UNIVERSITI TEKNIKAL MALAYSIA MELAKA

GAS DETECTOR FOR SAFETY HOME USING GSM

This report submitted in accordance with requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Department of Electronics & Computer Engineering Technology) (Hons.)

by

ABD HARITH BIN ABD HALIM
B071210210
900727-05-5473

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Gas Detector For Safety Home Using GSM**

SESI PENGAJIAN: **2015/16 Semester 2**

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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 of Engineering Technology (Type your department's name here) (Hons.). The member of the supervisory is as follow:

………………………………….
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ABSTRACT

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and business premises. One of the preventive measures to avoid the danger associated with gas leakage is to install a gas leakage detector at vulnerable locations. "Gas Detector for Safety Home using GSM" is a project that is use to detect a gas leakage from the gas storage (cylinder gas) to the cooking stove and it also detect the unattended cooking that are left without supervision. In this project the gas sensor are used to detect the gas leakage and PIR Motion Sensor and Temperature Sensor are used in this project to detect unattended cooking that are left without supervision. This project will send an alert to the user about unattended cooking that are left without supervision and detection of gas leakage through GSM Module where the number of user are set in the GSM Module by SMS. This project used Microcontroller (Arduino UNO R3) at the processor where it process the input from the sensor and send the output to shut-off valve to cut the gas supply and to GSM module to communicate with the user (send an alert through SMS). This project will detect the gas leakage and unattended cooking by detecting the gas leakage that occur in the kitchen through the MQ-2 Gas Sensor and detect the unattended cooking by DHT 11 temperature and PIR motion sensor. In this project, the analysis is done by measuring the distance of the sensitivity of the PIR sensor to detect the motion. The higher the motion near to the PIR sensor, the higher the sensitivity of these sensor. The benefit of these projects is to prevent the earlier stage of fire because of unattended cooking without a human supervision, could prevent the explosion because of gas leakage and prevent a gas poisoning.

ABSTRAK

Keselamatan memainkan peranan yang penting dalam dunia hari ini dan ia adalah perlu bahawa sistem keselamatan yang baik adalah yang akan dilaksanakan di tempat-tempat pendidikan dan bekerja. Kerja ini mengubah model keselamatan yang sedia ada dipasang dalam industri dan sistem ini juga boleh digunakan di rumah-rumah dan premis perniagaan. Salah satu daripada langkah-langkah pencegahan untuk mengelakkan bahaya yang berkaitan dengan kebocoran gas adalah untuk memasang pengesan kebocoran gas di lokasi yang terdedah. "Gas Detector for Safety Home using GSM" adalah satu projek yang digunakan untuk mengesan kebocoran gas daripada simpanan gas (gas silinder) kepada dapur memasak dan ia juga mengesan proses memasak yang ditinggalkan tanpa pengawasan. Dalam projek ini sensor gas yang digunakan untuk mengesan kebocoran gas dan PIR Motion Sensor dan Sensor Suhu yang digunakan dalam projek ini untuk mengesan masakan yang ditinggalkan tanpa pengawasan. Projek ini akan menghantar amaran kepada pengguna tentang masakan yang ditinggalkan tanpa pengawasan dan pengesanan kebocoran gas melalui GSM Modul di mana nombor pengguna telah dipprogramkan ke dalam Modul GSM dengan menggunakan SMS. Projek ini menggunakan pengawal mikro (Arduino UNO R3) sebagai alat pemproses di mana ia memproses input daripada sensor dan menghantar output untuk menutup-off injap untuk memotong bekalan gas dan kepada modul GSM untuk berkomunikasi dengan pengguna (menghantar amaran melalui SMS). Projek ini akan mengesan kebocoran gas dan masakan yang ditinggalkan tanpa pengawasan yang berlaku di dapur melalui Gas Sensor MQ-2 dan masakan tanpa dijaga oleh sensor suhu DHT 11 dan sensor pergerakan PIR. Dalam projek ini, analisis dilakukan dengan mengukur jarak kepekaan sensor PIR untuk mengesan pergerakan. Semakin tinggi pergerakan menghampiri PIR sensor, semakin tinggi sensitiviti sensor tersebut. Manfaat projek-projek ini adalah untuk mencegah peringkat awal api yang disebabkan masakan tanpa dijaga dan tiada penyeliaan manusia, boleh menghalang belakunya letupan disebabkan kebocoran gas dan mengelakkan keracunan gas.

DEDICATIONS

To my beloved

parents

Abd Halim Bin Seman and Zabidah Binti Othman

siblings,

Nor Hidayah, Fatin Hanani, Afifah Huda,

Dedicated in thankful appreciation for your supporting, encouragement and best

wishes.

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CHAPTER 1

INTRODUCTION

1.0   Background

Natural gas or LPG is the terminology for Liquefied Petroleum Gas. The gas is made up of hydrocarbon gases comprising of Propane and Butane. LPG is also colourless and odourless. However, for safety reasons, an odorants is added to LPG for easy detection of any gas leakage.

It is widely used in households for heating appliances such as ovens, stoves and water heaters. It is also used in industries such as iron and steel industry, aerosol propellant industry, glass and ceramic manufacture, copper tubing and cable manufacture. LPG is also an excellent alternative for automotive fuel.

Natural gas has become a widespread energy source because it's highly combustible, which means that it can produce large amounts of heat when it is burn small in amounts. Consequently, a natural gas leak can increase the risk of fire and explosion since it spreads quickly and combusts easily. An electrical spark or fire source can set this off if you have a leak in your house.

This project is produced to detect any leakage of cooking gas and it will alert the user about leakage. User will get the alert in SMS and will reply the SMS to shut off the gas supply. This project also will notify the user about the cooking that are unattended and fire that occurs in the kitchen. By using this project it will reduce the accident of fire and explosion. It also helps the early detection of fire before the fires are bigger and spread. This project also will avoid the human being from gas poisoning.

1.2 Problem Statement

Now day's home safety is importance to all people because it can avoid any injuries and accidents. People spend most of its time in the home so that why home safety is importance.

Home is a place to relax, play and enjoy spending time with family. Of course, accidents happen and there will be minor scrapes and bruises along the way. The accident that may happen at home is fire and explosion. This accident happen because of the leakage of the gas system and the cooking are left unattended.

The current products that are in the market are function as gas detector. It will only detect a gas and trigger an alarm. Some of the product it only detect a gas leakage and it will trigger an alarm and cut off the gas supply.

This project **Gas Detector for Safety Home using GSM** is a gas and heat detector that will detect any gas leakage especially the cooking gas or LPG gas, where heat detector will detect any heat that occurs in the house and it also detect the cooking are left unattended. This device will sent an alert through GSM module by SMS the user at the same time it will shut off the gas supply and trigger the alarm in the house. This can reduce the fire accident that happens in the house.

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1.3 Objective

The objectives of this project are:

1. To find out and understand the function of GSM Module and Arduino Board and its function.
2. To analyse the uses of sensor, GSM Module and Arduino in this project.
3. To implement the uses of sensor and GSM and Arduino in this project.
4. To provide the detection of gas leakage using sensor and transmit alert to user using GSM module.

1.4 Scope

The scope of this project is design help human being to reduce the fire accident and explosion because of the gas leakage and cooking are left unattended. Beside that it also can detect the cooking are left unattended and early stage of fire detection. This project will only focus for household. It will detect gas (LPG gas) and temperature (heat & human). In this project it uses three types of sensor smoke sensor, gas sensor, temperature sensor and human detection sensor.

Furthermore, there two part to make the project; software and hardware development. For the software part, includes the software coding for Arduino and GSM module. This software is importance to make the module work. For the hardware part, it consist of, Arduino, GSM module and sensor. The importance part is the GSM module and the sensor. The sensor will detect the gas leakage, smoke and heat.

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Each thing in a world has a limit same goes to this project. This project limitation includes:

- The sensor – the gas and smoke sensor it will only detect LPG Gas (Buttane/Propane) for gas
- The GSM module – the range it will cover only in Malaysia and the coverage of the Telco. The roaming coverage will not include.
- The GSM module its interface through Short Message System. The module will not able to call the user.

1.5   Project Significant

The project of Gas Detector for Safety Home using GSM was design mainly to detect the gas leakage and to detect the unattended cooking without supervision. Many benefit that user will get through this project which is alarming and prevention. This project will send and alert through SMS to the user about the detection of gas leakage or the unattended cooking without human supervision and it will cut the gas supply from the gas supply source form flowing to cooking stove.

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CHAPTER 2
LITERATURE REVIEW

2.0   Literature Review Overview

This chapter will provide a review about the previous research and existing project that is related to this Bachelor Degree Project to get an idea about the project design, conception and any information that related to improve the project. With a differences concept and design, there are other creation and innovation of projects done by the other people. The research that is related to this project also covered in this chapter.

2.1   Fire Statistics In 2013

PERANGKAAN KEBAKARAN MENGIKUT JENIS BANGUNAN DI MALAYSIA BAGI TAHUN 2013

BIL	JENIS BANGUNAN / NEGERI	PLS	KED	PP	PRK	SEL	KL	NS	MEL	JOH	PHG	TRG	KEL	SBH	SWK	LAB	PUT	JUMLAH
1	KEDAI	6	88	61	31	134	95	35	35	88	25	12	28	42	58	4	0	742
2	KILANG	0	33	36	17	96	12	19	25	42	8	3	3	18	20	0	0	332
3	SETOR	4	15	10	29	55	12	12	6	27	15	8	8	18	14	2	1	236
4	WOKSYOP	1	4	6	2	21	12	2	5	9	9	5	8	4	7	1	0	96
5	HOTEL	0	10	2	0	5	11	1	5	2	4	0	0	7	2	0	0	49
6	PUSAT B/BELAH	0	2	1	1	6	22	1	3	0	1	0	0	3	0	0	0	40
7	PEJABAT	1	13	5	3	34	54	7	4	11	4	4	0	8	15	2	0	165
8	TEMPAT HIBURAN	0	3	1	2	7	9	0	4	2	2	0	0	3	3	2	0	38
9	RESTORAN	1	15	3	6	15	25	0	3	3	1	1	2	5	6	2	0	88
10	RUMAH KEDIAMAN	23	303	188	167	656	482	106	117	252	145	106	106	294	272	16	2	3,235
11	SETINGGAN	1	9	8	5	32	26	2	0	4	5	0	0	10	4	0	0	106
12	BILIK DAPUR	2	8	28	12	35	1	14	5	13	9	6	3	12	4	1	0	153
13	MAKMAL	0	0	2	0	1	1	0	0	6	0	2	0	1	2	0	0	15
14	SEKOLAH	1	16	6	1	20	11	10	3	5	3	5	3	8	5	0	0	97
15	ASRAMA	0	2	2	4	10	4	1	0	9	1	4	0	5	14	0	0	56
16	HOSPITAL/KLINIK	0	1	3	1	1	7	3	0	2	3	3	1	6	6	0	0	37
17	GUDANG	0	5	3	0	17	0	0	0	1	1	0	0	2	2	1	0	32
18	LAIN-LAIN	3	20	22	13	71	13	9	17	38	18	17	12	23	24	0	0	300
	JUMLAH	43	547	387	294	1,216	797	222	232	514	254	176	174	469	458	31	3	5,817

Figure 2.1: Fire Statistics in 2013

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The statistics below show the fire case that occurs in Malaysia for the years of 2013 article. Residential area recorded the highest followed by the shop premises.

2.2 Meaning of fire

Fire can be illustrated as fast process of oxidation material that undergone combustion. For combustion to happen, fuel, oxygen and an ignition source must be present. Fuel, oxygen and an ignition source must be in contact before the fire can start. This can be represented by three sides of the triangle and the fire can't be started, or then, if one is not present or released (Anwor Sharif Bin Abdullah, 1995; Goodger, 1977).
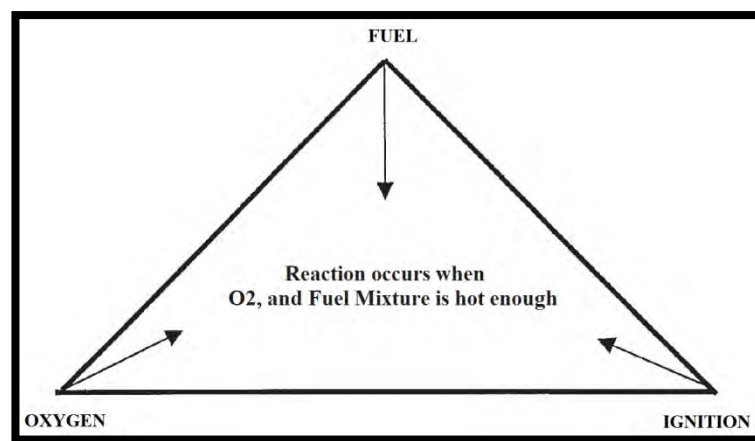
Figure 2.2: Fire Triangle

In the fire expansion process, there are variety types of fire propagation. In most fire ignition is a process of transition of heat input to the stable propagation of heat waves supported by the release of heat from the combustion. It happens only when there is an initial heat input from sources of ignition and combustion reaction followed by enough to create a heat wave (Zukoshi, 1986).

Ignition is the first stage that will produce of fire occurrence. Ignition characteristics such as ignition temperature, minimum ignition energy, and ignition delay time (Toshisuke, 1993).

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There are several types of heat sources such as flame, hot gases, and heated walls. These heat sources will characterize the fire behavior and for practical purposes, the effects of heat sources on flame behavior have been frequently examined rather than elucidating the heat and mass transfer processes (Harino, 1990).

Ignition refers to the arrival of a flame in the volatile gas flow evolved from a solid exposed to external ignition sources such as a flame or an electrical spark. It is categories as piloted ignition (Mahmood Abu-Zaid, 1993).

2.3   General Information on Natural Gases

Natural gas is mainly derived from common crude oil and non-related gas reservoirs and secondarily coal bed, tight sandstones and Devonian shale. There are also created from small sources such as landfills. In the future, it may also be acquire from natural gas hydrate deposits are located beneath the seabed in deep waters of the continental shelf or in connection with sub-surface thick permafrost zone in Arctic.

Natural gas is a combination of low molecular-weight aliphatic (straight chain) hydrocarbon compounds that are gases in surface pressure and temperature conditions. At the pressure and temperature conditions of the reservoir, it can happen as a free gas (bubbles) or dissolved in either crude oil or brine. Although the main constituent of natural gas is methane (CH_4), it may contain smaller amounts of other hydrocarbons, such as ethane (C_2H_6) and the various isomers of propane 4 2 6 (C_3H_8), butane (C_4H_{10}), and Pentane (C_5H_{12}), as well as trace amounts of heavier 3 8 4 10 5 12 hydrocarbons. (Trends, 1998) .

2.4   Potential Health Effects

Methane is not a toxic gas below the below explosive limit of 5% (50000 ppm). However, when methane gases are available at high concentrations, it acts as an asphyxiant. Asphyxiants will replace oxygen in the air and can cause symptoms of oxygen deprivation (asphyxiation) or suffocation. Oxygen is found should be to be at least 18% or harmful effects will occur. Methane will convert to 18% oxygen in the air when present at 14% (140,000 ppm).

The effect of oxygen deficiency in 12-16% to humans is breathing and the pulse rate is increased, with slightly muscular coordinates at 10-14% emotional disturbance, abnormal fatigue from exertion, breathing is interrupted by 6-10%, nausea and vomiting, inability to move freely, collapse, possible lack of awareness and under 6% of seizures movements, gasping, possible respiratory collapse and death.

Methane gas is not irritating to the skin. Contact with the refrigerated liquefied gas compressed gas escaping from a cylinder that can cause cold burns or frostbite. Symptoms such as mild frostbite include numbness, prickling and itching in the affected area. Symptoms of more severe frostbite include a burning sensation and stiffness of the the affected area. The skin may become waxy white or yellow. Blisters and tissue death, gangrene may also develop in severe cases. Methane gas is not irritating to the eyes. Contact with liquid or cold gas compressed gas escaping from a cylinder that can cause freezing burns or eye. Permanent eye damage or blindness can occur. (Canadian Centre for Occupational Health and Safety, 2009)

2.5   Previous Journal

2.5.1   GSM Based Gas Leakage Detection System

Gas leakage is one of the crucial problems that occur in industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive measures to reduce accidents related to gas leaks is to install gas leak detection kit in places that are vulnerable with the gas leaks. This purpose of this paper being produced is to create a design that can automatically detect and stop gas leakage in vulnerable premises. In particular, these gas sensor that are used is very high sensitivity to the propane (C_3H_8) and butane (C_4H_{10}). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns the user by sending SMS. However, the former gas leakage system cannot react in time. This paper provides the design approach on both software and hardware. (Ashish Shrivastava, 2013)

2.5.2   WSN Based Smart System for Detection of LPG and Combustible Gases

The sensing and detection technology are use openly to utilized and investigate gas detection. Due to the different compatibility and limitation of different gas sensing technology, the research has been made on different scenarios with the enhanced techniques. This paper will describe the recent developments in existing gas sensing technologies and proposes a new advanced system based on embedded logic. The advancement of smart sensor technology has allowed us to design and development of a flexible reliable smart gas detection system to detect gases such as combustible and LPG in the real life. The network consists of four units: a sensor node, a relay node, network coordinator, and a wireless actuator. (L.K. HEMA, Dr. D. MURUGAN,M.CHITRA, 2013)

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2.6   Hardware Overview

2.6.1   Arduino

Arduino is a device that use for computer that can detect and control more than one world physical than the desktop computer. It is an open-source physical computer platform that is based on a simple microcontroller board, and development environment for writing software for the board. (Arduino, 2015)

Arduino are used for development interactive objects, accepts input from switch or sensor and can control variety of light, motor and other physical output. Arduino project can be project that are using Arduino board without the other support (stand-alone), or the board can communicate with other software that are running on the computer (Flash, Processing, Max MSP). The boards that are sold are assembled by hand or can buy it preassembled. (Wheat, 2011)

The Arduino programming language is a progress of wiring, a platform of similar computing which is based on environmental multimedia processing.

2.6.2   Why using Arduino

There are a variety of microcontroller and microcontroller platform that is created for physical computing such as Parallel Basic Stamp, Netmedia,s BX – 24, Phidgets, MIT's Handyboard, and many other that offer same function. All of these tools take the messy details of microcontroller programming and combine it up in an easy-to-use pacakage. Besides that, Arduino also make a simpler the process of working with microcontroller, beside it provide some benefit for teacher, student, and interest amateurs over the other systems. (Arduino, 2015)

The Arduino is affordable – the Arduino board is affordable and inexpensive if compared with other microcontroller platforms. The cheapest version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than MYR 60. Besides that's, the Arduino board can cross platform - The Arduino software are able to runs on Windows, Macintosh OSX, and Linux operating systems. It can operate in various operating system but most of microcontroller systems are limited to Windows.

This programming of the Arduino is clear and simple programming environment - The Arduino programming is easy to use even for beginners, and it flexible enough for advanced users to take advantage. For instructors, it is conveniently based on the Processing programming environment for teaching, so students learning to program in that environment will be familiar with the look and feel of Arduino The Arduino software that is being published are open source tools, it available for extension by experienced programmers and amateur. The programming language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, The AVR-C code can be directly added directly into Arduino programs if the user wanted to use that code. Another that, Arduino is based on Atmel'sATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money. (Boxall, 2013)

There are several types of Arduino module that commonly used – Arduino UNO R3 and Arduino Mega