

DEVELOPMENT OF WIRELESS APPLICATION ON ELECTRONIC SHOES FOR
MONITORING ATHLETE PERFORMANCE

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Tajuk Projek : DEVELOPMENT OF WIRELESS MONITORING APPLICATION
ON ELECTRONIC SHOES FOR ATHLETE PERFORMANCE

Sesi Pengajian :

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APPROVAL

This report is submitted to the Faculty of Electronics and Computer Engineering, Universiti Teknikal Malaysia Melaka. In partial fulfillment for Bachelor of Electronic Engineering (Telecommunication). The member of the supervisory committee is as follow:

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DEDICATION

This study is dedicated to my beloved parents, Azizul Azlan Bin Abdul Aziz and Nor
Asmah Bt. Hj Yop.

To my supervisor, lecturers , my friend, Ahmad Faiq Bin Md Zin and my fellow friends
for all their helps and supports.

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ABSTRACT

Development of wireless monitoring application on electronic shoes for athlete performance is one of the most important elements of a good workout is wearing the proper kinds of athletic footwear. Electronic components mounted on a shoe can be very bulky and creating uneasiness for the wearer and those electronic data retrieve with wire is not possible for human movement monitoring, therefore this project focusing developing a wireless system with Zigbee wireless technology integration of the electronic shoe. The main objective of this project is to develop a wireless system which enables to monitor an athlete movement at anywhere by using Zigbee technology and display the details about their performance on the PC's screen using visual basic.

This overall project is divided into two parts. The first part is concern on the hardware development where all electronic components are connected on a single board. In the transmitter side sensor is use which is connected to the footwear of the person. As accelerometers can be easily embedded in shoes as well and the data will be transmit by using Zigbee as a wireless method. The second part is base on software application to operate the hardware structure. With the help of PC the data that has been transmitted will be display to monitor the values of foot pressure by using Visual Basic.

ABSTRAK

Pembangunan aplikasi pemantauan tanpa wayar kasut elektronik untuk prestasi atlet adalah salah satu elemen yang paling penting untuk senaman atau semasa latihan adalah dengan memakai kasut sukan yang betul dan sesuai. Komponen elektronik dipasang pada kasut yang sangat besar dan menimbulkan masalah bagi pemakainya dan sesiapa sahaja dengan mendapatkan data dengan wayar adalah tidak sesuai bagi pergerakan pemantauan manusia, oleh itu projek ini memberi tumpuan membangunkan sistem wayarles dengan ZigBee integrasi teknologi wayarles kasut elektronik. Objektif utama projek ini adalah untuk membangunkan satu sistem tanpa wayar yang membolehkan untuk memantau pergerakan atlet di mana-mana sahaja dengan menggunakan teknologi ZigBee dan memaparkan butir-butir mengenai prestasi mereka pada skrin PC menggunakan asas visual .

Projek keseluruhan dibahagikan kepada dua bahagian. Bahagian pertama adalah berkenaan dengan pembangunan perkakasan di mana semua komponen elektronik dihubungkan dengan satu litar tunggal. Pada bahagian penghantaran sensor adalah sebagai input bergantung kepada penggunaan yang berkaitan dengan aktiviti seseorang itu Litar yang ringkas dan mudah tertanam dalam kasut kemudiannya data akan dihantar dengan menggunakan ZigBee sebagai kaedah tanpa wayar. Bahagian kedua adalah berdasarkan aplikasi perisian untuk mengendalikan struktur perkakasan. Dengan bantuan PC data yang telah dihantar akan dipaparkan untuk memantau voltage pada tekanan kaki dengan menggunakan perisian Visual Basic sebagai perantaramuka.

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CHAPTER I

INTRODUCTION

This chapter will cover the introduction of the project where it involves of the project background, overview of project, problem statement, scope of project, thesis outline and summary of work.

1.1 Overview project

Development of wireless monitoring application on electronic shoes for athlete performance is one of the most important elements of a good workout is wearing the proper kinds of athletic footwear. Electronic components mounted on a shoe can be very

bulky and creating uneasiness for the wearer and those electronic data retrieve with wire is not possible for human movement monitoring, therefore this project focusing developing a wireless system with Zigbee wireless technology integration of the electronic shoe. The main objective of this project is to develop a wireless system which enables to monitor an athlete movement at anywhere by using Zigbee technology and display the details about their performance on the PC's screen using visual basic.

1.2 Problems Statement

Nowadays, the most common sport injuries are due to accidents, poor training practices or using the wrong gear or equipment. Electronic components mounted on a shoe can be very bulky and creating uneasiness for the wearer and those electronic data retrieve with wire is not possible for human movement monitoring. This project focused on developing a wireless system but there some problem to interfacing sensor between wireless module and software. [7]

Some wireless no perfect in speed transmission and there are some data loss. Therefore by choosing Zigbee wireless technology integration for this electronic shoe project because the low data rate, low cost, low power consumption, and wireless networking protocol targeted towards automation and remote applications. [1][2][5]

1.3 Objectives of Project

To ensure that the main purpose of the project can be achieved successfully in accordance with the scope of the project, scope of work mentioned, some of the objectives of this project have been listed include;

- I. To design a real time sensing system with wireless communication capability.
- II. To develop the PC based wireless monitoring system for health care applications.
- III. To demonstrate the design of the sensor wireless communication system for athlete performance.

1.3 Scope of works

The function of wireless monitoring application on electronic shoes for athlete performance project was based on below scope of work:

1. Different types input; accelerometer sensor, ADXL335, or piezoelectric force sensor can used in this system. An accelerometer works by sensing the motion of a suspended test mass. [2]
2. The ADXL335 is a complete 3-axis acceleration measurement system with measurement range of ± 3 g minimum. [3]
3. The output signals are analog voltages that are proportional to acceleration. The accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration. [3][4]
4. The wireless module is XBP24-AUI form DIGI International capability of the system in this project is up to 10 m and can be use indoor or outdoor. [2][5][9]
5. The wireless monitoring the analog signal from accelerometer or piezoelectric will be passing to PIC to continue the process which converts to the digital form by using the signal decoder.

6. The digital output results will observe and display at computer.
7. The Visual Basic for display the level of the movement or pressure measurement.
8. This application focused for athlete to monitor their performance but still can be used in healthcare.

1.4 Summary

This overall project is divided into two parts. The first part is concern on the hardware development where all electronic components are connected on a single board. In the transmitter side sensor is use which is connected to the footwear of the person. As accelerometers can be easily embedded in shoes as well and the data will be transmit by using Zigbee as a wireless method. The second part is base on software application to operate the hardware structure. With the help of PC the data that has been transmitted will be display to monitor the values of foot pressure by using Visual Basic.

1.5 Methodology

In order to achieve the objective of this project, there are several tasks that need to be done as shown in Figure 1.1below. These tasks are divided into three main categories that are study, design and implementation. Following the design is the implementation of the hardware, software and system integration.

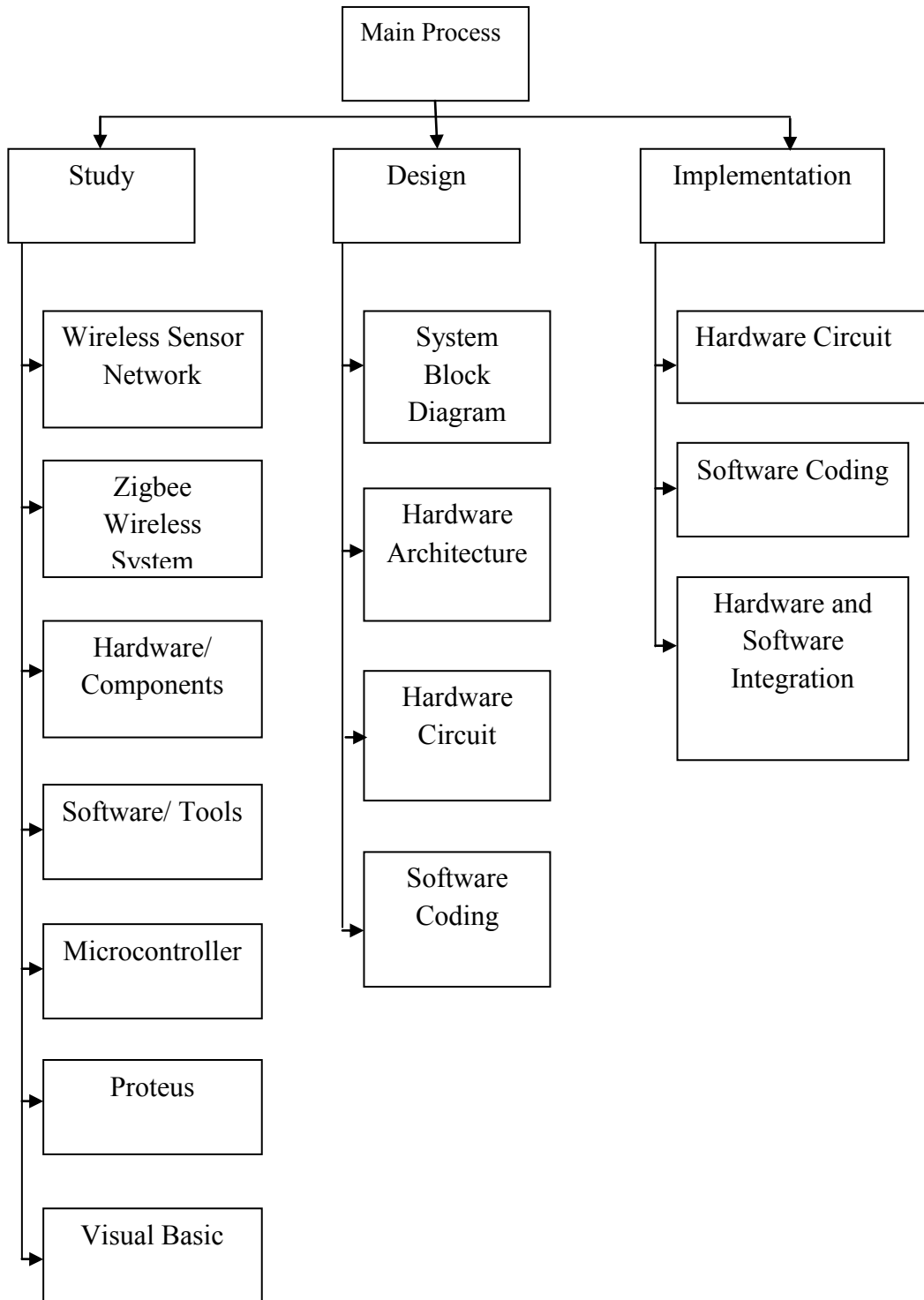


Figure1.1: Work breakdowns for the project

1.5 Thesis Outline

This project report consists of five chapters are organised as:

Chapter I – Introduces the project as a whole. The early and basic explanations are mentioned in this chapter. Introduction is discussed about background of the project, problem statement and the purpose of developing this project. It also mentions the important of this project.

Chapter II – Literature Review consist about the background study and research before developing this project. The topic explained in this chapter included wireless sensor network, wireless temperature monitoring, wireless transmission, accelerometer sensor, theory about hardware and software which is related in this project. There are also has a few of related research project in this chapter.

Chapter III – Methodology described about the methods or approaches use in solving projects. Among the main content of this chapter are Initial Planning, Planning, Requirements, Analysis, Implementation, Testing, Evaluation and Deployment.

Chapter IV –Concentrates on the result and analysis. The development of hardware and software has discussed in this chapter. All the result from the simulation has show in this chapter.

Chapter V – Conclusion and recommendations for this project. Conclusion will be concluding the overall of the object and achievement of the objectives. Recommendation has discussed which part can be improved.

CHAPTER II

LITERATURE REVIEW

Chapter two focuses on the project's background and other relevant information related to the project. In order to make this project successful, some studies and information have been done.

2.1 Introduction

This chapter consist of the information is fetching from many sources such as books, article, journals and the internet. The information based on some major

component and topic that related to the project that will be used in the project such as wireless sensor network, Zigbee Wireless Communication Network, Accelerometer Sensor ,USB to UART, Proteus and Visual Basic.

2.2 Fundamental Principle of Wireless Communication Network

2.2.1 Wireless Sensor Network

Wireless Sensor Network becomes an advance in recent science and technology. Wireless consist of column distribute autonomous sensors monitor environmental circumstance or physical, like temperature, sound, press and other and cooperate give their data through network to one prime location. WSN built node which from several to a few hundred in fact thousands whereby every node connect to a detector. Every sensor network has usually various parts that are radio transceiver with a pair of internal antenna or extension to an antenna out, a microcontroller, a electronics because interfacing with detector and a source energy. Sensor book may differ in size from one shoe box fall for dust size of a grain, although function microscopic dimension genuine way still not been created yet. [1,5]

The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communication bandwidth.

The topology of the WSN's can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

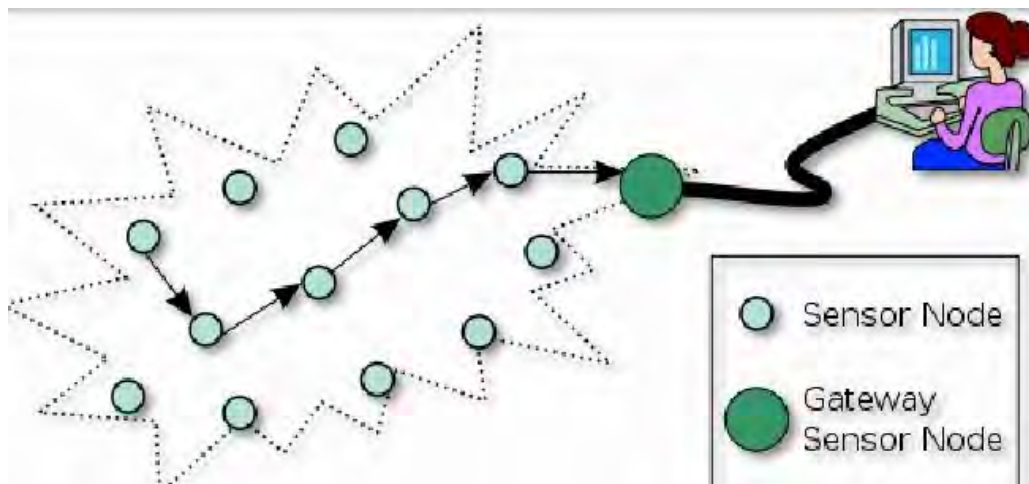


Figure 2.1: Wireless Sensor Network Architecture

The most important element in the WSN is sensory data from the real world. Sensory data comes from multiple sensors of different modalities in distributed locations. The advantages of wireless sensor over traditional sensor appear when multiple sensors are needed. The advantages are high mobility and high flexibility. High mobility means can move freedom without being tethered by wires. It is certainly the primary advantage of wireless devices. Wireless sensor can be implemented at several selected rooms at the hospital. The sensor can be attached at storage refrigerator and monitor the surrounding temperature at server room. [1,5]

Another advantage is high flexibility. High flexibility means that it is easier and less expensive to install the network. Installing network cabling in buildings can be a difficult and costly task. Also, the time to install network cabling is generally significant. It may take days to weeks to complete the whole cabling. When the location of the sensor has moved, the wired location also needs to be changed. All above works can be saved when wireless sensors are used.

2.3 Zigbee Wireless Communication Network

ZigBee is a new wireless technology developed by the ZigBee Alliance to overcome the limitations of Bluetooth and Wi-Fi. ZigBee is developed on the top of IEEE 802.15.4 standard. It is designed for low-power consumption allowing batteries to essentially last forever. Its allow batteries to last up to years using primary cells (low cost) without any chargers and easy installation. The ZigBee standard provides network, security, and application support services operating by IEEE 802.15.4. Zigbee standard has two basic layers medium Access Control (MAC) and Physical Layer (PHY) wireless standard. The network layer supports various topologies. There are star, clustered tree topology and self healing mesh topology. It's also has a wide application area.

2.3.1 Zigbee and IEEE 802.15.4

The IEEE 802.15.4 standard is a simple packet data protocol for light wireless networks and determines the Physical (PHY) and Medium Access Control (MAC) layers for Multiple Radio Frequency (RF) groups, including 868 MHz, 915 MHz, and 2.4 GHz. The IEEE 802.15.4 standard is designed to provide data transmission that many