GAS LEAKAGE AND FIRE ALERT WARNING SYSTEM VIA GSM

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This Report Is Submitted In Partial Fulfillment of Requirements for the Degree of Bachelor in Electronic Engineering (Electronics Telecommunication)

Faculty of Electronics and Computers Engineering
Universiti Teknikal Malaysia Melaka

JUN 2013

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UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : GAS LEAKAGE AND FIRE ALERT WARNING SYSTEM VIA GSM

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This report is submitted to the Faculty of Electronic Engineering and Computer Engineering (Electronic Telecommunication) of UTeM as a partial fulfilment of the requirement for the degree of Bachelor of Electronic Engineering (Telecommunication) (Hons.). The member of the supervisory committee is as follow:

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DEDICATION

Specially dedicate to

My beloved family, lecturers, supervisor and friends who have guided and inspired me through my journey in education. Also thanks to their support, beliefs and motivation.

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ACKNOWLEDGEMENT

Praise to Allah S.W.T the most Gracious, the most Merciful. There is no power no strength save in Allah, the Highest, the Greatest.

First of all, I would like to take this opportunity to express my deepest gratitude to my beloved project supervisor, Madam Nur Fatihah Bte Azmi for her guidance, motivation, encouragement and endurance during the whole course of this project. It is indeed my pleasure for his undivided support; invaluable inspirational ideas have very much contributed to the success of this undergraduate project.

A special thanks to my family escpecially my beloved mother, Madam Hajjah Kiti Baidah Binti Sulaiman who have given me encouragement, support and the strength to keep moving on no matter what the odds and obstacles is ahead. All of your support rather in there, physically and mentally indeed giving me lot of joy. With honours, I dedicated the success of completing this project to my late father, Allahyarham Haji Hamdzani Bin Haji Yasin. His spirits is still strong in my soul.

To all my friends especially my course mates in BENT 2009-2013 for their technical advice and material aid that have helped and supported me along the way, I thank you from the bottom of my heart. I wish you all the best in life and hope that our friendship will last forever.

Last but not least. I would also like to thank those who had helped me directly and indirectly. Unfortunately, it is not possible to list all of them in this limited space. Thank you.

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ABSTRACT

This project is about designing a gas leakage and fire alert warning system via GSM. This project used microcontroller system, sensors, GSM modem and several other devices. The detector is based on the commercial gas sensor from Hanwei Electronics Co. Ltd, Temperature Sensor by National Semiconductor and LCD alphanumeric display. This system uses Microchip microcontroller as a tool to collect input data, process and release output data. The significant of this project is to briefly show how to connect a microcontroller system with input and output devices consists of LCD display and GSM modem. This project will be a reference material to the future student or consumer in order to understand usage of a microcontroller and make use of its features. Reprogramming function of the microcontroller is enabled in order to allow user to explore and experience how to program a microcontroller. Output and input device are presented in such interactive way to actually show how microcontroller does the controlling part of the project.

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ABSTRAK

Projek ini berkenaan tentang mereka bentuk sebuah sistem amaran awal bagi mengesan kebocoran gas dan kebakaran melalui GSM. Projek ini menggunakan sistem mikropengawal, penderia, modem GSM dan beberapa alat lain. Pengesan gas ini berdasarkan penderia gas dari Hanwei Electronics Co. Ltd, penderia suhu dari National Semiconductor dan paparan LCD. Sistem ini menggunakan mikropengawal sebagai sebuah alat untuk mengumpul data masukan, memproses dan menghasilkan data keluaran seperti paparan pada LCD dan sistem amaran. Kepentingan projek ini adalah untuk menunjukkan secara ringkas bagaimana untuk menghubungkan sebuah sistem mikropengawal dengan peranti masukan dan keluaran seperti paparan LCD dan juga modem GSM. Projek ini akan menjadi bahan rujukan untuk pelajar masa depan atau pengguna bagi memahami penggunaan sebuah mikropengawal dan mempergunakan ciri-cirinya. Fungsi memprogram semula pada mikropengawal dibolehkan bagi membenarkan pengguna untuk meneroka dan mengalami sendiri bagaimana untuk memprogram sebuah mikropengawal. Peranti masukan dan keluaran dipersembahkan dalam cara yang interaktif untuk menunjukkan bagaimana mikropengawal melaksanakan bahagian pengawalan projek.

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LIST OF ABBREVIATIONS

GSM	-	Global System for Mobile Communications
LPG	-	Liquefied Petroleum Gas
NGV	-	Natural Gas Vehicle
PPM	-	Parts Per Million
CPU	-	Central Processing Unit
RAM	-	Random-Access Memory
ROM	-	Read Only Memory
I/O	-	Input / Output
ADC	-	Analog-to-Digital Converter
DAC	-	Digital-to-Analog Converter
PIC	-	Programmable Integrated Circuit
SMS	-	Short Message Service
LCD	-	Liquid Crystal Display
CO	-	Carbon Monoxide
RF	-	Radio Frequency
FM	-	Frequency Modulation
FPGA	-	Field Programmable Gate Area
VHDL	-	Verilog Hardware Description Language
DC	-	Direct Current
AC	-	Alternate Current
GND	-	Ground
RISC	-	Reduced Instruction Set Computer
3GPP	-	3rd Generation Partnership Project

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SIM	-	Subscriber Identity Module
LED	-	Light Emitting Diode
PCB	-	Printed Circuit Board
HEX	-	Hexadecimal
TX	-	Transmitter
RX	-	Receiver
COM	-	Communication
SOP	-	Standard Operating Procedure

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CHAPTER I

INTRODUCTION

This chapter will explain on the project's background, objective of project, problem statement of the project, scope of project, methodology and also the report structure.

1.1 Background of Project

When it comes to security issues, we cannot take it for granted. Security is the level of protection against danger and loss. Nowadays, in a world that full of technology, people needs the help of technology to provide early warning alert to ensure they have enough time to avoid danger. In designing this project, the dangerous sources that have been highlighted are about gas leakage and fire. This is because both of these can become a huge disaster if the security procedure is not taken early.

Today sensors have featuring a high sensitivity to a wide gases variety, are very compact in size and have significantly reduced their power consumption to better adapt to portable solutions. Building a system with a gas sensor is not as easy as it could appear. Despite the sensor could be treated, basically, as a variable resistor which value

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depends on gas concentration in air the practical implementation in a project should be done considering some design rules, especially if the final circuit is a device to be used in a field where reliability is strongly required. As an example the internal elements of a sensor such as heater and gas sensitive resistors have to be constantly kept under control to avoid failures leading to a wrong alarm indication. Furthermore, if the application needs to achieve good measurement accuracy, factors like environment temperature, sensor life have to be taken into account.

This project is about producing an alert warning system based on Global System for Mobile (GSM) network. It will be used to detect the presence of natural gases as well as fire. Whenever gas leakage or fire occurs, the sensors used in the circuit will detect it and the GSM modem will send out an SMS alert to the user and also to the nearest fire station. With the system that provides a real-time notification, it increases the response time of the owner. This will provide the immediate aid to the situation occur. This system can be installed in kitchens, Liquefied Petroleum Gas (LPG) storage rooms, near the Natural Gas Vehicle (NGV) tank in mobile cars or any places thinks required.

The combination of gas and heat sensors can make a valuable contribution to the safety of these processes. The detectors can be used to trigger alarms if a specified concentration of the gas is exceeded or fire occurred. This can provide an early warning of a problem and help to ensure people's safety. However, a detector does not prevent leaks occurring or indicate what action should be taken. It is not a substitute for safe working practices and maintenance.

The design of this system consists of two different types of sensors. The first sensor used is gas sensor. Usually, gas sensor has the capability to detect from 300 parts per million (ppm) to 500 ppm of gas concentration. While the other sensors used is temperature sensor that can measure change in temperature from -55°C up to 150°C. The increasing in temperature will indicate that the fire has occurred.

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Both of these sensors is connected and control by a microcontroller. The application of microcontroller in such an instrument will reduce cost. Primarily, the microcontroller is capable of storing and a programming. The microcontroller contains a CPU (Central Processing Unit), RAM (Random-Access Memory), ROM (Read Only Memory), IO (Input/Output), serial and parallel ports, timers, and sometimes other built-in peripherals such as A/D (Analog-to-Digital) and D/A (SM) converters. In this case, the microcontroller that had been chosen is PIC16F1938 from Microchip Technology [9].

Then, the output of the system is send out by using Short Message Service (SMS) to the users' phone and also to the nearest fire station via Global System for Mobile Communications (GSM) network. Besides that, the real-time reading also will be displayed on the Liquid Crystal Display (LCD).

1.2 Objective of Project

The objective of this project is to design a system that can detect the presence of natural gases as well as fire and send an SMS alert to the user and nearest fire station if gas leakage and fire occurred.

1.3 Problem Statement

Natural gases such as Liquefied Petroleum Gas (LPG) are widely used in the whole world. LPG is used for cooking in home or hotel. It is also used in certain gas-based industry. As for now, the use of natural gases instead of petroleum as the alternative fuel for mobile cars also has been increased. Although the procedure of installing LPG-based system is very tight, we could not give 100% guaranteed that the LPG-system will not having leakage.

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Even though human is a perfect creation of God, they still have certain weakness. Human cannot detect the presence of natural gases as fast as the sensor do. Thus, the use of gas sensing system is hugely needed to give real-time monitoring of the gas system.

In certain cases, gas leakage can cause fire that will destroy human property. The large scale of fire also could contribute to serious injury or death. This is due to the fire station got delay information about the fire occurred.

Therefore, this project shall be able to resolve the problem stated. This is because this project is able to sense the presence of natural gases as well as fire. Besides that, it is also capable to send out an SMS alert automatically to the owner and also to the nearest fire station.

1.4 Scope of Project

1. The circuit is basically on the gas sensor, temperature sensor and the Programmable Integrated Circuit (PIC). The gas sensor and temperature sensor could be treated, basically as variable resistor which value depends on gas concentration in air and temperature changes respectively. Both of these sensors have high sensitivity.
2. The gas sensor chosen is MQ2. It can detect gas concentration in the air from 300 to 5000ppm. 1000 ppm will be set as the dangerous level.
3. The sensor used to detect the fire is LM35 heat sensor. It can detect temperature changes from -55°C up to 150°C. After calibrating the sensor, it will only measure from 0°C to 100°C. 55°C will be set as fire burning starting temperature.
4. These sensors will be connected directly and controlled by a microcontroller. PIC16F1938 is chosen to makes the detector much simpler.
5. The output reading from the sensors will be displayed on the LCD.
6. The PIC16F1938 also will be integrated to the GSM modem by using MAX232 as the connector. Whenever the reading of the sensors exceeding the limit set, it will

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automatically send an SMS alert wirelessly by using the GSM Modem through GSM Network to the numbers as being set on the coding.

7. All of the circuit, simulations and coding are constructed and performed using Proteus 7.1, Eagle and MPLAB IDE.

1.5 Project Methodology

This project focuses more on the study case and the project development based on the gas and temperature sensor. The microcontroller will continuously receive the data from both of the sensor in analog packet of data. It will process the data and convert it to ppm and degree Celsius respectively. The converted data will be displayed by the LCD. Whenever the reading of the sensors exceeding the limit set, it will automatically send an SMS alert wirelessly by using GSM Network to the numbers as being set on the source code. The project methodology shows the step by step taken in order to complete the project. The methodology includes the planning, the development of the design and the management of the project.

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1.6 Flowchart Methodology

The process of how a system works can be understood well by figuring them in a flowchart. Figure 1.1 below shows the flowchart of the system that being designed.

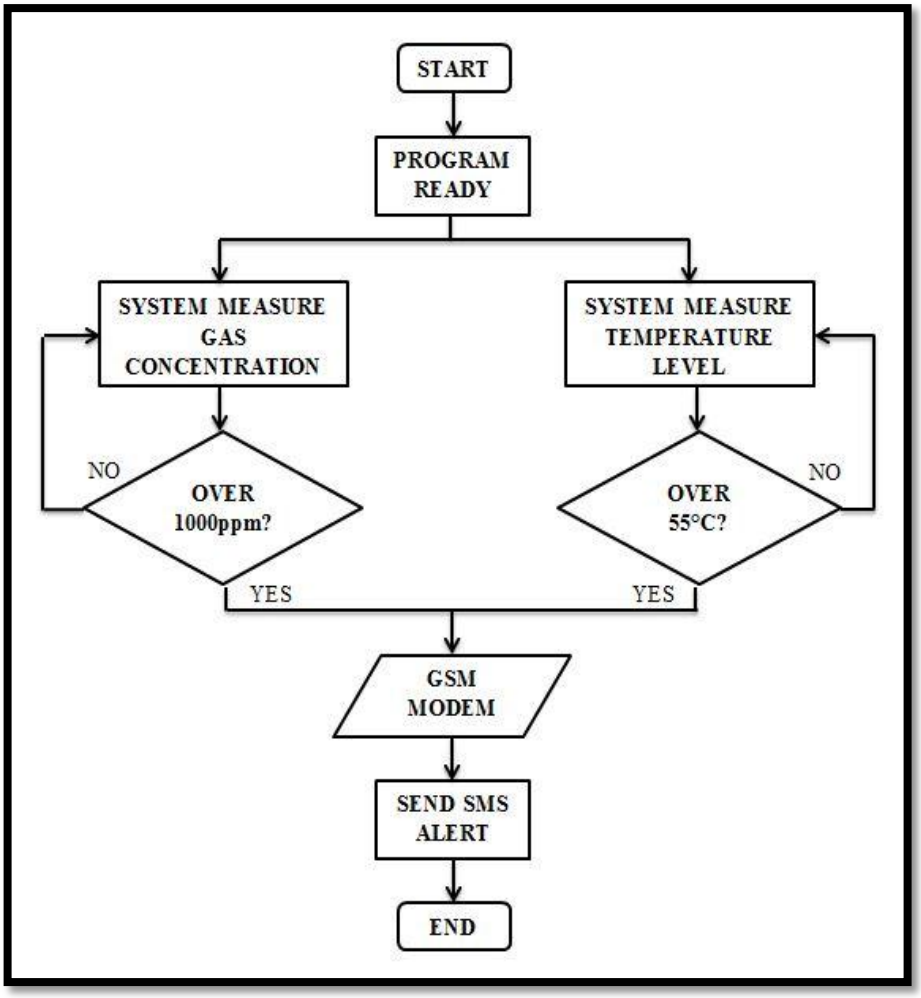

Figure 1.1: Flowchart of the System

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