Prototype of Indoor Air Purification Device Based on IoT

Azwardi Azwardi [1], Ariansyah Saputra[2], Fithri Selva Jumeilah [3]*, Kurniawan Adi Saputra[4]

[1-4] State Polytechnic of Sriwijaya, South Sumatera 30128, Indonesia
fithri.selva.jumeilah@polsri.ac.id

Abstract. Further details regarding the Internet of Things (IoT)-based indoor cigarette smoke monitoring and disposal tool that has been developed by the author. The main component of this tool is the ATMega328 Microcontroller which acts as the main controller of the tool. The ESP32 microcontroller is used for remote monitoring and control via the Blynk application on a smartphone. The MQ-2 sensor is used to detect the presence of cigarette smoke in the room, the Buzzer functions as an alarm that will sound if the smoke level exceeds the threshold. The LCD screen displays the ppm (parts per million) value of smoke in the room. The exhaust fan functions to expel smoke from room. By using IoT technology to allow users to view and control tools remotely via the Blynk application on their smartphone. The operating mode in this tool uses two modes, namely automatic mode and manual mode where the automatic mode will work. If the MQ-2 sensor detects smoke levels exceeding the limit, the buzzer will sound as a warning, and the exhaust fan will be activated to clean indoor air automatically. Manual mode, here users can control the exhaust fan remotely via the Blynk application on their smartphone.

Keywords: Smoke, ATMega328 Microcontroller, ESP32, MQ-2, Internet of things.

1. INTRODUCTION

Smoke and gases are substances that cannot be touched or seen. The danger of substances like these can threaten both the environment and those around us without us knowing. Yet, good air quality is essential for human comfort. For instance, in homes, there might be a gas leak that the owner is unaware of, in offices, there might be cigarette smoke harmful to breathing, and in the chemical industry or power plants that use hydrogen and fuel as turbine drivers and generator coolants. Therefore, monitoring is required to determine the air quality index in a particular area in order to assess the level of dangerous gases. One visible indicator of air pollution is cigarette smoke. Smoke becomes even more dangerous when it is present in enclosed spaces with poor air circulation because it cannot escape from the room.

Currently, air quality is very important, especially in Palembang City during the dry season. There is a lot of abandoned land in the Palembang City area which causes the Palembang City air quality index to fall into the very unhealthy category. With the MQ-2's ability to detect air quality, this can be used to filter rooms.

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There has been a lot of research discussing automation tools. Among the studies that have been carried out [1,2,3] which discuss detecting body temperature without physical contact. Apart from that, research related to gas waste has also been carried out [4]. By using the MQ-2 sensor which is able to detect LPG gas in normal air. The MQ-2 sensor which is sensitive to air quality is used to detect LPG gas, i-butane, propane, methane, alcohol (C2H5OH), hydrogen (H2), ammonia (NH3), sodium dioxide (NOX), benzene (C6H6), carbon dioxide (CO2), sulfur gas (H2S), cigarette smoke and other gases in the air.

Therefore, this research aims to design an indoor air purifier using Internet of Think technology.

2. LITERATURE STUDY

1. Internet of Things

IoT has emerged as a powerful tool for real-time IAQ monitoring and control. It enables the integration of sensors, data analytics, and automation for efficient air purification. Discussed the importance of IoT in IAQ management and presented a framework for a smart IAQ monitoring system that utilizes various sensors for data collection [5].

2. MQ-2 Sensors

The MQ-2 sensor is a sensor used to detect the concentration of flammable gases in the air as well as smoke and the output reads as an analog voltage. The sensitivity of the MQ-2 smoke gas sensor can be directly adjusted by turning the trimpot. This sensor is commonly used to detect gas leaks both at home and in industry[6]. The MQ-2 sensor can detect a variety of gases, including but not limited to methane (CH4), carbon monoxide (CO), hydrogen (H2), and smoke. This wide range of detectable gases makes it suitable for diverse applications. This sensor can detect the concentration of flammable gases in the air and smoke and the output is in the form of an analog voltage. The sensor can measure flammable gas concentrations from 300 to 10,000 ppm. Can operate at temperatures from -20℃ to 50℃ and consumes less than 150 mA current at 5V [7].

3. ATMega328

Arduino Uno is a microcontroller board based on the ATmega328 (datasheet) [8]. It has 14 input pins from digital output where the 6 input pins can be used as PWM output and 6 analog input pins, 16 MHz crystal oscillator, USB connection, power jack, ICSP header, and reset button [9]. To support the microcontroller so that it can be used, it is enough to simply connect the Arduino Uno board to a computer using a USB cable or electricity with an AC-to-DC adapter or battery to run it [10].

3. RESEARCH METODOLOGY

The research methodology for developing a prototype of an indoor air purification device based on IoT, are:

1. Problem Statement and Objective Definition:

   Clearly define the problem related to indoor air quality that your IoT-based air purification device aims to address. Establish specific research objectives, such as developing a functional prototype, evaluating its performance, and assessing its impact on indoor air quality.

2. Literature Review:

   Conduct a thorough review of existing literature related to IoT-based air purification devices, air quality sensors, IoT protocols, and relevant technologies. Identify best practices, previous research findings, and technological advancements to inform your project.

3. Conceptual Design:

   Develop a conceptual design for your IoT-based air purification device, including the selection of sensors, actuators, and communication modules.

   Define the device's architecture, including hardware and software components.

4. Sensor Selection and Integration:

   Choose appropriate sensors for detecting key indoor air pollutants (e.g., gas sensors, particulate matter sensors, humidity, and temperature sensors).

   Integrate selected sensors into the device's hardware, ensuring compatibility and accuracy.

The first step in planning the tool to be designed is to create a block diagram so that you can carry out the working process of the circuit in general. The aim is to make it easier to analyze the relationship between components in a block or other blocks so that it is easier to know clearly. The following is a block diagram of the relationships between components so that it can explain how the tool works which can be seen in Figure 1.

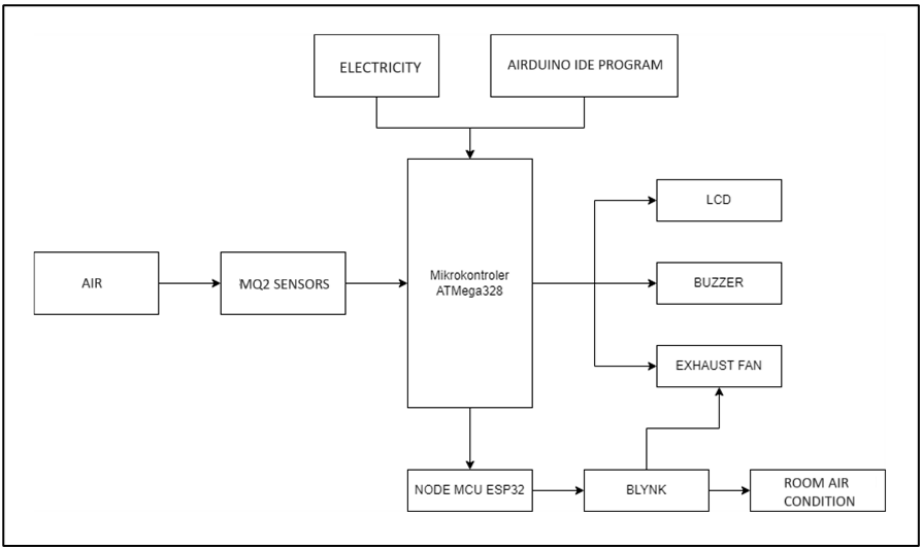

Fig 1 Block Diagram

1. Input tool created using the MQ2 Sensor. Useful for detecting the presence of cigarette smoke in the room.
2. The Arduino and ESP32 programs use the Arduino IDE application in the form of coding that has been created to run the tool that has been created, and the ATMega328 microcontroller on the Arduino Uno board functions as the controller and the ESP32 NODE MCU as a remote controller using the Blynk application on the smartphone.
3. The output from the processor is an LCD, buzzer and exhaust fan. The LCD is used to display PPM information regarding the detection of cigarette smoke in the room. The text displayed on the LCD screen can be customized according to needs. Exhaust fans work by producing a strong air flow to draw cigarette smoke into the device and channel it out of the room. The buzzer works as a sound indicator that notifies the user when the device detects cigarette smoke in the room, room conditions can also be monitored via smartphone and turn on the fan if necessary using the Blynk application on the smartphone.

4. RESULTS AND DISCUSSION

Preliminary design or often also called preliminary design is the initial stage in the design process of a product or system. At this stage, various ideas and concepts are translated into rough visualization forms such as sketches, block diagrams, or flowcharts. The aim is to provide a general overview of the product or system to be designed, so that you can know what should be considered in the next stage.

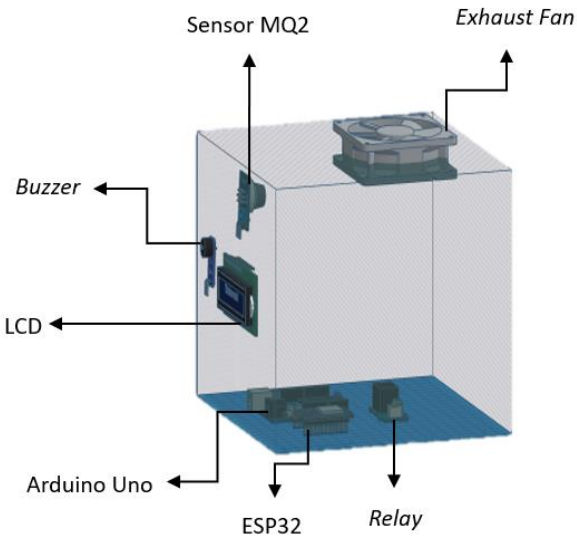

Fig 2 Tools Sketch

This stage is the stage of determining the circuit drawing which functions to determine the working system of the tool to be made

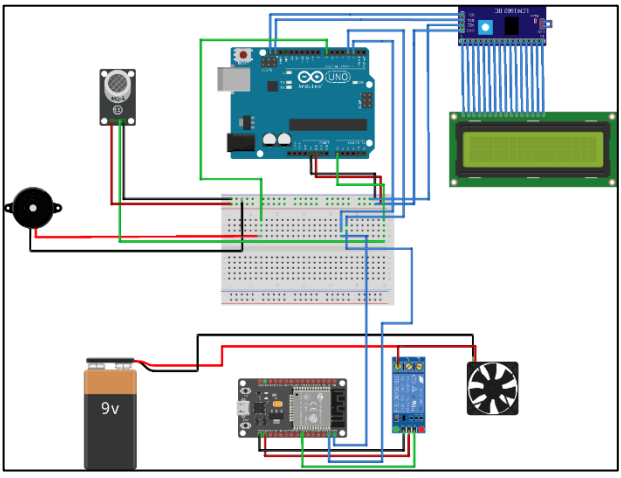

Fig 3 Network Cable Connections

A design method is a method or stage carried out in a design process, this method is needed to make it easier for designers to develop design ideas. At this design stage, it is the basis for whether the tool being made is suitable or operational or not. If we carry out the design stage well and meet the specified standards, then the tool that will be designed will also operate according to expectations.

5. CONCLUSION

The main components used by this tool are the ATMega328 microcontroller as the controller, the ESP32 as a remote controller using a smartphone, the MQ-2 sensor, as a smoke level detector in the room, a relay to transmit electricity and control the flow of electricity, and an exhaust fan as an air purifier indoor.

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The title "ACKNOWLEDGMENTS" should be in all caps and should be placed above the references. The references should be consistent within the article and follow the same style. List all the references with full details.

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