UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF LIQUID GAS PETROLEUM (LPG) LEAKAGE DETECTOR

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

By

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF LIQUID GAS PETROLEUM (LPG) LEAKAGE DETECTOR

Sesi Pengajian: 2019

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I hereby, declared this report entitled DEVELOPMENT OF LIQUID GAS PETROLEUM (LPG) LEAKAGE DETECTOR is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kini, terdapat beberapa kes di mana letupan berlaku disebabkan kebocoran gas di dalam rumah. Letupan bermula apabila seseorang menukar sebarang suis di dalam rumah tanpa menyedari gas memenuhi ruang di rumah mereka. Oleh itu, peranti projek ini sangat berguna dalam menghalang masalah daripada berlaku. Skop projek ini hanya dapat mengesan kebocoran Carbon Monoxide, Butana dan LPG. LPG juga merupakan jenis gas yang digunakan oleh kebanyakan pengguna untuk memasak. Mikrokontroler Arduino digunakan sebagai pengawal sistem. Sensor gas digunakan untuk mengesan kebocoran gas dan menghantar isyarat input analog kepada pengawal Arduino. Apabila isyarat melebihi tahap pencetus mikrokontroler, Arduino akan menghantar mesej peringatan kepada pengguna melalui modul GSM dan kipas ekzos akan melepaskan kebocoran gas dari kawasan yang tercemar ke udara luar untuk mengelakkan letupan berlaku. Objektif projek ini adalah untuk menghantar mesej amaran kepada pengguna apabila kebocoran gas berlaku di rumah mereka dan kipas ekzos secara automatik beroperasi untuk mengelakkan letupan akibat percikan elektrik apabila mengesan kebocoran gas.

ABSTRACT

Nowadays, there are some cases where an explosion occurs due to leakage of gas inside the house. The explosion starts when someone switches on any switches inside the house without gas noticing it fully filled the room in their home. Therefore, this project device is very useful in preventing problems from occurring. The scope of this project can only detect Carbon Monoxide, Butane and LPG leaks. LPG is also the type of gas most consumers use to cook. Arduino microcontroller is used as a system controller. Gas sensors are used to detect gas leaks and transmit analog input signals to Arduino controllers. When the signal exceeds the microcontroller's trigger level, Arduino will send a reminder message to the user through the GSM module and the exhaust fan will release the gas leak from the contaminated area to the outer air to prevent the explosion from happening. The objective of this project is to send someone a warning message when a gas leak occurs in their home and the exhaust fan automatically operates to prevent explosions as a result of electric splashes when detecting gas leakage.

DEDICATION

To my beloved parents,

Jari bin Wandi and Saadiah binti Liham

Thankful for your supporting and the best wishes

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First of all, I want to thank God for giving me the strength I need to prepare this report. With this opportunity, I would like to thank the Faculty of Electrical and Electronic Engineering (FTKEE), University Teknikal Malaysia Melaka (UTEM) and my supervisor, Ts Dr Aliza Bt Che Amran for the assistance, advice and guidance provided during this project. To my parents, thank you for supporting them with their prayers and love. Lastly, I would like to thank all my friends and I also want to thank those who supported and encouraged me in helping to complete this project.

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LIST OF ABBREVIATIONS

GSM	Global System For Mobile Communication
LPG	Liquid Petroleum Gas
LCD	Liquid Crystal Display
LEL	Lower Explosive Limit
UEL	Upper Explosive Limit
V	Voltage
I/O	Input / Output
LED	Lighting Emitting Diode
IDE	Integrated Development Envirronment
PCB	Printed Circuit Board
CPU	Central Processing Unit
IC	Integrated Circuit
TX	Transmitter
RX	Receiver
DC	Direct Current
SIM	Subscriber Identification Module
S	Seconds
PPM	Parts Per Million

CHAPTER 1

INTRODUCTION

1.1 Background

High innovation and industry have led to an unbelievable increase in living norms in the present age. Moreover, this has also been followed by a multitude of severe issues, such as the unwanted discharge of multiple chemical pollutants, flammable and poisonous substances, etc. Most natural gas is a mixture of hydrocarbon gases and is formed of methane, ethane, propane and butane gas. A natural gas leak can be dangerous, because it increases the risk of fire or explosion. A leakage of natural fuel can be hazardous because it raises the danger of flames or explosion.

This chapter provides information about Gas detector and GSM System. This chapter covers important information so that anyone who read this chapter knows what this project is all about. Information that covered in this chapter is background of the project that will explain to the reader when read this report. Besides, it has Scope of the Project to see the limitation of the project and what this kind of project can do and also Scope of the Report that will explain how this project will operate. Other than that, in this chapter also has objective that must be achieve at the end of project.

Usually gas detectors only use alarms or buzzers to warn but in this project a new project design that uses GSM to send messages to owners about leaking gas. Therefore, owners are warned about leakage of gas around the house through this system. However, these gas detectors and GSM systems will be operated after the sensor detects gas leakage. When a gas detector detects that there are some leaked gases, the system will send the message to the user and the exhaust fan works automatically to prevent the ignition electricity when the gas leak is detected. This issue can lead to the detection of gas leaks and will also prevent explosions at home, if there is no person at home. This gas detector is designed to follow the programmed instructions in Arduino. Arduino is the brain of the system, without this microcontroller the system will not functioning.

1.2 Problem Statement

Nowadays, Liquid Petroleum Gas (LPG) is a highly flammable chemical that is consist of several mixture of gases there is gas propane and butane. Mostly, the LPG is used for cooking at home, restaurant and certain of industry. They have certain weaknesses that make the gas leakage occur. If the gases is leaked at home or industry, the leakage of gases only can be detected by human nearby and if there is no human at surroundings, it cannot be detected and sometimes it also cannot be detected by human because human has a low sense of smell. Moreover, the gas leakage can cause fire that will to serious injury or death and also can destroy human properties. For this purpose, the LPG leakage detector device to sense that leakage and the system will send the messages to the user and the exhaust fan will operate to remove the leaking gas away from the leaking area. It is an early and precaution step to save assets also human lives.

1.3 Objective

1. To design the development of a Liquid Petroleum Gas (LPG) leakage detection system.
2. To build the (LPG) leakage detector prototype using Arduino Uno and Global System for Mobile Communication (GSM).
3. To simulate and analyze the operation of the LPG leakage detection system.

1.4 Scope of Project

In this project are used Arduino Uno, LPG sensor (MQ6), GSM module, LCD display and buzzer to make this project operated. All of this component will be combined their function such as detect the gas and sent the massage by using the GSM. This project is designed just to detect gas, it will be implant at home or an industry that using the dangerous gas. This project can help the person when they are busy with their work, travelling or people who always outstation. This project is design to meet the following scope:

1.2.1 The sensor will detect the gas leaking in particular range.

1.2.2 The GSM will send early warning text message to the owner.

1.2.3 The Arduino will function to operates the exhaust fan when detect gas leaking

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will present an overview of the previous research and existing project in order to get the idea of the design and any information related to improving the project. Although the literature covers a wide variety of such theories of LPG leakage detector and the theories of component that will be use also will be covered on this chapter.

2.2 Liquid Petroleum Gas (LPG)

According to Liquid Petroleum Gas (LPG) Storage Design, written by J.Jonatan (2012), Liquid Petroleum Gas consist of mixture propane and butane there is flammable mixture of hydrocarbon gases used as residential premises or industrial sector and the LPG is one of the alternate fuels used now days. LPG is a colorless, clean burning and non- toxic gas fuel that can readily available in market and it is also fuel for kitchen in the restaurant, fuel for heating, home cookware and used as fuel in transportation. Petroleum gas is also known as LPG, LP gas, Auto gas etc. In Malaysia, the commercial LPG might contain hydrocarbons mixture of propane, propylene, butane (normal-butane

or iso-butane) and butylene (including isomers) (Malaysian Standard (MS) 830, 2003). The mixtures ratio is different in countries around the world that having LPG (Prima Gas, 2011).

According to PETRONAS specifications in Malaysia in 2011, LPG as a propane can be used commercially referred to in most countries. Mixture of LPG products with the main component of propane at ratio 70:30 and with other major component butane are commercial LPG. Liquid in under pressure while the gas is at ambient condition known as LPG and for the commercial, LPG is distributed to the customers in liquid form. The ratio for LPG in liquid form to the gas phase is 270:1. Thus, for safety and convenience of the operator, LPG liquid at moderate temperatures and stored in a storage tank of LPG. After that, LPG is stored in liquid state and is used in the gas phase. Moreover, to change the LPG in liquid state into gaseous state, the vaporizer must be installed. LPG is highly liquid products (National Institute of Standards and Technology, 2010) and features of LPG in Malaysia as in Table 2.1

Table 2.1: Typical Liquid Petroleum Gas (LPG) Data Characteristics

(Gas Malaysia,2011)

Typical Liquefied Petroleum Gas (LPG) Data Characteristics		
Description	Unit	Specification
Density	Kg/1	Minimum 0.547
Composition(Propane+ Butane	% vol	Minimum 97
Copper Corrosion	A	Maximum 1
Vapour Pressure	kPa	380 ~ 830
Free water	% vol	Nil
Total Sulphur	Mg/kg	Maximum 100
Volatility	℃	Maximum 2.2

2.2.1 LPG conditions for ignition

Table 2.2: Properties of LPG

Gas	Formula	%LEL	%UEL	Ignition Temperature	Flash point in ℃
Propane	C_3H_8	2.2	9.5	470	97
Butane	C_4H_{10}	1.8	8.4	365	152

The table 2.2 shows the properties of LPG gas and the explosion occurs when the conditions below are met:

- The gas concentration is between LEL (lower explosive limit).
- There is a sufficient amount of oxygen.
- There's a source of ignition

2.2.2 Gas Propane

Colourless, odourless and combustible properties of Propane gas. There is particular gravity of 1.56 and is higher than air. An alkane hydrocarbon series with the C3H8 formula. Made from crude oil, natural gas as well as during petroleum refining as a by-product of the refinery cracking gases. Gas propane burns in the atmosphere at higher temperatures and produces carbon dioxide and water as the final products.