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Intelligent fire alarm system using bluetooth  
communication / Erna Nooryanti Azmi.

**INTELLIGENT FIRE ALARM SYSTEM USING  
BLUETOOTH COMMUNICATION**

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**MEI 2006**

## DECLARATION

**“ I hereby declare that the work submitted in this thesis entitled  
‘ Intelligent Fire Alarm System Using Bluetooth Communication’  
is my own, except for works that I have been clearly cited in the references”.**

**Signature** :  .....

**Writer** : ERNA NOORYANTI BINTI AZMI

**Date** : 5.5.2006

To my love.....

Father, Mother, Family

And last but never least, all my friends.

## ACKNOWLEDGEMENT

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## ABSTRACT

This project consists of a fire alarm system that performs the function of a sensor and the usage of a micro-controller. The objectives for this project are to design a low cost fire alarm system and using a 'Bluetooth' device as an interface. To achieve the objective to be a low cost system, that circuit was simplified so that it used fewer components and only used economical components. This fire alarm system is different than other traditional fire alarm because it could communicate with the personal computer without using any cable. It could be used in maximum range of 10 meters if there are no obstacles. This project had become an intelligent fire alarm because it's a two-way communications and capable of performing the function of a fire alarm and make used of the PC as a control panel. With control panel, users could check the surroundings temperature at any time and analyze the database. This fire alarm was designed so that it still can operate even if the 'Bluetooth' link failure. In this case, only the buzzer will function when the temperature reached the threshold value.

## ABSTRAK

Projek ini terdiri daripada sistem penggera kebakaran yang mana ia menggunakan pengesan suhu dan pengawal mikro untuk menjalankan fungsinya. Objektif projek ini adalah untuk membina penggera kebakaran yang berkos rendah dan mengaplikasikan kegunaan 'Bluetooth' sebagai perantaramuka. Untuk mencapai objektif untuk menghasilkan sistem penggera kebakaran yang berkos rendah ini, litar diringkaskan untuk mengurangkan penggunaan komponen dan hanya menggunakan komponen yang ekonomi (murah). Sistem Penggera Kebakaran ini adalah berlainan daripada yang lain kerana ia mampu berkomunikasi dengan komputer tanpa memerlukan sebarang kabel. Penggunaannya adalah lebih kurang 10 meter jika tiada sebarang halangan. Projek ini dipanggil pintar kerana ia mampu untuk berkomunikasi dalam dua arah dan menjalankan fungsi penggera kebakaran yang sekaligus menjadikan komputer sebagai panel kawalan. Dengan adanya panel kawalan, pengguna dapat melihat suhu sekitarnya pada bila-bila masa sahaja dan membuat analisa terhadap data yang diperolehi. Sistem Penggera Kebakaran ini direkabentuk supaya ianya sentiasa berfungsi walaupun 'Bluetooth' gagal beroperasi. Dalam keadaan ini, ia hanya akan membunyikan buzzer jika suhu melebihi daripada yang ditetapkan.

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## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Introduction**

Nowadays, the usage of fire alarm system is become popular either in office or homes. So, market will be up because of the request. But, users are no longer satisfied with a simple fire alarm detector that just senses and sounds the alarm. Many would like to have a fire alarm system that monitors and alert them in case of emergency especially when they are away. Price for this system is usually expensive and it's installation is complicated. However, user always suspected the cost of that system is cheap and easy to install.

Traditional fire alarm systems are classified in a hardwired. So, it will use many cable to connect one another. Users find it's untidy and inconvenience to handle wires. Many users would like to have an advanced technology which is wireless, easy to manage and install, multiple function and low power consumption. According to the request, occur one fire alarm project where it will includes all user needed. Intelligent Fire Alarm System using Bluetooth Communication is the name of that project.

## 1.2 Problem Statement

Traditional fire alarm systems are hardwired. Users find it cumbersome to handle wires and many face the inconvenience in installation with wires.

Simple security system just senses and sounds the alarm. It can't monitor and alert user in case of emergency. This case become seriously if they are away.

Many Fire Alarm products in the market are expensive and complicated. But, users are looking for a low cost and simpler solution.

## 1.3 Objectives

Implement a wireless technology. This fire alarm project is design to use a Bluetooth communication as a wireless technology. Bluetooth device is use for transferring data from fire alarm system to the computer.

This project will capable of performing the function of a fire alarm and make use of the computer as a control panel to monitor the temperature. All the reading from that day can be stored at the database. From the database, users can analyze it.

Build the fire alarm systems with a low cost; it's cheaper than a price at the market. To achieve this target, a minimize components and economical components must be use. Be a simple fire alarm, but multi-functions.

## 1.4 Scope of Project

This project is divided into two parts;

- a) Software - will involve with the development of a programming to provide a graphical user interface (GUI) and interconnection between Bluetooth devices and computer. This GUI can control and monitor the alarm system wirelessly through the computer. C programming and Visual Basic programming are needed to achieve the target of this project.
- b) Hardware - will involve in designing and developing an alarm system prototype that will be integrated with the software part. The hardware prototype will have basic fire alarm system.

## 1.5 Project Background

This project consists of a fire alarm system that performs the function of a sensor and the usage of a micro-controller. The concept of this project is a wireless fire alarm system. This project will build to be a low cost fire alarm system. Because of the target to be a lower price at the market, simple circuit must be designed. In circuit designing, the price and amount of the components must be considered. Cheapest components and minimize components are the best selection for designing the circuit.



To make the project low power consumptions, it will use a battery power. It will operate when 6V battery is supply (4 battery size AA). An alternative way to save the battery power, switch will be place after the battery supply. Users can easily switch the fire alarm system at anytime.

This fire alarm system is difference than others traditional fire alarm because it can communicates with the personal computer without using any cable. It's use a wireless technology which is calls "Bluetooth Communications". Using the Bluetooth technology, fire alarm and personal computer can communicates each other in maximum range of 10 meters without obstacles. With Bluetooth technology, it can penetrate the obstacles. But, the distance range is closer; about 3 meters only.

This project will become an intelligent fire alarm because it is a two-way communications and it's capable of performing the function of a fire alarm and make use of the PC as a control panel. With control panel, users can check the surroundings temperature at any time and make an analysis on their own from the database that is record. This fire alarm project is design to always be function even if the 'Bluetooth' is failure. In this case, it's only can sound the buzzer when the temperature is over limits.



## 1.6 Project Methodology

To achieve the target of this project, all this methodology have to follow:

- a) Firstly, the information of fire alarm system and Bluetooth technology is research. This research includes an Internet, journal and books. All the relevant circuit and information that can be use in this project must be record.
- b) Programming Language as C and Visual Basic language have to learn. This two languages will use in this project.
- c) Appropriate components will choose including the Bluetooth devices.
- d) Fire alarm circuit is design
- e) All planning of the project are monitor to the supervisor.
- f) Hardware part is build
- g) Software that compatible with the hardware is develop
- h) Testing
- i) Debug

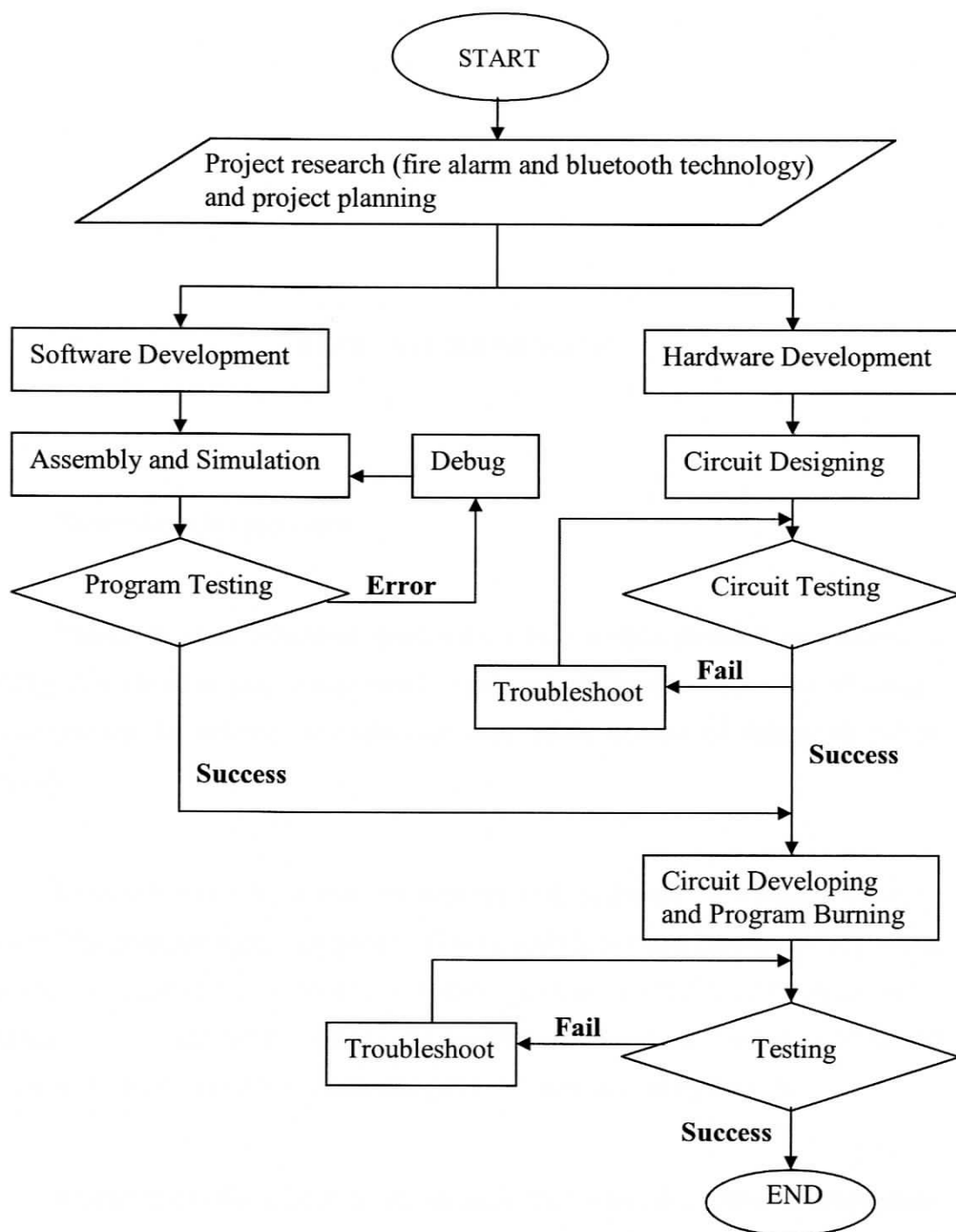


Figure 1.1 : Project methodology in a flowchart

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Technology Background

**Bluetooth** is an industrial specification for wireless personal area networks (PANs). It's a kind of close range wireless network. PAN offers users the advantage to personalize the network according to their needs instead of linking to public network.

Bluetooth provides a way to connect and exchange information between devices like personal digital assistants (PDAs), mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost, globally available short range radio frequency. Its design for low power consumption makes the technology well suited for use with small, portable devices that typically are powered by battery.

Bluetooth lets these devices talk to each other when they come in range, even if they are not in the same room, as long as they are within up to 100 metres (328 feet) of each other, dependent on the power class of the product. Products are available in one of three power classes:

- Class 3 ( maximum output = 1 mW; power = 0 dBm) is the rarest and allows transmission of 10 centimetres (3.9 inches), with a maximum of 1 metre (3.2 feet)
- Class 2 ( maximum output = 2.5 mW; power = 4 dBm) is most common and allows a quoted transmission distance of 10 metres (32 ft)
- Class 1 ( maximum output = 100 mW; power = 20 dBm ) has the longest range at up to 100 metres. This class of product is readily available.

## 2.1 Bluetooth Benefits

Some of the benefits are:

- Enhances users experience
- Connecting devices without the need for cables
- Becoming more integrated within laptops, mobile phones, handhelds, and many other devices
- Reduced power consumption
- Industry wireless communications standard
- Becoming more affordable for everyone
- One of the ways Bluetooth devices avoid interfering with other systems is by sending out very weak signals of 1 milliwatt. By comparison, the most powerful cell phones can transmit a signal of 3 watts.

### 2.3 Comparison Technology

Table 2.1 : Bluetooth versus Infra-Red

Bluetooth	Infra-Red
- It's use a reflection wave.	- It's use a 'Line of Sight'(LOS) technology
- Bluetooth works in point-to-point connections and in point to multi-point connections	- Infrared is almost always a "one to one" technology
- Signals can penetrate the obstacles	- Signals can't penetrate the obstacles
- Limit range is around 10 meter	- Limit range is around 2 meter
- Supports data speeds around 120kbps to 723kbps	- Infra-Red supports data speeds around 9.6kbit/s to 115kbit/s (- 4Mb)

## 2.4 Bluetooth works

Bluetooth devices operate at 2.4 GHz in the license-free, globally available ISM (Industrial, Scientific, and Medical) radio band. The advantage of operating in this band is worldwide availability and compatibility. A potential disadvantage is that Bluetooth devices must share this band with many other RF emitters. These include automobile security systems, other wireless communications standards (such as 802.11), and ordinary noise sources (such as microwave ovens). Bluetooth technology use IEEE 802.15.1 standard.

To overcome this challenge, Bluetooth employs a fast frequency-hopping scheme and uses shorter packets than other standards in the ISM band. This scheme makes Bluetooth communication more robust and more secure.



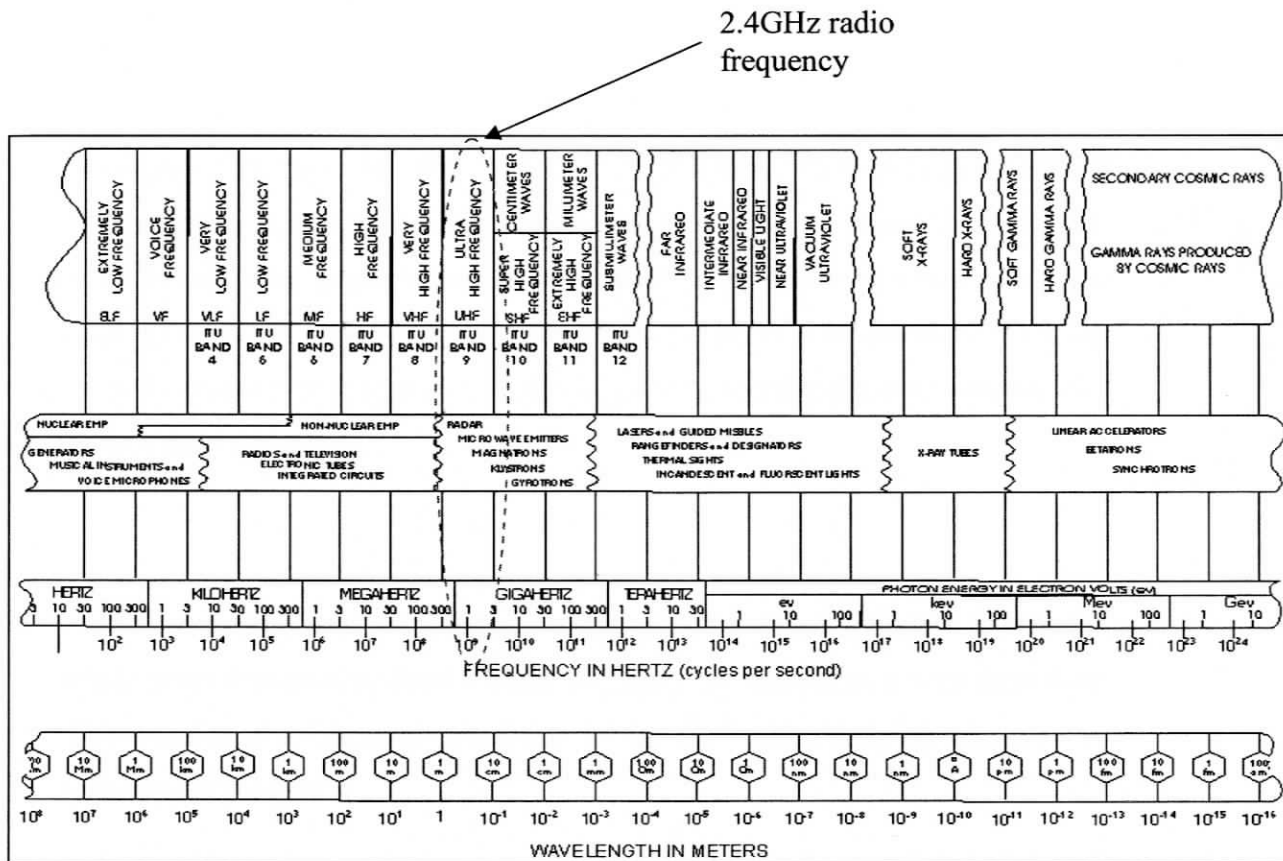


Figure 2.1 - Electromagnetic Spectrum

RFCOMM is the cable replacement protocol included in the Bluetooth specification. RFCOMM presents a virtual serial port that is designed to make replacement of cable technologies as transparent as possible. Serial ports are one of the most common types of communications interfaces used with computing and communications devices. Hence, RFCOMM enables the replacement of serial port cables with the minimum of modification of existing devices. RFCOMM provides for binary data transport and emulates EIA-232 control signals over the Bluetooth baseband layer. EIA-232 (formerly known as RS-232) is a widely used serial port interface standard.

### 2.4.1 Frequency Hopping

Frequency hopping is literally jumping from frequency to frequency within the ISM band. After a Bluetooth device sends or receives a packet, it and the Bluetooth device or devices it is communicating with “hop” to another frequency before the next packet is sent. The frequency-hopping scheme enables a Bluetooth to work not only in point-to-point connections but also in point to multi-point connections. This scheme has three advantages:

- It allows Bluetooth devices to use the entirety of the available ISM band, while never transmitting from a fixed frequency for more than a very short time. This ensures that Bluetooth conforms to the ISM restrictions on transmission quantity per frequency.
- It ensures that any interference will be short-lived. Any packet that doesn't arrive safely at its destination can be resent at the next frequency.
- It provides a base level of security because it's very difficult for an eavesdropping device to predict which frequency the Bluetooth devices will use next.

Of course, the connected devices must agree upon the next frequency to use. The Bluetooth specification ensures this in two ways. First, it defines a master-slave relationship between Bluetooth devices. Second, it specifies an algorithm that uses device-specific information to calculate frequency-hop sequences.