CHILD MONITORING SYSTEM (CHILD)

AMIRAH AAINAA BINTI ABDUL JALIL

UNIVERSITI MALAYSIA PAHANG

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Faculty of Electrical & Electronics Engineering
Universiti Malaysia Pahang

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Specially dedicated to my beloved parents, Abdul Jalil bin Abdul Kader and Aminah binti Osman who's been with me through all the years and those people who have guided and inspired me throughout my journey of education.

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ABSTRACT

Bluetooth is a technology for automatically identifies something using radio signals. This project is basically to assist parent to keep an eye on the children by using Bluetooth technology. It is a system designed for the supervisory user (parent), to supervise the child when they are out of sight. It consists of a portable module to be worn by the child, complete with wireless system. The module will alert the parent when the child is moving outside the predetermined area and if the tag is no longer attached to the child. There are three important things while developing this project. First is the selection of the appropriate Bluetooth module in order to reach the needed specification. The second one is the software implementation to integrate the Child Monitoring System using Programmable Intelligent Computer (PIC) microcontroller to interface the Bluetooth module consecutively to control the system. Lastly, a temperature circuit functioning as a sensor to detect either the child is wearing the tag or not. Bluetooth Child Monitoring System aims to benefit families by preventing missing children when they are out of sight and providing parents with a constant awareness of their children's whereabouts. Bluetooth Child Monitoring System use Bluetooth Technology between parent's module (receiver) and child's module (transmitter) to establish simultaneous data. It allows for a secure and wireless connection.

ABSTRAK

Bluetooth merupakan satu teknologi untuk mengenalpasti sesuatu menggunakan isyarat-isyarat radio secara automatik. Projek ini menyediakan satu penyelesaian yang efektif dengan menggunakan teknologi Bluetooth berkenaan isu pengawasan ibu bapa terhadap anak-anak. Ia merupakan suatu sistem yang direka khas untuk pengunaaan ibu bapa untuk mengawasi anak-anak apabila mereka berada di luar kawasan pemerhatian . Pengesan Kanak-Kanak Bluetooth ini terdiri daripada satu sistem tanpa wayar yang boleh dipakaikan kepada kanak-kanak. Ia menawarkan keupayaan mengawasi kanak-kanak di dalam ruang lingkup yang tertentu selain mengeluarkan amaran jika Pengesan Kanak-Kanak ini tidak lagi bersama kanak-kanak tersebut. Produk ini mengemukakan satu sistem amaran yang melaporkan kepada ibu bapa sekiranya anak-anak keluar daripada persekitaran mereka. Terdapat tiga perkara penting dalam menjalankan projek ini. Pertama adalah pemilihan modul Bluetooth yang sesuai. Modul Bluetooth yang sesuai perlu dipilih dalam usaha untuk mencapai spesifikasi yang dikehendaki. Kedua ialah pelaksanaan perisian menggunakan mikropengawal PIC bagi membolehkan Modul Bluetooth untuk mengawal sistem. Terakhir, litar suhu yang berfungsi sebagai pengesan untuk memastikan sama ada kanak-kanak tersebut masih memakai Pengesan Kanak-Kanak Bluetooth atau tidak. Pengesan Kanak-Kanak Bluetooth ini memberi kemudahan kepada setiap keluarga dalam menangani masalah kehilangan kanak-kanak ketika mereka berada di luar kawasan pemerhatian. Pengesan Kanak-Kanak Bluetooth menggunakan teknologi Bluetooth diantara ibu bapa (penerima) dan kanak-kanak (penghantar) dalam penghantaran data. Ia merupakan satu sistem tanpa wayar yang terjamin keselamatannya.

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CHAPTER 1

INTRODUCTION

1.1 Background

Bluetooth is a wireless technology with an open specification for a low-cost, low power, short-range radio technology for ad hoc wireless communication of voice and data intended for use in low power embedded system applications. It was named after a Danish Viking king, Harald Blaatand “Bluetooth” I who successfully united Denmark and Norway during his rule from 940 to 985 AD.

Bluetooth networking transmits data via low-power radio waves. It communicates on a frequency between 2.402 GHz and 2.480 GHz which has been set aside by international agreement for the use of industrial, scientific and medical devices (ISM). Even with the low power, Bluetooth does not require line of sight between communicating devices. The crucial part of the design is to make sure that it does not interfere with another. Bluetooth can connect up to eight devices simultaneously. With all of those devices in the same 10-meter radius, it is unlikely interfere with one another as it uses a technique called spread-spectrum frequency hopping that makes it rare for more than one device to be transmitting on the same frequency at the same time.

Bluetooth is a standard and communications protocol primarily designed for low power consumption with a short range (power-class-dependent: 1 meter, 10 meters or 100 meters) based on low-cost transceiver microchips in each device. Bluetooth protocols simplify the discovery and setup of services between devices. This makes using services easier because more of the security, network address and permission configuration can be automated than with many other network types. Bluetooth makes it possible for these devices to communicate with each other when they are in range. Because the devices use a radio communications system, they do not have to be in line of sight of each other. They can even be far apart if the transmission has sufficient power. In most cases, the effective range of class 2 devices is extended if they connect to a class 1 transceiver, compared to a pure class 2 network. This is accomplished by the higher sensitivity and transmission power of Class 1 devices.

Bluetooth systems create a personal-area network (PAN) that may fill a room or encompass desired distance where when it is established, the members randomly hop frequencies in unison so they stay in touch with one another and avoid other network that may be operating in the same room or area. It unleashes the concept of “hidden computing” by providing radio devices “unconscious” connectivity without the user’s proactive intervention. It provides a bearer service for wireless (WAP) applications which is a wireless protocol utilizing short-range communications technology facilitating data transmission over short distances from fixed and/or mobile devices, creating wireless personal area networks (PANs).

1.2 Problem Statement

The lacks of supervision from the parent had increased the numbers of missing child. Nowadays, there are many cases of lost child occurred at the public area such as at the mall, amusement park and even at the playground. In such crowded places, parents are unable to constantly control the whereabouts of their child.

As a child, their level of curiosity is extremely high especially when they find out something interesting that really attracted their attention which may lead them being far away from their parents and get lost.

With Child Monitoring System, it can assist the parent to supervise the child when they are out of sight but the parent have no idea whether the child is still wearing the module or it is left somewhere behind. Therefore, a temperature sensor is used so that parents can be notified if their child is not wearing the module.

1.3 Objective

The objective of this project is to;

1.3.1 To design the child part that consists of Bluetooth programming and temperature sensor.

The purpose of this system is to detect the child within a specified range and whether the child is still wearing the tag or not. The parent will be alert either if the child is in the predetermined area and if their child is still wearing the module.

1.3.2 To integrate child monitoring system using microcontroller.

As PIC16F877 microcontroller acted as the host for the Bluetooth module. The PIC microcontroller needs to be programmed in order to control the system.

1.4 Scope of Project

This Child Monitoring System (child) has two scopes;

1.4.1 Programming the microcontroller to interface the Bluetooth module in order to control the Child Monitoring System.

By using PICBasic Pro, PIC microcontroller is programmed in order to control the whole system of Child Monitoring System (child).

1.4.2 Using a temperature sensor for precaution reason of the child monitoring system module.

The sensor is design so that it can alert the parent if the module is no longer with the child.

1.5 Thesis Overview

The Child Monitoring System (child) final thesis is a combination of 6 chapters that contains and elaborates specific topics such as the Introduction, Literature Review, Methodology, Architecture, Result and Analysis, Conclusion and Further Development that can be applied in this project.

Chapter 1: Introduction of the project.

Chapter 2: Literature review for the development of the Child Monitoring System (child).

Chapter 3: Methodology of the project.

Chapter 4: Discuss about the architecture of the project that consist the hardware design and the software implementation.

Chapter 5: Result obtained regarding the performance of the Child Monitoring System (child).

Chapter 6: Conclusion and future recommendation of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Bluetooth

Bluetooth is a wireless protocol utilizing short-range communications technology facilitating data transmission over short distances from fixed and/or mobile devices, creating wireless personal area networks (PANs).

2.1.1 Bluetooth Technology

The Bluetooth network uses an unlicensed radio frequency at 2.45 GHz with a data rate close to 300kbps. This frequency band has been set aside by international agreement for the use of industrial, scientific and medical devices (ISM). The maximum range is 10 meters but can be extended to 100 meters by increasing the power. Bluetooth devices are protected from radio interference by changing their frequencies arbitrarily up to a maximum of 1600 times a second, a technique known as frequency hopping.

Bluetooth networks are ad hoc networks which mean that the Bluetooth device automatically detects devices within its range and forms networks with them. If a device goes out of range, the network automatically drops its membership. This network formation is known as a piconet. Figure 2.1 shows the operation of the piconets.

A Piconet can be a simple connection between two devices or more than two devices. Multiple independent and non-synchronized piconets can form a scatternet. Several piconets can be established and linked together ad hoc, where each piconet is identified by a different frequency hopping sequence. However, when establishing a piconet, one unit will act as a master and the other(s) as slave(s) for the duration of the piconet connection. Devices synchronized to a piconet can enter power-saving modes called Sniff and hold mode, in which device activity is lowered.

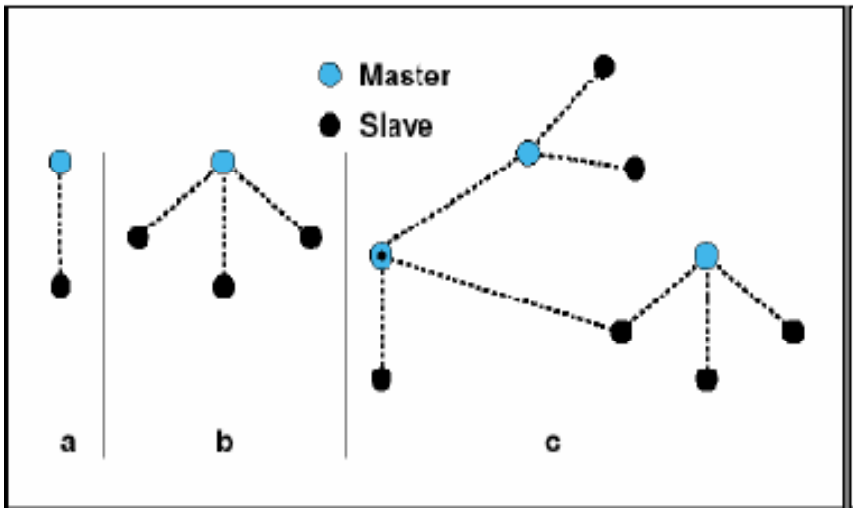

Figure 2.1 Piconets with single slave operation
(a) a multi-slave operation (b) a scatternet operation (c) Bluetooth Special Interest Group

2.1.2 Bluetooth Protocol

Bluetooth protocol stack is the core of the Bluetooth specification that defines how the technology works. It can be logically partitioned into three different groups where each contains different protocol layers. The transport protocol group facilitates the identification of other Bluetooth devices. The middleware protocol group provides the additional transport protocols that help new and existing applications to operate over Bluetooth links and the application group. It includes the actual applications that use Bluetooth links.

The organization of the protocol groups in the transport protocol layer developed by SIG facilitates the movement of voice and data traffic between Bluetooth devices. The transport protocol group is divided into two groups. The lower transport protocol group consists of the radio, baseband, Link Controller (LC) and Link Manager (LM). The upper transport group consists of Host Controller Interface (HCI) and Logical Link Control and Adaptation Protocol (L2CAP).

The layers of the transport protocol group work together to transport data from one device to another. The Bluetooth protocol stack is shown in Figure 2.2.

a) Bluetooth radio is the lowest layer in the Bluetooth protocol stack. The design specification is to ensure the development of a transceiver to comply with 2.4GHz ISM band regulations.

b) Baseband layer is responsible for the determination and instantiation of the air interface. The channels for the transmission of frequency traffic consisting of voice and data.

c) The Link Manager Protocol (LMP) performs all the function related to link management. Communication is established between two LMs when they discover each other.

d) The Host Controller Interface (HCI) provides a command interface which segregates the baseband layer and the LM from the host transport protocols. Thus, the Bluetooth hardware can be access without involving either the Transport layer or other hardware components.

e) Logical Link Control and Adaptation Protocol (L2CAP) layer shields the higher protocol layers from the operational intricacies of the lower protocol layer. L2CAP supports the sharing of the air interface between multiple protocols and applications.

f) The RFCOMM protocol is a subset of the European Telecommunications Standard Institute, ETSI standard TS 07.10 with certain adaptations that specifies in the Bluetooth RFCOMM specifications.

g) The Bluetooth Service Discovery Protocol (SDP) comes across as a boon in disguise for the dynamic ad hoc networks created by Bluetooth wireless communication. SDP defines a standard method for Bluetooth devices to determine the available services on a particular device.

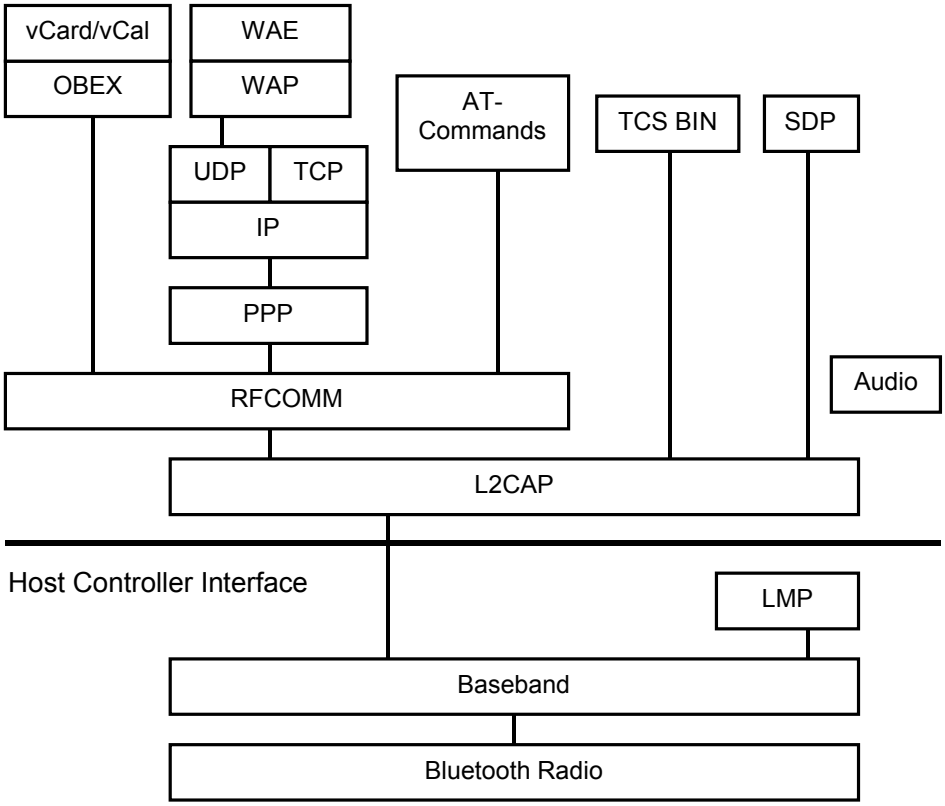

Figure 2.2: Bluetooth Protocol Stack

2.2 PIC16F877 Microcontroller

Programmable Intelligent Computer (PIC) is one of a family of Harvard architecture microcontrollers which made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. PICs are very popular for the low cost, wide availability, large user base, extensive collection of application notes and serial programming (and re-programming with flash memory) capability. Serial method programming allow the PIC 16F877 to be programmed while in the user's system so that it increased design flexibility.

The programmed PIC chips run 20 to 100 times faster. When a PIC chip is programmed, it is saved as a hex file. The hex file is than uploaded directly into EEPROM memory of the chip. Because the hex file is the native language of the PIC, the code does not need to be interpreted as it runs. Thus, the system enables the programmed PIC chips to run faster.

Programming PIC microcontrollers is a simple three-step process; write the code, compile the code and upload the code into a microcontroller. The program code saved as text file. The compiler reads through the text file and compiles an equivalent machine-code instruction listing (the hex file) of the program. The hex file is uploaded into the microcontroller and the CPU will run through the programmed list of hexadecimal numbers.

Because of their versatility, they add a lot of power, control and options for a small cost. It therefore becomes essential that the electronics engineer learns to program these microcontrollers in order to maintain a level of competence and to gain the advantages that microcontrollers can provide in their own circuit designs.

2.3 The ionKids System

Recently there's been a GPS system to track a child's whereabouts in the market. The ionKids System from Bluespan takes a slightly different approach to child monitoring. Instead of telling precisely where the child is located, it uses point-to-point technology to maintain a proximity radius. The ionKids System consists of a single monitoring device and up to four wristags using the monitor that can be set to a "safety zone" of up to 350 feet. If any child wanders out of the zone, ionKids triggers an alarm. A Find button activates the locator, which helps to zoom in on the straying child.

The monitor has a tamper sensor that goes off if someone tries to undo the security latch while the system's active but it has to be held steadily against the wristag in order to activate it and takes about seven seconds to become attuned to the watch. The wristag will flash a green light and beep when this process succeeds. At that point, the screen shows up to four wristags simultaneously. Each watch can be assign with a name so users do not have to remember who "Tag1" is. Besides, the wristag also beeps and flashes when the child goes out of range.

Compared to this system, the child monitoring system is only best used in a close quarters like shopping malls, short walks and playgrounds where wandering outside of a tight radius of 20 meters. Besides, the ionKids system only available in the United States with an expensive price of USD169.95 (RM586.75) per kit. In contrast, the child monitoring system will be available in Malaysia with not so highly cost. It has the same functionality as the ionKids. It triggers an alarm when the child moves outside the range and also when the tag is loosening from the child.

CHAPTER 3

METHODOLOGY

3.1 Project Methodology

To begin with any project, a lot of relevant and important information need to be obtained. By research and doing the literature review, not only a lot of information can be obtained but also it gain the knowledge of the technology used in world today. Most of the information that related with the project can be obtained by surfing the internet, browsing the books and also with the aid of supervisor in charge.

Research is one of the most important stages in this project to make sure that this project will be a success. Through these researches, a lot of information and knowledge can be collected to know which method will work and which will not. From this stage, the idea to make an ideal project is generated.

To begin with, the selection of the suitable Bluetooth module for the system is needed. The most suitable Bluetooth module with the specified range and other specification must be choose properly in order to achieve the expected result.

This project consists of two parts which are hardware part and programming for the software part. For the hardware part, all the components used need to be list down to proceed to the next stage. The idea is analyze to determine whether it is appropriate with the project and when the idea is fit, the project can be started to assemble.

The circuitry for the hardware is going to be developed. During this time, experimenting is the most important. If there is any incompatibility with the hardware, the cause of it must be tracked in order to make sure those circuits are fully functional.

For the software part, the PIC microcontroller needs to be program to interface the hardware part in order to control the whole project. After the integration of the hardware and the software, test and debug the system and make the verification of the outcome.

The most important element in this stage is to integrate the hardware as those circuits may behave differently when they are assembled together. If there is any problem occurred, the system need to be troubleshoot in order to find the cause of the problem. On the contrary, the project can proceed to the final report.

The methodology flowchart of the project can be seen in the figure shown in Figure 3.1.