

“LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm”

Rhommel S. Paculanan, Israel Carino

Abstract: LPG leakages are a mutual hindrance in household and manufacturing nowadays. It is very life threatening if you will not distinguish and modified right away. The idea behind our project is to give a solution by power cut the gas provision as soon as a gas leakage is perceived apart from activating the sounding alarm. In addition to this, the authorized person will receive a message informing him about the leakage

With the increase of natural gas productions in the last 10 years: Philippines gas industry has really taken its toll. However, the Bureau of Fire Protection prompted the society to yield preventive and security measures against defective electrical cabling and dissolved petroleum gas leaks regardless of fire alarming incidents in the first half of 2017.

I. INTRODUCTION

According to ABS-CBN news 2017 that from January to June last 2017, the BFP has recorded a total of 2,522 fire incidents. It was traced that LPG is one of the major cause of fire during that year where half of the total which is 1,253 beside from the electrical causes. " <https://news.abs-cbn.com/business/01/12/17/doi-to-cancel-scc-of-pasig-lpg-refilling-plant>

More than the lifetime Arduino has been a reason that thousands of projects from everyday bodies to complicated scientific mechanism. Worldwide societies of scholars, performers, programmers, and specialists have assembled around this open-source program. Their knowledge about the said matter contributions a lot to help the society in this subject area.

The project entitled “LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm”, will be a great help in terms of preventing any danger caused by gas leakage.

The purpose of this project is to detect the presence of LPG leakage as a part of a safety system. Apart from sound alarm, an SMS alert will inform the authorized person and the solenoid valve will be triggered to shut down the gas supply to prevent any harmful effects due to gas leakage.

Descriptively, we use a gas sensor to monitor the LPG if the gas leak reaches beyond the normal level. This proposed project will trigger the sound alarm. In addition, the authorized person will be informed about the leakage via SMS alert and the gas supply will be automatically shut down. The people can be saved from a potential explosion caused by gas leakage.

II. OBJECTIVES

General Objective

To layout and acquire a project “LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm”

Specific Objective

To layout and acquire project that will perceive gas outflow like Methane leak, Butane leak, and LPG leak, Methane outflow or any such petroleum centered on gaseous substance that can be discovered using MQ5 device (2) to layout and set up an SMS centered Alert method send SMS alert missives to restrict mobile number enter inside the Arduino program. (3) to layout and acquire a project that will fabricate a sound alarm during gas outflow and rest the alarm once gas outflow is regulated (4) show status in an LCD using a 16×2 LCD component and to rest the gas supply using Solenoid controller.

III. SCOPE AND LIMITATION

Scope are (1) notices Methane leak, Butane leak, and LPG leak, or any such petroleum centered gaseous material, (2) Generate Sound Alarm when gas outflow is noticed, (3) Transmit SMS Alert to consent person, (4) Displaying gas outflow status that signifies if the gas is in normal stage or not, (5) Automatic closure of gas source using solenoid controller .

Limitation are portable gas cooktop cannot be organized this proposed project.

And LPG hand wheel cannot be controlled in this proposed project.

IV. METHODOLOGY AND TECHNICAL BACKGROUND

4.1 System Methodology

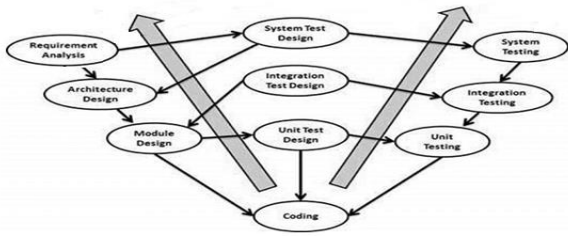
V model

The V-model technique was used to acquire the project. This technique is very easy to apprehend and utilize. The simplicity of this technique also makes it simpler to accomplish. The V-Model is based on the relationship of a testing stage for each corresponding improvement level. This means that for every single segment in the improvement drive, there is a directly correlated testing phase. This is a highly-restricted model and the next stage starts only after the end of the previous phase.

Revised Manuscript Received on April 15, 2019.

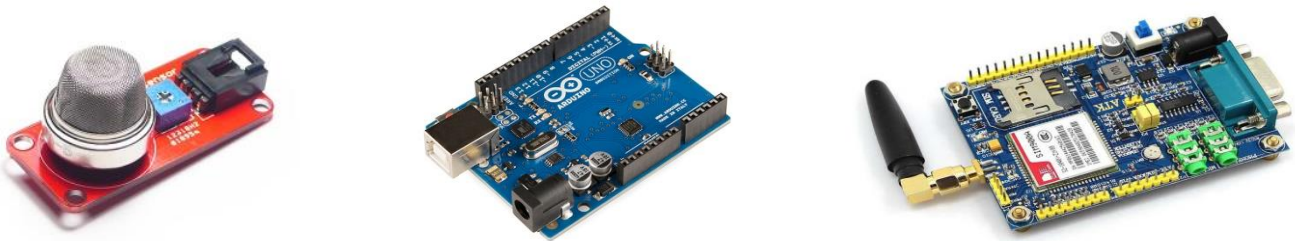
Rhommel S. Paculanan, Professor, University of Makati (Email: rhommel.paculanan@umak.edu.ph)

Israel Carino, Professor, Jose Rizal University (Email: israel.carino@jru.edu.ph)



4.1.1 Requirement Analysis

On this phase, the hardware requirement used in the project was discussed.



c) The actual writing of code in the system modules suggested in the design stage is taken up in the coding stage. The use of C++ programming language centered on the system and architectural obligations. The coding is presented based on the coding procedure and paradigms. The code goes through several code checks and is optimized for best execution before the final build is proved into the repository.

d) The Arduino IDE is a cross-program application created in Java and is originate from IDE for the deal with a programming language and the wiring project. It is proposed to establish programming to a performer and other new users unfamiliar with software enhancement. It includes code editor with feature such us syntax importance, automatic indentation, brace matching, and is also qualified of compiling and uploading a package to the board with a specific click.

a) The Arduino Software which is an open source (IDE) makes it simple to create code and upload it to the Arduino Uno board. It also needs a GSM module for the purpose of SMS alert, Buzzer or speaker for sound alarm, LCD module, and display, and Single relay to a triggered Solenoid valve for gas supply manipulation.

b) The Arduino Uno is the microcontroller chip that is responsible for all function of our proposed project. It functions as the brain of this system. The microcontroller chip used is Arduino Uno manufactured by Arduino. The chip works to control the hardware and the interface with the transmitter part.

4.1.2 Validation Phases

The unusual Validation Stages in a V-Model are explained in detail below.

Unit Testing

Unit tests intended in the module model are accomplished on the code during this validation phase. Unit testing is the assessment of code level and it helps eradicate bugs at an early stage, though all deficient cannot be exposed by unit testing.

Integration Testing

Integration testing is connected with the architectural design stage. Integration tests are accomplished to test the existence and transmission of the internal components within the system.

```

aw
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

int yellowLed = 8;
int redLed = 9;
int buzzer = 10;
const int pin = 7;
// Your threshold value
int analogSensor;

void setup() {
  pinMode(redLed, OUTPUT);
  pinMode(yellowLed, OUTPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(pin, INPUT);
  Serial.begin(9600);
  lcd.begin(16, 2);
  delay(500);
}

void loop() {
  analogSensor = analogRead(pin);
  Serial.println(analogSensor);

  if (analogSensor > 400 )
  
```

```

tone(buzzer, 2000, 400);
lcd.print("ALERT!! LPG LEAK");
digitalWrite(redLed, LOW);
digitalWrite(yellowLed, HIGH);
lcd.setCursor(0,1);
lcd.print("LPG VALUE =");
lcd.print(analogSensor);

delay(2000);
lcd.clear();
delay(500);
}
else
{
  digitalWrite(buzzer, LOW);
  digitalWrite(redLed, HIGH);
  digitalWrite(yellowLed, LOW);
  lcd.print(" NO LPG LEAK");
  delay(2000);
  lcd.clear();
}
delay(500);
}

```

Done uploading

Sketch uses 4164 bytes (12%) of program storage space. Maximum is Global variables use 289 bytes (14%) of dynamic memory, leaving 17

32 Arduino/Genuino Uno on COM4

The figure shows the Circuit Diagram of our proposed project “LPG Leakage Detector Using Arduino with SMS alert And Sound Alarm”.

System Testing

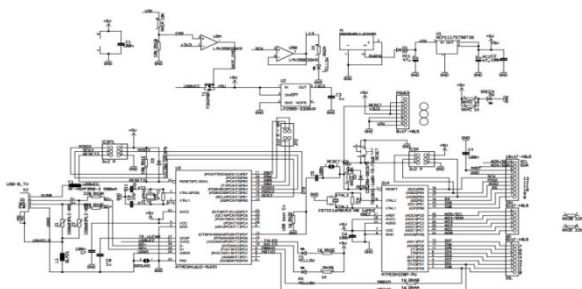
System testing is openly related to the system design phase. System tests inspection the entire system ability and the transmission of the system under improvement with external systems. The issue can be uncovered during test execution by using the software’s and hardware’s compatibility.



The figure shows the Project during test execution.

4.1.3 Architectural Design

The architectural requirement is comprehended and planned in this phase. Usually, more than one specialized approach is recommended and based on the specialized and financial feasibility when the final evaluation is taken. The system layout is broken down supplementary modules taking up another functionality. This is also denoted to as High-Level Design (HLD)



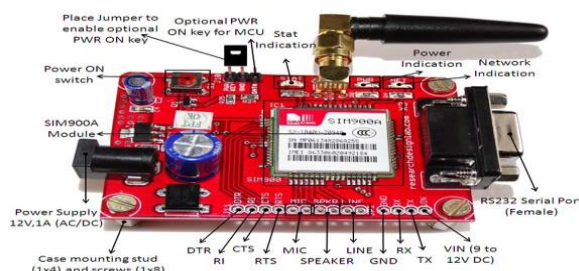
Detail parts of MQ2Sensor board

4.1.4 Module Design

In this phase, the specified internal project design for all the system modules is stipulated, referred to as Low-Level Design (LLD). It is important that the project design is harmonious with the other modules in the scheme architecture and the other external scheme. The unit tests are an important part of any improvement process and help eliminate the maximum mistakes at a very early period. These unit tests can be planned at this stage established on the internal module project designs..

4.1.5 A microcontroller board based on the ATmega328P is cord for datasheet or control with an AC-to-DC adapter or battery to get power on called as Arduino Uno . You can tinker with your UNO without disturbing too much about burden something erroneous. It has 14 digital enter/display pins (of which 6 can be used as PWM outputs), 6 analog enter, a 16 MHz quartz sparkler, a USB assembly, a power jack, an ICSP header, and a reset switch. It supports the

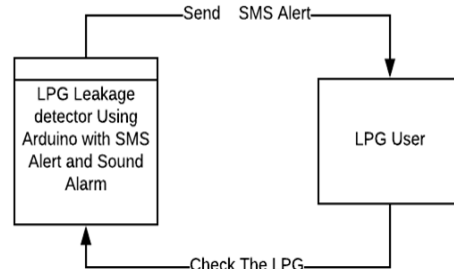
microcontroller by any means, simply attaches it to a computer with a USB.



ArArduino Uno

V. SYSTEM DESIGN (DATA FLOW DIAGRAM)

After the complete design of the project thru the clear and detailed needed components, the design will have the complete comprehensive and allocating the components and communication setup for the hardware and software under the design plan development.



Data Flow Diagram of “LPG Leakage Detector using Arduino and GSM Module with SMS Alert and Sound Alarm”.

VI. STATISTICAL TREATMENT

(1) Weighted mean (2) Five – Point Scale (3) Likert Scale and the (4) Criteria Evaluation (ISO)

The project used to survey and evaluation method for descriptive research methodology.

In the analysis and interpretation of data, We used the following statistical tools:

Weighted mean – an indicator of perception of the respondents described.

The weighted mean formula is: $WM = w(f) / n$

Five-Point Scale – a device psychological measurement that used to measure to gauge values, attitude, and opinions.

Likert Scale - is a tool for psychometric measure for questionnaires in research involvement ISO 9126

It is an international standard for the evaluation of software. The following subject such as the quality model; external metrics; internal metrics; and quality in use metrics are the 4 parts of the evaluation software standard.



The ISO 9126-1 part one referred to as ISO 9126-1 is an annex of a preceding job done by McCall (1977), Boehm (1978), FURPS and others in supporting a set of software quality personalities.

Functionality, Efficiency, Usability, Reliability, Maintainability, and Portability are the six (6) main quality characteristics of the ISO 9126-1 software quality model and 5 was used in the said project where Portability is not included.

VII. SYSTEM REQUIREMENTS (HARDWARE AND SOFTWARE)

Hardware Requirements are Arduino Uno, MQ5 sensor, GSM module, 16x2 LCD module, Solenoid, Valve, Single relay, PC, Intel Core I7,8GB RAM

Software Requirements is ARDUINO Compiler (IDE) - The open-source Arduino Software (IDE) that creates a simple code to write and upload it to the panel. It runs on Linux, Mac OS X, and Windows. Nature is written in Java and founded on managing and other open-source software.

VIII. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

8.1 Respondent of the study

Classification of Respondents for the survey

The survey conducted has a total of 75 respondents, 42 of the respondents are household ages 20 to 50 years old and 33 are employees ages 20 to 50 years old.

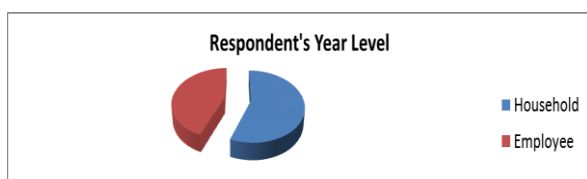
Respondents	Frequency
Household	42
Employee	33
Total	75

Distribution frequency for Survey

Figure shows the respondents of the conducted survey are the household and employees. The respondents are chosen based on their involvement in "LPG Leakage Detector Using Arduino with SMS Alert and Sound Alarm".

Graph for the distribution of the survey

Figure shows that 56% are household and 44% are employees, the total of 100%. All the respondents are chosen based on their involvement in "LPG Leakage Detector Using Arduino with SMS Alert and Sound Alarm".



Summary of evaluation

8.2 Analysis and Interpretation of Data

After counting the number of rating for each criterion, the proponents computed the average rating of each criterion using the weighted mean formula. The proponent's computation for each criterion can be seen on the table below:

Criteria	Average	Verbal interpretation
Functionality	4.84	Excellent
Usability	4.82	Excellent
Reliability	4.48	Very Satisfactory
Efficiency	4.7	Excellent
Relevance	4.8	Excellent
Result	4.73	Excellent

Summary Result of Evaluation of the proposed Project

Figure shows each of the criterions with their corresponding averages computed by the proponents and their respective verbal interpretation.

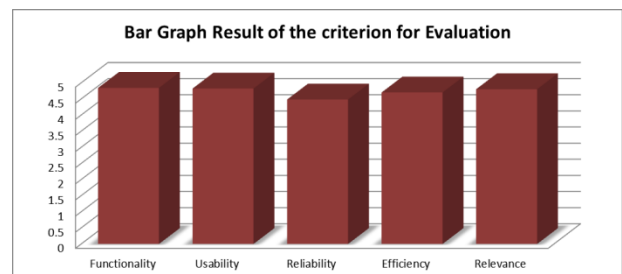


Figure shows the bar graph of all criterions. The rating excellent averaged of functionality is 4.84 while the rating excellent averaged of Usability is 4.82 and the rating excellent averaged of Reliability is 4.48 and the rating Very Satisfactory averaged of Efficiency is 4.7. And the rating excellent averaged of relevance is 4.8.

8. Summary of Findings, Conclusion, and Recommendation

The researchers sought to answer the following questions:

1. What is the profile of the respondents in terms of type of user?

LPG users

2. How do the respondents perceive the satisfactory of "LPG Leakage Detector Using Arduino with SMS Alert and Sound Alarm" in terms of the following criteria evaluation: Functionality, Efficiency, Usability, Reliability, and Maintainability

9. Summary of Findings

Based on the analysis of interpretation of data shown in Chapter 4, the following are the summarized findings:

The profile of respondents.

Based on the data presentation 100% of the respondents are using LPG.

Perception of the respondents usability of the developed “LPG Leakage Detector Using Arduino With SMS Alert and Sound Alarm” in terms of following criteria:

Functionality

The result shows the respondents agreed with interpretation that the prototype device is excellent and having a weighted mean of **4.84**.

Usability

The result shows the respondents agreed with interpretation that the prototype device is excellent and having a weighted mean of **4.82**.

Reliability

The result shows the respondents agreed with interpretation that the prototype device is Very Satisfactory and having a weighted mean of **4.48**.

Efficiency

The result shows the respondents agreed with interpretation that the prototype device is excellent and having a weighted mean of **4.7**.

Relevance

The result shows the respondents agreed with interpretation that the prototype device is excellent and having a weighted mean of **4.8**.

IX. CONCLUSION

After all the data had been gathered, analyzed and processed, the proponents arrived at the succeeding conclusion.

Therefore, the researchers concluded that the “LPG Leakage Detector Using Arduino with SMS Alert and Sound Alarm” will help a lot in terms of preventing any danger caused by gas leakage and useful as part of safety to avoid the gas leak that can cause harmful result. It will also improve the safety of all users of Liquefied Petroleum Gas.

X. RECOMMENDATION

Based on the conclusion of the research, the proponents formulated several recommendations for the study. The group would like to recommend to the future researchers that they continue to develop this prototype device to find a way to include the manipulation of LPG tank hand wheel and anything that will help to the proposed project.

REFERENCES:

1. https://www.researchgate.net/publication/319622819_GSM_based_Gas_Leakage_Detection_System
2. https://www.researchgate.net/publication/257555821_LP_GAS_LEAKAGE_ALARM

3. <https://www.researchtrend.net/ijet/pdf/24-S-807.pdf>
4. <http://www.eltsensor.co.kr/en/>
5. <https://ieeexplore.ieee.org/document/5752053/>
6. <https://ieeexplore.ieee.org/document/7877671/>
7. <https://www.computer.org/csdl/proceedings/iacc/2017/1560/0/07976812.pdf>
8. <https://www.computer.org/csdl/proceedings/iacc/2017/1560/0/07976812.pdf>
9. https://www.ijerst.com/ijerstadmin/upload/IJEETC_537b239a7d98d.pdf
10. https://www.researchgate.net/publication/231182479_Bluetooth_based_home_automation_system_using_cell_phone
11. <https://www.engineersgarage.com/contribution/microcontroller-based-lpg-gas-detector-using-gsm-module>