UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF MEASUREMENT HEARTBEAT AND BODY TEMPERATURE VIA ZIGBEE

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

by

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2015

DECLARATION

I hereby declare that this project report entitled

DEVELOPMENT OF MEASUREMENT HEARTBEAT AND BODY TEMPERATURE VIA ZIGBEE

Is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT　　:……………………………………..　　DATE:……………..
　　　　　　　(NOOR FARAHIYAH BINTI ASAN)

SUPERVISOR　:……………………………………　　DATE:……………..
　　　　　　　(IKA DEWI BINTI SAIFUL BAHRI)

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 (Type your department's name here) (Hons.). The member of the supervisory is as follow:

………………………………………….
(IKA DEWI BINTI SAIFUL BAHRI)

ABSTRACT

Aim of our work is to monitor the pulse rate and human body temperature. The human pulse rate and body temperature are detected in the working environment; this can be sensed by using respective sensors. The sensed information is send to the PIC16F877 microcontroller through signal conditioning circuit in the patient unit. A desired amount of sensor value is set and if it is exceeded preliminary steps should be taken by the indicating by buzzer. The sensor information will be transmitted from the patient unit to the main controller unit with the help of ZigBee communication system which is connected with the microcontrollers in the both units. The main controller unit will send those sensed data of that patient by wirelessly via ZigBee to the Computer to the observer/doctor. The observer/doctor can receive the data and further decision can be taken. The message is sent to a computer and the heart rate and body temperature will be shown by Graphical User Interface via Visual Basic. Both information also recorded and stored in the Notepad for monitoring purpose.

ABSTRAK

Tujuan projek ini adalah untuk memantau kadar denyutan dan suhu badan manusia. Kadar denyutan dan suhu badan manusia dikesan dalam persekitaran kerja; ini boleh dikesan dengan menggunakan pengesan yang ditentukan. Maklumat yang dikesan akan dihantar ke mikropengawal PIC16F877A melalui litar penyesuaian isyarat di unit pesakit. Nilai sensor akan ditetapkan pada jumlah yang diingini dan langkah-langkah awal akan diambil jika ia melebihi tahapnya ditunjukkan dengan buzer. Maklumat yang dikesan akan dihantar dari unit pesakit ke unit pengawal utama dengan bantuan sistem komunikasi ZigBee yang dimana kedua-dua unit tersebut tersambung dengan pengawal mikro. Unit pengawal utama akan menghantar data pesakit tersebut secara wayarles melalui ZigBee kepada Komputer kepada pemerhati / doktor. Pemerhati / doktor boleh menerima data untuk keputusan selanjutnya dapat dilakukan. Mesej dihantar ke komputer dan kadar jantung dan suhu badan akan dipaparkan kepada antara muka pengguna grafik (GUI) melalui perisian '*Visual Basic*'. Kedua-dua maklumat juga direkodkan dan disimpan di dalam *Notepad* untuk tujuan pemantauan

DEDICATION

Specially dedicated to my beloved parents and my family

For my supervisor, IKA DEWI BINTI SAIFUL BAHRI

LECTURER OF DEPARTMENT OF ELECTRONIC AND COMPUTER

ENGINEERING TECHNOLOGY

(UTeM)

For my evaluators, MD ASHADI BIN MD JOHARI

LECTURER OF DEPARTMENT OF ELECTRONIC AND COMPUTER

ENGINEERING TECHNOLOGY

(UTeM)

And lastly to my beloved friends and who have encouraged, guided and inspired me

throughout my journey in education.

ACKNOWLEDGEMENT

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Moreover, I also thank you to my family and my beloved that always support me and gave of words encouragement that feels never to give up until the end. Lastly, I would like to thank you to many people especially, our classmates and our team members supervisor because they have made valuable comment suggestions on this project which gave us an inspiration to improve my project. Thank you all the people for their help directly and indirectly to complete our Final Year Project.

THANK YOU

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LIST OF ABBREVIATIONS

bpm   beats per minute

CPU   Central Processing Unit

ECG   Electrocardiogram

GSM   Global System for Mobile

GUI   Graphical user interface

HRH   Human Resources for Health

IC   Integrated Circuit

IEEE   Institute of Electrical and Electronic Engineering

IR   Infrared

LCD   Liquid Crystal Display

LED   Light Emitting Diode

PCB   Printed Circuit Board

PIC   Peripheral Interface Controller

RF   Radio Frequency

RTD   Resistance Temperature Detectors

RX   Receiver

SMS   Short Message Service

TX   Transmitter

V   Volt

VB   Visual Basic

WAN   Wireless Area Network WHO

World Health Organization WLAN

Wireless Local Area Network WPAN

Wireless Personal Area Network Xbee

ZigBee

CHAPTER 1

INTRODUCTION

1.1   Introduction of Project

With increase in patient's number, and decrease number of workforce in healthcare industry, an alternative is sought using current technologies that are increasingly accepted by the community called wireless technology. According to statistics provided by World Health Organization (WHO) 2012, from 57 countries, 55% of these listed countries facing health workforce crisis due to the implementation of the national plan and yet only 9 of the selected 26 Human Resources for Health (HRH) crisis countries have a monitoring and evaluation system and strategy. From this statistics, Malaysia is not listed as one of the countries with difficult deficit of health workforce. However, this may change in time as Malaysia economic is growing very fast and with the current unhealthy lifestyle, increasing number of health problem is unavoidable. [1]

The definition of heart rate is self-explanatory and has been known to us since long before we entered medical school: heart rate is the number of heartbeats per unit of time, usually expressed as beats per minute (bpm). The principal purpose of heart rate monitoring is to detect numerical changes from normal or baseline [2]. Normal heart rate of a resting person is about 70 bpm for adult males and 75 bpm for adult females. A heart rate monitor is simply a device that takes a sample of heartbeats and computes the beats per minutes so that the information can easily track heart condition [3].

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Like heart rate, normal body temperature also varies from person to person and changes throughout the day. The body temperature is lowest in the early morning and highest in the early evening. The normal body temperature is about 37 °C or 98.6 °F [4]. However, it can be as low as 36.1 °C (97 °F) in the early morning and as high as 37.2 °C (99 °F) and still be considered normal. Thus, the normal range for body temperature is 97 to 100 degrees Fahrenheit or 36.1 to 37.8 °C [5]. The normal range of human body temperature also vary due to the person's metabolism rate, if higher is higher normal body temperature or a lower metabolic rate of normal body temperature is lower [6].

ZigBee wireless communication technology is a kind of newly arisen wireless network technology; the characteristic is short distance communication, low speed, low power dissipation, and low cost. It, application of ZigBee wireless communication technology, makes that inconvenient wire repeat can be avoided in the area of home, factory, hospital, etc [7]. It allows ZigBee networks where there is no centralized control or a high-powered transmitter/receiver and can reach all devices. ZigBee has a rate at 250 kbit/s, suitable for periodic data or intermittent or single signal transmission from a sensor or input device. A applications such as wireless light switches, electric meters in homes, systems for traffic management, user equipment, industrial uses in close proximity wireless transfer of data and the relatively low rate [8].

Graphical user interface (GUI) is a user interface that allows users to interact with electronic devices, it uses images rather than text commands. GUIs are always found to be used on computers, MP3 players, portable media players, household appliances, office equipment and the industry. GUI shows the information provided to the user through graphical icons and visual indicators such as secondary notation, in contrast to the text-based interface, navigation text or typed command labels [9].

ZigBee technology is a good solution for the wireless transmission of sensor signal, the nodes have the coverage to tens of meters and could also increase the route node, and expand coverage. Power consumption is very little and allowing the monitor.

1.2   Objective Project

The aim of the project is to design and develop the heart rate and body temperatures device using ZigBee. This general objective can be broken down into two more specific objectives that would together achieve the overall aim of this project as follows:

1. To apply the wireless transferring data using ZigBee technologies on recording the data.
2. To design a portable wireless devices on measurement of heart rate and body temperatures.
3. To increase the security performance by avoiding third party access.

1.3   Problem Statement

Nowadays, doctors / specialist still use the old system to record the data by written. They have difficulty to monitor condition of each patients because need to go and check directly to the patient. Besides, the database information not in the system and all information for conventional system are saved in the file and not secure. All the information have been compiled and maintained by health care provider, many assume that the information in medical records is sensitive and personal information should be protected by the expectation of privacy, and there are ethical issues and public law involved in their management.

Another problem that occurs nowadays is it is difficult to keep track on abnormalities in heartbeat count for patient itself manually. Patients are not well versed with manual treatment which doctors normally use for tracking the count of heartbeat. So there must be some device which would help patient to keep track on their health by themselves. There are various instruments available in market to keep track on internal body changes. But there are many limitations regarding their maintenance due their heavy cost, size of instruments, and mobility of patients.

To overcome these limitations a device use to keep track on heartbeat count of patient should be easy to use, portable, light weighted, small size etc so that it give freedom of mobility for patient.

1.4   Scope of Project

The scope for this project divided into two parts, hardware and software. Hardware is divided into three parts heartbeat sensor, body temperature sensors and ZigBee Module. Software is also divided into three parts, Multisim, Proteus and Visual Basic.
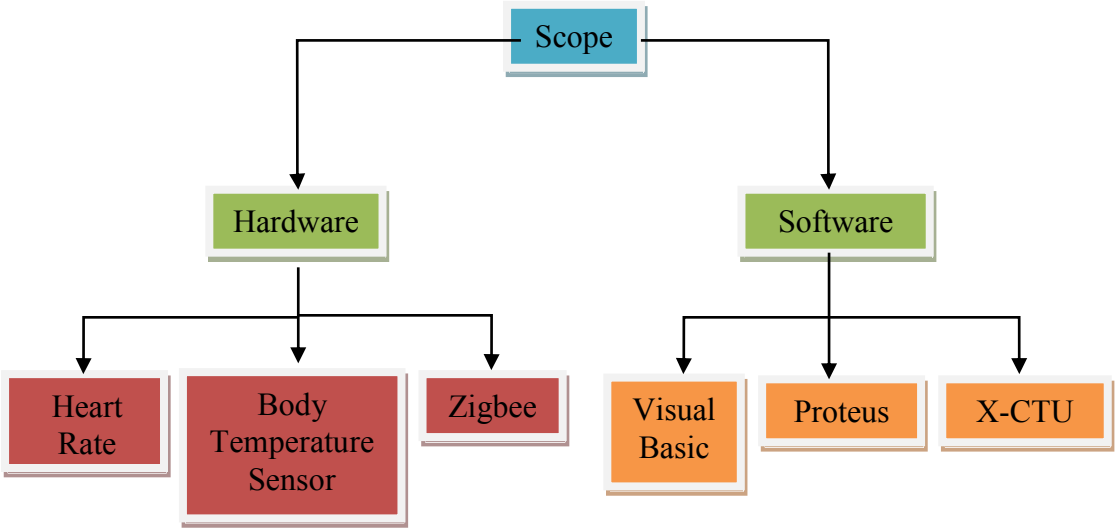

Figure 1.1: Scope of Project

This project focuses on wireless transmission data and the project development based via ZigBee technology. The project methodology shows that the step will be taken to complete the project. This method covers the management, development design and Project planning.

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User Section
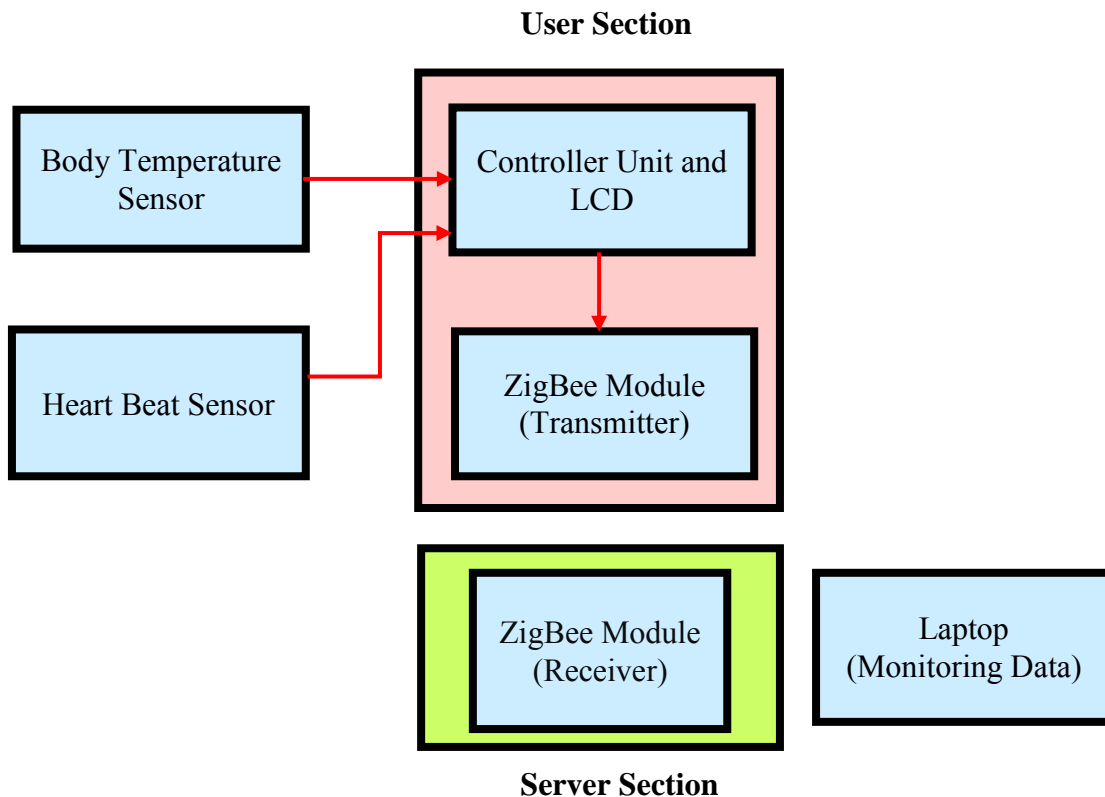
Figure 1.2: Blok Diagram of Project

Server Section

This project will require both hardware and software parts. For software part, the output will display at personal computer. The circuit simulation part for this project will be done by using Proteus software. From the simulation, the circuit will be implementing in the breadboard to check the functionality. If the circuit is failed to operate as expected, it must be examined and connected. After that, all circuits will be constructed in breadboard before implemented it in a real PCB board with simplified circuitry design made using Proteus software. All circuits will be fabricate and the hardware will be finalize for real application testing after implement the software (GUI) using visual basic. Lastly, combination of both software and hardware will be integrated together.

1.6   Report Structure

This report is covered by five chapters. The first chapter starts with the introduction, problem statement, objective and scope of work. The literature review is discussed in Chapter 2 and project methodology in Chapter 3. Here are the main chapters for PSM 1:

Chapter 1:   Study the objectives and scope of work the project.

Chapter 2:   Literature review about wireless ZigBee system.

Chapter 3:   Project methodology covers the planning, design and management of development projects.

<u>Chapter 1: Study about objectives and scope of work the project.</u>
The aim of this project is to design and develop a wireless ZigBee system that consists of sensor to detect the heartbeat and body temperature.

<u>Chapter 2: Literature review about wireless ZigBee system, sensor and GUI.</u>
Research, find and read relevant topics from the sources such as reference books, internet and journal let's get deeper knowledge and information for the project. Research on the same system or even less in the market and know what are the characteristics and capabilities of the product will also provide more information and understanding in this project.

<u>Chapter 3: Project methodology covers the planning, design and management of development projects.</u>
This chapter explains more about the project methodology used in this project. This section will explain more about the way it projects from start to finish. Every single thing that has been implemented in the project should be described step by step.

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CHAPTER 2

LITERATURE REVIEW

2.1   Chapter Overview

In this chapter will discuss the projects and paper work associated with this project. A word must relate carefully in advance to produce the quality and reliability of the project. By analyzing the projects done before by other researchers, are likely to find out there are a few features about the projects done. They also recommend some future work that can be undertaken to improve the project. In addition, there are a few ideas that are used to implement this project from other projects similar. An extended literature review process from beginning to end of the project. By reviewing previous work, the right action for the project can be undertaken and the features must be enhanced to make this project reliable and marketable. In addition, there are a few findings from the internet and books used in this project. Along analysis at the beginning of the project, special features specified in this project and the components used in the project is determined. In addition it is functional and well understood concept.

2.2 Previous Projects

2.2.1 Title: GSM Based Heart Rate and Temperature Monitoring System (2015) [10]

This paper provides relief to medical advisory for patient monitoring and also to patients for freedom of movement. Therefore heart rate sensor and temperature sensor are used for patient monitoring. Sensors gives accurate output therefore it rules out the use of traditional medical instruments such as thermometer and other devices. For continuously sending message from patient's location to medical advisory GSM modem used. This paper deals with solving above problems. The project consist of heart rate sensor and temperature sensor which measures the heart rate and body temperature and sends SMS through GSM module to the medical advisory for the preliminary precautions so that patient can be prevented from serious situation before reaching to the hospital. For temporary storage of the data, PIC16F877A controller device used. For display the measured values of heart beat and body temperature, LCD is used. [10]
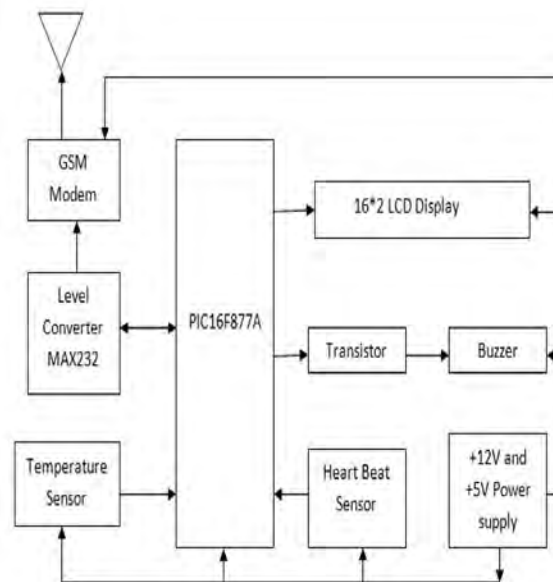

Figure 2.1: Block Diagram of System. [10]

Comparison between this paper with the current project is the authors send the heart beat and temperature information to the patient by using GSM, but the current project will display the information by LCD display for nurse to recorded and simultaneously to the computer for doctor take any further action if found abnormality to the patient.

2.2.2 Title: A Wireless Heartbeat and Temperature Monitoring System for Remote Patients (2013) [11]

This paper explains about the heart rate and temperature monitoring. The heart rate increases gradually during exercise and returns to its normal value after exercise. The rate at which the pulse returns to its normal value is an indication of the fitness of a person. Temperature can be measured by using different types of sensors. These sensors come in different forms such as thermocouples, thermistors, resistance temperature detectors (RTD), and integrated circuit (IC) sensors. The temperature sensor requires analog to digital (A/D) converter so that the analog output voltage can be converted to digital form [12]. The output of the temperature sensor is connected to the Port A of PIC16F72 microcontroller. The microcontroller processes this data and displays it in LCD as well as sends it to the receiving end for displaying at the remote place. [11]

This paper describes the design of a very low-cost remote patient monitoring system which measures heart rate and body temperature of a patient and sends the data to a remote end where the data will be displayed and physician or doctor will be able to examine him/her. This device will be much needed during emergency period or for saving time of both patient and doctor.

The transmitter/receiver (TX/RX) pair in this project operates at a frequency of 433MHz. The range of RF module is 100 meters in open space under standard conditions. The transmission occurs at the rate of 1Kbps to 10Kbps. The data transmitted with the help of antenna is received by RF receiver at same frequency at which the transmitter was operating [13]. The system is started by initializing the LCD and input/output ports of the microcontroller. Then, the system waits for the signal, which is