UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PC-BASED HEART RATE MONITOR

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

by

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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 (JTKEK) (Hons.). The member of the supervisory is as follow:

……
(Madam Norain Binti Rahim)

ABSTRAK

Inovasi teknologi dalam bidang pencegahan dan penyelenggaraan kesihatan pesakit penyakit telah membolehkan evolusi bidang seperti sistem pemantauan. kadar jantung adalah parameter kesihatan yang sangat penting yang secara langsung berkaitan dengan kekukuhan sistem kardiovaskular manusia. kadar jantung adalah berapa kali jantung berdegup setiap minit, mencerminkan keadaan fisiologi yang berbeza seperti beban kerja biologi, tekanan di tempat kerja dan tumpuan pada tugas, mengantuk dan keadaan aktif sistem saraf autonomik. Ia boleh diukur sama ada dengan bentuk gelombang ECG atau dengan mengesan nadi - pengembangan berirama dan pengecutan arteri darah dipaksa melaluinya dengan kontraksi biasa jantung. nadi boleh dirasai dari kawasan-kawasan di mana arteri terletak berhampiran dengan kulit. Kertas ini akan membincangkan teknik untuk mengukur kadar jantung melalui hujung jari dan Arduino. Ia adalah berdasarkan kepada prinsip photophelthysmography (PPG) yang merupakan kaedah tidak invasif untuk mengukur perubahan dalam jumlah darah dalam tisu menggunakan sumber cahaya dan pengesan. Walaupun jantung berdenyut, ia sebenarnya mengepam darah ke seluruh badan, dan yang menjadikan jumlah darah di dalam arteri jari untuk berubah. Ini turun naik darah boleh dikesan melalui mekanisme penderiaan optik diletakkan di hujung jari. Isyarat boleh dikuatkan dan dihantar ke Arduino dengan bantuan komunikasi port siri. Dengan bantuan pemantauan kadar jantung perisian pemprosesan dan kiraan dilakukan.

ABSTRACT

Technological innovations in the field of disease prevention and maintenance of patient health have enabled the evolution of fields such as monitoring systems. Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. Heart rate is the number of times the heart beats per minute, reflects different physiological conditions such as biological workload, stress at work and concentration on tasks, drowsiness and the active state of the autonomic nervous system. It can be measured either by the ECG waveform or by sensing the pulse - the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart. The pulse can be felt from those areas where the artery is close to the skin. This paper describes a technique of measuring the heart rate through a fingertip and Arduino. It is based on the principal of photophelthysmography (PPG) which is non-invasive method of measuring the variation in blood volume in tissue using a light source and detector. While the heart is beating, it is actually pumping blood throughout the body, and that makes the blood volume inside the finger artery to change too. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified and is sent to arduino with the help of serial port communication. With the help of processing software heart rate monitoring and counting is performed.

DEDICATION

I would like to specially dedicate this paper to my Father, my Mother and to all my family.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATIONS, SYMBOLS AND NOMENCLATURES

-	-	Negative terminal
+	-	Positive Terminal
A0	-	Analog input for Port 0
BPM	-	beat per minute
ECG	-	Electrocardiogram
EEPROM	-	Electrically Erasable programmable read-only memory
GND	-	Ground
GPS	-	Global Positioning System
GUI	-	Graphical user interface
HR	-	Heart Rate
I/O	-	Input or Output
IC	-	Integrated Circuit
ICSP	-	In-Circuit Serial Programming
IDE	-	integrated development environment
iOS	-	Iphone Operating System
KB	-	Kilobytes
LDR	-	Light Dependent Resistor
LED	-	light-emitting diode
mA	-	miliampere
MHz	-	MegaHertz
OP-AMP	-	Operational Amplifier
OS	-	Operating System
PC	-	personal computer
PCB	-	printed circuit board
PPG	-	photo plethysmography
PWM	-	Pulse Width Modulation
RX	-	Receiver
S	-	Analog terminal

SRAM	-	Static random-access memory
TX	-	Transmitter
USB	-	Universal Serial Bus
V	-	Voltage
VCC	-	Collector supply voltage

CHAPTER 1
INTRODUCTION

This part concentrates on the project's introduction, background, problem statement, objective and project scope about the project. The improvement of PC-Based heart rate monitor will be clarified more in specifics. The problem statement expresses the purpose why this project is showed. At that point, toward the end of the section the association of the theory will be clarified.

1.0 Introduction

The general population now have a ton of ailments. A PC-based heart rate monitor is an individual checking gadget that lets a person measure their heart rate progressively or record their heart rate for later utilization. The heart rate of a healthy adult very still is around 72 beats per minute (BPM) and children at around 120 BPM, while more established youngsters have heart rates at around 90 BPM. The heart rate rises step by step amid activities and returns gradually to the rest values after it. The rate when the beat comes back to ordinary means that the wellness of the individual. Lower than typical heart rates are generally a sign of a condition known as bradycardia, while higher is known as tachycardia.

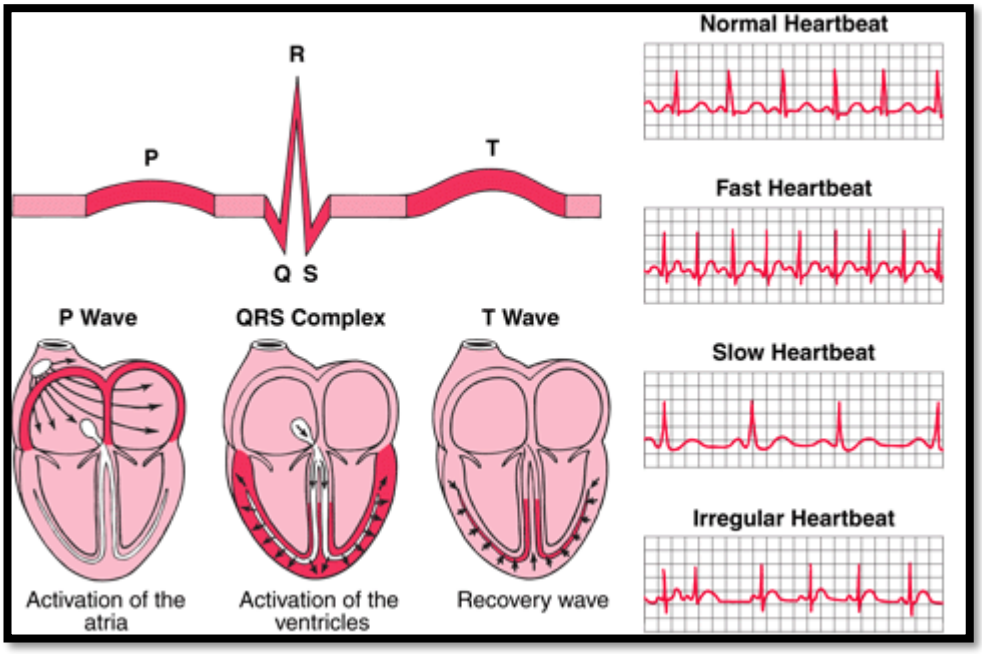

Figure 1.0: Theoretical of BPM reading graph

Heart rate is basically measured by putting the thumb over the subject's blood vessel throb, and feeling, timing and including the beat for the most part around a period. Heart rate of the subject is then found by multiply the got number by 2. This technique while straightforward, is not exact and can give mistakes when the rate is high. More refined strategies to quantify the heart rate use electro-cardiogram (ECG) is one of every now and again utilized technique for measuring heart rate. Be that as it may, it is and costly gadget. Minimal effort gadgets as wrist watches are likewise accessible for the momentary estimation of the heart rate. Such gadgets can give precise estimation yet their cost is typically in abundance of around and a half thousand ringgit, making them uneconomical.

1.1 Background

In this project, the primary territory is cantered around the home or even a small medical centre. The purpose of this project is to create a system that can save cost in to check their level of health. By using a pulse sensor that use Photo plethysmography (PPG) concept, the user will be used own self to take a reading of BPM and no longer needs help doctor or staff to find the information about condition of their health.

The infrared pulse sensor will create and simulated by using simulation software which is PROTEUS Design Suite. The Proteus Design Suite is completely one of a kind in offering the capacity to co-re-enact both high and low-level small scale controller code with regards to blended mode SPICE circuit recreation. Arduino UNO are used in this project as a controller. Arduino IDE will be used as a programmable software to create the Arduino Uno more compatible with pulse sensor. Arduino is the open-source programming (IDE) makes it simple to compose code and transfer it to the board. It keeps running on windows, Mac OS X and Linux. Nature is composed in Java and in light of Processing and other open-source programming.

Processing software is an adaptable programming sketchbook and a language for figuring out how to code inside the setting of the visual expressions. Processing software is used for produce a graph on the pc based on the reading that will take.

1.2 Problem Statement

The heart rate, additionally indicated to as heartbeat rate, has been perceived as an imperative sign since the start of medicine, and it is straightforwardly identified with a man's cardiovascular health. Nowadays, we know that most of people have diseases included old men, adult and even young. There are not easy to check their health by going to the hospital or clinic to get medical check-up. You have to pay a lot of money just for medical check-up to know how your healthy you are. In addition,

current heart rate monitor is too expensive and are not easily available to the community.

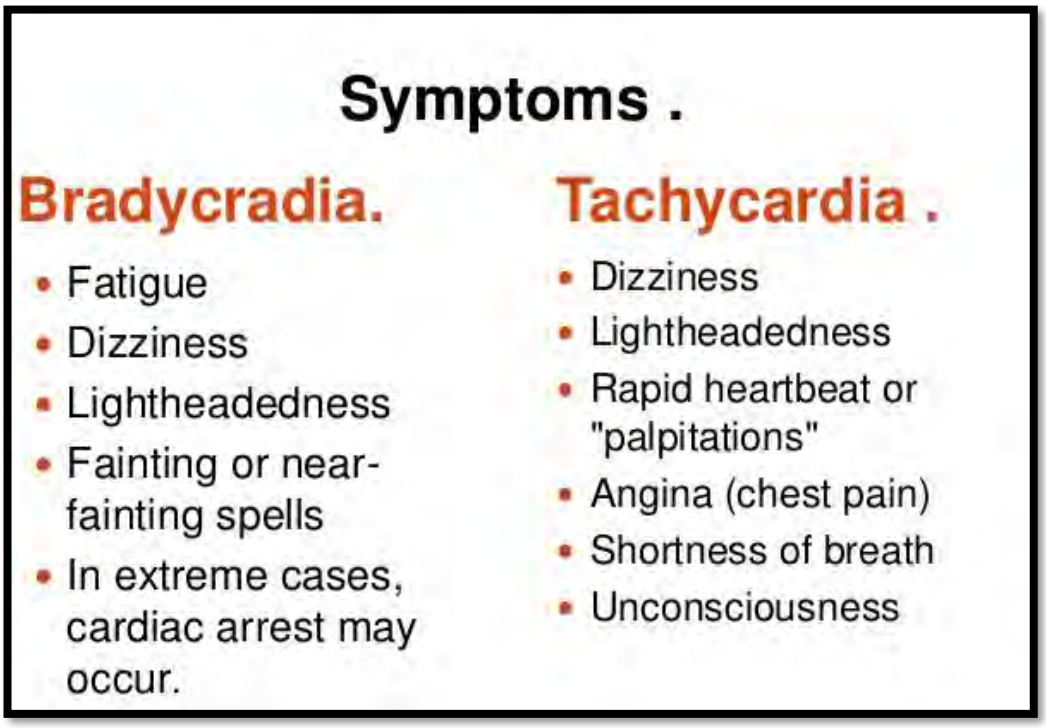

Figure 1.1: A certain symptom of Bradycardia and Tachycardia

While these application have ended up being productive, the market still stays open for use in bigger group place such hospital, clinic or even school. An aspect of PC-Based heart rate monitor using Arduino that has been largely unexplored ability to detect pulse easily. Although there are same gadgets have as of now been made by different organizations and establishments, they are still fundamental and not reasonable.

1.3 Project Objective

This project that is the PC-based heart rate monitor was created utilizing the most significant improvements to give more space to the customer. Rather, there are a few objectives as shows:

1) To study the source of transferring Photo plethysmography (PPG)
2) To develop a system that was a capable of detecting pulse using Arduino
3) To analyse the heart rate in Beats per minute (BPM) using pulse sensor

1.4 Scope of Project

The scopes of this project included the understanding of pulse sensor, application of pulse sensor, Arduino and Processing. By detecting a fingertip by using pulse sensor and at the same period, the data will be read through the Processing software.

This project is to detect the pulse rate of the person through the fingertip by using pulse sensor. In a period, the sensor will take the reading based on BPM. Later the pulse sensor will send the information to the Arduino and it will process the reading and give the visualization through the Processing software.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This section will clarify about the past improvement of the heart rate monitor system that is at present utilized around the worlds. The states that are utilizing heart rate monitor incorporates of United State, Europe, Japan, and numerous different countries. Additionally, this part will concentrate on the Arduino. Furthermore, it will focus on the equipment and programming that will be used for the task. This part is likewise completed with the examination improvement that has been done to gather all the data about the principle thought of the exception. The source originated from the journal and articles composed by the past specialists what we expected. Their hypothesis and results help this examination as they can be a correlation between this exploration and theirs.

2.1 Evolution of heart rate monitor

2.1.1 ECG (Electrocardiogram)

Figure 2.0: Electrocardiogram

An electrocardiogram (ECG) is a device that do some basic test that can be used to check your heart pulse and early signs of illness. This device is equipping with sensors attached to the skin are used the electrical signal that are produced from heartbeats. All the signal is recorded by this device and it will observe by doctor which either the graph is normal or vice-versa. In addition, this device is usually used by doctor or heart specialist which is cardiologist who thinks the patient might have a problem with a heart. Usually the test will have carried out at the medical Centre or hospital by a specialist called cardiac physiologist.

2.1.2 Jabra Sport Pulse wireless earbuds

Jabra Sport Coach Wireless earbuds is a couple of sweat-verification Bluetooth earbuds with an implicit virtual mentor intended to stream your motivational music as well as give verbal input on how your workout is going. This gadget adds the capacity to monitor and remotely stream your heart rate information to your keen gadget running the Jabra Sport application.

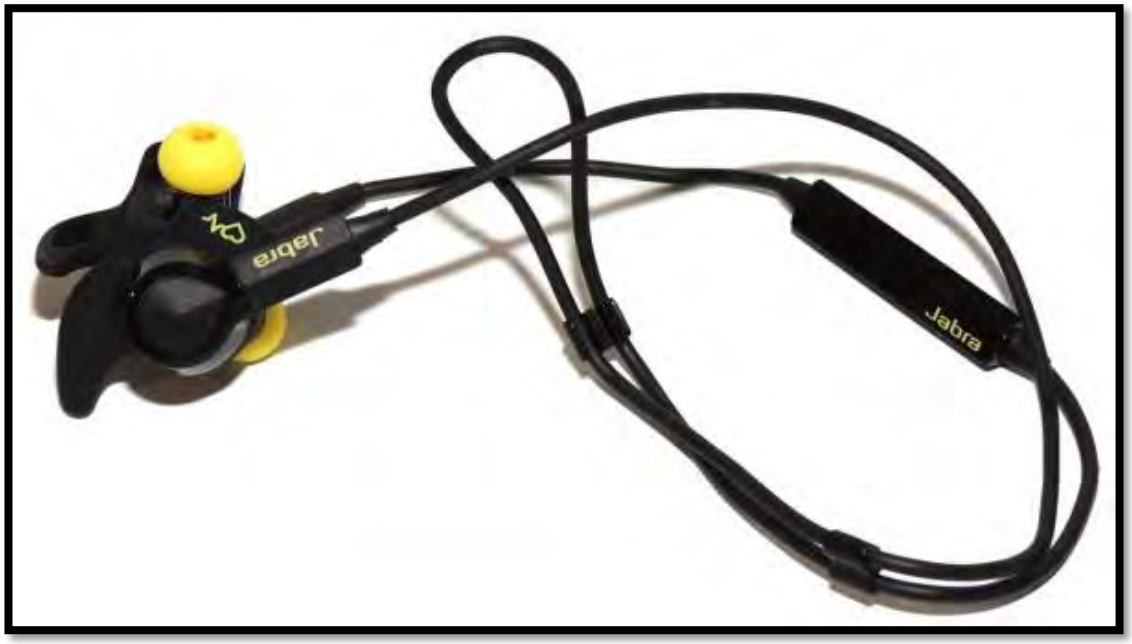

Figure 2.1: Jabra Sport Pulse wireless earbuds

As its name suggests, the principle highlight of these earbuds is their capacity to monitor your heartbeat. To exploit this, workout information, and instructing highlights, you should introduce the iOS or Android Jabra Sport Life application on your keen gadget. The Jabra application is suited for huge number of workouts including broadly educating, running, circular, strolling, cycling and some more. This application will track your present heart rate and in addition ascertain your normal heart rate throughout a workout. Alongside having the capacity to stream your music by means of the application, you can stream elective music administrations out of sight, for example, Pandora while the Jabra application is running. It likewise good with different wellness application, for example, Nike+, Endomondo and RunKeeper.