



Article

# Air Quality Monitoring System and Air Neutralizer in Hotel Rooms with Notification Via Telegram

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## A B S T R A C T

Indonesia is rich in natural beauty, and it offers a variety of attractions in different regions that draw tourists from various regions and abroad. Hotels serve as an excellent form of public accommodation that is very useful for tourists who are traveling due to the fact that it provides lodging services in the form of hotel rooms. Visitors who book hotel accommodations certainly desire the facilities provided by hotels, such as air quality monitoring tools and air neutralizers in hotel rooms. The poor air quality, which is bad for health, is no longer a concern for tourists. Therefore, implementing a tool installed in the hotel will be very beneficial. The MQ-135 sensor is used by this tool to detect levels of carbon dioxide (CO<sub>2</sub>) gas and also appears in the form of an Internet of Things connected to the hotel staff telegram, allowing hotel staff to monitor the carbon dioxide levels in hotel rooms without having to check the rooms directly.

## INTRODUCTION

The Indonesian people are certainly familiar with hotels. A hotel is a structure that resembles a room for tourists who want to visit a region, as well as a provider of services and accommodation businesses with the intention of turning a profit. Hotel guests certainly need the comfort of the facilities provided by the hotel. In this modern era, the sophistication of human-made technology used to support work is getting more advanced.

Air neutralizers and tools for air quality monitoring are present in hotel rooms to

improve guest comfort. The manufacturer of this tool uses the MQ 135 sensor, which functions to determine the level of carbon dioxide (CO<sub>2</sub>) in the room using telegram notifications or the Internet of Things (IoT). This sensor can assist hotel staff in their efforts to provide guests with the best facilities. In addition, the Internet of Things (IoT) enables the automatic data transfer from microcontrollers to digital devices as a reminder indicator if carbon dioxide levels increase.

Air pollution is the excessive release of pollutants into the air, which degrades air quality. Both, whether they occur naturally

or as a result of human activity, can cause the air quality to deteriorate. A few examples of natural air pollution include smoke from forest fires, volcanic ash from volcanoes, and salt emissions from seawater. Furthermore, a few examples of factors that contribute to man-made air pollution include transportation, industrial activity, and the burning of household waste.

Carbon dioxide gas (CO<sub>2</sub>) is a component of air quality. High levels of carbon dioxide (CO<sub>2</sub>) can have negative effects on human health, including respiratory acidosis, which is characterized by excessively acidic blood caused by the accumulation of carbon dioxide in the blood, which prevents the body from receiving oxygen[1].

Despite the fact that the maximum allowed level is 5000 ppm, CO<sub>2</sub> levels in the air that exceed the 600 ppm threshold have an impact on user comfort and health. In order to protect the health of hotel guests, it is necessary to have an air neutralizer in addition to a monitoring system to reduce excess levels of carbon dioxide gas in the room [2].

**I. LITERATURES REVIEW**

According to research by Septiana Jernita Sitinjak titled “IoT-based monitoring of CO<sub>2</sub> and CO<sub>2</sub> gas pollutant air quality”, the research aimed to monitor CO and CO<sub>2</sub> gas pollutant air quality using a microcontroller that is then connected to the IoT platform and whose output will be sent to telegram. [3]

The next research from Grace C. Rumampuk, was titled “Design of an IoT-based indoor air quality monitoring system” which aimed to monitor the air quality in a room so that it could provide information directly. [4]

Based on the research above, the researchers are interested in conducting research titled "Air Quality Monitoring System and Air Neutralizer in Hotel Rooms with Notifications via Telegram." Further research was conducted on CO<sub>2</sub> air quality monitoring systems with the aim of

improving the comfort and health of hotel guests who use the hotel’s services.

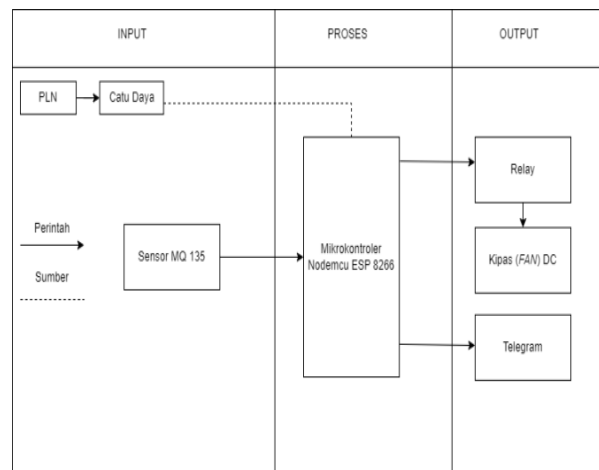
System monitoring is a systematic and continuous process of collecting and analyzing information regarding operations or programs based on predetermined indicators and taking corrective actions to further improve those operations, activities, or programs.

This tool also makes use of the “internet of things”, namely technology that allows data to be transmitted and the benefits of the internet to be expanded, which is constantly connected without requiring human-computer interaction and using wireless methods or automatic control regardless of distance. [5]

However, IoT is more than just remote control of devices; it also involves data sharing, the virtualization of all real things in the form of the internet, etc. The Internet automatically becomes the link between the machines. In addition, there are also users who serve directly as regulators and monitor the operation of the tool. The benefit of implementing IoT technology is that it makes people's work faster, easier, and more efficient. [6]

**II. FRAMEWORK**

An essential part of tool design is the block diagram. A block diagram depicts the operation of all the tools to be used, so creating an overall block diagram produces a system that can be used or worked on.

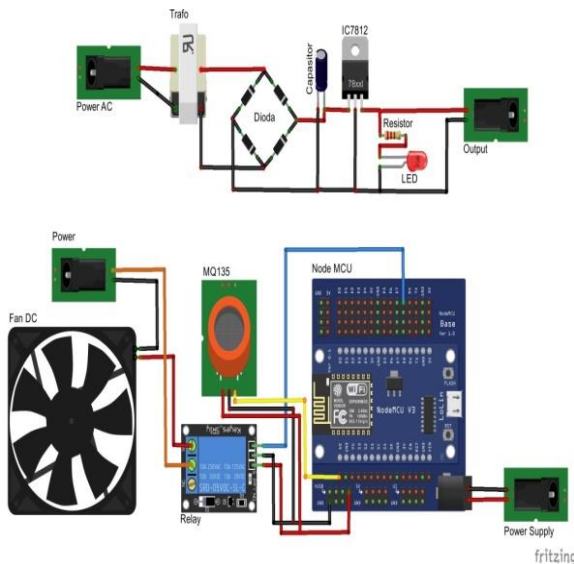


**Figure 1. Block diagram**

The block diagram in Figure 1 is explained as follows:

The Nodemcu ESP8266 Microcontroller, a tool used to receive data from the MQ 135 sensor, receives electricity from PLN after having the voltage lowered using the power supply. Furthermore, the data will be processed and issued by Nodemcu via telegram. The relay functions as a breaker and activates the flow of electricity like an on/off switch, so that the fan will only activate if this value is met. The Telegram bot will send users notifications periodically, informing them of the CO2 levels in the room according to a predetermined schedule. If the amount of CO2 levels meets an exacting standard, the fan will activate as a room neutralizer to reduce CO2 levels in hotel rooms.

In addition to block diagrams, schematic circuits are also significant in the creation of tools. Circuit design process include schematic circuit design such as wiring.



**Figure 2. Schematic circuits**

The schematic circuit of the tool is explained as follows:

The power supply is connected to the Nodemcu ESP8266, Pin D8 is connected to the relay, Pin A0 is connected to the MQ-135 sensor, Pin Vin is connected to the positive sensor, and the relay is connected.

Relay output pins to fan and power supply inputs

### III. METHODS

In order for the research process to proceed without any difficulties, it is essential to use a research method with distinct research stages, such as the action research method used in this research. This method is a research-stage design that can explain and describe conditions for improvement purposes. [7]



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**Figure 3. Methods of action research. [8]**

The methods of action research shown in Figure 3 are explained as follows:

#### 3.1 Diagnosing

At this stage, the researchers conducted a survey of several previous research results as well as some reports related to air quality monitoring systems and air neutralizers used in hotel rooms.

#### 3.2 Action Planning

Following the survey, the researchers developed a strategy for providing appropriate problem-solving assistance.

#### 3.3 Action Taking

After creating plans and designing scenarios, the researchers used the hardware or software needed to create a Telegram bot.

### 3.4 Evaluation

At this stage, the researchers evaluated the findings, which could be displayed on the Telegram bot.

### 3.5 Learning

This stage is the final stage of the research method. At this stage, the researchers monitored the air quality in the room. Moreover, a solution was provided if the amount of carbon dioxide gas increased by utilizing a DC fan to neutralize the air in the room.

## IV. RESULT

The air quality monitoring system and air neutralizer in this hotel room are prototypes at a scale of 1:25, where 4 cm of the tool corresponds to 1 m of the 25 m<sup>2</sup> total size of the actual room.



Figure 4. Top view of the tool

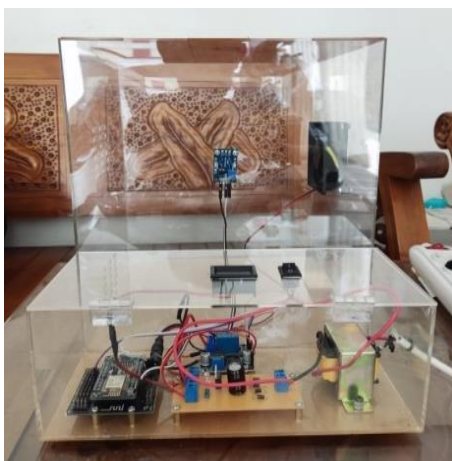


Figure 5. Front view of the tool



Figure 6. Side view of the tool

At the design stage, the expected objectives for this tool had been determined. It was intended that the tool would function properly throughout the manufacturing process so that it could be used perfectly as desired. The purpose of the kit design is to determine the component arrangement so that they can be installed correctly and in the correct order. In addition, a flowchart was needed to design this tool. The purpose of this flowchart is to outline the steps in the process by which this tool can achieve the desired result.



Figure 7. Flowchart



The flow chart in Figure 7 is explained as follows:

In the beginning, Nodemcu receives the power source from the power supply, after which the MQ 135 sensor reads CO2 levels, and if the MQ 135 sensor detects CO2 levels in the room, then Nodemcu ESP8266 sends data to the Telegram bot. If the detected CO2 level exceeds 600 ppm, the fan will turn on and start generating neutralizing air in the room. Finished.

The tool works in the following manner:

Turn on the hotspot on the smartphone so that NodeMcu is connected to the device. Plug in the power outlet, then turn on the device. Ascertain whether NodeMcu is connected to your smartphone by checking the hotspot connection. If it is connected, enter the Telegram bot that we have set. The explanations and pictures are as follows:



Figure 8. Display on the Telegram bot



Figure 9. Click status to find out the amount of CO2 gas present in the room; the value will then be displayed.



Figure 10. If the CO2 gas value is harmful, then the Telegram bot will notify users with the message "Co2 Value High !!!! "

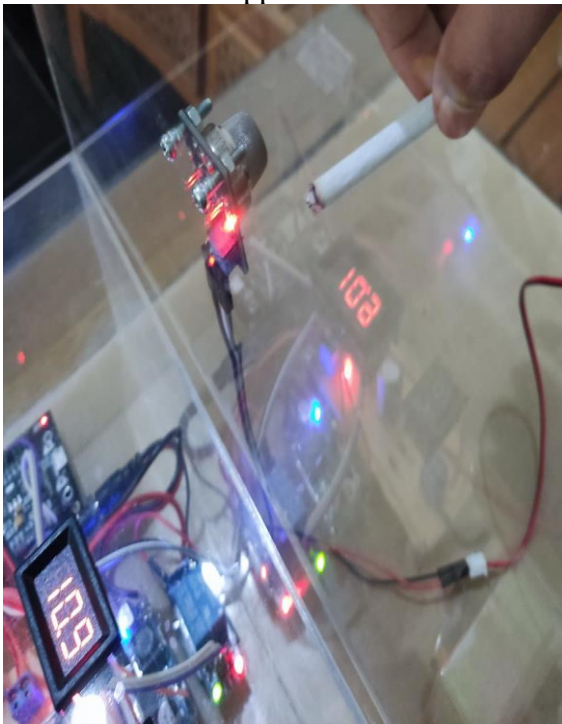


Figure 11. The fan will automatically activate to remove CO2 gas from the room.



**Figure 12. After the CO<sub>2</sub> level has decreased to a predetermined value, the fan will stop.**

For tool testing, cigarette smoke was used with a 130 ppm value set on the mq 135 sensor; this figure was only for testing because the CO<sub>2</sub> level that is harmful to humans is above 600 ppm.



**Figure 13. The image of testing tools covered in cigarette smoke**

## V. CONCLUSION

The researchers drew a few conclusions from the results of implementing the design of an air quality monitoring system tool and air neutralizer in hotel rooms with notifications via telegram. A few conclusions are presented as follows:

1. The MQ 135 sensor was able to estimate the amount of carbon dioxide gas present in the room.
2. A relay is very useful because it acts as a breaker and connector for electric current going to the fan, preventing the fan from turning on continuously, which would heat up the motor and increase the risk of fire.
3. Notifications sent by the Telegram bot from an air quality monitoring system installed in hotel rooms may provide us with information on the air quality.

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## **BIOGRAPHY**

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