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Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT-BASED LPG GAS LEAKAGE DETECTION SYSTEMUSING SYSTEM-ON-CHIP MODULE

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MUHAMMAD HISHAM BIN AHMAD ASRI

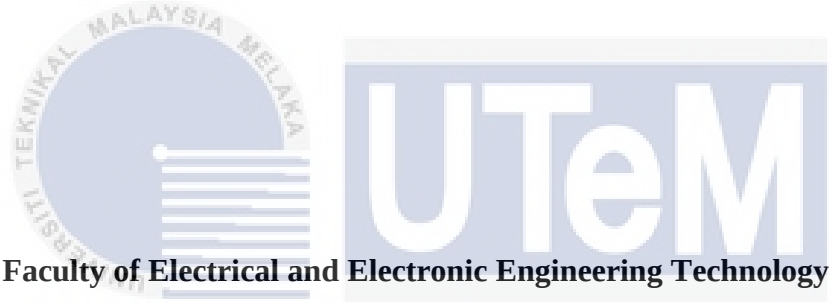
Bachelor of Computer Engineering Technology (Computer Systems) with Honours

2022

DEVELOPMENT OF IOT-BASED LPG GAS LEAKAGE DETECTION SYSTEM USING SYSTEM-ON-CHIP MODULE

MUHAMMAD HISHAM BIN AHMAD ASRI

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Computer Engineering Technology (Computer Systems) with Honours



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2022

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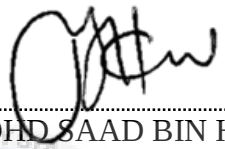
I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

Signature : 

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DEDICATION

This Dissertation is dedicated to my parents.

Ahmad Asri bin Harun

and

Zubedah binti Ahmad

who given me invaluable educational opportunities.

I also dedicate this dissertation to my friends who have supported me throughout the process. I will always appreciate all they have done.

I dedicate this work and give special thanks to my best friend.

Hazim Mazlan
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Muhammad Firhad
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For being there for me throughout the entire doctorate this program.

Along with all hardworking and respected.
Lectures

ABSTRACT

Liquefied Petroleum Gas (LPG) is a popular fuel source, particularly in metropolitan areas, because it is cleaner than wood or charcoal. Leakage of gas is a serious issue in the industrial sector, as well as in residential areas. Because of the rising number of gas leaks, home security has been a serious concern in recent years. Gas leakage is a major cause of concern in ateliers, residential areas, and vehicles that run on gas, such as compressed natural gas (CNG). Installing a gas leakage detecting kit in hazardous areas is one of the preventive techniques for preventing accidents caused by gas leaks. The purpose of the implementation of the Internet of Things is to solve an issue to a gas leakage problem where it can detect, produce alarm, and control gas leakage automatically. This proposed system also features a user alerting system via smartphone. The method relies on a sensor that can quickly identify or sense a gas leak, that is helpful to notify the person even when the person is not around.

Keyword: gas leakage, LPG, home security, alerting system

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ABSTRAK

Gas Petroleum Cecair (LPG) ialah sumber bahan api yang popular, terutamanya di kawasan metropolitan, kerana ia lebih bersih daripada kayu atau arang. Kebocoran gas adalah isu serius dalam sektor perindustrian, serta di kawasan kediaman. Disebabkan bilangan kebocoran gas yang semakin meningkat, keselamatan rumah telah menjadi kebimbangan serius sejak beberapa tahun kebelakangan ini. Kebocoran gas adalah punca utama kebimbangan di kawasan kedai, kawasan kediaman dan kenderaan yang menggunakan gas, seperti gas asli termampat (CNG). Pemasangan kit pengesan kebocoran gas di kawasan berbahaya adalah salah satu teknik pencegahan untuk mencegah kemalangan yang disebabkan oleh kebocoran gas. Tujuan pelaksanaan IOT adalah untuk menyelesaikan isu kepada masalah kebocoran gas di mana ia boleh mengesan, menghasilkan penggera, dan mengawal kebocoran gas secara automatik. Sistem yang dicadangkan ini turut menampilkan sistem amaran pengguna melalui telefon pintar. Kaedah ini bergantung pada penderia ataupun pengesanan yang boleh mengenal pasti kebocoran gas dengan cepat, yang berguna untuk memberitahu seseorang itu walaupun ketika ketiadaan kehadiran seseorang itu.

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CHAPTER 1

INRODUCTION

This chapter provides the background of studies which includes the details of the problem statements, research objectives, project scope and the significance of the project.

1.1 Research Background

Liquefied Petroleum Gas as knows as LPG regarding terminology. The gas is the combination between propane and butane that will make hydrocarbon gases. LPG is nearly exclusively generated from fossil fuel sources, being created during the refining of petroleum (crude oil) or collected from petroleum or natural gas streams as they emerge from the earth thus LPG now highly affordable, particularly for families, not only because it is inexpensive but also because it is simple to use.

It does not pollute the earth or water since it is a gas, but it may pollute the air. LPG is frequently delivered in pressure steel tanks since its boiling point is below room temperature and it evaporates fast at normal temperatures and pressures. LPG is colourless and odourless as well. However, an odorant is added to LPG for safety purposes so that any gas leakage may be easily detected.

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Unlike natural gas, LPG is heavier than air, so it will flow along surfaces and sink in low areas like basements. There are two major hazards associated with this. The first is the potential of an explosion if the LPG and air combination is within explosive limits and an ignition source is present. The second is suffocation, which occurs when LPG replaces air, resulting in a drop in oxygen concentration.

The problem of gas leakage has recently become one of the most critical problems since it is one of the leading causes of fires. This project is designed to detect any cooking gas leaks and provide an alarm to the user. By that, the SMS alert will notify to the user. This program will help to lower the risk of fire and explosion. It also aids in early gas detection before the gas concentration reaches a harmful level.

1.2 Problem Statement

The identification of leaks in gas pipelines has received huge interest in recent years since a leak might do a lot of harm to society. LPG is frequently used for cooking in homes, restaurants, and certain industrial applications. They contain flaws that cause gas leaking. Gas leakage can only be recognised if there are humans around, and it cannot be identified if there are no humans nearby. However, those with a poor sense of smell may not be able to notice it. As a result, this device will aid in the detection of gas leaks.

Figure 1.1: LPG gas leakage [1]

From the survey show in Appendix F, we can observe that most of the restaurant were using cooking gas tank and gas piping system. Both of them can lead into gas leaked which is very dangerous for the workers in the restaurant. This is a great concern regarding safety for the workers. More worrying if the workers don't have a proper training to handle this kind of situation. Furthermore, gas leaks may produce fires, which can result in significant injury or death, as well as the destruction of human property. This system was created utilising the Internet of Things to provide real-time responses to the user and the nearby fire station.

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1.3 Project Objective

The main objective for this project

- To identify the requirement and development of IOT-based LPG gas leakage detection system using system-on-chip module.
- To develop of IOT-based LPG gas leakage detection system using system-on chip module with mobile phone push notification
- To evaluate the prototype functionality of the project in a controlled environment IOT prototype testing.

1.4 Scope Research

The scope research of this project focuses on the system-on-chip module to apply the LPG gas leakage system. The MQ6 gas sensor is used to sense gas leaks. The gadget will connect to WIFI in this IoT gas leakage detector, and the minimum and maximum parameters may be configured appropriately. Gas leakage detection systems based on IoT and NodeMcu may be put in houses, hotels, and LPG storage locations. The MQ6 gas sensor is used in this LPG gas detector system to detect LPG gas. The presence of LPG gas in the air will be continually monitored by this gadget. If the value of LPG gas in the air is within the specified limit, the LED on the circuit will green light up, signalling that the system is safe. When the gas level rises over the predetermined limit, the LED will turn red LED light up, and notification will automatically send and be updated through IOT. This NodeMcu and IoT project will aid in the detection of gas leaks in the area.

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1.5 Project Outline

This report is divided into five chapters that detail the “Development of IOT-based LPG gas leakage detection system using system-on-chip module” project's implementation. Based on the previously mentioned goals and the approach that has been offered, this project has been separated into five (5) chapters.

Chapter 1:

The first chapter outlines the project's basic concept. This chapter covers the history of the project. It concentrated on the project's overview, including the goals, problem description, and scope of work.

Chapter 2:

The second chapter discusses the method's idea, theory, and some of the hardware components utilised in this project. This chapter also includes a glossary of terms utilised in this project, as well as an explanation of the research topic and how it relates to the theory.

Chapter 3:

This is the methodology section. The methodology chapter contains a list of tasks that must be completed, as well as full summaries of research conducted to reach the goal. This chapter details the steps involved in completing the project. It contains the project's detailed development.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Some research and studies have been conducted to make this project a success. This project's data and research came from a variety of sources, including books, papers, journals, and the internet. All this information was utilized as a reference in this project to ensure that it could be completed in the time allotted. All the investigations and information gathered were based on the project's principal component and theme.

2.2 Concept/Theory

The improvement from the existing Gas Detector is the Gas Leakage Detector with Notifier System. This project is mostly for an individual who want to protect their house from fire. The advantage of this technology is that it can detect any cooking gas leaks and notify the user. Microcontroller NodeMCU at the processor where it processes the input from the sensor and to communicate the user by sending an alert through SMS. This kind of gas detector is more efficient since the user receives information more quickly and the gas detection is continuous.

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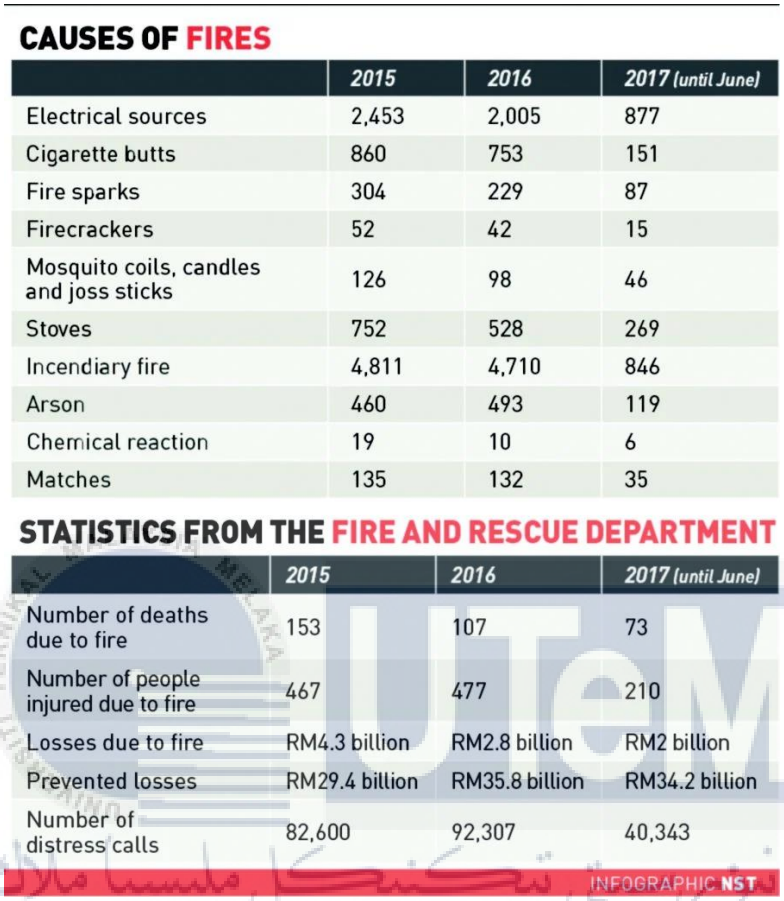
2.3 Fire Incidents Statistics 2015 – 2017



CAUSES OF FIRES

	2015	2016	2017 (until June)
Electrical sources	2,453	2,005	877
Cigarette butts	860	753	151
Fire sparks	304	229	87
Firecrackers	52	42	15
Mosquito coils, candles and joss sticks	126	98	46
Stoves	752	528	269
Incendiary fire	4,811	4,710	846
Arson	460	493	119
Chemical reaction	19	10	6
Matches	135	132	35

STATISTICS FROM THE FIRE AND RESCUE DEPARTMENT

	2015	2016	2017 (until June)
Number of deaths due to fire	153	107	73
Number of people injured due to fire	467	477	210
Losses due to fire	RM4.3 billion	RM2.8 billion	RM2 billion
Prevented losses	RM29.4 billion	RM35.8 billion	RM34.2 billion
Number of distress calls	82,600	92,307	40,343

INFOGRAPHIC NST

Figure 2.1: Fire Incidents Statistics in 2015 – 2017 by Aliza Shah – Sept 21, 2017 [2]

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The numbers below indicate the number of fires that occurred in Malaysia for the year [2]. According to statistics from 2017, the stove is the third most common cause of fire. Matches and incendiary flames are both major sources of fires. According to data from the Fire and Rescue Department, the number of individuals wounded and killed has been steadily decreasing over time. Not only can fire harm or kill individuals, but it can also burn down houses, causing significant losses to a family or business. This figure shows that gas leaks are very hazardous, and people should not ignore them for their own safety.