Arduino ESP8266 board. ESP8266 is a bit troublesome because it requires several wiring techniques and an additional USB to serial module to download the program. However, the ESP8266 has packaged the ESP8266 into a compact board with various features such as a microcontroller and Wi-Fi access capability as well as a USB to serial communication chip. So to program it, it only requires the existence of the exact USB data cable that is used as a data cable and a smartphone charging cable.(Saputro, 2017)

2.3 MQ2 sensors

The MQ2 sensor is one of the sensors used to detect flammable gases in the air and smoke and reads output as an analog voltage. This sensor is usually used to detect gas in both homes and industries. Gases that can be detected by this sensor include: LPG, Propane, Methane, Alcohol, Hydrogen and smoke. This gas sensor is composed of SnO2 compounds, with low conductivity properties in clean air, or poor conducting properties. The conductivity properties increase if the smoke gas concentration is higher around the sensor

Design Method

3.1 System Analysis

System limitations that will be designed on a pollution detection system using MQ2 and Telegram sensors based on NodeMCU ESP8266 are as follows:

1. The detection system that will be implemented is the installation of MQ2 sensors, buzzers, LEDs and LCDs as well as the Telegram application to provide notifications.
2. The MQ2 sensor functions to detect pollution in the form of smoke that has been connected to Telegram so that it can provide notifications when smoke is detected.
3. The buzzer will sound when the sensor detects smoke.
4. The LED will light up when the sensor detects smoke.
5. The LCD will display the smoke level value.
6. NodeMCU ESP8266 as the input and output control center as well as the place where the program is stored.
7. Arduino IDE (Integrated Development Environment) is the software used to program the NodeMCU ESP8266.
8. The Telegram application is used to provide notifications about pollution.
9. Arduino IDE (Integrated Development Environment) is software used to design programs via Arduino, in other languages Arduino IDE is a medium for Arduino board programs. Arduino IDE functions as a text editor to edit, create and validate program code. The Arduino IDE can also upload actions to the Arduino board. The program code used in the Arduino programming process can be referred to as the Arduino "sketch" or can be said to be the Arduino source code.
10. Telegram. Telegram is a cloud-based, multi-platform instant messaging service application that focuses on speed and security. Telegram is designed to make it easier for users to send text, audio, video and image messages to each other securely. Not only safe, Telegram is also an instant or fast message sharing application.

3.2 Architectural Design and Process Flow

This architectural design is part of an explanation made in series to make it easier to understand the connections to the tools being made. The following is the architectural design of a pollution detection tool based on NodeMCU ESP8266 at the Banjaran District Office.

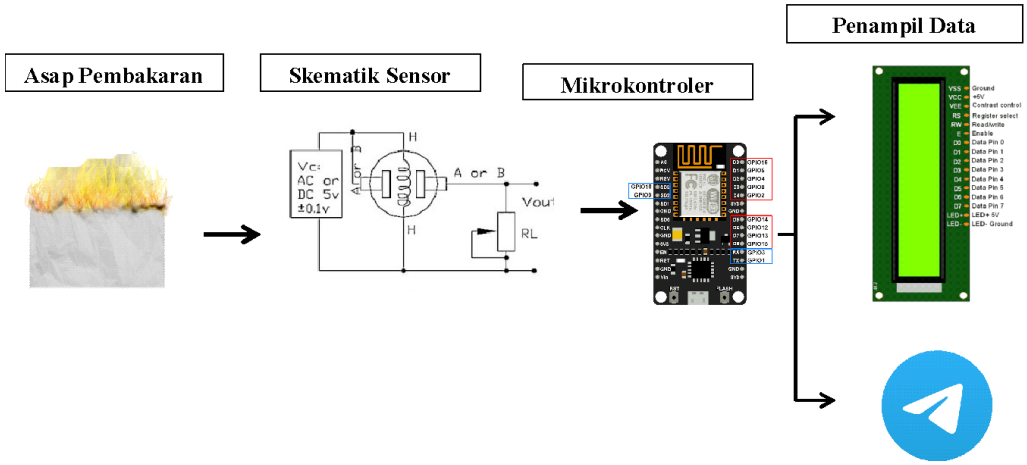

Fig. 1 Design Architecture and Flow Process

In describing the data flow that occurs in the pollution detection system, a flowchart is made as follows.

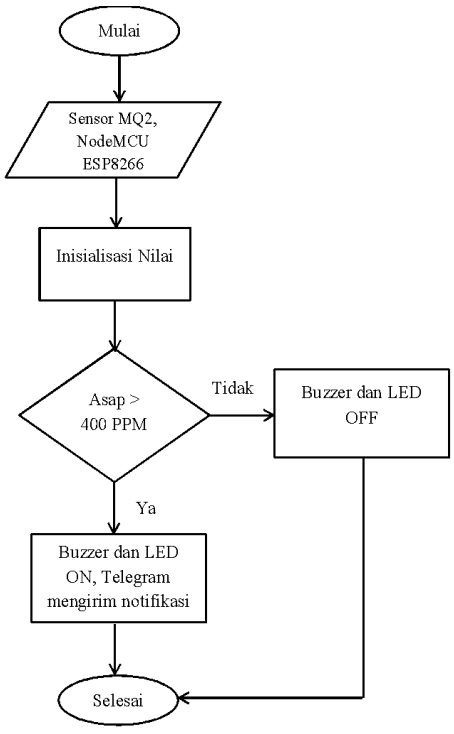

Fig. Pollution Detection System Flowchart

Results and Discussions

4.1 How the System Works

The way this system works is based on the circuit scheme that has been made. There is an MQ2 sensor as a pollution detector, a buzzer and an LED as an indicator. All of the functions above will work well if everything is assembled according to the schemes and tools that have been programmed through the Arduino IDE software and the Telegram application and connected to the internet so that all components will carry out their functions properly.

1. Connect NodeMCU to laptop USB
2. Upload the code that has been made to NodeMCU
3. After the coding is finished uploading, assemble all the components
4. Display Telegram that is already connected

4.2 Testing

Testing of this pollution detection system is carried out so that the program made is in accordance with expectations. This is done after the system is turned on and connected to a wi-fi internet connection. Testing is carried out as follows. The test is carried out by giving smoke around the MQ2 sensor. When it reaches a value of more than 100, a warning notification will appear from the telegram along with the buzzer and LED flashing.

Table 1 MQ2 Sensor Testing Table

Smoke	Notifications	Buzzer sound	LEDs On
<100PPM	No	No	No
>100PPM	Yes	Yes	Yes

4.3 Test Results

Based on the results of the analysis and testing of the pollution detection system tool using the MQ2 sensor and a telegram based on NodeMCU ESP8266, the following conclusions can be drawn:

The sensor will detect smoke that is around the sensor. If smoke is detected with a value of more than 100 PPM, the telegram will send a warning notification along with the buzzer and LED flashing. However, if the detected value is less than 100, Telegram will not send notifications and the buzzer and LED will not light up.

Conclusion

Based on the analysis and testing of the pollution detection system using the MQ2 sensor and a telegram based on NodeMCU ESP8266, it can be concluded that this pollution detection tool can be linked to the Telegram application and will send notifications containing warnings of unsafe air if pollution reaches a value of more than 400 PPM. Everything is assembled according to the schemes and tools that have been programmed via the Arduino IDE and connected to the Telegram application. As well as connected to the internet so that all components will carry out their functions according to the program made.

This research is expected to provide benefits to the community and especially to the environment affected by air pollution and it is hoped that further research can be complemented by integrating other features

References

Disperkimta, A. (2019). Sources and Causes of Air Pollution. Disperkimta. Bulelengkab. Go. Id. https://disperkimta.bulelengkab.go.id/formasi/detail/artikel/source-dan-pembebab-pencemaran-udara-75

Kho, D. (2020). Definition of LCD (Liquid Crystal Display) and Working Principles of LCD. Teknikelektronika.Com. https://teknikelektronika.com/pengertian-lcd-liquid-crystal-display-principle-work-lcd/

Kho, D. (2020). Understanding LED (Light Emitting Diode) and How it Works. Teknikelektronika.Com. https://teknikelektronika.com/pengertian-led-light-emitting-diode-cara-work/

Rashid, A. (2020). Understanding MQ-2 Sensors. Samrasyid. Com. https://www.samrasyid.com/2020/12/pengertian-sensor-mq-2.html?m=1

Razor, A. (2022). Arduino Buzzer: Definition, How it Works, and Example Programs. Aldyrazor. Com. https://www.aldyrazor.com/2020/05/buzzer-arduino.html?m=1

Saputro, TT (2017). Getting to Know NodeMCU: The First Encounter. Embeddednesia.com. https://embeddednesia.com/v1/tutorial-nodemcu-pertemuan-pertama/

Singgih, DR, Suwartika K, R. (2021). Designing An IOT-Based Smart Home Control Using Blink Application and ESP8266 Wi-Fi Module. *Journal of E-KOMTEK* (Electrical-Computer-Engineering), 5(1), 1–12.