UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SECURITY HAZARDS ALERT AND PREVENTION SYSTEM IN SPECIFIC AREA IN INDUSTRY BY USING GSM

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

by

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(Project Supervisor)
ABSTRACT

This report is based on Global System for Mobile Communication (GSM) networks for the monitoring and preventing solution from hazard conditions of gas leakage, humidity and dangerous temperature in different site area for industries. This system provides ideal solution for monitoring critical plant on open place in industry which involves workers. The system is wireless and it use the Graphical User Interface (GUI) to update phone number therefore more adaptable and cost-effective. This system was used gas leakage sensor, temperature sensor and humidity sensor. The system can detect gas leakage and the reading of temperature and humidity at different area in industry. The GSM modem is use to send alert about the gas leakage, dangerous temperature and humidity through Short Message Service (SMS). Whenever the system detects the increase in the gas leakage, dangerous temperature and humidity in different site area, it immediately alerts by activating an alarm, light emergency and simultaneously sending message to the specified mobile phones. The exhaust fan is switched on only at the gas leakage and dangerous temperature site. The device ensures safety and prevents suffocation and explosion.
ABSTRAK

DEDICATION

I dedicate my thesis work to my family and my fellow friends. A special feeling of gratitude I would like to give to my loving parents, Encik Yahaya Bin Abd Hamid and Puan Mashitah Binti Haji Ghazali which give encouragement for me to complete this final year project degree report.
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<td>authentication center</td>
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<tr>
<td>A/D converter</td>
<td>analog to digital converter</td>
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<tr>
<td>BTS</td>
<td>base transceiver station</td>
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<td>BSC</td>
<td>base station controller</td>
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<td>FYP</td>
<td>final year project</td>
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<td>GSM</td>
<td>global system for mobile communications</td>
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<td>GUI</td>
<td>graphical user interface</td>
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<td>HLR</td>
<td>home location register</td>
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<td>ISDN</td>
<td>height</td>
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<td>LPG</td>
<td>liquid petroleum gas</td>
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<td>LED</td>
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<td>liquid crystal display</td>
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<td>temperature sensors</td>
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<td>LNG</td>
<td>liquefied natural gas</td>
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<td>dual driver or receiver</td>
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<td>MSC</td>
<td>mobile services switching center</td>
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<td>NPN</td>
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<td>angular velocity</td>
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<td>displacement</td>
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<td>read only memory</td>
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<td>resistance temperature detectors</td>
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<td>Sn02</td>
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<td>SMS</td>
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CHAPTER 1
INTRODUCTION

This chapter covered project’s background, objectives, problem statement, scope of the project and project result. Overview of methodology used was stated. The organization of this report also explained in this chapter.

1.1 Background

This project is microcontroller interface with Graphical User Interface (GUI). The controller system, Global System for Mobile Communications (GSM) modem and GUI is installed at maintenance room in industry which controlled by safety officer worker. The sensors used are temperature, humidity, and gas sensor. This project is to monitor the dangerous temperature, humidity, and gas in different area site which are site 1 and site 2. The GUI is creating to update the number of phone of receiver and it function to send the message in form of Short Message Service (SMS) to give information of dangerous temperature, humidity, and gas. The alert system which installed at each site 1 and site 2 are buzzer and light emergency. For the prevention system, each site 1 and site 2 are installed with exhaust fan which it trigger when detect the dangerous temperature and Liquid Petroleum Gas (LPG). In this project there are mainly three units, microcontroller unit, GSM modem and the GUI which controlled in computer. Microcontroller used to send the output of dangerous temperature, humidity, and gas using serial port RS 232. Then the information is reading in GUI and it sends the information by SMS on updated number using GSM modem. GSM modem can be configured by standard GSM AT command set for sending and receiving SMS and getting modem status. In the
system of microcontroller, the system also always shows the reading of temperature humidity and gas status on LCD.

Hardware requirements:
(a) Gas sensor
(b) Temperature sensor
(c) Humidity sensor
(d) Microcontroller
(e) LCD display
(f) GSM
(g) MAX 232

1.2 Problem Statement

The problem to control dangerous temperature, humidity and gas leakage is very difficult among safety officer worker especially it involves to control in different site area. The system was proposed is an extended approach to automating a control system for prevention and give faster information through SMS. This system can minimize the energy of safety officer worker to monitor hazard especially which involved temperature, humidity and dangerous gas. This system will be a powerful and flexible tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. The problem also comes when the safety officer worker is involved with different individual to control the safety in different site in one place. So, the system must very convenient and the GUI is suitable mechanism to exchange the phone number of different worker. This system is created which the user can exchange the phone number where the GSM modem only sends the information in form of SMS to the updated number phone only. The industry site is very wide, so it's very difficult for maintainer to manage site which are very expose to dangerous situation especially burn and explosion. The specific place in industry is needed to be monitoring its gas leakage, suitable humidity and temperature. There is a need for a system to detect and also prevent leakage of LPG gas, and dangerous temperature and humidity.
1.3 Objective

The objectives for this project are to:

(a) design and develop system in monitoring hazards of dangerous temperature, humidity and gas in industry
(b) maintain the safety in industry by create the new system which can be used in alert and prevent hazard
(c) make system which produce faster information about hazard in industry

1.4 Scope

The system proposed consists of three major sensors namely gas leakage sensor MQ-5, temperature sensor LM 35 and humidity sensor SN-HMD-MOD. All the sensors give the output with PIC microcontroller send information through the serial port RS 232 to the GUI and to the GSM module act as a medium to send the SMS to user. This project uses Microchip’s PIC 16F877A, which is an 8 bit microcontroller. The scope of the project is for industry critical plants which are involved many site. So, it's easy for maintainer or safety officer worker to monitor different site for example site 1 and site 2 by using GSM. The system detects the leakage of the LPG gas, dangerous temperature and humidity in different site area which are site 1 and site 2, it immediately alerts by activating an buzzer alarm, light emergency and simultaneously sending message to the specified mobile phones. The exhaust fan is switched on as prevent to exhaust gas leakage and to release excessive heat. The exhaust fan only trigger at the gas leakage site and dangerous temperature site. The additional function of this system is the user can change the phone number where the GSM modem function to send the information about hazard only for number that updated in application on the GUI.
1.5 Project Significant

The system can detect dangerous temperature and humidity and gas at specific area in industry which involve different site. The sensor has excellent sensitivity combined with a quick response time. The gas leakage, dangerous temperature and humidity detected are messaged to the authorized person like technician or safety officer worker using cellular network called GSM. Sending written text messages is very popular among mobile phone users. Instant messaging, as it is also known, allows quick transmission of short messages that allow an individual to share ideas, opinions and other relevant information. This system also use the GUI that function to exchange phone number of user and send the information to GSM modem that act to send massage to user.

1.6 Conclusion and Summary

The industry site is very wide, so it's very difficult for maintainer to manage site which are very expose to dangerous situation especially burn and explosion. The specific place in industry is needed to be monitoring its gas leakage, suitable humidity and temperature. There is a need for a system to detect and also prevent leakage of LPG gas, and dangerous temperature and humidity. The paper proposes a wireless solution, based on GSM networks for the monitoring and preventing solution based on hazard conditions of gas leakage, humidity and dangerous temperature in specific area for industries. This system provides ideal solution for monitoring critical plant on open place in industry which involves workers.
1.7 Report Outline

In this report, there are five chapters which will briefly explain all the efforts and flows in completing this project.

Chapter 1 introduces the background knowledge of the project, explains work scope of the project, for instance, problem statements, objectives and the scope of the project has been briefly defined in this chapter.

Chapter 2 explains the basic knowledge of GSM technology and also reviews related information of hardware equipment used such as temperature sensor LM 35, humidity sensor SN-HMD-MOD, and gas sensor MQ-5. The information of microcontroller used also explained in this chapter. All information was got from reading books, journal article, conference proceedings, and other sources.

Chapter 3 states the methodology taken to complete this project successfully with a given period of time. In this chapter also will give a details work schedule in terms of Gantt chart for Final Year Project (FYP 1) and (FYP 2), project planning, block diagram of project and the brief descriptions for this project.

Chapter 4 implies the results obtained from the system testing and troubleshooting in order to achieve the overall objectives required to complete this project. After gone through all the process and successfully achieved all the objectives as stated in the earlier chapter, the overall project can be conclude as explains in chapter 5. Future recommendation for this project is included as well for future works and further improvement.
CHAPTER 2
LITERATURE REVIEW

This chapter explains the basic knowledge of GSM technology and also reviews the related information of hardware equipment used such as temperature sensor LM 35, humidity sensor SN-HMD-MOD, and gas sensor MQ-5. The information of microcontroller used also explained in this chapter. All information was got from reading books, journal article, conference proceedings, and other sources.

2.1 Related work using GSM

This section describes some earlier works related to the monitoring system using GSM network services.

The work presented by Islam et al. (2009), has developed a Prepaid Water Meter System for prepaid billing of water consumption through remote monitoring without any human intervention. This system promises may be fast and accurate billing of water as well as preventing any misuse of it. This project is can save energy and time of user to monitor the quantity of water used and it prepaid billing. In this Final Year Project (FYP), it was used the Global System for Mobile Communication (GSM) as a method to monitor hazard in industry with faster information.

However, according to Abd Wahab et al. (2011), developed a water meter reading using GSM network that appropriate for remote places to monitor the water meter reading before any billing process. This could reduce the use of human
resource for reading the meter and issuing a bill. There was also a work on monitoring of electrical meter reading using GSM network done. The system was capable of monitoring the meter reading and sent an SMS to the authorized center for billing purpose. This could reduce the number of estimated reading when the authorize person unable to reach the meter. The project before only monitor the output in one place but for this FYP project, it involve more than one place to monitor hazard at a time.

According to Landolsi et al. (2010), using wireless text messaging system to send early warning SMS messages to users advising them to proactively reduce their power consumption before system capacity is reached and systematic power shutdown takes place. This could increase cost-effective wireless distributed load shedding system for non-emergency scenarios. The project above has same application in this FYP project which it come with the prevention after the hazard was detected like when the system detect LPG gas, the exhaust fan will on automatically to exhaust the gas outside the industry building.

2.2 Main Equipment used in this project

This project consists of several main equipment which are GSM modem, microcontroller PIC16F877A, Liquid Crystal Display (LCD), gas sensor, temperature sensor, and humidity sensor.

2.2.1 GSM technology

GSM is a Global System for Mobile Communication. GSM is an international digital cellular telecommunication. According to Inderpreet Kaur (2010), the GSM standard was released by European Standard Telecommunication Standard (ETSI) back in 1989. The first commercial services were launched in 1991 and after its early introduction in Europe, the standard went global in 1992. Since then, GSM has become the most widely adopted and fastest-growing digital cellular standard, and it is positioned to become the world’s dominant cellular standard.
Today’s second generation GSM networks deliver high quality and secure mobile voice and data services such as SMS with full roaming capabilities across the world.

According to Jayanta Kumar Pany et al. (2011), GSM platform is a hugely successful technology and as unprecedented story of global achievement. In less than ten years since the first GSM network was commercially launched, it become, the world’s leading and fastest growing mobile standard, spanning over 173 countries. Today, GSM technology is in use by more than one in ten of the world’s population and growth continues to sour with the number of subscriber worldwide expected to surpass one billion by through end of 2003.

GSM platform is used for living, growing and evolving and already offers an expanded and feature-rich ‘family’ of voice and enabling services. The GSM network is a cellular telecommunication network with a versatile architecture complying with the ETSI GSM 900/GSM 1800 standard. Siemens' implementation is the digital cellular mobile communication system D900/1800/1900 that uses the very latest technology to meet every requirement of the standard.

2.2.2 GSM architecture

From the point of view of the consumers, the key advantage of GSM systems has been higher digital voice quality and low cost alternatives to making calls such as text messaging. The advantage for network operators has been the ability to deploy equipment from different vendors because the open standard allows easy interoperability. Like other cellular standards, GSM allows network operators to offer roaming services which mean subscribers can use their phones all over the world. Figure 2.1 show the GSM architecture.
2.2.3 GSM Modem: MOD 9001D RS232 GSM/GPRS Modem

GSM modem is a wireless modem that works with GSM wireless network, which used the radio waves interface to send and receive data. This GSM modem needed Subscriber Identity Module (SIM) card in order to function. Moreover, to control the function of GSM modem, AT command is used. Basically, AT commands is a standard command for GSM modem, which will allow it to perform various commands such as:

(a) Read, write and delete SMS
(b) Send SMS
(c) Monitor the signal strength
(d) Monitor the charging status and charge level of the battery
(e) Check on the credit balance.