



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INDUSTRIAL PROTECTION SYSTEM USING GSM

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) 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 of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

.....
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ABSTRACT

Nowadays, as technology becomes more advanced and modernized; more features are added to the existing system for the purpose of satisfying the increasing security needs by the people. Security is the most important in day-to-day life for almost all the sectors of the world. A special security is essential for industries and it is made possible by integrating various sensors with GSM network. This paper proposes a review of industrial protection system using GSM that was developed using Arduino and implemented the uses of wireless sensor networks (WSNs). This system can wirelessly transmit and receive electrical signals from a wireless sensor network. GSM module is used to receive and transmit the data from the Arduino Uno board, which is connected directly with GSM network and wireless sensor network (WSNs) to the user. Its main feature is its use of the GSM protocol as the communication medium between the system and user. It illustrates that the new GSM standard performs well industrial environments. The device gives many advantages to the user by providing simple and effective security solution for whatever the threatening is that could disturb the productivity and control system in the industry by continuously monitoring industries with different sensory systems like smoke, gas, and temperature. The threatening may be from natural, incidental, intended, unintended, accidental and human-made problems. Proper use of wireless sensor networks (WSNs) can lower the rate of catastrophic failures, and increase the efficiency and productivity of industrial operations.

ABSTRAK

Pada era masa kini, teknologi semakin berkembang maju dan semakin moden. Oleh sebab itu, lebih banyak ciri-ciri yang ditambah kepada sistem sedia ada bagi memenuhi keperluan keselamatan yang semakin meningkat dan mendapat permintaan daripada masyarakat. Keselamatan merupakan salah satu faktor yang penting dalam kehidupan sehari-hari bagi hampir semua sektor di dunia. Sistem keselamatan merupakan perkara penting terhadap sistem kawalan dan produktiviti di industri dan ia dicipta dengan mengaplikasikan pelbagai jenis sensor dengan rangkaian GSM. Projek ini mencadangkan satu kajian mengenai sistem perlindungan industri yang mengguna pakai teknologi GSM yang telah dibangunkan menggunakan Arduino dan melaksanakan penggunaan rangkaian sensor tanpa wayar (WSNs). Sistem ini secara wayarles boleh menghantar dan menerima isyarat elektrik daripada rangkaian sensor tanpa wayar. Modul GSM digunakan untuk menghantar dan menerima data dari papan Arduino Uno, yang berkaitan secara langsung dengan rangkaian GSM dan rangkaian sensor tanpa wayar (WSNs). Ciri-ciri utamanya adalah penggunaan protokol GSM sebagai medium komunikasi antara sistem dan pengguna. Ia menggambarkan bahawa standard baru GSM dapat memberi impak positif terhadap persekitaran industri. Peranti ini memberikan banyak kelebihan kepada pengguna dengan menyediakan penyelesaian keselamatan mudah dan berkesan untuk apa sahaja perkara yang boleh mengancam sistem kawalan dan produktiviti di industri; dengan memantau keadaan di industri menggunakan sistem sensor yang berbeza seperti sensor asap, sensor gas, dan sensor suhu. Antara punca-punca berlakunya masalah di industri mungkin tercetus secara semula jadi, sampingan, secara sengaja dan tidak sengaja, atau berpunca daripada kecuaihan manusia di industri. Penggunaan yang betul terhadap rangkaian sensor tanpa wayar (WSNs) boleh menurunkan kadar kegagalan bencana, dan meningkatkan kecekapan dan produktiviti operasi industri.

DEDICATION

*A deep appreciation
for the support, encouragement and understanding
of my beloved parents, **Zahari bin Abdul Ghani** and **Ruslina binti Awang Teh**,*

This work is dedicated to them.

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Table of Contents

DECLARATION	i
APPROVAL.....	ii
ABSTRACT	iii
ABSTRAK	iv
DEDICATION	v
ACKNOWLEDGMENT	vi
TABLE OF CONTENT	vii
LIST OF FIGURE.....	ix
LIST OF TABLE	x
LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE	xii

CHAPTER 1: INTRODUCTION

1.0 Introduction.....	1
1.1 Project Background.....	2
1.2 Problem Statement	3
1.3 Objectives.....	3
1.4 Work Scope.....	4
1.5 Report Organization.....	5

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction.....	6
2.1 Related Research.....	6
2.1.1 Research on issues that occurred in the past	8
2.2 Global System for Mobile (GSM).....	9
2.2.1 GSM Module.....	10
2.2.2 GSM Network	11

2.2.3 GSM Frequency Bands	12
2.2.4 GSM Specifications	13
2.2.5 Accessing A GSM Network.....	15
2.2.6 GSM SIM900	15
2.3 Arduino Uno Board.....	16
2.4 Arduino IDE Software	18
2.5 Wireless Sensor Network.....	19
2.5.1 Advantages of Wireless Sensor Network.....	20
2.5.2 Sensor Network Application.....	21
2.5.3 Applications Example	22
2.5.4 Temperature Sensor	23
2.5.5 Gas Sensor.....	23

CHAPTER 3: METHODOLOGY

3.0 Introduction.....	25
3.1 Phases involved in the development of the project.....	25
3.2 Project Development Process.....	26
3.3 Project Overview.....	30
3.4 Hardware Development	31
3.4.1 Details about Arduino Uno Board.....	31
3.4.2 GSM Module.....	32
3.4.3 Temperature Sensor	34
3.4.4 Gas Sensor.....	34

CHAPTER 4: RESULT AND DISCUSSION

4.0 Introduction.....	36
4.1 Results of Experiment.....	36
4.2 Hardware Development Result	37
4.3 Software Development Result.....	38
4.4 Analysis Project	42
4.4.1 Result of Temperature Sensor Testing.....	42

4.4.2 Result of Gas Sensor Testing	46
4.5 Discussion	47

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion.....	49
5.2 Problem Faced in this Project	49
5.3 Recommendation.....	50

REFERENCES	51
-------------------------	----

APPENDIX

Appendix A (Arduino Source Code).....	53
Appendix B (Gantt Chart).....	62

LIST OF FIGURE

Figure 2.0 GSM Module	10
Figure 2.1 GSM Network Elements	12
Figure 2.2 GSM Frequency Bands	13
Figure 2.3 Front view of Arduino Uno Board	17
Figure 2.4 Back view of Arduino Uno Board	17
Figure 2.5 Arduino IDE 1.6.3 software	19
Figure 2.6 Types of MQ Gas Sensor	24
Figure 3.1 Block Diagram of Methodology Implementation	25
Figure 3.2 Flow Chart of the Project Development Process	28
Figure 3.3 Flow Chart of the System Operation for the "Industrial Protection System Using GSM"	29
Figure 3.4 Block Diagram of the Project	30
Figure 3.5 The Pin-Out of an Arduino Uno Board	32
Figure 3.6 (a) GSM Module interfacing Arduino	33
Figure 3.6 (b) GSM Module Connection with Arduino	33
Figure 3.7 Pin Diagram of LM35	34
Figure 3.8 Pin Diagram of MQ2 Gas Sensor	35
Figure 4.0 Circuit Connection for Industrial Protection System using GSM	37
Figure 4.1 Graph of Temperature Testing at Café FTK	43
Figure 4.2 Graph of Temperature Testing at FKM Building	44
Figure 4.3 Graph of Time (s) against Distance (m) for Gas sensor Testing	46

LIST OF TABLE

Table 2.0 Specifications and characteristics for GSM	14
Table 2.1 The Specification of Arduino Uno Board	16
Table 3.1 The Planning for the Development Process	26
Table 4.0 Step to Configure and upload the program into Arduino board using Arduino IDE software	38
Table 4.1 Show Reading of Temperature Testing at Café FTK (Normal Temp $\geq 30^{\circ}\text{C}$)	43
Table 4.2 Show Reading of Temperature Testing at FKM Building (Normal Temp $\leq 27^{\circ}\text{C}$)	44
Table 4.3 Testing Results for the Gas Sensor	46

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

IDE	-	Integrated Development Environment
SMS	-	Short Message Service
GSM	-	Global System of Mobile
D/O	-	Digital Output
A/O	-	Analog Output
I/O	-	Input or Output
LCD	-	Liquid Crystal Display
GND	-	Ground
PSM	-	Projek Sarjana Muda
FYP	-	Final Year Project
FTK	-	Faculty of Engineering Technology
UTeM	-	Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.0 Introduction

In today's world, industries, companies, and manufacturers deal with unceasing and increased provisions of products, and growing demands for services. Intelligent and low-cost protection and secureness of industrial processes are vital in order to improve process efficiencies, deliver quality products, and ensure timeliness and accuracy of systems. Security is a huge challenge universally far and wide because people may not know when the unforeseen accident/problem/issues will happen due to the insecure and unsafe protection systems especially in industries. A protection system is considered to be preeminent only if it offers protection and detection that guard against a number of threats, keeping industries against whatever the unwanted elements that could disrupt the industries environment and activity. A protection system is very crucial for the industries and it is made possible by integrating various wireless sensors network (WSNs) with GSM technology. A protection system should be customizable, offer excellent monitoring and allow communication with the owner. It also offers simple and effective protection solution for any natural, incidental, accidental harmfulness, disaster, human made error or whatever the elements is that could threatened the industrial production or process. The use of GSM technology is to make the system easier to relay information to the user from distant location. So, the high demand from users gave rise to the idea for "Industrial Protection System Using GSM".

1.1 Project Background

“**Industrial Protection System Using GSM**” is a system that is used in industries mostly in factory, workshop, quarry, mine, farm and etc., to monitor the condition in the industries. The ideas for this project originated from observing the Smart Home Security or Home Automation Systems that applied the concept of security system at home. So, this idea was implemented to the industries systems in order to gives a better quality management and more secure protection systems in the industries. This project is to improve the protection system and to indicate the status of the surrounding area in a certain area in the industrial using GSM technology. The use of GSM technology is to make it easier to notify the current condition in certain areas such as factory, workshop, quarry, mine, farm and etc. This paper presents architecture for secure service discovery for use in industries networks. This project proposed a wireless detection and notifying system that applies the GSM technology and wireless sensor network (WSNs) based industrial protection system to create a device that can increase the safety and lessen harmfulness or any undesirable accident that could happen in the industry. Industrial Protection Systems using GSM technology can be realized by adopting central controllers (arduino uno) to control the sensors that sense different variables in the allocated area.

The key trait of this system is that it consist of the sensory system that collects the parameter information like smoke, gas, temperature, fire, etc., and sends the corresponding data to the microcontroller (Arduino uno). This controller is programmed so that when these parameters cross their prescribed limits, it will sends the command signals to various final controlling devices like LCD, buzzer, and GSM devices. This system provide protection from natural, accidental and human made problems by constantly sensing the allocated area within the industries with different sensory systems such as smoke, gas, temperature, and fire. GSM standard for WSNs (Wireless Sensor Networks) provide the suitable and affordable protection system due to its low power consumption, low cost, and support for various ad hoc network configurations.

1.2 Problem Statement

In the present day, there are countless possibilities that the industries might face especially in term of secureness and protection. Various possible threats such as natural, incidental, intended, unintended, accidental or even human made error can ensue in the industries that could hinder production process and activity in the industries but barely any system that could detect these kinds of unusual events. While looking forward to the creation of protection for the industries it is necessary to overcome the above mentioned threats. Despite the fact that there are others protection system in the market sales but the cost for these systems could be expensive or pricey. The proposed system consists of a control console interfaced with different wireless sensors network using GSM technology to detect a wide variety of conditions that could offer the consumer a satisfaction in term of low cost, low power consumption and as well as user friendly.

1.3 Objectives

The main objectives of this project Industrial Protection Systems using GSM are:

- i. To understand and gain knowledge about the function of arduino, wireless sensors system and the basic concept of GSM Technology.
- ii. To design an Industrial Protection Systems using GSM that requires low cost, low power consumption and user friendly.
- iii. To apply the GSM technology that can provide a way of a reliable detection and notification for the secured environment.

1.4 Work Scope

The scope for this project focuses primarily on the protection system in the industries. In this study, GSM technology is used to establish a protection system for industries and by applying the wireless sensory system to detect and collect the parameter information like smoke, gas, temperature, and fire. The other purpose is that the designated system could be able to transmit and receive the information through SMS (Short Message Service) or Call using GSM (Global System for Mobile communication) technology in case of crisis or emergency event occurred. The Arduino Uno act as the micro-controller for the protection system. The idea is to see how well this project can benefit the industries in term of secureness and protection.

1.5 Report Organization

This part explains all the process and the flow for completing this report and project. This report is divided into a few chapters and each is stated below:

Chapter 1: Introduction

This chapter will introduce the background of the project, the problem statement, the objectives, the work scope, and the report organizations.

Chapter 2: Literature Review

This chapter explains the literature research of related or previous projects. All literatures on previous projects are stated in this chapter. The summarization of the previous project will also be included here.

Chapter 3: Methodology

This chapter shows the project methodology. The methodology is based on System Development Life cycle (SDLC). The simulation, analysis and evaluation of the process of the project will be discussed in this chapter.

Chapter 4: Expected Results

This chapter will state the expected result that will be obtained using software and hardware development.

Chapter 5: Conclusion

This chapter will discuss the summary of the project.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this chapter it will review and discuss about the “Industrial Protection System using GSM”. The idea of this project originates from the problem faced by any user to inspect the condition/surrounding area in industries. Sensor detection of a remote place could be difficult or sometimes impossible for example in places where humans are prohibited to enter. The problem can be solved by using wireless sensor network to ensure the safeties of the area can be in check continuously by the user at any time and from anywhere. This chapter will explain about all the components that will be used and some related researches regarding this project.

This chapter begins with a general outline of GSM technology, wireless sensor network, microcontroller (Arduino), and others related components. The second part of this chapter is dedicated to a related research that has correlation with this project “Industrial Protection System Using GSM”. The third part of this chapter is the overview of the GSM standard, wireless sensor network, microcontroller (Arduino), and others hardware or software that are used in this project.

2.1 Related Research

Dongmei Yan, Zhiguang Dan (2010), conducted a project that aims to construct a Smart Home system based on ZigBee wireless communication technology. The article will introduce the Smart Home industry and analyze the advantages of ZigBee wireless communication technology used in the Smart Home

system. It describes the structure composition of the Smart Home system based on ZigBee, and finally gives the system design concept and implementation approach.

H Ali Majeed (2014), conducted a research to develop Arduino Based Home Security System. Home security system has been designed that has a special feature and which make a dial with the owner of the house to inform him that his house has been hacked. Arduino card was used, which is considered one of modern programmable device and utilize from speed dial function in mobile phone.

According to the B. Yang (2009), the security of wireless sensor networks is very important. In order to research the security of wireless sensor networks based on the ZigBee standard, firstly introduces the stack architecture of the ZigBee protocol, security suites, stating the codes of encryption and data integrity authentication algorithm. Then, it analyses the security defects on wireless sensor networks- e. g., channel interference, address assignment conflict and route found flooding in the networking; and key-tapping, defects in the encryption without integrity protection and no identity certification in the security services. Finally, it offers some coping methods: setting standby channel setting, improving routing algorithm, using asymmetric authentication and key exchange based on elliptic curve cryptography, etc.

Based on the research conducted by Zhao, Yanbo Ye, Zhaohui (2008), home security system is needed for occupants' convenience and safety. The content in their paper describe the design and implementation of a low cost, low power consumption, and GSM/GPRS (global system for mobile communication /general packet radio service) based wireless home security system. The system is a wireless home network which contains a GSM/GPRS gateway and three kinds of wireless security sensor nodes that are door security nodes, infrared security nodes and fire alarm nodes. The nodes are easy installing. The system can response rapidly to alarm incidents and has a friendly user interface including a LCD (liquid crystal display) and a capacitive sensor keyboard. The wireless communication protocol between the gateway and the nodes is also suitable for other home appliances. Furthermore, some methods are taken to ensure the security of system information.

According to Arbab Waheed Ahmad, Naeem Jan, Saeed Iqbal, Chankil Lee (2011), the proposed system consists of a control console interfaced with different sensors using ZigBee. Suspected activities are conveyed to remote user through SMS (Short Message Service) or Call using GSM (Global System for Mobile communication) technology. Upon reply, the remote user can control his premises again through GSM-ZigBee combination. Besides, traditional burglar alarm enhances security in case of no acknowledgment from remote user. This system offers a low cost, low power consumption and user friendly way of a reliable portable monitoring and control of the secured environment. Using the concept of serial communication and mobile phone AT-commands (Attention Telephone/Terminal commands), the software is programmed using C-language. The design has been implemented in the hardware using ZigBee EM357 module, Atmega128 MCU (microcontroller unit) and Sony Ericsson T290i mobile phone set.

2.1.1 Research on Issues that Occurred in Industries in The Past

M.Kassim, M.N. Ismail, C.K.H. Che Ku Yahya (2011) conducted a research to develop a web based temperature monitoring system that allows the user to continuously monitor the current temperature reading in a remote location. This research is about monitoring temperature reading in the server room which is set between 150c to 200c. If the temperature is lower or higher than the set temperature range, the server might crash. The web – based temperature monitoring system is developed to display the temperature reading in the server room. The web-based system was proven very cost effective.

According to M. Abbaspour, N. Mansouri (2005), many dangerous chemicals are produced and transported. Due to the vast use of chemicals, more chemical accidents are taking place with huge losses. In this study a city hazardous gas monitoring network was designed to detect the dispersion of toxic and combustible gases in the primary stages. The network could cover hazardous chemical facilities, important hazardous chemical routes,

warehouses and special locations which may be the targets of terrorist attacks. The network is consisted of several local networks and a central control panel complex. In case of high level gas detection, a team of experts who are fully equipped with different portable detectors depart to the site to test the field to identify the chemicals. All readings of detectors are saved in a data bank and then analyzed to find any chemicals spills and leakages. The network was simulated by a special program so that the components of local networks and the central panel are shown in separate windows. By clicking on one detector on environmental window the formerly designed responses will be activated in central panel window.

Norman Thomson (2002) discusses about the important role of risk assessment in preventing fire and explosion, human suffering, and damage to property. Fire-risk assessment is mandatory not only for large chemical process plants or complex premises but also for employers regardless of the size and complexity of the premises or work operation. The important aspect of fire-risk assessment is that it matches the complexity of hazards and risks within a particular workplace. Depending on the number of people, presence of flammable materials and rapid fire-spread risk workplaces can be classified into high-risk premises, medium-risk premises, and low-risk premises. Risk assessment is a powerful tool for making the work environment a safer place. It is a concept used in modern health and safety legislation, which centers on the principle of being reasonably practicable. Employers must ensure that they have taken reasonable steps to reduce risk to a level as low as reasonably practicable.

2.2 Global System for Mobile Communication (GSM)

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely

used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

2.2.1 GSM module

A GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board – say TTL Output (for Arduino, 8051 and other microcontrollers) and RS232 Output to interface directly with a PC (personal computer). The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections. These type of provisions vary with different modules.



Figure 2.0: GSM Module

GSM Modules are manufactured by connecting a particular GSM modem to a PCB and then giving provisions for RS232 outputs, TTL outputs, Mic and Speaker interfacing provisions etc. The most popular modem under use is SIM 900 gsm modem from manufacturer SIMCom.