



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WEARABLE BRACELET FOR CHILD MONITORING SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Bachelor's Degree in Electrical Engineering Technology Industrial Automation & Robotics) (Hons.)

by

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I hereby, declared this report entitled
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is the results of my own research except as cited in references.

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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 Engineering Technology (Bachelor's Degree in Electrical Engineering Technology Industrial Automation & Robotics) (Hons.). The member of the supervisory is as follow:

.....
(Aminurrashid Bin Noordin)

ABSTRAK

Kanak-kanak adalah berharga bagi ibu bapa dan kasih sayang yang diberikan tidak pernah berkurangan. Oleh itu, apabila berlakunya kes kehilangan kanak-kanak ia akan memusnahkan kehidupan ibu bapa kanak-kanak tersebut dan bahagian yang paling teruk ialah apabila kanak-kanak itu didapati mati dalam keadaan yang amat mengerikan. Hal seperti ini boleh berlaku kerana kurangnya pemantauan yang diberikan oleh ibu bapa kepada anak-anak mereka. Oleh yang demikian, menerusi projek ini sistem pemantauan menggunakan gelang keselamatan yang mudah dipakai kanak-kanak yang dikenali sebagai *Wearable Bracelet for Child Monitoring System* akan dibangunkan. Sistem pemantauan adalah melalui telefon pintar android yang mana akan digunakan oleh ibu bapa untuk memantau anak-anak yang berasaskan konfigurasi Bluetooth *master-slave*. Sistem pemantauan ini mempunyai keupayaan pemantauan lebih daripada seorang anak pada satu masa dengan menggunakan hanya satu monitor. Ia mengaplikasikan satu konsep yang mudah di mana gelang akan dihubungkan dengan telefon pintar melalui sambungan bluetooth. Selagi anak-anak berada dalam lingkungan Bluetooth, ibu bapa tidak perlu kluatir akan keselamatan mereka. Ini kerana Bluetooth mempunyai jarak tertentu untuk membenarkan sambungan Bluetooth diterima secara berterusan. Apabila sambungan diputus atau terputus program penggera dalam telefon pintar akan diaktifkan untuk segera memaklumkan kepada ibu bapa bahawa anak mereka pergi terlalu jauh. Status kanak-kanak tersebut juga akan disertakan seiring ketika penggera berbunyi. Makluman awal diberikan kepada ibu bapa ini akan membawa kepada tindakan segera untuk mencari kanak-kanak di luar lingkungan Bluetooth dan dengan ini peratusan yang keselamatan kanak-kanak juga boleh ditingkatkan.

ABSTRACT

Children are precious for a parent as their love is unparalleled towards them. Therefore, when a child is missing it destroys the lives of those parents and the most worst part is when the child is found death. This could happen due to less security provided by parent to their children. Therefore, a monitoring system for children known as Wearable Bracelet for Child Monitoring System is built. The monitoring system is through android Smartphone which will be used by the parent to monitor their children base on Bluetooth master-slave configuration. This monitoring system have the capability of monitoring more than one child at a time by using only one monitor. It apply a simple concept of monitoring where the bracelets will be connected with a Smartphone through bluetooth connection. As the children stay in the bluetooth range, parent will able to feel leisure as their child is not going far from them since bluetooth have limited range or short range. Once the connection is disconnected the alarm program in the smartphone will be triggered to immediately inform parent that their child is went too far. Together with the alarm is a notification of the child's status. When an early notification given to parent this will lead to an instant action to find the child outside of the range covered and the percentage of that child safety is also increasing.

DEDICATION

To my beloved parents

ACKNOWLEDGEMENT

First and foremost, I praise to Allah SWT for giving me all His blessing to complete my Bachelor Degree Project successfully. I would like to express my sincere gratitude to En Aminurrashid bin Noordin for his supervision, encouragement, suggestions and trusted throughout the duration of this project. I also would like to express my big thanks to all the FTK's lecturers who are direct or indirectly involve with my project. Event such a small contribution means a lot to me. Not to forget my colleagues who are always support me during my hard time while completing this project. Last but not least, I would like to thanks my beloved parent and family for giving me full support, understanding and patient.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

OS	-	Operating System
iOS	-	iPhone Operating System
GUI	-	Graphical User Interface
PDA	-	Personal Digital Assistant
SIG	-	Special Interest Group
IEEE	-	Institute of Electrical and Electronics Engineers
BLE	-	Bluetooth Low Energy
GPS	-	Global Positioning System
WSN	-	Wireless Sensor Network
RFID	-	Radio Frequency Identification

CHAPTER 1

INTRODUCTION

In this chapter the purpose of the project is described generally including problem statement, objective and scope. The problem statement is related to the current issues while the objective is the target for this project in solving the problem arise. However, there will be limitation in completing this project which is discussed in the scope.

1.1 Background

Child went missing without trace is the most upsetting moment for the parent's child and it is worsen when that child is found death in horrible condition. Thus, a solution to a security problem is provided the child with safety device which can be monitored by parent themselves. This project proposed a device known as Wearable Bracelet for Child Monitoring System. This device aims to help parent in monitoring their children base on Bluetooth coverage area.

Android OS is well known nowadays especially for Smartphone. Since android is open source, information and reference to develop application can be easily obtained. The system will communicate through Bluetooth which one Smartphone act as master (parent) and the bracelet as slaves (child). This bracelet will be focus on using low-power Bluetooth as the main design for this device. This is to ensure that child monitoring will last longer and guarantee their safety.

1.2 Problem Statement

It is a worst case scenario for a parent when their child is missing as there are no trace of where they are and if they are alive. Many cases of child missing are due to abduction. The facts that may relate to child abduction include taken by a family member and strangers. Abduction might be another option in gaining money as child is selling for their organ for a very high price and it is still worrisome for parent these days. If considering the factor lead to abduction is causes by family problem which makes the child feeling stress and always isolating themselves from others thus, create an environment for an abductor to abduct without witness. It is fine when the missing child can be found even for days but it is restless when they cannot be traced plus there is no clue on where they were abducted.

Statistic provided by Deputy Internal Security Minister of Malaysia show that in 2004 about 6270 teenagers have been reported missing in Malaysia and out of these number, 4620 of this missing children are teenage girls. From January 2004 to May 2005, 4237 of the 6270 missing children who are mostly teenagers, were found and returned to their home However, at the same time, a total of 149 girls age under nine years old were also reported missing. The police statistics have recorded that in 2005 the 71 girls who ran away from their homes and another 71 missing girls in 2006 were found death. While in 2007 it was recorded that there were about 3246 reports lodged with the police for missing girls and about 303 children and teenagers below the age of 18 have been reported missing in 2008 between January 1 and April 13 in Malaysia.

The statistics of missing children in Malaysia since 2004 recorded about 5,996 cases involving children below 18 years old. Excluding 1904 children, the rest of the child reported missing subsequently were found and returned home by the police safely. Out of the 1904 children that still missing are girls aged around 14 years to 17 years old.

Base on the statistic above it is show that cases involving children are still worrisome and it is likely no sign it would decrease if nothing is done to overcome this situation.

Therefore, this child safety device is proposed to encounter the problem faced nowadays for a better child safety.

1.3 Project Objective

The project aims to meet the following objectives:

- (i) To design GUI for monitoring system.
- (ii) To develop wearable bracelet for children that can communicate with android smartphone by using Bluetooth.
- (iii) To built a monitoring system that can receive data from multiple Bluetooth bracelet at a time.

1.4 Scope

The project scope will cover aspect such as follows:

- (i) Using MIT Apps Inventor 2 to develop a graphic user interface (GUI) for an android smartphone.
- (ii) Bluetooth master-slave configuration for communication between Smartphone and bracelet.
- (iii) Child monitoring development only cover for two Bluetooth slave connection to one master Bluetooth.

CHAPTER 2

LITERATURE REVIEW

Throughout this chapter, literature review is made to discuss on the previous researches which are related to this project. The sources of the previous research is gather from journal, conference papers and website to study the concepts, theory and the method of the related aspect. Comparison from the referred sources are based on aspect as follow:

1. Smartphone
2. Mobile Wireless Technology
3. Tracking Devices

2.1 Smartphone

Smartphone has become the matter which is famous among teenager and adult conversation nowadays. Usually Smartphone brand, Operating System (OS), OS version and application are the topic often being discuss when having the conversation. Smartphone is a solution to information management, email, mobile, internet access and social networking. It is like having personal computer feature together in a mobile phone and it is portable. However, Smartphone is slightly bigger in size if compare to the standard mobile phone.

There are abundant type of Smartphone in the market today which are using different type of OS and version such as Samsung, Nokia, Apple and etc. Top mobile phone manufacturer sales and market share done by Gartner has shown that Samsung is leading with sale in 2013 about 444.4 millions of unit as shown in Table 2.1.

Table 2.1: The top 10 mobile phone manufacturers in 2013 (millions of units) according to Gartner

Vendor	2013 sales	2013 market share	2012 sale	2012 market share
Samsung	444.4	24.6%	384.6	22.0%
Nokia	250.8	13.9%	333.9	19.1%
Apple	150.8	8.3%	130.1	7.5%
LG	69.0	3.8%	58.0	3.3%
ZTE	59.9	3.3%	67.3	3.9%
Huawei	53.3	2.9%	47.3	2.7%
TCL	49.5	2.7%	37.2	2.1%
Lenovo	45.3	2.5%	28.2	1.6%
Sony	37.6	2.1%	31.4	1.8%
Yulong	32.6	1.8%	18.6	1.1%
Others	613.7	34.0%	609.6	34.9%
TOTAL	1807.0	100%	1746.2	100%

2.1.1 Mobile Operating System

A mobile operating system always referred as mobile OS is an operating system that able a Smartphone, PDA, tablet or any other device to operate. The features of a personal computer operating system which combined with other features such as Bluetooth, touchscreen, Wi-Fi, video camera, cellular and many more are the combination of nowadays modern mobile operating system.

There are several mobile operating systems use in Smartphone but not all of the operating system are used nowadays as Android, iOS, Windows Phone and Blackberry are the most common and famous among Smartphone users today. However, Android and iOS are in the fiercest competition. Android has become world's most commonly used Smartphone platform as it is widely used by many different phone manufacturer while for iOS, it is only used on Apple device that is iPhone. Even though, iOS is only used by iPhone but the royalty show by their customers make iOS a tough competitor to Android.

However, due to price offer for iPhone is quiet expensive for each of their model only certain user are able to experience iOS. Due to that most of the users choose

Android Smartphone which has many different choices and large price range. It is proven base on 2013 Smartphone sales in Table 2.2 which show Android OS rank first. The Statistic Portal has done the analysis on Smartphone sale base on operating system and it show that Smartphone with Android OS's sale is increasing uniformly from the first quarter of 2010 until the fourth quarter of 2013. Figure 2.1 shows the sale statistic of Smartphone by operating system shared by The Statistic Portal.

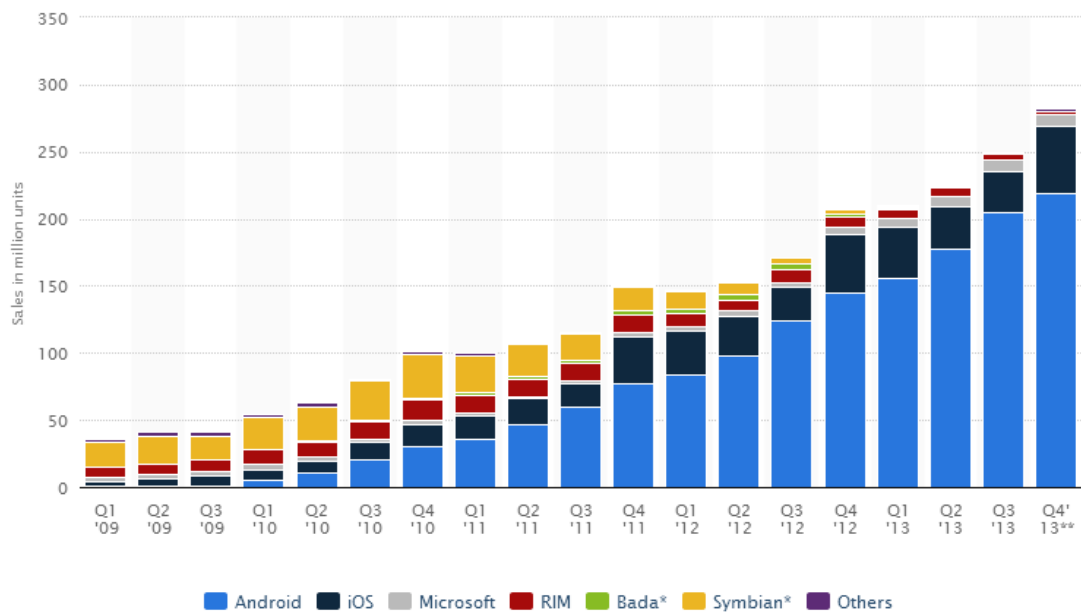


Figure 2.1: Global Smartphone sale to end users from 1st quarter 2009 to 4th quarter 2013, by operating system

Table 2.2: Global Smartphone operating system share in 2012 and 2013 according to IDC

Operating System	2013 sales(millions)	2013 market share	2012 sale(millions)	2012 market share
Android	793.6	78.6%	500.1	69.0%
iOS	153.4	15.2%	135.9	18.7%
Microsoft	33.4	3.3%	17.5	2.4%
BlackBerry	19.2	1.9%	32.5	4.5%
Others	10.0	1.0%	39.3	5.4%
TOTAL	1009.6	100%	725.3	100%

2.1.1.1 Android

Android is based on Linux kernel operating system with direct manipulation user interface. It is designed primarily for touchscreen mobile devices like smartphones and tablet computers. Android is defined by Android developers as a software stack which is a set of software subsystems needed in delivering a fully functional solution for mobile devices. The stack software includes an operating system, middleware which is partly based on Java. Android achieved its popularity in technology companies as it is ready-made, low-cost and customizable operating system for high-tech devices. Besides that, its open nature characteristic has encouraged a lot of developers and enthusiasts to use the open source code as a foundation for community-driven projects. The success in the operating system has triggered smartphone wars among technology companies.

In Android, there are several versions released since the release of Android beta in 2007 and the first Android commercial version, Android 1.0, was released in 2008. Starting from the year of 2009, each of their Android versions is named after something sweet such as Cupcake (1.5), Doughnut (1.6), Éclair (2.0-2.1), Froyo (2.2-2.2.3), Gingerbread (2.3-2.3.7), Honeycomb (3.0-3.2.6), Ice Cream Sandwich (4.0-4.0.4), Jelly Bean (4.1-4.3) and the latest version released is KitKat (4.4-4.4.2).

2.1.1.2 iOS

Previously known as iPhone OS is an operating system exclusively distributed for Apple hardware. The user interface is based on the concept of direct manipulation that is using multi touch gestures. There are three elements in the interface control, they are sliders, switches and buttons while the OS interactions are swipe, pinch, reverse pinch and tap which have specific definitions within the context of iOS multi touch interface and operating system. iOS consists of four abstraction layers which are the core OS layer, Core Services layer, Media layer and Cocoa Touch layer.

2.2 Mobile Wireless Technology

As there is rapid growth in phone technology, nowadays mobile phones; smartphones are implemented with wireless technology such as Bluetooth and Wi-Fi. Bluetooth and Wi-Fi are the mediums for transferring data from one phone to another. Bluetooth is usually used for sending data between two phones which are connected when they are paired. As for Wi-Fi, it is commonly used and connected for more than two devices at a time.

2.2.1 Bluetooth

Bluetooth is an example of wireless technology for exchanging data in a short distance. Bluetooth is managed by the Bluetooth Special Interest Group (SIG) which is joined by more than 20,000 member companies from many different areas such as communication, networking and computing. Ehsan Ullah Warriach et al. (2008) in his paper says Bluetooth is a wireless communication standard (IEEE 802.15.1) that was specially designed for a short range communication with low power consumption based on low cost transceiver microchips in each device. Bluetooth devices can form a small network which is called piconet. Piconets allow device pairing up to seven connections through master-slave configuration. The seven

connection is refer to slaves which connected to a master. J.Mander and D. Picopoulos (2009) state that the connection is either Point to Point or Point to Multipoint. Point to Point is when there is a master and a slave while for Point to multipoint is when there are many slaves and it is connected to a Master.

Bluetooth has its own range which has been classified into class 1, class 2 and class 3. These 3 classes of Bluetooth is refer as classic Bluetooth for the version below 3.0 while version 4.0 and above is classed as Bluetooth Low Energy (BLE) and it is referred as Smart Bluetooth. Refer to Bluetooth Page it is state that class 1 range about 1 meter or 3 feet, class 2 range about 10 meters or 33 feet and class 3 range up to 100 meters or 300 feet while for BLE it range is estimate about over 100 meters.

2.2.2 Wi-Fi

Wi-Fi also written as Wi-Fi is the most successful wireless local area network. Chaoli Zhou and Jianhua Zien (2011) state in their paper that rapid growth of Wi-Fi improve the infrastructure facilities and advances of Smartphone technologies nowadays make most of the shelf Smartphone today support Wi-Fi.

Adnan Alam Khan and Noor Zaman (2009) says that Wi-Fi is very successful at delivering data over range of 150 meters with Wi-Fi installation can accommodate at 54 Mbit/s of bandwidth in 100 meter of radius for 32 users. Wi-Fi also require less power to transmit signal as Wi-Fi cards and equipment can communicate over short distance.

2.3 Tracking and Monitoring System

Xiaoxin Xu et al. (2010) design a system based on ZigBee for Outdoor Wireless Healthcare Monitoring System for Hospital Patients. The system are aim to

continuously monitor the patient remotely and to track the patients location as patient health is the priority when they are admit to a hospital. It says in this paper that the reasons outdoor monitoring system is design base on ZigBee is due to the longer communication range and less power consumption although it has less transmission rate. By using ZigBee the percentage of data lose is high due to ambient radio interference that will affect the communication between ZigBee node. Thus, through this paper they also proposing a reliable data transmission method to prevent data losing in their healthcare monitoring system by using time response mechanism, the original code and their compliment code check.

Meanwhile, in tracking the patient it mix the location engine which is embedded onto TI CC2431 chipset with localization algorithm base on Manhattan distance. Manhattan distance is the distance between two points in a grid where it is the sum of the horizontal and vertical component. Figure 2.2 show the architecture of this device on how it will monitoring the patient health. For the diagonal distance it is calculate base on Pythagorean theorem. The device is include with backup power to ensure continuous monitoring of patient.

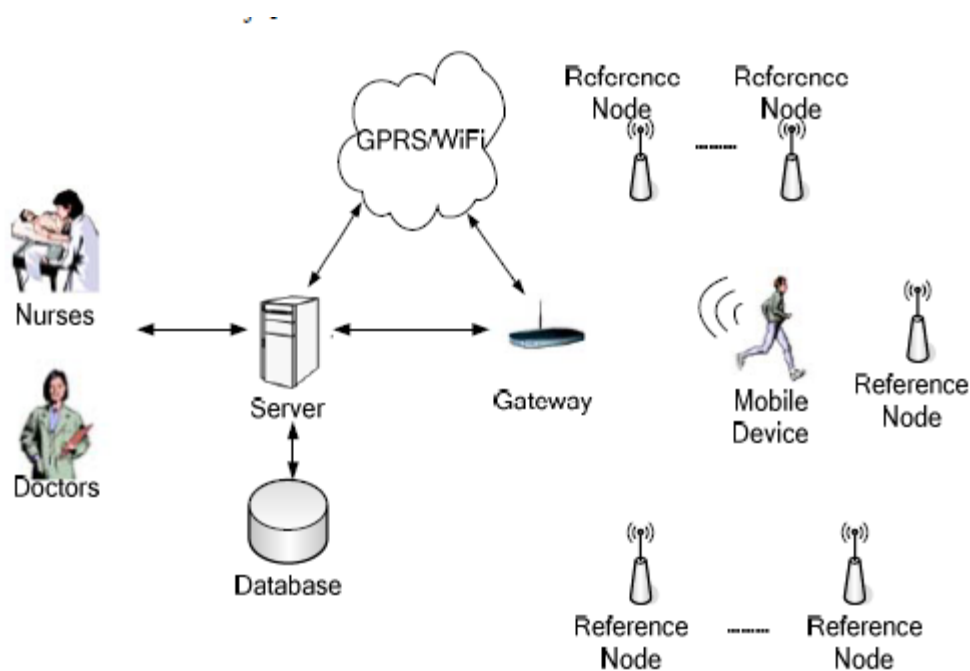


Figure 2.2: Outdoor Wireless Healthcare Monitoring System Architecture

Lei Zhang and Jiangchuan Liu (2013) introduce Energy-Efficient Location Tracking with Smartphone Sensor or known as SensTrack. This project is mainly targeting to tracking location with the minimum use of Global Positioning System (GPS) yet still achieve high accuracy. Besides that it also aim to improve energy consume by a tracking device as GPS consume a lot of energy and battery will completely drain in just a few hours. In addition, as GPS usage is reduce this project also targeting to expand the coverage area by using Wi-Fi. The SensTrack actually executes a GPS sampling gain from the acceleration and orientation sensor and later switch to the alternate location sensing method when user move indoor by Wi-Fi. Figure 2.3 is the system architecture which summarize this device overall operation.

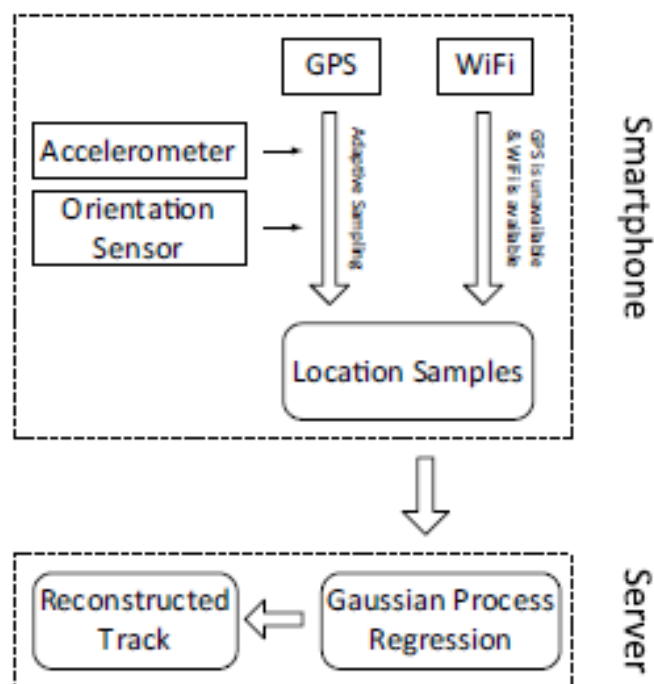


Figure 2.3: The system architecture

Giovanni Pau and Gianfranco (n.d) Scata propose WSN/RFID Architecture for Children's Monitoring. Its aim to track children location in shopping centers within the area monitored by the combination of wireless sensor network (WSN) and Radio Frequency Identification (RFID) . The application allow the monitoring of crowded places with high precision. The uses of RFID in this project is to provide real-time information in order to improve the efficiency and safety which indirectly reduce management cost. The architecture propose is to work together with RFID bracelet