UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FACULTY OF ELECTRICAL ENGINEERING

FINAL YEAR PROJECT 11

A SMART HOME SECURITY SYSTEM BASED ON ZIGBEE

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(Control, Instrumentation & Automation)

June 2014

SUPERVISOR DECLARATION

" I hereby declare that I have read through this report entitle " Home Security System using Zigbee" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

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A report submitted in partial fulfilment of the requirements for the degree of Bachelor in Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2014

STUDENT DECLARATION

I declare that this report entitle "*A SMART HOME SECURITY SYSTEM BASED ON ZIGBEE*" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ....

Name   : NUR FATIHAH BINTI MOHD MARZUKI

Date   : 17/6/2014

To my beloved father and mother who always there for me

MohdMarzuki Bin Ibrahim and KarimahBintiYaakob

To my Supervisor and lecturer, for their guidance and encouragement

Prof MohdAriff Bin Mat Hanafiah

To my friends, for their unconditional support

Dedicated in thankful appreciation for your supporting, encouragement and best wishes.

ACKNOWLEDGEMENT

In the Name of ALLAH, the Most Gracious and the Most Merciful

Praise be to ALLAH

First and foremost, I would like to take this opportunity to express my deepest grateful appreciation to all wonderful people have continuously giving me support, advices, knowledge, understanding and contribution towards the successful completion of this Final Year Project.

In particular, I wish to express my sincere appreciation to my supervisor, Professor MohdAriff Bin Mat Hanafiah for encouragement, guidance, critics, advices, suggestion and motivation on developing this project. I also wish to express my sincere appreciation to, Wan NurShelaEzwane Wan Jusohwho is willing to spend his precious time to give some ideas and suggestion towards this project. This thesis would not have been the same as presented here without continued support and interest from them. They have contributed towards my understanding and thoughts.

My sincere appreciation extends to all my undergraduate friends especially BEKC member of batch 2010-2014 who have helped and shared brilliant ideas throughout the whole year.

Last but not least, I would like to express my sincerest gratitude and deepest thankfulness to my parent MohdMarzuki Bin Ibrahim and KarimahBintiYaakob for their love, support and encouragement that they had given to me.

ABSTRACT

The purpose of this project is to design and develop a security system for monitoring any intruders and others emergency situation around the house and display to the user in the form of computer monitor display. The chosen sensor is PIR motion sensor and the semiconductor sensor. The PIR can be used to detect movements, normally used to detect human movement when passing in or out of range sensor The gas sensor used in this project is MQ2, the semiconductor gas sensor which detects the presence of combustible gas and smoke at concentrations from 300 to 10,000 ppm. These sensors will detect the concentration of the gas according the voltage output of the sensor. To make the sensors operate in the alarm system and data monitoring system, Arduino Uno was used as the microcontroller for the whole system. The circuit also includes LEDs, buzzer, exhaust fan and Xbee. Xbee will send the data reading from gas sensor to data monitoring system that display on computer monitor display.

ABSTRAK

Projek ini bertujuan untuk mereka bentuk dan membangunkan sistem keselamatan dan memantau penceroboh dan keadaan kecemasan di sekitar rumah dan memapaparkan kepada pengguna dalam bentuk komputer monitor. Sensor dipilih adalah PIR sensor gerakan dan sensor semikonduktor. Passive Inframerah PIR boleh digunakan untuk mengesan pergerakan, biasanya digunakan untuk mengesan pergerakan manusia ketika melalui atau di luar julat sensor. Sensor gas yang digunakan dalam projek ini adalah MQ2 , sensor gas semikonduktor yang mengesan kehadiran gas yang mudah terbakar dan asap pada kepekatan daripada 300 kepada 10,000 ppm. Sensor ini akan mengesan kepekatan gas mengikut output voltan sensor. Sensor beroperasi dalam sistem penggera dan sistem pemantauan data, Arduino Uno telah digunakan sebagai pengawal mikro untuk keseluruhan sistem. Litar ini juga termasuk LED, buzzer, kipas ekzos dan XBee . XBee akan menghantar membaca data dari sensor gas dan sensor gerakan untuk sistem pemantauan data yang dipaparkan pada monitor komputer paparan

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PIR   -   Pyroelectric Infrared

WSN   -   Wireless Sensor Network

LED   -   Light Emitting Diode

PPM   -   Parts Per Million

WPAN   -   Wireless Personal Area Network

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Project Background

Home security is a worldwide concerned issue, always emphasized and enhanced system. Different ways of security system have been enhanced such as use a large number of security officers, the use of sophisticated weapons, the use of alarms, monitoring system, through the production of electronic hardware and software and much more. One of the most important safety system and required for all social group is home security. Houses need to be monitored at all times such as from theft, fire and short circuits. Recently, the rate of crimes involving robbery, murder and fires is increasing and worrying all of us. So, home surveillance system must be upgraded to be more effective to keep up with the increasing crime rate. Various methods can be done to improve home security monitoring including the usage of security officers. However, this method is not suitable for all levels, wasteful and less reliability. All these improvements need to work more effectively, giving advantages to the user and can monitor without any errors that may hinder the security process. At present, a lot of study on smart home systems has been done and it covers all aspects. For example, smart home systems study in terms of multimedia, security monitoring, lighting, temperature control and others. In a smart home system, manual methods are no longer used and replaced by an automated system that helped users to monitor the condition of the house, thus facilitating and speeding up daily works. Automatic system can prevent the effects of human error and saving electricity.

1.2 Problem Statement

Security monitoring system requires data transmission system fast receiving data and accurate at a certain distance, so that users can place devices freely at important locations for the data display receiver. In other words, this system must be portable and user friendly. Display system is shown to be straightforward and easy to understand, so that users can take important immediate action. The system must not be hacked by anyone, no matter in various ways including on input source power, the content of data transmission, content of receiving data and location of security sensor device's main processor is stored [2]. The system must also have characteristics such as water resistant, high temperature resistant and robust, so that data transmission process and data receiving will not fail. Many of other security systems have some limitations on the usage of sensor devices. These problems will result in limitations of the security system. However, it is inevitable that a security system requires extensive use of sensors for the system to area of the house. The use of sensor devices is also very important in security systems. Sensors must be sensitive to human motion. Sensors must be working on the most appropriate range, that is not too close and too distant to detect movement and should be according to the human nature. [2]

1.3 Objectives

The main objective of this project are design and develop a security system for monitoring any intruders and others emergency situation around the house and display to the user in the form of computer monitor display.

a) To design and develop the home security system based on Zigbee technology

b) To develop the hardware and the programming the system

1.4 Scope of Research

In effort of achieving the objectives, several scopes have been outlined. The scopes of work in this project are:

a) To study the Zigbee Technology for home networking

b) To investigate the hardware and software appropriate with the Zigbee home automation.

c) To investigate and study the appropriate application software

1.5 Report Outlines

There are five chapters in this thesis which are introduction, literature review, methodology, result and discussion and finally conclusion and recommendation. Each chapter will discuss its own aspects related to the project.

Chapter one is the introduction for the project. Problem statement, object and scope of the project along with the summary of works have been discussed in this chapter. Then, chapter two discusses more on the theory and literature. Besides that, this chapter also discusses the type of Arduino used for the project, the sensor chosen, and also the software involve in programming the Xbee and Arduino.

Chapter three focuses on the methodology and approaches on the project. This includes the programming the software and hardware development of the project. Results and discussion are presented in chapter four. Lastly, chapter five is the conclusion for the whole project. Some future suggestions such as a functional addition and hardware improvement the project are also mentioned.

CHAPTER 2:

LITERATURE REVIEW

2.1   Introduction

This chapter will discuss in details on the components and instruments used for this project. Besides that, there are couple more of past related project or paper work that is related to the project.

2.2   Overview of Zigbee

ZigBee is a specification for wireless personal area networks protocol (WPANs) operating at 868 MHz, 915 MHz and 2.4 GHz. A WPAN is a personal area network in which the device in which the connections are wireless and a network for interconnecting an individual's devices. Using ZigBee, devices in a WPAN can communicate at speeds of up to 250 Kbps while physically separated by distances of up to 100 meters in typical circumstances and greater distances in an ideal environment. ZigBee is based on the 802.15.4 specification approved by the Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA) [1].

ZigBee provides for high data throughput in applications where the duty cycle is low. This makes ZigBee ideal for home, business and industrial automation where control devices and sensors are commonly used. Such devices operate at low power levels, and this, in conjunction with their low duty cycle (typically 0.1% or less), translates into long battery life. Applications well suited to ZigBee include heating, ventilation and air conditioning (HVAC), lighting systems, fire sensing and the detection, intrusion detection and notification of unusual occurrences. ZigBee is compatible with most topologies including peer-to-peer, star network and mesh networks.

2.2.1 ZigBee Alliance

The ZigBee Alliance is an association of companies working together to define an open global standard for making low-power wireless networks. The objective of ZigBee Alliance is to create a specification defining how to build different network topologies with data security features and interoperable application profiles. The association includes companies from a wide spectrum of categories, from chip manufactures to system integration companies.

The first specification was ratified in 2004 and the first generation of ZigBee products had reached the market in 2005. A big challenge for the alliance is to make the interoperability to work among different products. To solve this problem, the ZigBee Alliance has defined different profiles, depending on what type of category the product belongs to [3].

2.2.2 History of ZigBee

1) ZigBee-style networks began to be conceived about 1998, when many installers realized that both WiFi and Bluetooth were going to be unsuitable for many applications. In particular, many engineers saw a need for self-organizing ad-hoc digital radio networks.

2) The IEEE 802.15.4 standard was completed in May 2003.

3) In the summer of 2003, Philips Semiconductors, a major mesh network supporter, ceased the investment. Philips Lighting has, however, continued Philips' participation and Philips remains a promoter member on the ZigBee Alliance Board of Directors.

4) The ZigBee Alliance announced in October 2004 that the membership had more than doubled in the preceding year and had grown to more than 100 member companies, in 22 countries. By April 2005 membership had grown to more than 150 companies and by December 2005 membership had passed 200 companies.

5) The ZigBee specifications were ratified on 14 December 2004.

6) The ZigBee Alliance announces public availability of Specification 1.0 on 13 June 2005, known as ZigBee 2004 Specification.

7) The ZigBee Alliance announces the completion and immediate member availability of the enhanced version of the ZigBee Standard in September 2006, known as ZigBee 2006 Specification.

8) During the last quarter of 2007, ZigBee PRO, the enhanced ZigBee specification was finalized [4].