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THE DEVELOPMENT OF PORTABLE AIR QUALITY DETECTION

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ABSTRACT

Air quality is very important to ensure the health of humans, plants, and even animals. The tragedy of chemical waste disposal in the Kim Kim river has resulted in air pollution in the surrounding area. Therefore, this innovation has been developed to produce a mobile device that has a low cost, detection of the gas in real-time, and overcome the problems faced due to chemical waste pollution such as shortness of breath, nausea, and vomiting. Portable air quality detection is an innovation used to detected and measured the connections between software and hardware that are required for analysis purposes. The outputs detected are carbon dioxide, benzene, alcohol, ammonia, nitrogen oxide, and smoke. Data analysis was done by making a comparison between the output values in LCD and Favoriot and Blynk. This project also can measure the value of temperature and humidity. The sensor used to detect gas readings is MQ135 gas sensor and for temperature and humidity sensor is DHT22 sensor. The value of gas, temperature, and humidity in the environment will be displayed on the website as well as on the phone applications. This innovation used two types of platforms to display the data, Favoriot in website platform and Blynk used on smartphones. In addition, this value will be recorded and stored on the website for future use by the users. The users will also be able to compare readings before and after to ensure that the air in the environment is in good condition. In addition, this project can warn users if the reading is at danger level. The buzzer will sound and users will be notified by email. For future recommendations, the A3OZ sensor can be used to achieve high precision values for O3 and NO2 readings with a detection range of 0-10 ppm and detection accuracy of 20 ppb.

Keywords: Portable, gas sensor, temperature, humidity

INTRODUCTION

Air pollution is a situation in which chemical substances are released into the atmosphere that affect humans and living organisms as well as the environment (Al Ahasan et al., 2018). In 2019, Malaysia experienced air pollution problems caused by haze outbreaks as reported by Malaysiakini (2019). Innovations are also required to deal with this issue of air pollution, which can quantify in real time gas emissions in the local region. The invention (Nettikadan and Raj 2018) used to view the output for each parameter using NodeMCU, connected to the gas sensor MQ135, on ThingSpeak and Twitter platforms. The Arduino Uno is a controller for the invention created by (Fatkiyah, Persada, and Andayati, 2019) and connected to the gas sensors MQ6.

Data is displayed on LCD displays and websites. Innovation by (Vasantakumaar et al., 2018) applies ESP8266 Wifi Module where ThingSpeak and LCD are used to display output values. Based on observations of innovations that have been developed previously, the ESP8266 Wifi Module was selected as the controller and the MQ135 gas sensor was used to detect the presence of gas in the environment. Due to its cheaper cost and a single core processor feature that runs at 80MHz, the ESP8266 Wifi Module has been chosen as a controller. MQ135 gas sensor has been chosen because of its low price and can detect six different types of gas. To display the output value, Favoriot website application and Blynk applications have been used. Using the Favoriot website and installing Blynk software on mobile phones, users can view the output value. This invention also has a low price and can be carried everywhere because of its compact and lightweight nature. This breakthrough also has a high social benefit, as air pollution monitoring can be carried out in real time and users can be alerted if the reading exceeds normal value.

METHODOLOGY

Figure 1 show the waterfall technique that use a software development approach in series or linear form. The project is divided into a set of activities, which are called phases at the highest stage. A true approach to waterfalls includes phases that are sequentially completed and have specific exit requirements (Thummadi and Lyytinen, 2020).

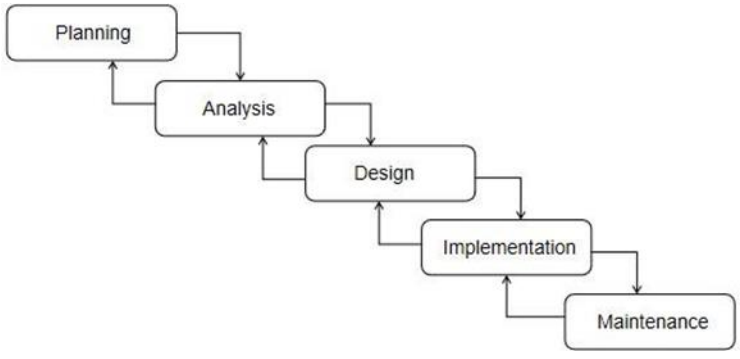

Figure 1. *Waterfall Model*

Planning

To identify all the information and requirement such as hardware and software. Planning must be done in the proper manner. Each details such as project scope, project objectives, statement problems are specified.

Analysis

Connections between software and hardware are required for analysis purposes. The outputs detected are carbon dioxide, benzene, alcohol, ammonia, nitrogen oxide and smoke. Data analysis was done by making a comparison between the output values in LCD and Favoriot as well as Blynk.

Design

Throughout the design stage, the emphasis will be on the sensor activity, so that data log on Favoriot and Blynk can be displayed and alerts sent to users via email. A small and light box is chosen to store all hardware and make it easy to transport anywhere.

Implementation

The implementation of ESP8266 controller and MQ135 sensor to generate connection between Favoriot and Blynk. Also, for the ESP8266 controller to connect with WiFi. This phase will describe the structure of the system and the flow of the system. The system uses several coding techniques to implement. At this phase, coding is mixed so that the MQ135 can link to the Favoriot website and Blynk application as well as to the buzzers.

Testing And Maintenance

At this phase, testing and maintenance for Portable Air Quality Detect is done. This innovation is tested to ensure that the MQ135 gas sensor, ESP8266-WiFi, DHT22, buzzer, Favoriot and Blynk work well. In case of a dispute with the hardware or software, the maintenance process is enforced.

RESULTS AND DISCUSSION

Compared to previous innovations, this prototype is cheaper at only RM90. This innovation is portable and not same as previous innovations because innovations in the market are mostly placed permanently at certain points only. This innovation uses a lightweight material and use a power bank as a power supply therefore it is easy to carry anywhere, saves electricity and can be recharged. The list of materials used in this prototype as shown in Table 1.

Table 1

List and price of each component used in the prototype

Hardware	Price (RM)
DHT 22	12.41
ESPB8266	19.30
Male To Female Jumper Wire	2.10
Buzzer DC3-24V SFM-20B	3.20
MQ135	7.00
Power Bank	35.00
Perspex Box	10
Total	89.01

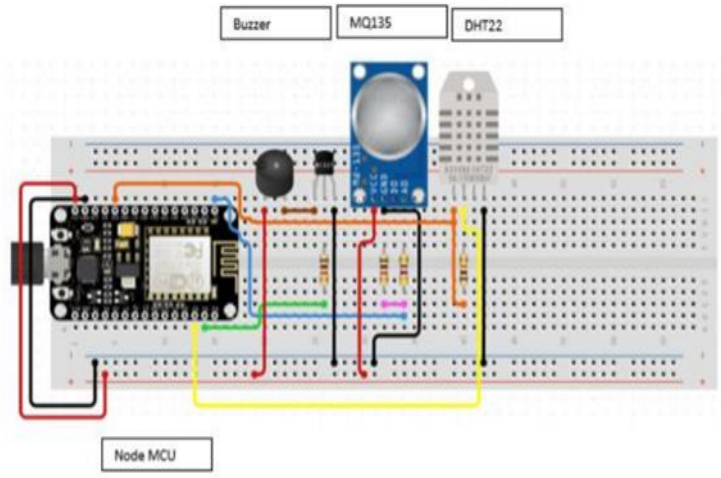

Figure 2. *Circuit connection consists of NodeMCU, sensor and buzzer*

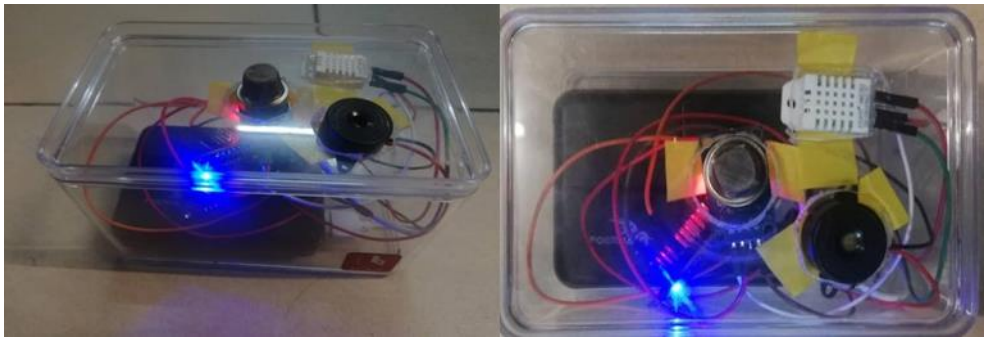

Figure 3. *Prototype of Portable Air Quality Detection*

The circuit connection is show in Figure 2 and the prototype of Portable Air Quality Detection is show in Figure 3.

Table 2

Gas type, gas range / buzzer beep and method

Type of Gas	Gas Range(ppm)/ Buzzer beep	Method
Carbon Dioxide	>110 & <200 Buzzer beep 1 time	Mouth Breath
Nitrogen Oxide	>200 & <500 Buzzer beep 2 times	Air Freshener
Benzene	>290 & <470 Buzzer beep 3 times	Gasoline
Alcohol	>300 & <530 Buzzer beep 4 times	Perfume
Ammonia	>270 & <410 Buzzer beep 5 times	Shining Wax
Smoke	> 130 & <440 Buzzer beep 6 times	Burning paper

The programming for this innovation uses the Arduino IDE and is divided into four main parts namely declaration sensor, serial monitor, Blynk and Favoriot. For sensor declaration coding, this process is important to set the parameters name according to the gas types. The sensor programming is as shown in Figure 4.

```
void loop() { Blynk.run(); MQ135.update();
float h = dht.readHumidity();
float t = dht.readTemperature();
String gas = String(map(analogRead(A0),0,1024,100,0));
CO = MQ135.readSensor("CO"); // Return CO concentration
Alcohol = MQ135.readSensor("Alcohol"); // Return Alcohol concentration CO2 =
MQ135.readSensor("CO2"); // Return CO2 concentration
Tolueno = MQ135.readSensor("Tolueno"); // Return Tolueno concentration NH4 =
MQ135.readSensor("NH4"); // Return NH4 concentration
Acetona = MQ135.readSensor("Acetona"); // Return Acetona concentration
```

Figure 4. *Sensor declaration coding*

Figure 5 shows a display on the Favoriot platform for carbon dioxide, benzene, alcohol, ammonia, nitrogen oxide and smoke, temperature and humidity and Figure 6 shows the Data Stream function for each parameter according to the time set by the user.

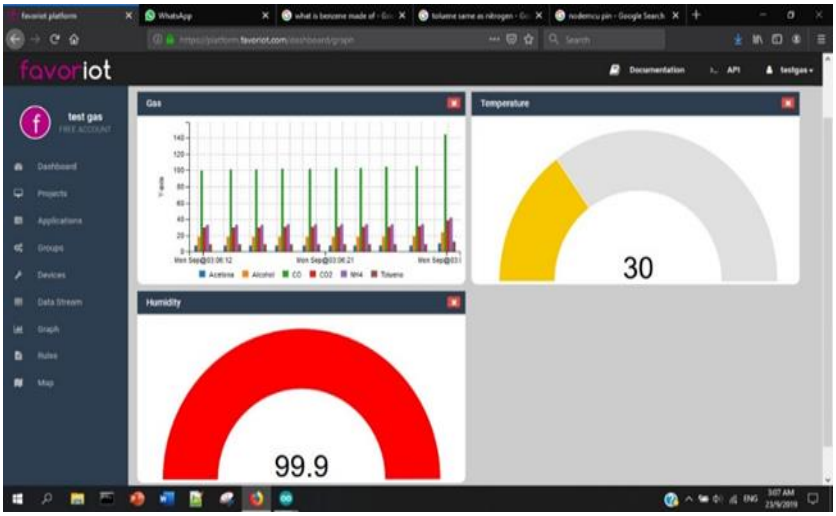

Figure 5. *Favoriot platform*

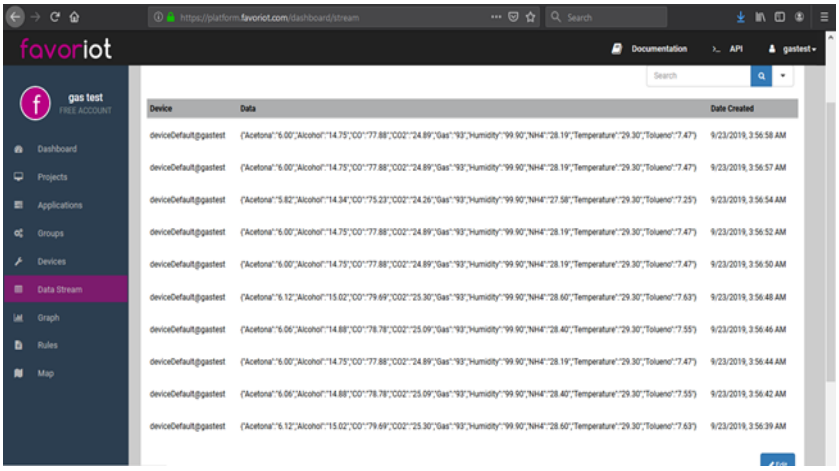

Figure 6. *Data Stream function*

Figure 7 below shows the values for carbon dioxide, benzene, alcohol, ammonia, nitrogen oxide and smoke as well as the temperature and humidity displayed on the Blynk application.

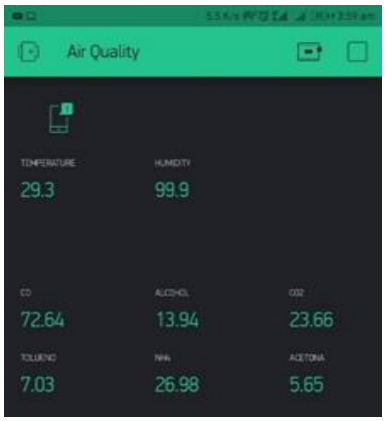

Figure 7. *Blynk application*

CONCLUSION

Air quality decreases day by day, due to smoke and pollutants emitted by manufacturing, urban growth, and human actions. This invention is therefore important to alert the community to air pollution in its surroundings. This is because air pollution is not visible to the naked eye and it is important to always measure the parameters of gases that are harmful to the environment that contribute to air pollution in real time using the ESP8266 Wifi Module and MQ135 gas sensor.

The value of each gas is displayed on the main display of Favoriot and Blynk and a notification will be sent when the water quality is above a certain level. This notification will be emailed to the user according to the time set on Favoriot and Blynk. This detection will allow users to take immediate action in the event of a gas leak in the surrounding area. This rapid detection is to ensure that the air always kept in a condition and free from the threat of gases that can endanger public health.

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