



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF FIRE AND GAS ACCIDENT  
PREVENTION SYSTEM USING ARDUINO AND GSM**

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

by

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2018 / 19

**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

Tajuk: DEVELOPMENT OF FIRE AND GAS ACCIDENT PREVENTION SYSTEM USING ARDUINO AND GSM

Sesi Pengajian: 2019

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## APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor in Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

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## ABSTRAK

Sistem pencegahan kebakaran dan kejadian kebocoran gas menggunakan Arduino dan GSM merupakan sebuah sistem untuk mencegah kebakaran dan kejadian kebocoran gas di rumah kediaman. Dengan penggunaan Arduino sebagai unit kawalan utama dan GSM sebagai alat komunikasinya, sistem ini boleh memaklumkan pengguna tentang kejadian yang berlaku melalui tiga jenis sensor yang berbeza iaitu sensor gas, sensor suhu dan kelembapan, dan sensor api. Bacaan daripada ketiga-tiga sensor ini akan dihantar kepada Arduino supaya komponen-komponen yang lain seperti injap solenoid, kipas ekzos, GSM, buzzer, paparan LCD dan LED boleh dicetus apabila berlaku kebakaran atau kebocoran gas. Sistem ini boleh memberikan amaran kepada orang yang berdekatan serta pengguna sistem ini tanpa mengira lokasi penggunaannya. Pengguna selepas mendapat amaran daripada sistem ini boleh menentukan apakah yang harus dibuat seterusnya.

## **ABSTRACT**

Fire and gas leakage detection system using Arduino and GSM is a system to prevent fire and gas accident at residential household. Using Arduino as its main controlling unit and GSM as its communication output, the system can inform the registered user about any fire occurrence or gas leakage detection in the house. The detection of the events occurrence is by three different sensors: gas sensor, temperature & humidity sensor and flame sensor. The output from these three sensors will be send to the analog and digital I/O pins of Arduino microcontroller. When fire or gas leakage occur, the program of Arduino will trigger all the output including gas valve, exhaust fan, GSM (Global System for Mobile), buzzer, LCD display and LED. This system can alert nearby personnel and registered user despite the user's location of the events occurred for further action to be taken (example: calling the nearest fire station).

## ACKNOWLEDGEMENT

I would like to thank Madam Racihah binti Mohd Zain, teaching engineer of Faculty of Engineering Technology (UTeM) for her vocational guidance throughout the whole project. From giving suitable suggestions to sharing her knowledge to improve the quality of the project, she has always been a great help when I am in the situation of needing help the most. Without her assistance and proper guidance, this project wouldn't be completed in such a smooth and successful manner.

Next, I want to state my gratitude to my family members for providing me with their moral support during the completion of this project. They always provide me with comfortable and suitable surroundings so that I can complete this project with a peace in mind. They also encourage me when I'm feeling stressed out by the work load thus I can be stronger and bolder than ever before.

Lastly, I would like to express my appreciation to all my friends who helped me directly or indirectly in the process of completing this project. They shared their knowledge, ideas, opinions and tips regarding my project which have been a great help. They also helped in the process of writing the project report by providing me information regarding the formats and which parts to be included.



## **DEDICATION**

This project is specially dedicated to  
My beloved parents, my family members, lecturers and all of my friends,  
Thanks for all the supports, encouragement and faith during the completion of this  
project.

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## LIST OF SYMBOLS

- $\Omega$  - Ohm
- $^{\circ}$  - Degree

## **LIST OF ABBREVIATIONS**

## LIST OF PUBLICATIONS

# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

This chapter briefly describes the idea of the project. It gives a brief explanation on the background of the project, states the problems that lead to the idea of the project, objectives that need to be achieved from the project, the scope it is targeting and the expected outcome of the project.

### 1.1 Background of Project

In this era of fast advancing technology, the risk of fire occurrence is still a main concern to be tackled because it can happen anytime and anywhere. Over the past few years, the incident of house fire has seen a noticeable increase. House fire is a fire involving the structural components of residential buildings. There are many causes to house fires for example electrical appliances, gas leakages, open flames, children playing with matches or spreading of fires from house to house. House fire is proved to be lethal and can cause considerable damage if no immediate actions are taken. However, to ensure that immediate actions can be taken, a specific party or a specific person must be notified as soon as possible when fire is detected. Thus the idea of developing a fast responding fire detector along with a notifying system came up.

The earliest fire alarm system was in the form of a smoke detector. It is a device used to sense smoke as an indication of fire occurrence. The first automatic electric fire alarm was patented in year 1890 by Francis Robbins Upton. However, the first practical application of the smoke detector was recorded in year 1951 and an ionization smoke

detector was used. Many years had passed since then, yet not much improvement was done to the fire alarm system. Although the current fire alarm system consists of multiple devices working together to detect fire occurrence in different forms (smoke, fire and carbon monoxide) and warn people through visual and audio appliances, it still has its weakness and improvement can still be done. For example, the current fire alarm system is complex to be installed and implemented into residential household thus it cannot benefit the residents.

## **1.2 Problem Statement**

Nowadays, the numbers of fire incidents reported are on the increase. Fire incidents that occurred had caused lots of damages and losses. From a news report from [www.themalaymailonline.com](http://www.themalaymailonline.com) dated 5 February 2018, it shows a statistic of total losses due to fire incidents nationwide in Malaysia has increased from RM 4 billion in year 2016 to RM 5 billion in 2017. The deputy director-general (Operations) of the Malaysian Fire and Rescue Department (JBPM), Datuk Soiman Jahid stated that the main contributors to the increase in losses were fires at factories which have high value assets and rising fire cases at housing areas.

Another report on the statistics on fire breakouts in Malaysia from year 2007 to 2013 by Mohd Saharul Nizam Abdul Rahim in the Malaysian Journal of Forensic Sciences stated that, from the trend observed over those years, the number of fire breakouts has shown a steady increase with the number of injuries increases but the number of death decreases. He also stated that fire investigations as well as the safety and prevention steps should be implemented in the country.

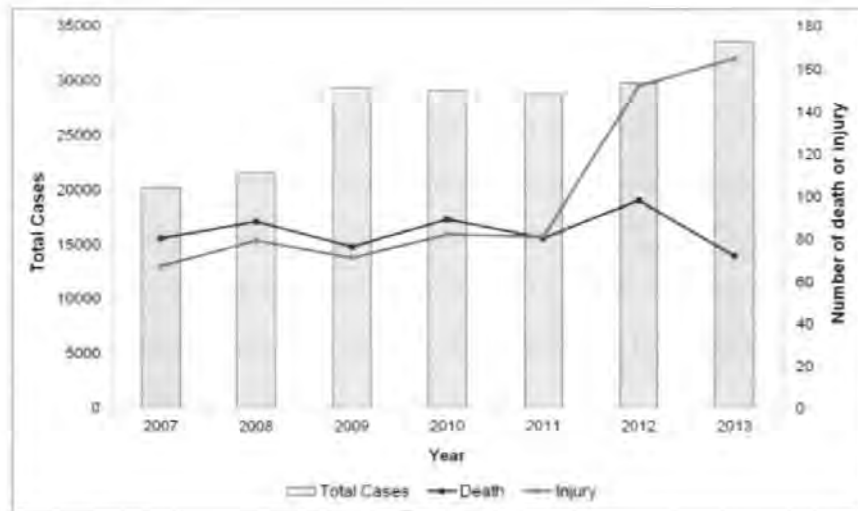


Figure 1.1: Statistics on fire breakouts in Malaysia, 2007-2013 (Source: FDRM, 2014)

According to all these statistics, it is important to implement a functioning fire detection and prevention system. This is because fire incidents can breakout at any time, without anyone knowing it. Even when no one is at home, fire accidents can still occur and cause subsequent damages and losses. Therefore, a fire and gas accidents prevention system is developed to alert everyone within the scope of the fire incident and help prevent and minimize the damages and losses.

### 1.3 Objectives

There are a few objectives to be achieved from this project:

- 1.3.1 To utilize GSM module and buzzer to alert the residents and user about leaking gas or fire occurrence in the house whether the residents are present at home or not so that further actions can be taken.
- 1.3.2 To develop a smart fire and gas accident prevention system using Arduino UNO.
- 1.3.3 To build an immediate responding system towards the leaking gas or fire occurrence using solenoid valve and fan to prevent or minimize casualties and loss due to that incident.

## **1.4 Scope of Project**

From the problem statement and objectives stated in the previous sections, this project mainly target the users from residential or household areas. This project was meant to be implemented in house so that even when no one is at home, the user can rest assured because if anything happened, he/she can be informed immediately and further responding actions can be taken. Therefore, the design of the smart fire & gas accident prevention system must be small and easy to install.

Besides that, this project aimed to use Arduino UNO microcontroller as its main-control unit. The Arduino microcontroller will be used to read values from temperature, gas/smoke and humidity sensors and compare them to the threshold value set. Then, it will control the actions of other connected components such as GSM, buzzer, stepper motor and fan based on the values read from the sensors. The circuit of the system will be designed using Proteus whereas the coding of the microcontroller will be done using Arduino IDE.

## **1.5 Expected Output of Project**

Since the main function of this project is to prevent fire and gas accident system, there are some expected outputs of this project under different conditions. This project was meant to be implemented in household or residential areas, thus only conditions related to these situations were took into consideration. All the possible conditions are listed below with the corresponding expected outputs. The reasons for some outputs were included as well to clarify the usage of these components.

Table 1.1: Possible conditions and corresponding outputs

Conditions	Expected Outputs	Reasons
Liquefy petroleum gas leakage	Solenoid valve, exhaust fan, GSM message, buzzer, LCD display, LED	<p><b>Solenoid valve:</b> to switch off the gas supply to prevent further leakage.</p> <p><b>Exhaust fan:</b> to eliminate the flammable gas or to eliminate smoke to reduce risk and provide clearer vision for evacuation.</p> <p><b>Buzzer:</b> to alert nearby personnel to evacuate.</p>
Fire occurrence	GSM message, buzzer, exhaust fan, solenoid valve, LCD display, LED	<p><b>GSM message:</b> to notify registered user about fire occurrence.</p> <p><b>LED:</b> function similar to buzzer but buzzer outputs audio signal and LED outputs visual signal.</p>