UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART FLAMMABLE GAS DETECTOR

This report is submitted in accordance with requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree of Electronic Engineering Technology (Computer System) with Honours

by

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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's Degree of Electronic Engineering Technology (Computer System) with Honours. The member of the supervisory is as follow:

……………………………………………

(Supervisor)

ABSTRACT

A lot of danger and incidents happened during these days caused by the leakage of flammable gas. This leakage can lead to fire and damage a house. By switching off the Liquefied petroleum gas (LPG) before leaving the house does not mean the house is safe. Gas leakage can occur in many possibilities and ways to destroy a home which can also spread to neighbourhood. The development of Smart Flammable Gas Detector, generally known as gas detector is introduced to take an early action before any danger to happen. Even when the owner is not around, this gas detector can send a notification to the owner as a warning of the leakage. In this project, Global System for Mobile communication (GSM) module is used to send the warning through Short Message Services (SMS). In order to prevent any fire occur, this project connected to the fan. Whenever the sensor detect the flammable gas, the fan will suck out the gas outside the house. This project is tested and analyzed to prevent any error before it launched and safe to use.

ABSTRAK

Baru-baru ini, banyak bahaya dan kejadian yang tidak diingini berlaku disebabkan kebocoran gas yang mudah terbakar. Kebocoran gas ini boleh menyebabkan kebakaran dan merosakan tempat tinggal. Dengan menutup Gas Petroleum Cecair (LPG) sebelum meninggalkan rumah tidak bermakna rumah itu selamat. Kebocoran gas boleh berlaku dengan banyak posibiliti dan cara untuk merosakan rumah dan juga boleh merebak ke kawasan jiran. The development of Smart Flammable Gas Detector, atau lebih dikenali sebagai pengesan gas diperkenalkan untuk mengambil langkah awal sebelum sebarang bahaya berlaku. Walaupun pengguna tiada di rumah, pengesan gas ini akan hantar notifikasi kepada pengguna sebagai amaran tentang kebocoran itu. Projek ini menggunakan GSM (Global System for Mobile communication) modul untuk menghantar amaran melalui SMS (Short Message Services). Untuk mengelakkan sebarang kebakaran daripada berlaku, kipas akan digunakan dalam projek ini. Apabila pengesan gas mengesan gas yang mudah terbakar, kipas ini akan menyedut keluar gas itu keluar rumah. Projek ini diuji dan dianalisis supaya tiada masalah yang akan berlaku dan selamat digunakan sebelum pelancaran.

DEDICATIONS

To my beloved parents,

Marzuki bin M.Nor and Hamidah Binti

Abdullah for raising me become who I

am today.

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LED	-	Light Emitting Diode
GSM	-	Global System for Mobile communication
CEPT	-	European Conference of Postal and Telecommunications
TDMA	-	Time Division Multiple Access
ETSI	-	European Telecommunication Standard Institute
GPRS	-	General Packet Radio Service
MSC	-	Mobile Switching Centre
SMSC	-	Short Messaging Service Centre
PWM	-	Pulse-width modulation
GND	-	Ground
IDE	-	Integrated Development Environment
LEL	-	Lower Explosive Limit
PPM	-	Parts per million
LCD	-	Liquid crystal display
DC	-	Direct current

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter introduces the project with its background, problem statement, objectives, scope and project significance, to provide a sense of purpose and reasons to proceed with this project.

1.1 Background

The proposed of Flammable Gas Detector is a small and efficient device to detect flammable gas at home or at the work place. It can tell the level of danger by the colour of the LED planted on it and send a notification as an early warn (Baichtal John, 2013). This device uses less component and suitable to use at any kind of place. It is really a safe device that connected to Global System for Mobile Communications, also known as GSM module that can help to send the notification. As a detector, it use a flammable gas sensor that portable with arduino/stm/raspberry platform (Iovine, 2004). All the combustible gas can be detected by using this device and it will help to alert the people before the combustion occur (Craft Brock, 2013). Moreover, this project is made of from a cheap components to help others to buy a simple detector in a low cost perspective. In order to make a device safe to use for any ages, this project will be tested and analyzed before it is launched.

1.2 Problem Statement

The problem faced in detecting the type of flammable gas (Greg, A. 1997), is the current device that used in the market now can detect gases but mostly the specified gases only. So this device can detect multiple type of flammable gases. Most of the device in the market used battery. Once the battery runs out, it need to be changed. But not with this device, the battery is rechargeable. Moreover, this device used GSM module which allow the user to be alerted by the notification from the device compared to others.

1.3 Objectives

The main objectives of this project are based on aspect as listed below:

    i.   To detect flammable gases in certain area.

    ii.   To develop a program based on arduino mobile.

    iii. To design a prototype of flammable gas detector.

1.4 Project Scope and Limitations

Once the sensor detect the flammable gases, the sensor will calculate the gas volume and send it to the LEDs. The green LED shows that the amount of the gas is low, yellow LED shows the amount of the gas is in the middle range and red LEDs shows the volume of the gas in the place is in higher volume that are very dangerous almost 100% LEL (Bruce, H. 2004). The device then send the notification through the GSM modul and the user would be alerted. The levels of the gases is reduced when the gases is reduced.

Figure 1.1: Block Diagram of Flammable Gas Detector

1.5 Contribution Of Research

By doing this project, it has contributed to a new knowledge about type of flammable gas and detector that widely used in industries. Detector accuration is depends on the type of gas it sense in order to avoid injury in some places. Gas like butane and propane are some of the example that can lead to a fire. Moreover, sensor also play a main role as it has various type and different accuration range. It must be choosen carefully or injury will occured due to robustness of the sensor. Through this project, analysis is known as part of the important thing in daily life. Without analysis of project, this project can be the same as other devices out there with no speciality.

1.7 Summary

`   In a nutshell, Flammable Gas Detector use GSM in order to send notification as an early warning to the user. This project uses gas sensor and other components that will help the system to perform better. The purpose of this project is to act as an early warning because a lot of cases due to fire occured nowadays can consume to injury. Installation of this device at home while travelling is the smarter way to notice early danger.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter provides understandings of theories and previous researches that are related to this final year project. This includes an overview of GSM, the specifications of sensors, similar products from all kind of sources, and more.

2.1 Global System for Mobile Communications

Global system for mobile communication also known as GSM uses digital radio transmission services in order to provide voice, data, and multimedia communication services and it is a wide area wireless communications system. Cellular technology is a telecommunication applications that growing rapidly nowadays. This is because GSM system coordinates the communication between a mobile telephones which is mobile stations, base stations, and interconnecting switching systems. Each GSM radio channel is divided into frames that hold 8 time slots. It has 200 kHz wide channels for each (Lawrence Harte, 2008).

Figure 2.1: Official Logo of GSM

Figure 2.1 illustrate the official logo of GSM. GSM has been the most successful communication system and widely used in the world today. It has over four billion subscriber to communicate with anyone from every country because GSM was founded to provide specifications that define the function and interface of different technologies (Saily, et al., 2011). GSM is used to minimize the limitation in technological design but in a meantime it maintain the wide range of application (TelecomSpace, 2010).

2.1.1 History of GSM

Cellular telecommunication is a fastest growing telecommunication application(Stuckmann, P., 2003). In order to get where it is now, GSM took many years in the result of both technical development and international cooperation. In the year 1982, European Conference of Postal and Telecommunications Administration (CEPT) established Groupe Speciale Mobile in order to develop the pan-European cellular mobile system standard. Then basic list of recommendations was adopted in 1985. This first step has made GSM known to the world with technologies that help people. Through my project, the use of GSM is needed to create Flammable Gas Detector which is different in the market today. Through table 2.1, we can see the timeline of GSM revolution since year of 1982.

Table 2.1: GSM Evolution Timeline

History of GSM	
Year	**Description**
1982	Groupe Speciale Mobile established by European Conference of Postal and Telecommunications Administrations (CEPT) to develop the pan-European cellular mobile system standards.
1985	Basic list of recommendations was adopted.
1986	Field tests undertaken to prove which techniques should be adopted for the new system.
1987	TDMA approach adopted as the main access method for GSM.

	Europe produced the first GSM Technical Specification. Initial Memorandum of Understanding was signed by telecommunication operators from 12 member countries.	
1988	GSM system validation undertaken	
1989	ETSI takes on responsibility for managing the GSM standards.	
1990	GSM specifications released (phase 1).	
1991	Commercial launch of the GSM service. The first SMS was sent, GSM standard was expanded to 1800 MHz frequency band.	
1993	Coverage of main roads GSM services start outside Europe. Telecom Australia became the first network operator.	
1995	GSM specifications released (phase 2). New technologies services were launched commercially (fax, data, and SMS messaging)	
1996	Prepaid GSM SIM cards were launched. Subscribers exceeded 10 million.	
2000	GPRS services were launched commercially. GSM subscribers exceeded 500 million in this year.	
2002	Multimedia Messaging Service (MMS) were introduced.	
2004	Announcement made at 3GSM in Cannes.	
2005	75% of the worldwide cellular network uses GSM network. GSM subscriptions exceeded 1.5 billion.	

In March 1989, European Telecommunication Standard Institute (ETSI) taken over the GSM Association, and has been called the Special Mobile Group (SMG) in year 1991. The abbreviation of GSM underlining its claim as a worldwide standard (Stuckmann, 2003).

2.1.2 Short Message Services by GSM

GSM provides a lot of technologies such as voice transmission and fax transmission, but with this project, Short Message Services (SMS) will be focussed on because Flammable Gas Detector need it as a further step in evolution of gas detector. Basically, the sender of an SMS sends the SMS via a signalling channel to a Mobile Switching Centre (MSC). Once, the MSC receives an SMS from the sender, it transparently forwards the SMS to the Short Messaging Service Centre (SMSC). If the message from the mobile device contains the address of the subscriber's SMSC, the SMS can be forwarded from the foreign MSC to the home SMSC without the need for an international SMSC database (Sauter, 2011). The illustration of this system can be seen as Figure 2.1.2 below.
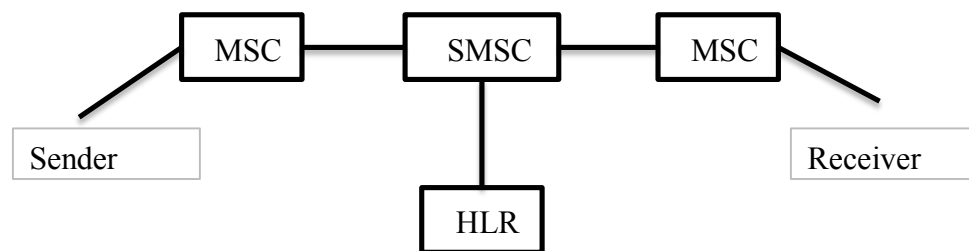

Figure 2.1.2: Illustration of SMS operation

Home Location Register (HLR) is a database from a mobile network. This is the place which information of mobile subscriber is stored. The transmission of this short messages use a connectionless and protected packet switching protocol (Eberspacher, et al., 2001).SMS has the capability to receive or send short messages at the mobile station, known as TS21 and TS22. TS21 is a point-to-point version of SMS. It allows a single station to send a message up to 160 characters. But for TS22, it is the optional implementation of the capability to send the short messages from a mobile station.

2.2 Arduino Uno

Arduino is an open-source prototyping platform (Banzi, 2011). This system is based on hardware and software that is easy to use. By using this Arduino boards, it has the ability to read inputs such as a finger on a button, light on a sensor, or even read messages from social network and turn it into an output like activating a motor, turning on LEDs and can also publishing something online. This can be done by sending a set of instructions to the microcontroller on the board. But, in order to do the things, Arduino programming language based on Wiring, and the Arduino Software (IDE) based on Processing must be used.

Arduino was born at the Ivrea Interaction Design Institute and it is an easier tool for fast prototyping and has been used to create thousands of projects. Arduino is known in a wider community by providing new needs and challenges. It differentiates its offer from simple 8-bit boards to products for Information and Communications Technology (ICT) applications, wearable, 3D printing, and embedded environments from everyday objects to a more complex instruments. All Arduino boards are completely open-source that give users to do or build projects independently by giving their particular needs.

2.2.1 Arduino Board

As we can see in Figure 2.3, arduino board contains of several input and output that help users to build projects easier.
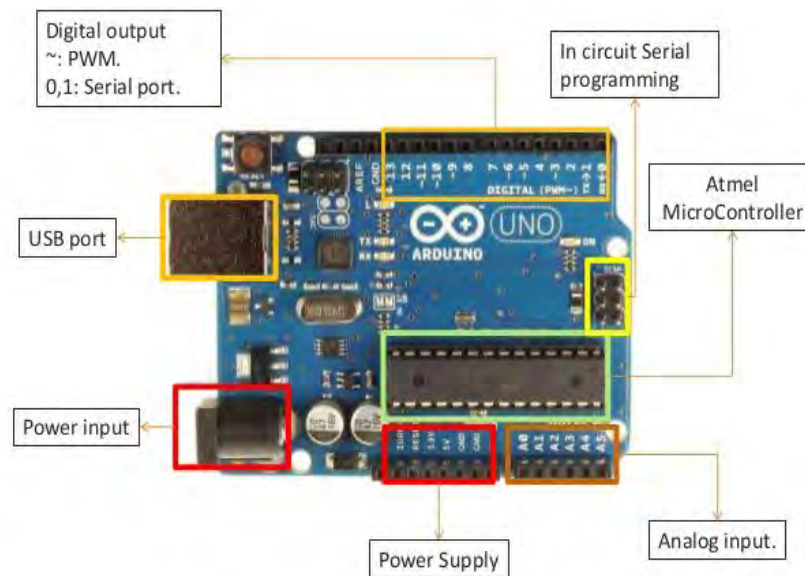
8

Figure 2.2.1: Arduino Uno Board

Based on figure 2.2.1, there are 14 digital Input/Output pins that has number from 0 to 13. These are the most important pins on Arduino because it can be used as either input or output. Through this board, it is a very helpful in the form of the core of many projects. For Digital output, it can make the signal of these pins to write or read as on or off.

From the board, there are 6 digital pins that are marked by the sign (~). These pins are capable to do Pulse Width Modulation. Pulse-width modulation (PWM) also known as pulse-duration modulation (PDM) which is a technique of modulation used to encode a message into a pulsing signal. Not only for encoding information for transmission, it is also can be used to allow the control of the power supplied to electrical devices. With PWM, arduino is in an advantage because it has the technique to control the analog circuits with its digital outputs. For example, digital control can be used to be only turn on with full 5v or off with 0v in the binary format, and this on or off pattern can generate a square wave signal. This is very useful tool to make a LED to be half bright by either reducing the current across the LED into half or using this technique of PWM by sending 50% duty cycle square wave signal to the LED. By using PWM, it can provides a range of output levels like dimming an LED or rotating a DC motor at varying speeds.