IOT-Based Pollution and Air Quality Monitoring Equipment with ESP-8266

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Abstract. Modern industry urgently needs air quality detectors, which are used to detect air pollutants, such as; CO, CO_2, SO_2, and NO_2, which are not good for the health of living beings and the environment. In this study, we created a tool that can monitor the gas and provide results in PPM (parts per million). Sensors will collect parameter data and environmental data will be output to the server.The conclusions as follows: first, The design of the air pollution detection device uses the MQ-135 gas sensor with IOT-based technology to detect CO_2, SO_2, and NO_2 gases. The input from the gas sensor is processed through the ESP-8266, will produce an air quality index output, thus displaying the index in various places/locations, which will be displayed on the monitor, and, the second is The latest implementation of this air pollution detection tool using the MQ-135 can identify hazardous air levels of CO_2, SO_2, and NO_2 gases, which then provide indications and information to android application users and computers, with an air quality index/value.

Keywords: Air Polution Detector; ESP-8266; Internet of Things.

1 Introduction

The PMS5003 particle sensor, PM2.5 from Plantpower measures particle concentrations in PM1.0, PM2.5 & PM10 [1];[2];[3]. An additional component that is also very important in this tool is an air detection sensor, with component type MQ-135, this component can measure the concentration of CO, CO2, SO2, and NO2 gases, giving results in PPM (Parts per Million) [4];[5];[6];[7];[8]. Likewise with the BME280 component which functions to measure the temperature, pressure & humidity of the environment. The sensor will collect data from various environmental parameters and send it to a server which displays the data online after an interval of every 15 seconds.

2 Result and Discussion

1.1 IoT Based Pollution/Air Quality Monitoring with ESP8266

The development of prototypes related to hardware assembly and programming, we can see in the figure 1, which illustrates the systematic steps, to achieve this goal. the first stage is by making a hardware device, and doing the software coding, for the second stage we create a

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system which functions for evaluation (feedback or distribution of delivery to the client) from users to get input and criticism, so we can modify it as desired clients.

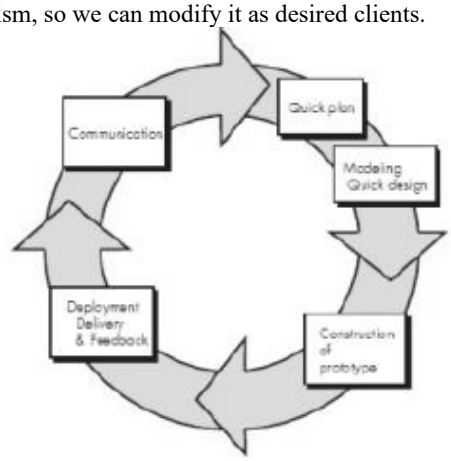

Figure. 1. Block diagram system

Block diagram showing the correlation in an IoT-based air quality monitoring system, which is as follows:

a. data that are inputted and detected by the MQ-135 sensor are CO, CO_2, SO_2, and NO_2, which are obtained from the surrounding air.
b. MQ-135 which is a component feed that detects pollutants is connected to the ESP-8266 microcontroller.
c. input read from the MQ-135 will be processed by the ESP-8266, and the wifi module contained in the microcontroller will send information to the internet.
d. information sent by the ESP-8266 microcontroller will be sent to the Thingspeak server. Thingspeak is an IoT platform that functions to record data from sensors that have been sent by the microcontroller, so that the platform converts input data into output in the form of graphic information.
e. information that has been translated by the platform, can also be synchronized on the Blynk App, so as to notify the user via smartphone if the air quality has increased or decreased to a significant degree.

Table 1. System Functionality Testing

Component	Condition	Function testing process	Results
Air quality sensor:MQ-135	Active detectors and sensors in standby	Delivering liquid alcohol or approaching smoke in the vicinity of the MQ-135 sensor	The MQ-135 sensor can detect an increase in alcohol, CO and CO_2levels
Microcontroller	Active detector and Microcontroller connected with MQ-135 . sensor	The information that has been processed by the MQ-135 component is in the form of analog information, so that the MQ-135 can send data to the Microcontroller	Receives the input signal from the sensor and processes the signal
Blynk Apps	Activation Installing the blynk application on a smartphone	Tests if the value sent from the sensor can be passed to blynk	The Blynk application will receive air quality information in the form of notifications
Thingspeak server	Thingspeak is an IoT-based platform server that functions to record air quality data that has been read by the MQ-135 sensor and sent by the microcontroller in the wifi module.	Testing whether the data sent by the microcontroller has arrived and can be processed by the Thingspeak server	Thingspeak can receive, and manage data that has been sent by the microcontroller

We have carried out the experiment, and got the results of testing the system functions, which are shown in the table 1. Functional of the entire component is a part of the system. we carried out a test method, by providing some of the gases we have mentioned around the pollutant sensor, namely the MQ-135 sensor. The result of this experiment is that the MQ-135 sensor can detect gas concentrations, and provide data to the ESP-8266 microcontroller, according to the indexed air quality level value in the program.

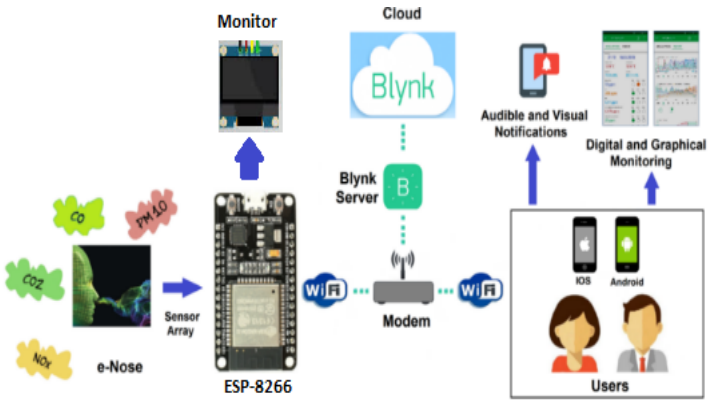

Figure 2. Block diagram system

It is shown in the figure, which is evidence from the thingspeak report, that each listed point is a real-time detected value, with PPM [10];[11]. The test scenario carried out is to activate a component, and place it in the room. The next process is to observe the values displayed on the IoT platform on the Thingspeak server. Analog values are recorded from the server, which are taken randomly over a certain period of time [12];[10]. Based on log data from server testing with a monitoring time of about 20 minutes, a report will be obtained from the digital graphics server, that the MQ-135 analog sensor value is in the range of 356 to 531.

Figure 3. Monitoring graph on thingspeak server server

We have calculated the total analog value is 11254 with 23 data of detected data. so that the average value of the detected data results is an average of 489.3. The results of the program on the ESP-8266 have determined three levels of air quality detection, namely normal air levels, moderately polluted, and highly polluted. Normal air altitude is in the analog value of less than 400. Medium polluted levels are in the range of 400 to 800. While high polluted levels are in the analog value range above 800 to 1023. From the results of the sample calculations discussed previously, the average analog value is 489.3. These results indicate that the level of

air quality at the time the test was carried out was at a moderately polluted level so that notifications were sent to the user's smartphone via the Blynk application..

Figure. 4. Air pollution notification from *blynk* apps

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