BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

LUEQUEFIED PETROLEUM GAS LEAKAGE MONITORING AND CONTROL SYSTEM

BY

KAMUKAMA JAVAN

REG.NO:BU/UG/2012/1796

TEL: +256-78166872/700814542

EMAIL:kamujavan@gmail.com

SUPERVISED BY

MR.ALUNYU ANDREW EGWAR

Aproject report submitted to the department of computer engineering in partial fulfilment of the required for the award of a bachelor's degree in computer engineering of busitema university

JUNE, 2016

DECLARATION

I, KAMUKAMA JAVAN , registration number BU/UG/2012/1796 do hereby declare this Project entitled liquefied petroleum gas leakage monitoring and control system

as my original work except where explicit citations has been made and that it has never been submitted to any Institution of higher learning for academic award.

Signed: ..... Date: .....

Kamukama Javan

APPROVAL

This is to certify that the Project Report entitled liquefied petroleum gas leakage monitoring and control system has been done under my supervision and is hereby being submitted for examination with my recommendation.

Signed: ..... Date: .....

Mr.Alunyu Andrew Egwar

Lecturer, Department of Computer Engineering

Faculty of Engineering, Busitema University

DEDICATION

I dedicate this project report to my beloved parents Mr kanyontore Eliphaz and Mrs jadress kanyontore for the love and support they have provided to me throught this project period, my Brother Nturanabo Abert and Odongo Fabius for the advice and financial support they rendered to me during the research period.

I also dedicate it to my project supervisor Mr. Alunyu Andrew Egwar for his tremendous effort and guidance in relation to my project report , the courage, and the moral & support he offered to me during my research period MAY the almighty GOD BLESS him.

ACKNOWLEDGEMENT

My supervisor, Mr. Alunyu Andrew Egwar, has been a vital requirement in helping me to accomplish this project report. Thank you so much for the aid offered to me.

Also, I acknowledge all the other department lecturers who have always given me time for consultation regardless of whether they are my supervisors or not, thank you for the helping attitude.

Many fellow students offered help in form of advice and information and such is greatly recognized.

Special thanks my family for their never ending financial and advisory support. May God reward them abundantly.

Above all, I acknowledge the Almighty God for the gift of life, wisdom and guidance for without Him, I would not have been able to accomplish this project report.

LIST OF ACRONMY

SMS: Short Message Service

SIM: Subscriber Identification Module

GSM: Global System for Mobile computing

LPG: Liquefied Petroleum Gas

AC: Alternating Current

DC: Direct Current

ROM: Read Only Memory

RAM: Random Access Memory

ADC: Analogue Digital Conversion

LCD: Liquid Crystal Display

HEP: Hydro Electricity Power

LIST OF FIGURES

Figure4. 1 System flow chart 14
Figure4.2 Conceptual diagram 15
Figure 4.3 GSM sim 900 18
Figure 4.4 Relay switch contacts 19
Figure 4.5 Relay switch 20
Figure 4.6 Relay driver circuit 22
Figure4.7 LCD 24
Figure4.8 Circuit diagram 27
Figure 5.1ystem testing 29

LIST OF TABLES

Table 1 Flow chart Key symbols 13
Table 2 Specification of LPG sensor 17

ABSTRACT

LPG is a flammable mixture of hydrocarbon gases which is used as a source of energy for cooking in many homes in the world.in Uganda, the use of LPG is increasing due to its reliability and low cost compared to other sources of energy like HEP. However, since this gas is highly flammable, if not handled with care it can be of great danger to people's lives and property. This gas is heavier than other natural gases like air and so when it leaks; it does not easily disperse and may lead to suffocation when inhaled and explosions when its concentration in air rises beyond. The currently used LPG cylinders do not have an automated mechanism for detecting leakages and automatic control of these leakages. This has led to increase in number of home accident cases related to LPG leakages.in this system, MQ-6 gas sensor is used to detect any leakages in the horse pipe and the system automatically turns off the gas supply to the cooker so that gas wastage is minimized. This also controls the risk of explosion which can lead to fire outbreak. AGSM modem is used to notify the user about the leakage status so that the necessary actions are taken to avoid danger. This system will reduce the increasing gas leakage related accidents, save people's lives and property.

TABLE OF CONTENT

DECLARATION i
APPROVAL iii
DEDICATION iv
ACKNOWLEDGEMENT v
LIST OF ACRONMY vi
LIST OF FIGURES vii
LIST OF TABLES viii
ABSTRACT ix
CHAPTER ONE 1
INTRODUCTION 1
1.1 Background of the study 1
1.2 Problem Statement 2
1.3 Objective 2
1.3.1 Main Objectives 2
1.3.2 Specific objectives 2
1.4 Justification 2
1.5 Significance 2
1.6 Scope 3
1.6.1 Physical scope 3
1.6.2 Technical scope 3
1.6.3 Time scope 3
CHAPTER TWO 4
LITERATURE REVIEW 4
2.0 Introduction 4
2.1 Definitions, Descriptions and Concepts 4
2.1.1 LPG (liquefied petroleum Gas) 4
2.1.2 LPG leakage 5
2.2 Overview of the existing related systems 5
2.21. Embedded system for Hazardous Gas detection and Alerting 5
2.2.2 A security alert system using GSM for gas leakage 6

2.2.3 Automatic LPG booking, leakage detection and a real time LPG measurement monitoring system 7
2.3 Implemented system 7
CHAPTER THREE 8
METHODOLOGY 8
3.0 Introduction 8
3.1 System Study 8
3.1.1 Data collection methods. 8
Literature review 8
3.1.2 Data analysis 9
3.2 System analysis 9
3.3 System design 9
3.3.1 Hard ware 9
3.3.2 Software 10
3.4 System testing 10
After there was Integration testing where 10
3.5 Validation 10
CHAPTER FOUR 11
SYSTEM ANALYSIS AND DESIGN 11
4.0 Introduction 11
4.1 Functional Analysis 11
4.2 Requirements Analysis 11
4.2.1 Functional requirements 12
4.2.2 Non-functional requirements 12
4.3 System design and analysis 12
4.3.1 Hardware analysis 12
4.3.2 Software analysis 13
4.3.3 Logic design 13
4.3.4 Hardware (Physical Design) 15
4.4 Software (Logical Design) 25
4.4.1 Arduino 25
CHARPTER FIVE 28

IMPLEMENTATION AND TESTING 28
5.0 Introduction 28
5.1 Development platforms 28
5.1.1 Arduino 28
5.1.2 Proteus 29
5.2 Code design 29
5.2.1 Sample code design for a LPG leakage monitoring and control 29
5.3 The system operation 31
5.4 System Testing 31
5.5 system Verification 32
5.6 Validation of the system 32
5.7 System Evaluation 32
CHAPTER SIX 34
DISCUSSION AND RECOMMENDATIONS 34
6.0 Introduction 34
6.1 Summary of work 34
6.1.1 Choosing the project 34
6.1.2 Planning, Executing and Managing the project 34
6.1.3 Documentation 35
6.1.4 Critical analysis /appraisal of the work 35
6.2 Challenges 36
6.3 Proposals / recommendations for future work 36
6.4 Conclusion 36
LIST OF REFERENCES 37
APPENDIX 38
Appendix 1: Project code design 38
Appendix 2: circuit design 40
Appendix 3:system testing 41
Appendix4: Testing SMS sending 42

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

LPG is flammable mixture of hydrocarbon gases which is used as fuel in many applications like homes, hostel, industries, automobiles, vehicles and this is because of its desirable properties which include high calorific value, which produce the less smoke, less soot and does not cause much harm to the environment. Natural gas is another widely used fuel in homes. Both gases burns to produce clean energy, however there is a serious problem about their leakage in the air. The gases being heavier than air do not disperse easily and may lead to suffocation when inhaled also when gas leaks into the air may lead to explosion. However, the home continues to be the main site for accidents.

In Turkey, the increased usage of LPG as a cooking or heating fuel has resulted in many burn injuries from LPG mishaps. Between January 2000 and June 2011, 56 LPG-burned patients were compared with 112 flame-burned patients. There were no significant differences with respect to the mean age, sex, hospitalization time, and mortality in both groups. In the LPG-caused burn cases, 41 burns (73.2%) occurred at home, seven (12.5%) were work-related mishaps, and eight (14.3%) were associated with car accidents. The majority of the LPG burns (82%, 46 patients) resulted from a gas leak, and (18%, 10 patients) of them were related to the failure to close LPG tubes in the patients' kitchens. General awareness regarding the risk of LPG and first aid for burns appears to be lacking. Due to the explosion of LPG gas has been increased in recent years to avoid this problem there has been some system that detect and also monitor leakage of LPG by turning the alarm if the amount of gas leaking increases also sending messages to the owner to turn the gas cylinder off [***1***].

Uganda Liquefied Petroleum Gas Association estimates that gas usage among Ugandans, is at 1% because Ugandans have not yet embraced the technology. This is partly because of the fear of the gas cooker. Although there are no specific reported house fires related to the few homes that use them, one mother tells of how her son got wounded with bruises when her maid tried to light the gas cooker without instruction. She turned the knob and the whole house smelled of gas. But she was just in time to save her little son. Christine Amuge, the marketing manager of

the Oxyl Uganda Ltd says gas cylinders require a regulator which holds back the high pressure gas in the cylinder and allows a constant low pressure supply to the cooker [***2***].

1.2 Problem Statement

Gas leakage leads to various accidents resulting into financial loss as well as human injuries and this is due to badly fitted or poorly maintained gas appliances which produce a highly poisonous gas called carbon monoxide (CO) which can leak into homes. This gas we cannot see it, taste it or smell it but it can kill quickly with no warning and also cause long term problems such as brain damage. Therefore there was a need for the system that can monitor the horse pipe and turn off the gas cylinder automatically.

1.3 Objective

1.3.1 Main Objectives

To design a liquefied petroleum gas leakage monitoring and control system

1.3.2 Specific objectives

i. To review the current liquefied petroleum gas leakage monitoring and control systems.
ii. To identify and analyze the requirements needed to accomplish the development of the system.
iii. To design a liquefied petroleum gas leakage monitoring and control system.
iv. To implement the system.
v. To test and validate the system.

1.4 Justification

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in both domestic and work places. The existing systems do not handle the safety issues fully since they are able to only detect the gas leakage and send the messages to the responsible person but don't turn off the gas cylinder automatically in case there is a leakage. Thus there was a need for an automatic LPG leakage control system which will be able to turn off the gas supply in case the leakage along the horse pipe.

1.5 Significance

The proposed system will keep on monitoring the horse pipe and in case there is a leakage it will automatically turn off the gas supply.

The proposed system will automatically notify the user in form of SMS about the status of the leakage.

1.6 Scope

1.6.1 Physical scope

LPG is used in homes, hostels, industries and vehicles among others in many applications because of its desirable properties However, the proposed system shall only be used if there is any domestic gas leakage and if gas leakage exceeds certain level, this system automatically turns the gas cylinder off and also sends messages to the responsible person using a GSM module about the leakages status.

1.6.2 Technical scope

The project prototype was designed and implemented on project prototype board. The system utilized LPG sensor, Atmega328 and it operates at 5V and 12V DC. A SIMcom Technologies SIM900 modem was incorporated to enable remote monitoring of the LPG leakage status using SMS technology. The system software was written in C++ embedded high level language using arduino compiler.

1.6.3 Time scope

This project was designed and implemented in a time frame of eight months.

LIST OF REFERENCES

[1] Tarim MA, "Evaluation of burn injuries related to liquidfied petroleum gas ," *J Burn Care Res.*, 2014 May-June.

[2] Carol Natukunda. (2013, Jun 17) Death trap at home. New Vision,Sunday Vision.

[3] Dr Anitha Anchan. (2015, March,19) THE HealthSite. [Online]. www.thehealthsite.com

[4] B.Palaniappan V.Ramya, "Embedded sytem for Hazardous Gas Detection and Alerting," *International Jaournalof Distributed and parallel Sytems(IJDPS)*, vol. vol.3, p. 14, may 2012.

[5] T.SWAPWA S.RAJISHA, "A SECURITY ALERT SYSTEM USING GSM FOR GAS ," *International Journal of VLSI and Embedded Systems-IJVES*, vol. vol 3, no. issue 04, p. 3, September-october 2012.

[6] E.Kamini R.Padmapriya, "AUTOMATIC LPG BOOKING, LEAKAGE DETECTION AND A REAL ," Arunai College of Engineering,Tiruvannamalai., proposal.

[7] R.Ramos, *Requirement Engineering A good Practice guide*, 6th ed., 1997.

[8] A.shamoo, "principles of Research Data Audit," *Responsible Conduct of Research*, 2003.

[9] G.Walraven, *Basic Arrhythias*, 7th ed., 2010.

[10] Eric Haln. (2010-2015) ELGAS. [Online]. www.elgas.com.au/blog

[11] I.Juvanna,N.Meenakshi, "International Journal of Computer Science and Mobile Computing," *Research Article*, vol. III, no. 2, p. 5, Febuary 2014.

[12] Nikita Mahajan,Neha Bhosale,Mamta Khatape, "STUDY OF WEIGHT MEASUREMENT SYSTEM USING PIC MICROCONTROLLER," *International Journal of Advanced Scientific and Technical Research*, vol. iv, no. 4, p. 13, July-August 2014.

[13] Northern Illinois University, DeKalb, IL 60115, U.S.A. Faculty Development and Instructional Design Center. (2005, may) Responsible conduct in data management. [Online]. https://ori.hhs.gov/education/products/n_illinois_u/contactus.html