



LPG GAS LEAKING DETECTOR USING ARDUINO FOR HOUSEHOLD APPLICATION

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ABSTRACT

Nowadays people are busy with work for full fill our daily life hence we forget to care about the small matters in our living area, especially in the kitchen household such as Liquefied Petroleum Gas (LPG) stove. Leaking of LPG can happen without we notice that when the LPG has some or small leakage either from the rubber tubing, faulty regulator fitting, and poor handling of gas appliances that can affect to the house or risk the life of the living persons in the house. Besides that, this gas is colorless and odorless which makes us not notice it. The main objective of this project is to study the operation of Arduino and GSM modules on LPG detectors. Other than that, to develop a programming software system for Arduino. This System design consists of two main modules: detection and transmission module, and receiver module. Detection and the transmission module detect gas changes in concentration using special sensing circuits built for this aim. This module checks for changes in concentration gas has exceeded a predetermined limit and the receiving module functions as a cellular alarm device to allow it mobility in the house. This project is focusing on the product that will be created and the effectiveness of the product on the household application. This project had achieved the objective that has been stated and it is successfully functioning.

Keywords: LPG detector, arduino, gas appliances, gas transmission.

INTRODUCTION

LPG use widely by households, especially for cooking. According to E Fatkiyah [4], LPG plays an important role in the needs of society now with the use of LPG kerosene which was very high, and even in 2017 land is very rarely used. This statement was also further strengthened by a quote from Republika.co.id (2018) [8] mentioned "Consumption of LPG in Indonesia has increased. In 2007 only around one million metric tons per year almost reached 7 million metric tons in 2016. The figure grew by 700 percent for nine years. Pertamina's Deputy President Director Ahmad Bambang said the increase in LPG consumption was due to the program to convert BBM to LPG conducted by the government for household needs since 2007 and for fishing boat engines which are carried out starting in 2016, the plan will be continued in 2017". Bruce N [2] stated that LPG is widely available across geographical regions of sub-Saharan Africa, although with limited use in many countries, and is an efficient and safe cooking fuel with the potential to deliver benefits for health, climate, environment, and development. All statements are also supported by research done by [7] which stated that domestic LPG consumption is high as 90% in the Brazilian, Egyptian, and Arab republics and above 30% in the Philippines and China. In India, the percentage of households using LPG for cooking purposes is 26.9 percent, but the Kumar et al. study shows that the number of households using LPG in Delhi is now almost 70 percent, and this percentage is

increasing every year. In addition, LPG gas burns cleanly and is less environmentally harmful also LPG gas burns cleanly and is less environmentally harmful.

Since LPG is very useful for households, sometimes it will cause people to be less careful and careless in handling it. According to [9], carelessness in handling it will cause a big life threat. This is also supported by an article written by ABS-CBN News [1] which stated that 2017 from January to June last 2017, the BFP recorded a total of 2,522 fire incidents. It was traced that LPG is one of the major causes of fire during that year where half of the total which is 1,253 besides the electrical causes.

To avoid this happening repeatedly and worse, the researchers are advised and interested to come out with this project. This project purposed to detect the leakage of LPG using an Arduino detector. This project shows a safety device for the detection of gas leakage. This device is intended for use in the home as a safety equipment device and heater that can be a source of risk for LPG. The system too can be used for other applications in industry or factories that depend on LPG in their operations.

Based on the title LPG Gas Leaking Detector Using Arduino for House Application the objectives that will be achieved at the end of this project are: (1.) To study the operation of Arduino and GSM module to LPG detector. (2.) To develop a programming software system for Arduino. and (3.) To identify the overall effectiveness of the purpose system in LPG.



METHODOLOGY

The flowchart is arranged so that it does not deviate from the path that has been made to ensure the project runs smoothly. First is identifying the scope and objectives of both projects. Next, we learn from the system that requires to be used about literature review followed by hardware and software research. Then there will be the development of software (Arduino IDE & Android) and hardware (Arduino UNO and GSM) as shown in Figure-1.

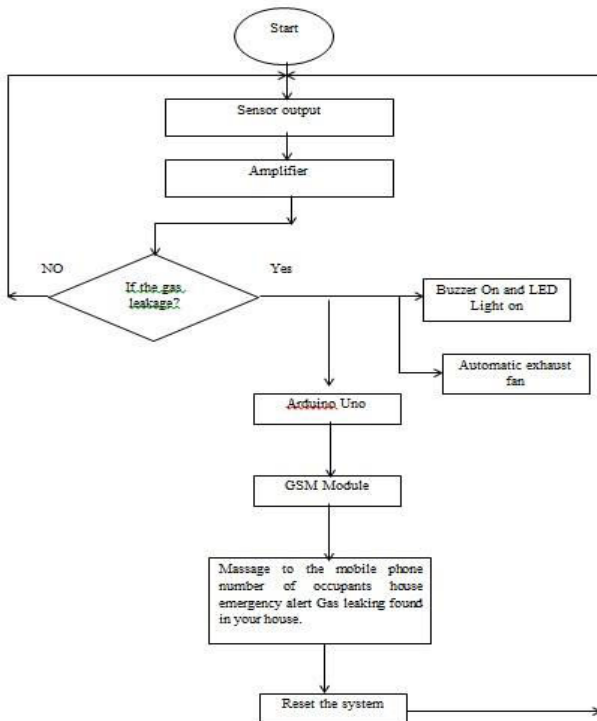


Figure-1. Project flow chart for overall process system.

A. Hardware Selection

This part will discuss this project briefly, which reveals the knowledge gained from reference books, journals, articles, newspapers, and websites that contain applications, research work, and related theories through sources. Knowledge gained and studied about Arduino, GSM, SMS-related search, programming language, Android, hardware, and technology requirements.

B. Arduino UNO

For early Arduino, the UNO is a great choice because it consists of a 14-digit Input/output (I/O) pin in which 6 pins can be used as PWM which is the Pulse Width Modulation output. While Arduino also has 6 analog inputs, reset buttons, power jacks, USB, and more. Arduino Uno includes all that the microcontroller needs to hold. With the help of a USB cable, we can attach the Arduino Uno board to the PC and supply to start the AC-to-DC adapter.



Figure-2. Arduino UNO board.

C. Global Mobile Communications System (GSM)

According to [3], GSM represents the Global Mobile Communications System. GSM Modem is a special type of modem that receives SIM cards just like mobile phones and operates via mobile operator subscription. GSM modems look like mobile phones from the perspective of a mobile operator. According to [9] the source of the International Journal of Computer Science and Information Technology, GSM (Global Mobile Communication System) technology is used to communicate the input signal from the device to the device's output message. That means sending the appropriate message to the house owner's phone after detecting any GSM modem intrusion. GSM module digitizes the signals or data from sensors or other equipment and sends it to a receiver.



Figure-3. GSM modem.

D. Mq-6 LPG Gas Sensor

LPG gas sensors are one type of device used to perceive the presence of harmful LPG gas leaks at service stations, cars, storage tanks, and homes. This sensor is installed on the alarm circuit to alert the operator through the buzzer sound in the area where the gas leak occurs. Based on the article written [5] and [6], stated that the type of sensor is according to the situation and type of uses for this project the M6 is suitable to use because it is specific to isobutene, propane, and LPG uses.



Figure-4. Mq-6 LPG Gas sensor.

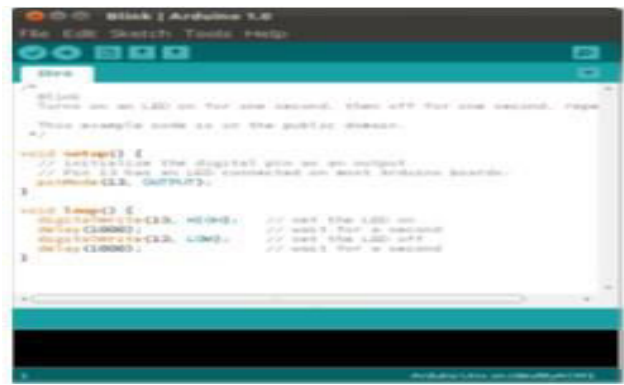


Figure-6. Arduino software IDE.

E. Piezoelectric Buzzer Alarm

A sound-producing transducer is a piezoelectric buzzer or tone generator. It is small, lightweight, and compact, but even with the smallest energy input, it can produce high sound. The way the bell works is quite simple. A thin piezoelectric ceramic material is adapted into a metal-thin diaphragm. Piezo material starts vibrating at the same frequency as the voltage given when applying constants or repetitive voltage and thus creates sound.



Figure-5. Piezoelectric buzzer alarm.

F. Arduino Software IDE

Arduino IDE software is an Arduino open-source software to write and upload code to the board. Then executed on the chip after uploading the code. In this microcontroller, programming languages C and C++ are used. Act as a platform for Arduino controllers to set up coding. Two functions of this software are setup and loop. When the sketch starts after power or resumes, the setup is called. It is used to initialize variables, pin modes for input and output, and other libraries in sketches required. The loop function will be repeated in the main program repeatedly after setup is called. Until the board is turned off or reset, it controls the board. Windows, Mac OSx, and Linux can run this software. In view of other open-source processing and programming, the Earth comes in the form of Java.

RESULT AND DISCUSSIONS

A. Data Collection

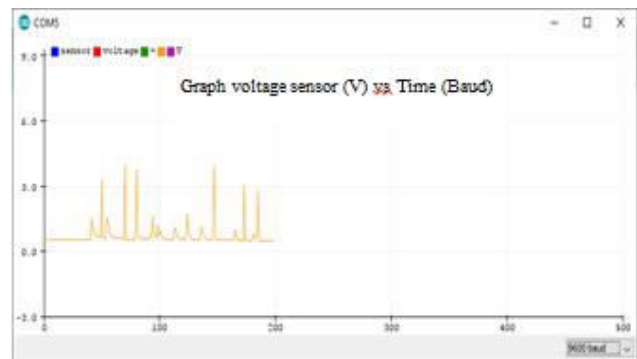


Figure-7. Graph voltage sensor (V) Vs time (Baud).

From the graph, in Figure-7 the voltage versus time, from which the standard voltage for the gas sensor mq6 is below 0.68 volts and the graph shows a uniformly reading, but when the LPG leakage is detected, it is dramatically increased and the higher voltage can be reached above 4.0 volt after the gas sensor is gradually lowered after the situation is normal and the average below 0.68 volts.

Table-1. LED Lights ON.

Gas Sensor Voltage	Led light ON
Below 0.68 volt	NO
Over 2.00 volt	YES

Table-2. Buzzer sound ON.

Gas Sensor Voltage	Buzzer Sound ON
Below 0.68 volt	NO
Over 2.00 volt	YES

**Table-3.** Exhaust fan moving.

Gas Sensor Voltage	Buzzer Sound ON
Below 0.68 volt	NO
Over 2.00 volt	YES

Table-4. GSM sending SMS.

Gas Sensor Voltage	Buzzer Sound ON
Below 0.68 volt	NO
Over 2.00 volt	YES

CONCLUSIONS

As mentioned previously, the main objective of this project is to study the operation of Arduino and GSM modules to LPG detectors. As the result gained, the table shows that the voltage normal for the gas sensor mq6 is below 0.68 which is the normal reading for the gas voltage which there is no LPG leakage but when it detects the gas leakage, the voltage gas sensor of mq6 become higher or more than 2.00 v the Arduino will send information or instruction to the GSM module that has been set up the coding by using IDE software to send an SMS warning alert to the occupant in that house. Besides that, the buzzer and LED light will sound and light on. The automatic exhaust fan is a ventilation for blowing the gas leaking to the outside house when the voltage of the gas sensor is less the automatic fan will stop automatically because it has been set up below 0.68 the fan will not move but when the voltage above 2.00v the fan will move.

Besides that, it also achieved to develop a programming software system for Arduino by using IDE software where this software is specific for coding for Arduino. This development consists of part by part of the components that will be tested. After successfully testing parts they will combine together in Arduino and it will test for this hardware in a real situation before it becomes a successful hardware project.

Last but not least, this project hardware is to identify the overall effectiveness of the purpose system in LPG where we can see from the objective achieved that although it takes a several time for the gas sensor detect the LPG leaking but the gas sensor successfully detected and give good feedback based on the coding that has been set up in the Arduino UNO. The results can see in the graph stated in Figure 7, where this graph shows the voltage versus time taken to detect the gas leakage and this will help the researcher to take the data.

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