



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART HOME APPLICATION USING GSM

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

by

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TAJUK: **Smart Home Application Using GSM**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) (Hons.). The member of the supervisory is as follows:

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ABSTRACT

Nowadays, smart home system is considered a need, especially for residential area in a town or city. The increasing rate of criminal cases reported in news recently may due to the people busy lifestyles and their increasing number of outdoor activities. Smart Home Application using GSM system is developed to help people in controlling home safety and to reduce electricity cost. This project focuses on monitoring electrical appliances at home without walking up to them and to access lock system using short message service (SMS). This system consists of the GSM modem; microcontroller circuit and relay are used as the output. GSM modem is used as a link between the user and the system. The system was integrated with the Arduino UNO board and a SM network interface using C language. Arduino Ide software was utilized to accomplish the integration. An Arduino UNO board which is based on ATmega328P microcontroller and it as the main controller to control the relay either that in normally open (NO) state or normally closed (NC) state. This system is operated when the GSM modem receive SMS from a user, then it will send the data to the microcontroller unit. The microcontroller unit will give the next command to the relay. This relay is connected to the electrical device such as lamp or bulb and magnetic lock. As a conclusion, this product is very useful to people those are busy in their life.

ABSTRAK

Pada hari ini, sistem rumah pintar telah menjadi satu keperluan terutamanya di kawasan perumahan di bandar. Hal ini disebabkan oleh peningkatan kadar jenayah dan kesibukan manusia dengan aktiviti luar rumah. Sistem Aplikasi Rumah Pintar menggunakan GSM ini dibina bagi memudahkan orang ramai untuk mengawal keselamatan dan membantu mengurangkan pembaziran elektrik di rumah mereka. Fokus projek ini adalah untuk mengawal barangan elektrik di rumah tanpa berada di rumah serta mengakses sistem kawalan kunci menggunakan sistem pesanan ringkas (SMS). Sistem rumah pintar ini terdiri daripada modem GSM dan litar mikropengawal serta menggunakan geganti sebagai keluaran. Modem GSM digunakan sebagai penghubung diantara pengguna dan sistem tersebut. Sistem yang bersepadu antara litar Arduino Uno dan rangkaian GSM ini menggunakan program Bahasa C. Perisian Arduino Ide telah digunakan untuk mengintegrasikan sistem ini. Litar Arduino Uno adalah sebuah projek berdasarkan mikropengawal Atmega328P dan ia sebagai pengawal utama untuk mengawal geganti samada dalam keadaan “normally open (NO)” atau “normally closed (NC)”. Sistem ini beroperasi apabila modem GSM menerima SMS daripada pengguna, kemudian modem GSM tersebut akan menghantar data tersebut kepada unit mikropengawal. Seterusnya, unit mikropengawal tersebut untuk memberi arahan kepada geganti. Komponen geganti ini telah disambung kepada alat elektrik seperti lampu serta kunci magnetik. Konklusinya, produk ini sangat berguna kepada orang ramai dalam menjalani kehidupan yang semakin sibuk.

DEDICATIONS

Alhamdulillah, praise to the Almighty Allah S.W.T

This thesis is dedicated to:

My family,

My Supervisor,

My lecturers,

And all my friends

Thanks for their encouragement and support

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Alhamdulillah, thank you Allah because of His blessing, I finally complete and finish my final year project successfully.

During the process to complete this project, there are lots of problems I have faced. With the guidance and support, I finally complete the project and report within the time given.

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LIST OF SYMBOLS AND ABBREVIATIONS

AC	-	Alternating Current
AT command	-	Attention command
BCS	-	Base Station Controller
BSS	-	Base-Station Subsystem
BTS	-	Base Transceiver Station
CDMA	-	Code Division Multiple Access
DC	-	Direct Current
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
IC	-	Integrated Circuit
GND	-	Ground
GSM	-	Global System of Mobile
GSM EDGE	-	Enhances Data Rates for GSM Evolution
IDE	-	Integrate Development Environment
ISDN	-	Integrated Services for Digital Network
LDR	-	Light Dependent Resistor
MS	-	Mobile Station
NC	-	Normally Close
NO	-	Normally Open
NSS	-	Network and Switching Subsystem
PCB	-	Printed Circuit Board

POTS	-	Plain Old Telephone Services
PWR	-	Power
SIM	-	Subscriber Identify Module
SMS	-	Short Message System
TDMA	-	Time Division Multiple Access
TTL	-	Time to Live
TX	-	Transmitter
RX	-	Receiver
USB	-	Universal Serial Bus

CHAPTER 1

INTRODUCTION

1.1 Project Background

The use of technologies in human life becomes wider and more new features exist to make human life better. One of these technologies is a smart home system that is demand for people. The smart home system includes many aspects such as for safety, health care, energy efficiency and others. This Smart Home Application using GSM is designed to control electrical devices and lock system remotely.

Nowadays, there is increase of electricity consumption, especially in homes due to the busy lifestyles where people may have forgotten to turn off electrical devices unnecessarily. Apart from that, keypad interface with a combination of ancient numeric keypad has caused difficulty to users to remember the numeric combination password. Thus, this research is carried out to provide a mechanism by the development of a prototype through remote control using short message service (SMS).

This project used the GSM modem which is connected to the microcontroller devices and it could receive SMS from users that allow the owner to monitor devices at home. SMS technology is a form of data communication with the broadest coverage in a minimum cost. GSM modem will make use of a SIM card to identify the user's account. After the GSM modem receives the message, it will subsequently forward the said message to the microcontroller. Then, the microcontroller will verify the message is true or not. If the message is true, the microcontroller will activate the relay which is connected to the devices. Therefore, the owner will be able to control electrical devices and lock system remotely using the mobile phone.

Besides, this project also will help user to check the status of the lamp whether it is ON or OFF. So, light sensor LDR is used to sense the light.

Basically, the relay is operated as a switch which is can be controlled either in normally open (NO) or normally closed (NC) state. NO state means that there is no current flowing in the circuit while for NC vice versa. In summary, the devices are in OFF condition (NO state) or ON condition (NC state). The lock system used in this project is a magnetic lock. Based on the electromagnetic principle, the magnetic core will change into a magnet when there a current flowing in, resulting door lock due to the relay in NC state.

1.2 Problem Statement

Electricity is one of the main sources of energy in today's life. Electricity is distributed on demand; it is constantly made and cannot be stored. Based on the research by Christopher Teh Boon Sung, a senior lecturer at Universiti Putra Malaysia (2010) stated, that Malaysia's consumption of energy increases every year. In 2008, the total energy demand in Malaysia was 522,199 GWh, of which the residential and commercial sectors contribute 14% of the total energy consumption in Malaysia. The consumption of electricity in Malaysia rises rapidly every year, with an average of 2,533 GWh per year. Hence, people should be aware of the increase in electricity consumption and should take necessary steps to address this issue. One of the causes of electricity wastage is the electrical devices which are not turned off. This includes, leaving lights ON when nobody around at home.

Besides, this project also is designed to replace the existing technology lock systems which are providing a keypad interface with complex features. Mostly the electronic lock is using numerical codes for authentication; the correct code must be entered for the lock to deactivate. It is difficult to learn and have not been accompanied with suitable interface designs. Thus, this project aims to help users on this both matter.

1.3 Objective Project

The purpose of this project is to design and develop a smart system for home application using GSM network. This system not only helps to reduce the electricity wastage, also will be able to control key system automatically. This system is a combination of two existing systems become one simple system. In addition, the project is also to evaluate the performance of the software and hardware for the smart home system.

1.4 Scope of Project

The scope of the project is important to ensure that the project is heading in the right direction to achieve its intended objectives. The scope of this project will focus on how the smart home system works.

Firstly, it is pertinent to research on Arduino programming and the global system for mobile communication (GSM). In this aspect, this model of home application using GSM network is developed by using Arduino UNO board which consists of ATmega328P microcontroller, while Arduino Ide software is used to program the Arduino board by using C language. This project uses the Arduino UNO board because of a fast prototyping and its a great tool for developing interactive. Lastly, to build the program that can integrate and control the overall system.

1.5 Project Methodology

The project can be divided into two main parts which consists of designing and evaluating performance stages as follows:

Stage 1: Conduct literature review for the project system by studying and searching information about smart home system and GSM network. Then, to conducting research on the characteristic of the components that will be used and understand the operation of the circuit.

Stage 2: Identify the hardware and software that will be used in the project system and understand the operation of the circuit. Also to have a plan on how the project or problem formulated is organized and possible solutions are highlighted systematically.

Stage 3: The project is divided into two parts; hardware design and software design. The Proteus software has been chosen in the circuit design, while the Arduino Ide software is used to program the Arduino UNO board using C language.

Stage 4: The final circuit design and program are conducted. The unit test is performed to ensure it is error free and subsequently final testing will be conducted to ensure that the integration also will free from any error. Troubleshooting activity will be executed if an error is encountered.

1.6 Thesis Outlines

This thesis consists of five chapters. The following chapters are the outline of the implementation of smart home systems.

Chapter 1 will explain briefly the overview of this project. It included project background, problem statement, objectives, scope of the project and project methodology.

Chapter 2 will cover on the research and information about the project on several important concepts of smart home system, GSM technology and tools used in the study. All the information is obtained from journal papers, articles, books, technical papers and reliable internet sources. This chapter will provide details software and hardware designs for the smart home system, background of GSM, a comparison GSM system with the other system and several types of existing smart home that are available in the market.

Chapter 3 contains of the methodology used in order to complete the project. The methodologies include the design, process, simulation and hardware developing should be followed to get a better performance.

Chapter 4 will provide in detail about the result and analysis of designing a smart home system model. All construction circuit, analysis result, observations and designs will be presented in this chapter.

Lastly, Chapter 5 will discuss the overall conclusion and suggestion of this project. Any other suggestions to improve the project in the future will also be discussed attached in this chapter.

CHAPTER 2

LITERATURE REVIEW

This chapter will discuss about the literature review, which it contains the details and information collected to gain knowledge and ideas to complete this project. It was included the details in software and hardware design which is useful in the project. Background on GSM technology and several types of related work that consist in our industry also are discussed in this chapter. There are several sources that have taken as a resource such as books, thesis, journal and website.

2.1 Electrical Control System Uses GSM Technology

According to Mohd Helmy Abd Wahab, Norzilaati Abdullah, Ayob Johari and Herdawati Abdul Kadir (2010) on their study of GSM Based Electrical Control System for Smart Home Application; a prototype based on microcontroller device using SMS is developed. The use of electricity is very important as one of the main source of energy that is necessary in modern life. Some kinds of mechanism using available technology could be used to reduce wastage in electricity usage. The smart home system can automatically control any electrical equipment at home remotely using a mobile phone. Hence, the electrical energy saving in daily life can be made more efficient and effective. The purpose of using SMS is to provide wider coverage at minimal cost. Therefore, the use of SMS would ease in controlling the electrical device at home from long distance and low in maintenance. At the present time, people use electrical energy as one of the main source of power of energy to operate any electrical device or appliance. Most of the people turn on the light for 24 hours per day when they are away from home. Leaving the light turned on continuously, lead to energy waste. Thus, the electrical control system is to facilitate the home owner to optimize usage of electricity remotely using SMS.

2.2 Door Lock System

According to Mohd Helmi Alsuykran (2008) on his study of Automatic Door Lock System; the door lock system is a design based on the electromagnetic principle. It will have the magnetic core and change to a magnet when power supply is fed to it. This magnet will act as a locking part of the door and the door will always lock at all time. The system will act after receiving and identifying SMS for the safety purposes.

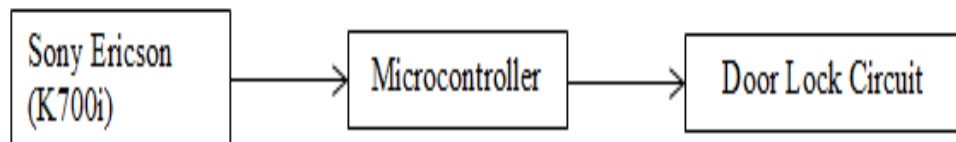


Figure 2.1: Block Diagram of automatic lock system

Figure 2.1 is a block diagram of Automatic Door Lock system. It shows that phone (Sony Ericson (K700i); GSM modem) will receive an SMS from the user, as a consequence a signal will be sent to the microcontroller. Then, the microcontroller will verify the signal whether it is the right person or not to open the door. If the right person sends the SMS, then it will activate the door lock circuit. If the SMS is not from the authorized person then it will keep the door lock.

2.3 Home Security System with GSM

Tarun Agarwal is a Chief Customer of Support Officer at Edgefx Technologies Pvt Ltd (2013) described that home security or home automation can be achieved by adopting central controllers to control home devices or appliances that sense different variables using appropriate sensors. The microcontroller is the heart of the system wherein the central processing of data takes place. It collects the data or information from various sensors and compares it with appropriate prescribed lists. It is programmed by embedding C or assembly language. Then, GSM modem