Journal of Applied Intelligent System (e-ISSN : 2502-9401 | p-ISSN : 2503-0493)
Vol. 8 No. 1, February 2023, pp. 9 – 24
DOI:

Design of Gas Leak Detection using Gas Sensor and Microcontroller based On Android

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Abstract – Today the use of gas cylinders is increasingly widespread in society. Starting from simple stalls, street vendors and many households use these gas cylinders. The impact that occurs is an increase in orders to producers to produce gas cylinders. With the increase in orders, it causes less attention to the safety side of gas cylinders. One side of security that is not given enough attention is gas leaks. This study aims to implement Internet of Things (IOT) concept by designing a tool that can be used to detect leaks using the MQ-2 gas sensor and android. This tool serves to provide leak notifications in the form of an alarm. The alarm will turn on automatically when the sensor detects gas that emits an odor so that it can be anticipated immediately. The test results show that this detector can work properly and optimally in giving gas cylinder leak warnings.

Keywords – Internet of Things, Liquefied Petroleum Gas,Android,Microcontroller,Sensor MQ-2

1. INTRODUCTION

The development of a very fast era makes humans increasingly spoiled with information technology. Information technology is any tool that can assist humans in managing and transforming information in various forms of communication media that are connected to hardware and software. One part of information technology is the Internet of Things.

Internet of Things (IoT) is a term intended for greater use of the internet, adopting mobile computing and connectivity and then incorporating them into our daily lives [1]. In addition, [2], a technology visionary and creator of the term IoT, conveys the following definition in the e-book entitled “Making Sense of IoT”: making connections open all the time, and sharing data freely and enabling unexpected applications, so computers can understand the world around them and become part of human life. According to [3], the Internet of Things is a concept where objects can have the ability to communicate using a network, such as the

process of sending data without using human-to-human communication or from humans to computer devices or a controller. With the concept of Internet of Things technology, the performance of a system will be wider, have a wider reach and the better the processing and data analysis of a system will be. Susanto [4] said that the Internet of Things is an embedded system that has the aim of expanding the utilization of the internet network that is continuously connected. Internet of things has many capabilities such as remote data control, data transfer, also includes food, electronic equipment, energy resources and devices that are connected to sensors and connected to the network.

The Indonesian people's need for energy is an inseparable part of their daily needs. The needs of people's lives so far have depended on nature, with the decreasing availability of natural resources, namely from fossil energy, especially petroleum. Therefore, its use must be limited by switching from fossil energy to natural resources that are still abundant, for example natural gas energy. It has been almost 11 years since the Decree of the Minister of Energy and Mineral Resources No: 1971/26/MEM/2007 dated 22 May 2007 regarding the conversion of petroleum (kerosene) to Liquefied Petroleum Gas (LPG) as an effort to shift from limited natural resources from fossil energy natural resources that are still abundant, namely natural gas. Almost all people in Indonesia switch to using LPG, besides the price is cheap, the method of use is also more effective.

LPG, which has begun to be widely used by the community, is not comparable to gas cylinder producers who have experienced a decline in the quality of their production. This can result in a hazard due to lack of supervision of gas cylinder products. It is proven that many gas cylinders are damaged, easily corroded, dented, so they are very prone to gas leaks in these tubes. One of the effects of gas leaks is the frequent explosion of gas cylinders. This explosion occurs because LPG has flammable characteristics and has a density greater than air, making it difficult to detect the gas in the event of a leak. The flammability of LPG is caused by the gas accumulating at the bottom of the room and flammable in the presence of a fire source. This gas cylinder explosion incident was caused by many factors such as the lack of supervision of gas leaks that could cause accidents or because the regulator was not installed properly. In the event of a leak there will be a pungent gas smell, this gas will explode if there is an ignition or spark.

This research was conducted with the aim of producing a system in the form of a gas leak detector using a microcontroller and Android. This gas detection tool has various anticipatory features that can prevent gas leaks as soon as possible, one of which is an alarm and gas leak protection device. The function of this alarm is to notify the user in the event of a gas leak. The alarm will fire when the sensor detects gas is on, while a small electric fan serves as protection or anticipation of leaking gas that will light up when the alarm is triggered.

Several previous studies that discussed the use of IoT include research conducted by [5] in a journal entitled Development of Internet of Things Technology Systems That Need to be Developed by the Indonesian State describing the results of a review of the application of IoT in people's daily lives, starting from the field of education, health, economy, security, to transportation. The results of this study conclude that based on the literature study conducted in this study, valid information about IoT and research on IoT does not exceed 10% of the total research that has been reviewed. So increasing the development of IoT research is very necessary, its development can be done starting from things that are directly related to human life. Then the research conducted by [6] in the journal entitled Implementation of the Application of the Internet of Things (IoT) on Infusion Monitoring Using Esp 8266 and the Web for Data Sharing explains how IoT technology can be used to monitor the amount of patient infusion fluids via Web and Android connections. The results of the study concluded that the test obtained an error rate of 2.46%, which means that the load cell sensor has a small error rate in detecting the infusion volume. Bonifacius [7] in an article entitled Automatic Key

Control System for Matic Motorcycles Using an Android-Based Microcontroller explains how to utilize IoT technology through microcontrollers and androids to control motorcycles, both turning on and off the engine. From the results of testing using three types of motor matic variants, it was concluded that the results of system testing and implementation carried out, it can be concluded that the use of this Arduino UNO-based android application can be used as a tool for motorcycle control systems both to turn on and turn off the engine at a distance. -a certain distance as expected. Research conducted by [8] which raised the topic of Internet Of Things (IoT) Applications for Monitoring and Controlling Electrical Loads in the Room, describes ways to control electrical loads using IoT through hardware in the form of NodeMCU ESP 8266 as the main controller. The results of this study indicate that the overall performance of android-based aerodynamics learning media has been able to run well according to the plan. All buttons on each display can function as planned. Muktiawan [9] in a journal entitled Internet Of Things (IoT)-Based Storage Monitoring System for Basic Needs describes how to design a basic needs monitoring system using the Internet of Things (IoT). The results of the study conclude that this system utilizes the internet network and utilizes Thingspeak as a control medium, the Arduino Mega 2560 microcontroller as an integrated control for Android-based applications. So it can be monitored the inventory of basic needs with a performance distance of more than 25 meters with an average speed of 35.42 seconds.

2. RESEARCH METHOD

According to [10], research methodology is a way to understand something through investigations that arise in connection with the problem to be studied, which is carried out carefully so that a stable problem solving is obtained, while according to [11], research method is a scientific way to obtain data with specific purposes and functions. The research method provides an overview of the research design, namely procedures and steps that must be taken, research time, data sources, and by what steps the data is obtained and then processed and analyzed.

2.1. Research Methods

In this study the research method used is research and development methods. Research and development methods are defined as research methods used to produce a particular product, and test the effectiveness of the product. The stages of research from this method include:

a. Problem formulation : The basic idea of this research is the frequent occurrence of gas leaks caused by human negligence and the production of gas cylinders. From this idea, there is a main problem, namely how the user can find out if the LPG cylinder has a leak.
b. Information gathering: This stage is carried out through observations and literature studies to find solutions to the problems faced. In this case, look for information from libraries related to the use of IoT technology to anticipate gas leaks.
c. System design: The system to be designed is realized in the form of a chart or image so that it can be used as a basis in the manufacturing process.
d. Design validation: Design validation is the process of assessing product design. Validation can be done by presenting several experts who have a lot of experience as appraisers of the newly designed product. Design validation is carried out in a discussion forum. Before the discussion begins, the research team can explain the research process until the design is found, along with its advantages.

e. Design improvement: After the experts carry out an assessment of the design made, it will be able to find the weak points of the design. The findings were then tried to be reduced by improving the design.
f. Testing: Tests are conducted to obtain information on whether the system/tool design is more effective in solving problems. Information is obtained from the conclusions given by the users of the tool.
g. Product improvement: after the system and tools are tested, the test results will be known. If a deficiency is found, it needs to be repaired.
h. Follow-up testing: After the system is repaired, the results of the repair are tested again whether it is in accordance with the objectives or not.
i. Final improvement: From the results of further testing, it will be found again whether the system is still not in accordance with the objectives or is it appropriate. If it is not appropriate then the system is repaired again until no more system deficiencies are found.

The research method carried out can be illustrated as in Figure 1.

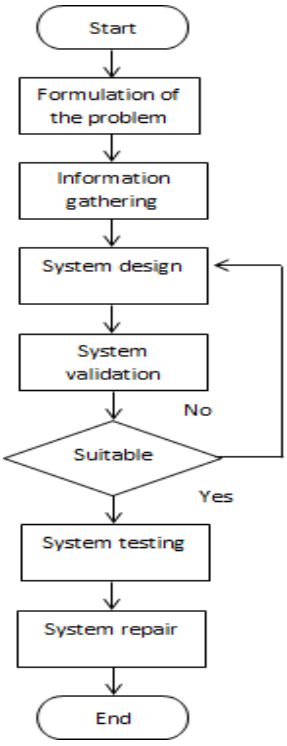

Figure 1. Stages of research methods

2.2. Internet of Thing (IoT)

Internet of Things can be defined as the ability of various devices that can be connected and exchange data with each other through the internet network. IoT is a technology that allows for control, communication, collaboration with various hardware, data through the internet network. IoT is also meaningful when we connect something that is not operated by humans, to the internet [12]. How IoT works refers to the following principles:

a. Big Analog Data: Analog data represents natural things in the human world. Examples of analog data are: light, sound, temperature, vibration, speed, acceleration, time, location, and so on. Analog data is the oldest, fastest and

largest data from other types of big data, especially digital data. Therefore, analog data should receive special treatment than digital data.

b. Perpetual Connectivity: Internet of things will always be connected and always active. In other words, the connectivity is immutable. So, the device will be connected to the internet continuously. Thus, users can monitor real time information on an ongoing basis and maintain device for optimization as needed.
c. Really Real Time: Real time on the IoT concept doesn't work like anything else. Real time in this concept is not even when data about network switches or IoT computer systems carries the really real time concept which starts operating when the sensor gets the data. For example, for a fire suppression device. We certainly need information as soon as possible before the fire devours the house. Therefore, the tool will work within a fraction of a second after the smoke sensor and temperature sensor detect a fire. Imagine having to wait for data to be sent to the cloud or data center.
d. The Spectrum of Insight: Spectrum of Insight" is derived from IoT data. The data is included in 5 phases of data flow, namely: real time, in motion or moving, early life or starting to light up, at rest or at rest, and archives. Spectrum of insight includes real time data to determine the immediate response to the control system. In addition, data is archived (data center), so insights are important for performing comparative analysis with more recent mobile data.
e. Immediacy Versus Depth: In this concept, "Time-to-Insight" is very important. That is, data analysis that has value or has value to support decision making. The principle of immediacy versus depth means exchanging depth of information with speed of time-to-insight. With computers and internet of things solutions, we can get Time-to-Insight" at the time of basic analytics.
f. The Next V: Experts usually call the characterization of big data with the term V's, namely: Volume, Velocity, Variety, and Value. The principle of The next V means, there is one V in question is Visibility. This means that when data is collected, data scientists around the world must have access so that they can use it as needed.

2.3. Arduino IDE

Software written using the Arduino Integrated Development Environment (IDE) is called a sketch. Sketch is written using a text editor. Sketch is saved with a file with the extension .ino. The message area provides information and error messages when we save or open a sketch. The console displays text output from the Arduino Integrated Development Environment and also displays an error message when we compile the sketch. In the lower right corner of the Arduino Integrated Development Environment window, it shows the type of board and serial port being used [13]. Arduino IDE that uses the simplified C programming language and is equipped with its own library and bootloader. The Arduino IDE display is shown as Figure 2.

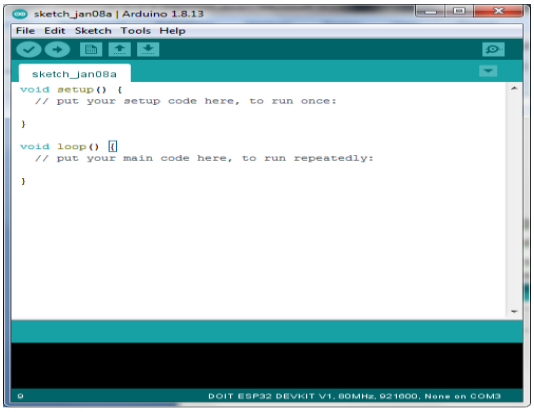

Figure 2. Arduino IDE display

The Arduino environment, as shown in Figure 2, has many command buttons. The descriptions and key functions of the Arduino IDE are shown in table 1.

Table 1. Shortcut Button Function

No	Icon	Name	Function
1		Verify	To check the program code errors that have been made
2		Upload	Uploading the program to the Arduino board.
3		New	To create a new sketch.
4		Open	Open the saved program sketch.
5		Save	Save the created program sketch.
6		Serial Monitor	Open the serial monitor screen

2.4. Blynk

Blynk is a platform that runs on Android or IoS. Blynk can be used to control Arduino, Rasbery Pi, Wemos and similar modules over the internet. This application is very easy to use for people who are still layman. Blynk has many facilities that make users feel easy to operate [14]. According to [15] Blynk is an application platform that can be accessed for free for iOS and Android that functions in controlling Arduino, Raspberry Pi and the like via the Internet. Blynk is specially designed for the Internet of Things with the intention of being able to control hardware remotely (remotely), being able to display sensor data, being able to store data, visually and do many other advanced things.

Blynk was created with the aim of controlling and monitoring hardware remotely using internet data communications. The ability to store data and display data visually using numbers, colors or graphics. There are 3 main components of Blynk, namely: Blynk Apps, Blynk Server and Blynk Library.

3. RESULTS AND DISCUSSION

3.1. Hardware Requirements

To support the need for designing tools that will be used to implement the research results, several software components are needed as presented in table 2.

Table 2. Hardware Requirements

No	Device	Information
1	ESP8266	ESP8266 is a wifi module that functions as an additional device for microcontrollers such as Arduino so that it can connect directly to wifi and make TCP/IP connections. This versatile WiFi module is already a SoC (System on Chip). and clients at the same time.
2	Sensor MQ-2	MQ-2 is an electronic component to detect gas levels. This gas sensor can be used to detect gas leaks in homes / factories, for example to make an electronic circuit that detects LPG leaks.
3	Relay	Switch (Switch) which is operated electrically and is an Electromechanical component (Electromechanical) which consists of 2 main parts, namely Electromagnet (Coil) and Mechanical (a set of Switch Contacts/Switch).
4	Buzzer	Buzzer is an electronic component that can produce sound vibrations in the form of sound waves. Buzzers are used more often because of their minimal power consumption size.
5	Fan	Generally, this fan serves to help maintain the temperature of the components so that they are maintained at optimal temperatures on computer equipment, the fan is generally installed on the main processor as a cooler for that part, but this fan is used to anticipate gas leaks in this research tool.
6	Jumper Cable	Jumper cable serves as a channel for digital data and as a power line used by all the hardware contained in this system.
7	BreadBoard	BreadBoard is the basis for the construction of an electronic circuit which is a prototype part of an electronic circuit that has not been soldered so that the schematic or component replacement can still be changed.

3.2. Software Requirements

In addition to requiring several software components, this study also required some software as presented in table 3.

Table 3. Software Requirements

No	Software	Explanation
1	Arduino IDE	Arduino IDE software is used to type sketches and is used as a means of uploading finished sketches into the ESP8266 hardware.
2	Blynk	The Blynk software is used as a bridge between the ESP8266 and the internet, so if the sensor detects gas then with the standards that have been applied, Blynk will send a notification to Android
3	Android	The Android device used to receive notifications from blynk.

3.3. Hardware Assembly

After all the hardware is collected, it's time to assemble the hardware. The first step is to attach the jumper cable to the ESP8266 Microcontroller on the GND pin and the other end is mounted on the MQ-2 sensor in the GND section. Then prepare a jumper cable to be installed on the ESP8266 Microcontroller on the VIN pin and the other end is mounted on the MQ-2 sensor in the VCC section. Next, prepare another jumper cable for pin A0 on the ESP8266, and the end for the MQ-2 sensor on pin A0 as well.

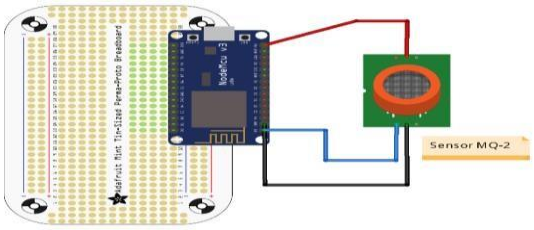

Figure 3. Mounting the MQ-2 Sensor to the ESP8266

The next assembly process is Buzzer. The first step is to prepare two jumper cables, connect the black cable to GND, then another cable is paired with pins D1 to D4 according to the code, then attach the pins as shown in Figure 4.

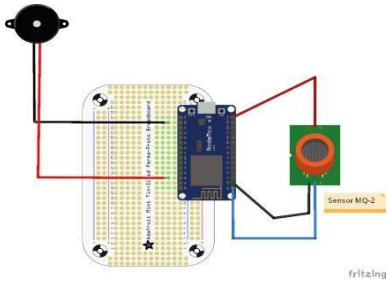

Figure 4. Buzzer Installation

After the sensor and buzzer are assembled, the next step is to install the fan. For the installation of this fan, a relay is needed that functions as a guard of electrical stability so that problems do not occur when it is finished assembling. The initial step for installing this fan is to prepare 3 jumper cables to connect the Arduino to the bottom of the relay while the top is for the fan that already has its own cable, the first cable connects the cable from the Arduino pin VIN to the relay pin VCC, the second cable connects the cable from pin D1 to D4 corresponds to the coding to the relay pin next to it, the third cable connects the cable from the Arduino GND pin to the GND pin relay. Here is the finished circuit shown in Figure 5.

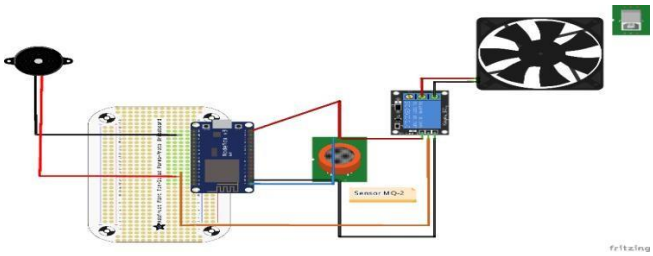

Figure 5. Final Series

3.4. System Programming

Programming on the ESP8266 Microcontroller is done in the Arduino IDE. The initial step and preparation before programming in the Arduino IDE is to install the ESP8266 into the Arduino IDE by opening the Arduino IDE and then opening File -> Preferences as shown in Figure 6.

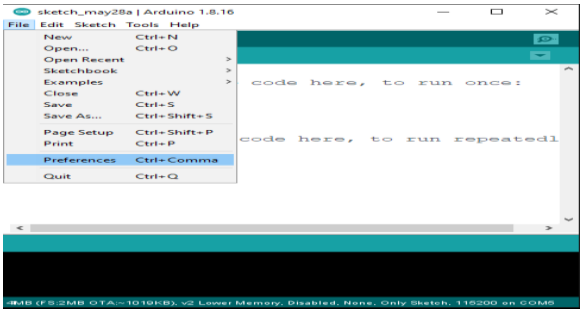

Figure 6. File Ribbon Tab on Arduino IDE

In the Preferences menu there are Additional Board Manager URLs settings. From the preference dialog box, fill in the URL for Package ESP8266 which contains http://arduino.esp8266.com/stable/package_esp8266com_index.json and then select the OK button in the lower right corner as shown in figure 7.

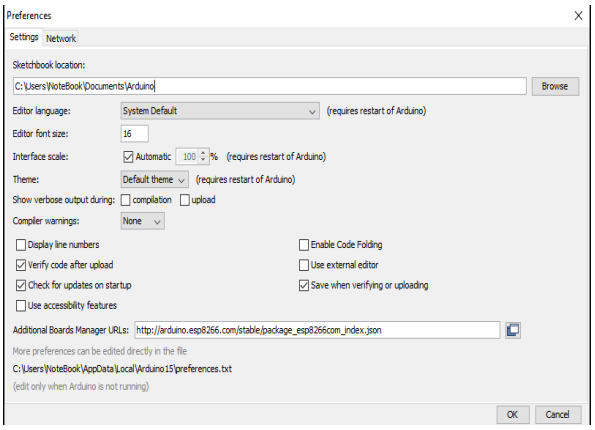

Figure 7. Preferences tab

After installing the ESP8266 into the Arduino IDE, the next step is to install the libraries needed in this project, the libraries needed in this project are the WiFi libraries. The WiFi library is used to enable network connections (local and Internet), with this library the ESP8266 can be used to create servers, clients, and send/receive UDP packets over WiFi, IP addresses can be assigned statically or via DHCP, the library can also manage DNS. The way to install the library is by opening the Arduino IDE and then opening Tools -> Manage Libraries as shown in Figure 8.

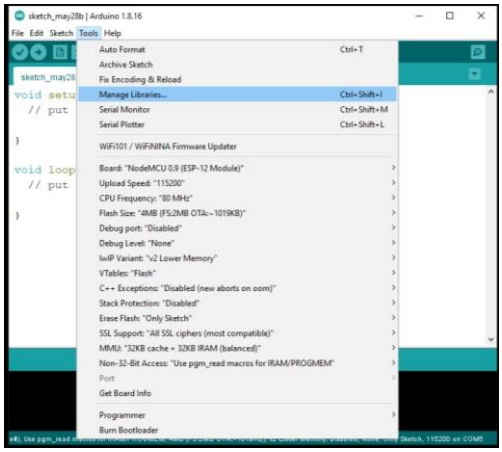

Figure 8. Ribbon Tools tab on Arduino IDE

In manage libraries, type wifi, several libraries related to WiFi will appear, look for the library called WiFi and click the install button, after waiting a few seconds the WiFi library will be installed. The results are shown in Figure 9.

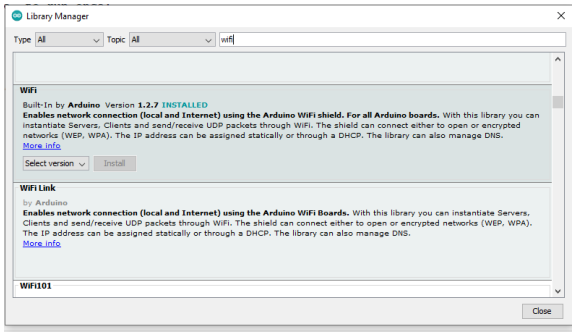

Figure 9. Library tab

After the IDE is installed and the required libraries are met, the next step is system coding. Here is the required code.

```
#define BLYNK_PRINT Serial //Pendeklarasian Library
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

char auth[] ="RsS8dodY-6oK8jcSIF5ueBlh0H-TGt29"; // masukkan kode autentikasi disini
char ssid[] = "ABCDEFG"; //nama wifi
char pass[] = "1234567"; //password
int buzzer = D2; // Pemilihan Pin dan pendeklarasian variabel
int smokeA0 = A0;
const int kipas = D3;
int sensorThres = 400;
void setup() { //Pengaturan Pin dan Variabel
  pinMode(buzzer, OUTPUT);
  pinMode(smokeA0, INPUT);
  pinMode(kipas, OUTPUT);

  digitalWrite(kipas, HIGH);
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
}

void loop() {  //Perulangan Program
  int analogSensor = analogRead(smokeA0); //Pembacaan Sensor
  Serial.print("Pin A0: ");
  Serial.println(analogSensor);
  if (analogSensor > sensorThres)
```

```
{
  tone(buzzer, 1000, 200);
  digitalWrite(kipas, LOW);
  Serial.print("Alert: Gas Bocor ");
  Blynk.notify("Alert: Gas Bocor");
}
else
{
 digitalWrite(kipas, HIGH);
  noTone(buzzer);
}
delay(100);
Blynk.run();
    }
```

After the coding process is complete, the next step is to connect the USB cable on the ESP8266 to the computer. If the cable has been connected, all you have to do is activate the Upload button and wait for the system to finish uploading. The result is as in Figure 10.

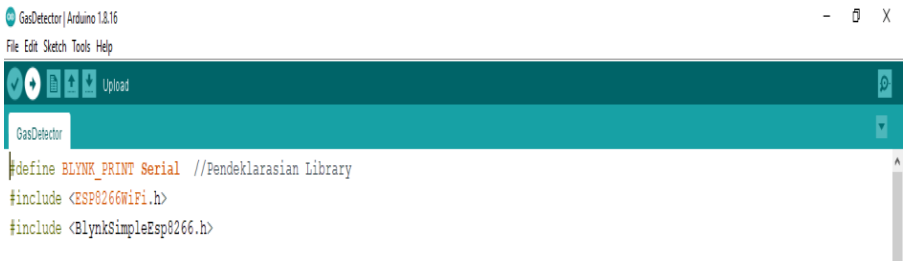

Figure 10. Upload Process

3.5. System Design

The block diagram above aims to explain the flow of how the hardware runs. The MQ-2 sensor functions to detect gas, while the buzzer and fan serve as a warning. The buzzer is used as a sound warning while the fan is used to anticipate the gas that has accumulated somewhere. ESP8266 functions for controllers or microcontrollers from other hardware. Figure 11 shows the system design flow.

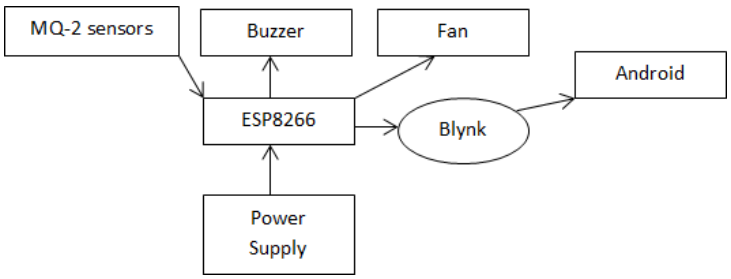

Figure 11. System Block Diagram

3.6. MQ-2 Sensor Testing

This test is carried out to determine whether the MQ-2 sensor is running well or not when used. This MQ-2 sensor pin component will be connected to the component from the Arduino pin then the Arduino is connected to electricity using a charger cable. After this tool is connected, the new sensor can be used. This sensor functions as an input or responds to gas levels coming out of the gas lighter. The results are shown as in Figure 12.

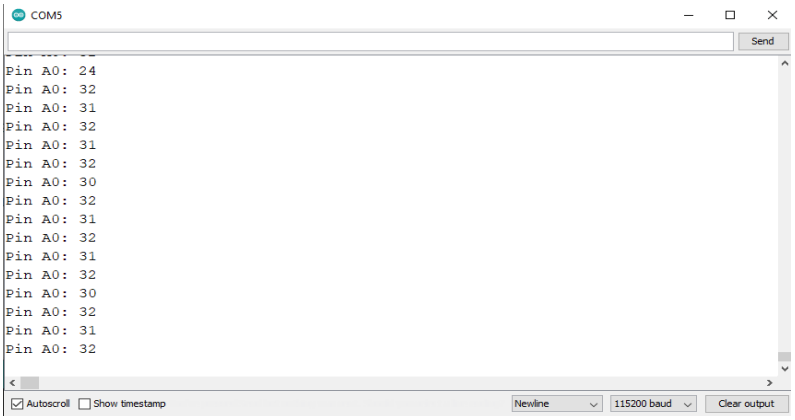

Figure 12. Gas Levels from Arduino IDE Serial Monitor

To determine the sensitivity of the MQ-2 sensor, an experiment was carried out in the form of the distance made between the gas source and the sensor, and the experiment is available in Tables 4 and 5.

Table 4. Sensor Test Results Against the First Distance

No	Distance Sensor MQ-2 with Gas (Cm)	Experiment Results		
		Gas lighter		
		1	2	3
1	5	Yes	Yes	Yes
2	10	Yes	Yes	Yes
3	20	No	No	No
4	30	No	No	No

The data listed in the table describes the MQ-2 sensor test for gas lighter leaks. From the test results it can be concluded that the MQ-2 sensor is able to properly detect gas leaks with a distance of 5-10 meters from the object.

Table 5. Sensor Test Results Against Second Distance

No	Distance Sensor MQ-2 with Gas (Cm)	Experiment Results		
		Small Gas Cylinder		
		1	2	3
1	5	Yes	Yes	Yes
2	10	Yes	Yes	Yes
3	20	Yes	Yes	Yes
4	30	No	No	No

Table 5 above describes the results of the MQ-2 sensor test to detect leaks in small gas cylinders. From the test data above, it can be concluded that the MQ-2 sensor is capable of detecting gas leaks at a distance of 5-20 meters from the object's position.

3.7. ESP8266 Testing

This test is made to ensure when the tool is turned on whether the ESP8266 module is connected to the existing wifi or not. Here the wifi used is sourced from the smartphone

hotspot. This test is carried out so that it can be seen whether the performance of the module is running properly or not. The test results on the Esp8266 module that have been carried out are presented in table 6.

Table 6. Test Results of the ESP8266 Wifi Module

No	Tool Position	Connection Results	
		Connect	Not Connect
1	Inside the house	Yes	-
2	Outdoors (5 Meters)	Yes	-

If the ESP8266 Wifi module is really connected to the internet, you can see Figure 13.

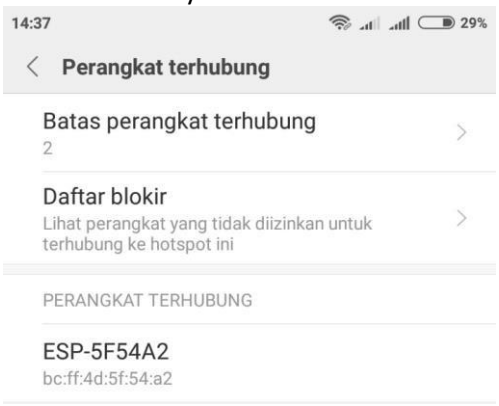

Figure 13. ESP8266 Module Connected

3.8. Blynk Connection Test on Smartphone

This test aims to prove that the application used in the form of Blynk is able to generate notifications when a gas leak exceeds the threshold. The test results of the Blynk application using two smartphones are presented in table 7

Table 7. Test Results of Blynk Connection with Smartphone

No	Gas Content (PPM)	Output Results	Information	Waiting Time (Second)		
				Test		
				1	2	3
1	Gas > 400	Notifications	Sent	6	5	5
2	Gas < 400	Notifications	Not Sent	6	5	5

The notification generated when Blynk is successful is the message: Gas Leaks. Figure 14 shows an example of a notification.

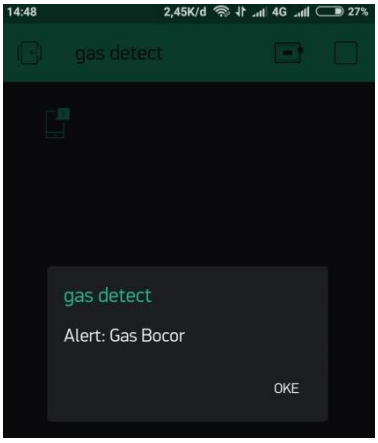

Figure 14. Notification Example

3.9. Testing On Buzzer And Fan

This test is to ensure whether the gas leak detector is running according to the instructions in the program that has been entered or not. The following are the results of testing these tools which are listed in table 8.

Table 8. Test Results on Buzzer, and Fan

No	Component	Gas Input	
		Gas > 400	Gas < 400
1	Buzzer	On	Off
2	Fan	On	Off

3.10. MQ-2 Sensor Test Analysis Results

The MQ 2 sensor is used as an input device to detect gas levels in the air. After the pins of the MQ-2 sensor are connected to the Arduino component pins, the sensor can be used for testing. If the gas content given from the gas lighter can be responded to by the MQ-2 sensor properly, the sensor will give results that can be seen on the Arduino IDE serial monitor screen display. However, if the input results given by the gas lighter and small gas cylinder are not responded to by the MQ-2 sensor, it means that there is a considerable distance between the leaking gas source and this tool. In order for this tool to detect more accurately then the placement of this tool is placed not far from the gas cylinder. Distance is an obstacle in reading the MQ-2 sensor, the maximum distance is 10 cm for gas lighters while for gas cylinders it is 30 cm, if it exceeds the distance that has been tested then gas will not be detected.

3.11. ESP8266 Module Test Analysis Results

This module also has an important function in the design project of an Arduino microcontroller-based gas leak detector. This module functions as an intermediary to connect one device to another using wireless. The wifi network used comes from a smartphone hotspot. The tool to be connected is a gas leak detector in the form of a pin component on the Arduino which is connected to a pin component on the MQ-2 sensor and the ESP8266 Module. The input results that are responded to by the MQ-2 sensor can be sent to the owner's smartphone in the form of notifications from the blynk application. This module is affected by the existing wifi signal. If the signal provided is not good or interrupted, the delivery may fail due to the device not being connected to an existing wifi device or hotspot. Before activating this tool the wifi signal must be active.

3.12. Buzzer and Fan Test Analysis Results

The buzzer and fan testing here is to provide output results as a form of response when the tool is placed where the gas cylinder is installed. The pin components on the buzzer and fan will be connected to the Arduino pin components and the program will be entered as desired. If the components have been installed, then when turned on the tool can already respond to the situation around it. In the situation where no gas leak is detected, the buzzer and fan are not turned on. Conversely, if there is a gas leak that exceeds the predetermined limit, the buzzer and fan response will turn on or be active. The function or response of the buzzer itself is in the form of a strong sound like a siren so that the owner immediately knows if there is a gas leak. This is in a condition if the owner is not far from the room, while the response from the fan is that it immediately turns on if there is a gas leak past the predetermined threshold. The fan serves to break up the concentration of gases that are around so that they do not accumulate in one place. The fan is an early anticipation when a gas leak occurs.

4. CONCLUSION

Based on the results of testing the system and tools that have been made, it can be concluded that the system can detect gas leaks using sensors that are programmed accurately according to the specified limit, namely 400 ppm (Parts per Million) and the system can cope with gas leaks by using the fan feature lights up when a gas leak occurs.

REFERENCES

[1] Fawzi B., Kwok W.. Collaborative Internet of Things (C-IoT): for Future Smart Connected Life and Business. Wiley, 2015.

[2] Kevin A., Making sense of IoT How the Internet of Things became humanity's nervous system. Hewlett Packard, 2012

[3] Abdullah, et al. Utilization of IoT (Internet of Things) in Monitoring Smoke Concentration Levels and Camera Tracking Control. *CIRCUIT: Scientific Journal of Electrical Engineering Education.* 2021. Vol.5, No.1, p. 86-92.

[4] Fredy S, et al. Implementation of the Internet of Things in Daily Life. *Imagine Journal.* 2022. Vol. 2 No 1. P. 35-40.

[5] Seri M, Ansarullah L., Development of the Internet of Things Technology System that Indonesia Needs to Develop. 2021. *JIEET:(Journal Information Engineering and Educational Technology).* 2021. Vol 05 No 01, p. 19-26.

[6] Dani S, Yanuar A.W., Implementation of the Internet of Things (IoT) on Infusion Monitoring Using Esp 8266 and the Web for Data Sharing. *Scientific Journal of Informatics*. 2017. Vol 2 No. 1. p. 90-98.

[7] Bonifacius V.I,et al. *Automatic Lock Control System on Automatic Motors Using an Android-Based Microcontroller*. National Seminar on Applied Technology Innovation and Development. Cilacap. 2022.

[8] Erwan E.P. Internet Of Things (IoT) Applications For Monitoring And Controlling Electrical Loads In The Room. *Technical Journal.* 2017. Vol. 4 no. 2. p. 28-39

[9] Danang A.M, Nurfiana. Internet Of Things (IoT) Based Essential Storage Monitoring System. *Explore – Journal of Information Systems and Telematics*. 2018. Vol.9 no. 1 p. 88-98.

[10] Muhammad A. Educational Research Methodology and Applications. Jakarta : Bumi Aksara, 2014

[11] Sugiono, Quantitative, Qualitative and R&D research methods.Bandung:Alfabeta, 2016.
[12] Hafid H. Internet of Things Concept in Web-Based Learning. Journal of Informatics Dynamics. 2017. Vol. 6, No. 1. p. 87-97.
[13] Nasruddin S. Android-Based Smartphone and Tablet PC Application Programming. Bandung, PT Elex Media Komputindo, 2014.
[14] Marina A., Aidah NR. Smart Home Node Mcu Iot App For Blynk. *Nusa Putra Technological Engineering Journal*. 2020. Vol. 7, No. 1, p. 1-7
[15] Fina S, Eka J.S. Design and Build Iot Temperature Controller For Bts Enclosure Based On Wemos And Android Microcontroller. *Journal of Electrical Technology, Mercu Buana University*. 2017. Vol. 8 No. 2 p. 145-150