FINAL YEAR PROJECT REPORT

THE DETERMINATION OF EARLY HEART ATTACK USING IOT DEVICE

SUPERVISOR NAME : DR. BAHARUDDIN BIN MUSTAPHA

NAME	MATRICS NUMBER
MUHAMMAD AIMAN SYAZANI	08DEU17F2024
MUHAMMAD ADAM B ROSLAN	08DEU17F2003

ABSTRACT

Heart rate is affected by body temperature, heat is an important indicator that needs to be monitored so that any abnormality can be detected early enough to allow treatment. The need for a portable device of a suitable size for the daily activities of the measurement and control of vital indicators. The aim of this project is to design and develop a device that continuously monitors the vital indicators, as it periodically measures heart rate and temperature. It also triggers an alarm in case the signal has been measured above or below predetermined values. In addition, it sends this information via Bluetooth technology to be displayed in the Android application interfaces to be saved in the database files and retrieved upon request. In addition, the project aims to develop a common platform to provide a means of communication between the doctor and patient, where the doctor can see the patient's daily records.

CHAPTER 1

1.1 INTRODUCTION

Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patient's health status. Telemedicine is a newest technology which combining telecommunication and information technology for medical purposes. It gives a new way to deliver health care services when the distance between the doctor and patient is significantly away. Rural area will get the benefit from this application. Patient monitoring is one of the telemedicine, which always needs improvement to make it better. It is vital to care in operating and emergency rooms, intensive care and critical care units. It is also important for respiratory therapy, recovery rooms, out-patient care, radiology, ambulatory, home and sleep screening applications. The advantages of a patient monitoring system are it can reduce the risk of infection and other complication in order to make the patients comfortable. Furthermore, implement of patient monitoring in hospitals might reduce the costs in terms of installation and also maintenance of wiring.

1.2 PROBLEM STATEMENT

According to WHO, 17 million people die from CVD which makes up to 31% of the deaths worldwide. Hence a method to prevent or to help in reducing the losses of people's lives.

1.3 OBJECTIVE

The goal of this thesis is design low-cost device which measures the heart rate of the subject by clipping sensors on one of the fingers and then displaying the result on android application interface. Miniaturized heart rates monitor system based on a microcontroller. It offers the advantage of portability over tape-based recording systems. The thesis explains how a single chip microcontroller can be used to analyse heart beat rate signals in real time. The Hardware and software design are oriented towards a single-chip microcontroller-based system, hence minimizing the size.

1.4 SCOPE OF PROJECT

The scopes in this project include the hardware and software parts. For the hardware part, ECG circuits have been designed in order to interpret data from ECG simulator, which act as a patient. Then, a temperature sensor was developed to measure the temperature of human being. Both systems are controlled by Arduino Nano board, which connected to the Bluetooth module and need some programming works. For the software part as and Arduino IDE software have been used.

1.5 IMPORTANT OF RESEARCH

- Provides an overview of this project as a whole containing a background about the project, objectives, motivation, scope of the project and finally the thesis layout.
- Contain brief introduction about the heart and heart rate as well as literature review discussion about remote health monitoring systems.
- Specify the design methods used, system operations, implementation techniques and a description on the components used.
- Present the results obtained from the system implementation and a brief discussion on these results.
- Includes a final conclusion of the project and possible future work and enhancements on the project performance

CHAPTER 2

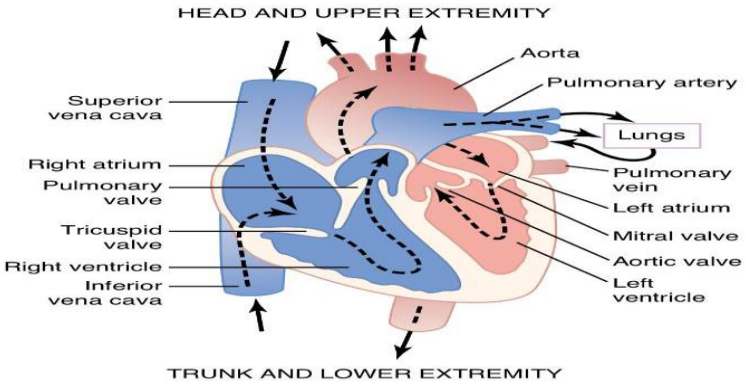
2. LITERATURE REVIEW

Vital signs derive its significance from the fact that they can be considered as an indication of the person health. Any change in the measurements of these signs indicates an abnormality in the physical condition of the patient. A considerable number of medical conditions can be detected from variations in one or more of the vital sign. The specialized devices for measuring the vital signs are not portable and can't be found anywhere. Hence, in this thesis, the concept of using an arm band potable heart rate monitor and mobile phone as a diagnosing tool. There are four vital signs which are standard in most medical settings:

- Pulse rate.
- Respiratory rate.
- Blood pressure.
- Body temperature.

Heart

The heart is the main organ within the human body, which responsible for pumping blood throughout the body. It is located in the middle of the thorax, slightly offset to the left and surrounded by the lungs. The heart is made up of two separate pumps, a right heart that pumps blood through the lungs, and a left heart that pumps blood through the peripheral organs. At the same time, each of these hearts is a pulsatile two chamber pump composed of an atrium and a ventricle. Each atrium is a pump helps in moving blood into the ventricle. Then the ventricles supply the main pumping force that propels the blood either through the pulmonary circulation by the right ventricle or through the peripheral circulation by the left ventricle. That blood passes through the right ventricle and is pumped to the lungs where it is oxygenated and goes back to the heart through the left atrium, and then the blood passes through the left ventricle and is pumped again to be distributed to the entire body through. The heart also consists of three major types of cardiac muscle: atrial muscle, ventricular muscle, and specialized excitatory and conductive muscle fibres. The atrial and ventricular types of differ from the specialized excitatory muscles in the method of contraction. The latter muscles exhibit either automatic rhythmical electrical discharge or conduction of the action potentials through the heart, providing an excitatory system that controls the rhythmical beating of the heart. The cardiac events that occur from the beginning of one heartbeat to the beginning of the next are called the cardiac cycle.



Structure of the heart and blood flow

Heart Rate

Heart Rate is the rate at which the heart beats and affected by the expansion of the arterial wall with each every beat. The most prominent areas for the pulses are wrist, neck, inside of the elbow, behind the knee and ankle joint. The HR changes according to age and the physical and psychological impacts on the body. Higher pulse rate indicates the presence of abnormality in the body which can also be caused by other reasons such as anxiety, anger, excitement, emotion, and heart disorders. The pulse rate of an individual can help in determining various problems within the body, but it cannot be used lone to diagnose an abnormality. The average heart rate is about 72 bpm for sedentary males and 80 bpm for sedentary females but these rates are often significantly different for trained athletes.

AGE	HEART RATE	RESPIRATORY RATE
0-5 MONTH	90-150	25-40
6-12 MONTH	80-140	20-30
1-3 YEARS	80-130	20-30
3-5 YEARS	80-120	20-30
6-10 YEARS	70-110	15-30
11-14 YEARS	60-105	12-20
14+ YEARS	60-100	12-20

Effect of Temperature on Heart Function

Variations in body temperature can cause a greatly variations in heart rate in a proportional relationship. Decreased temperature can cause the HR to fall as low as a few beats per minute when a person is near death when the body temperature range of 60 to 70F. These effects assure the fact that heat increases the permeability of the cardiac muscle membrane to ions that control heart rate, resulting in acceleration of the self-excitation process.

Heart Rate Monitors

Many heart monitoring devices ensure a more accurate measure of heart rate than manual methods. In most physical training situations they are the preferred method. These devices advantages:

- Far more accurate than finger tests.
- Give continuous and real-time readings that can be viewed via digital display.
- When the heart rate is measured a simple formula can be used to work out whether the individual is training at the right intensity:
- 220 - Age = Maximum Heart Rate
- Small and lightweight to carry. Some can be programmed to sound an alarm or warning when set heart rate ranges are breached.

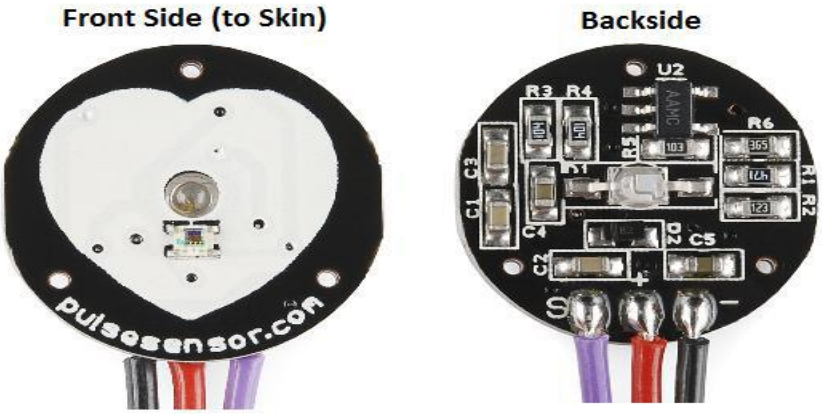
CHAPTER 3

3. METHODOLOGY

Hardware product that we used. It consists of Pulse sensor, LM35 Temperature Sensor, Microcontroller, Nano Arduino, Buzzer and HC-05 Bluetooth Module.

Pulse sensor

It is an Open Source heart rate monitor which considered as a PPG device used to monitor the non-invasive heart rate. It measures the real-time heart beats and calculates BPM with the aid of algorithms implemented by Arduino. This sensor has two sides, the front one which has a heart shape is the side to be attached to the skin. The pins of the pulse sensors are three as shown in Figure 3.4 below. If the frond side is facing you, then the most left pin is the GND while the middle one is the input voltage which will be connected to the +5v of the Arduino. The last one for outputting the electrical and will be wired with the analog bins of the Arduino. The Pulse sensor converts the physical PPG into electrical signals. The sensor outputs a raw signal of analog voltage fluctuations, amplifies it and normalize the wave at V/2. With every beat of the heart, a pulse wave travel along all arteries to the tissues where the Pulse Sensor is attached. When this pulse wave goes under the sensor, the signal experiences a rapid upward rise in its value. It falls back down toward the normal point and before the next pulse sensor goes under the sensor, the signal stabilizes to the ambient noise. Due to the repetitive characteristic of the pulse wave, the peak is chosen as a reference point because it's recognizable. By applying calculation algorithm on the time between each two successive peaks the heart rate is measured. Ideally we want to find the instantaneous moment of the heart beat for accurate measurements. According to heart researchers, the instantaneous moment is when the signal gets 25% or 50% of its amplitude. This pulse sensor first measures the IBI when the signal gets 50% of the amplitude, which from the BPM is derived from average of 10 IBI times.



Pulse Sensor

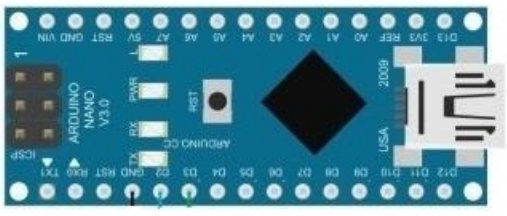
Buzzer 5v DC

Buzzer is an audio signalling device that has many applications includes timers and alarm devices. Many types of buzzers are available mainly they are electromechanical, mechanical and electrical buzzers.

Buzzer

Microcontroller

The filtration of the measured signals, apply calculation on it and prepare it for transmission to the next unit mainly done by the microcontroller unit. In this project, the microcontroller chosen is a Nano Arduino board which is based on ATMEGA328 controller. Nano Arduino is a small and complete board with the same functionality of Arduino Duemilanove just in different package. The only difference is that Nano Arduino doesn't have a power jack instead it works with mini-B USB. It fits perfectly for this project as it's easy to use as well as it provides mobility feature due to its suitable size for a wearable device. Furthermore its ability to communicate with android applications via Bluetooth module as it supports serial port Bluetooth communication.

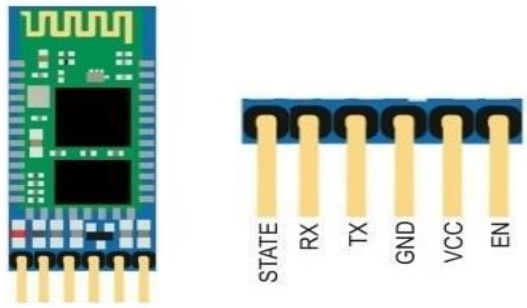


Nano Arduino

HC-05 Bluetooth Module

HC05 is a serial port protocol designed for wireless serial connection setup. It was chosen for it its ability to simplify the circuit design Send measured data to android application and due to its compatibility with the Nano Arduino. In addition, it was chosen over HC-06 module because it has the ability to operate as both as master and slave modules rather than just a slave in the case of HC-06. The HC-05 has six pins, four of them are programmable input or output lines. While the three others, one is GND and the other is for Vcc. Some of the HC-05 features:

- Integrated antenna and edge connecter within it.
- UART interface and PIO control.
- Requires low power (1.8 – 3.6v).
- Supports variety of baud rates.
- Supports auto-pairing and auto-reconnection.



HC-05 Bluetooth Module

SOFTWARE

MIT APPLICATION

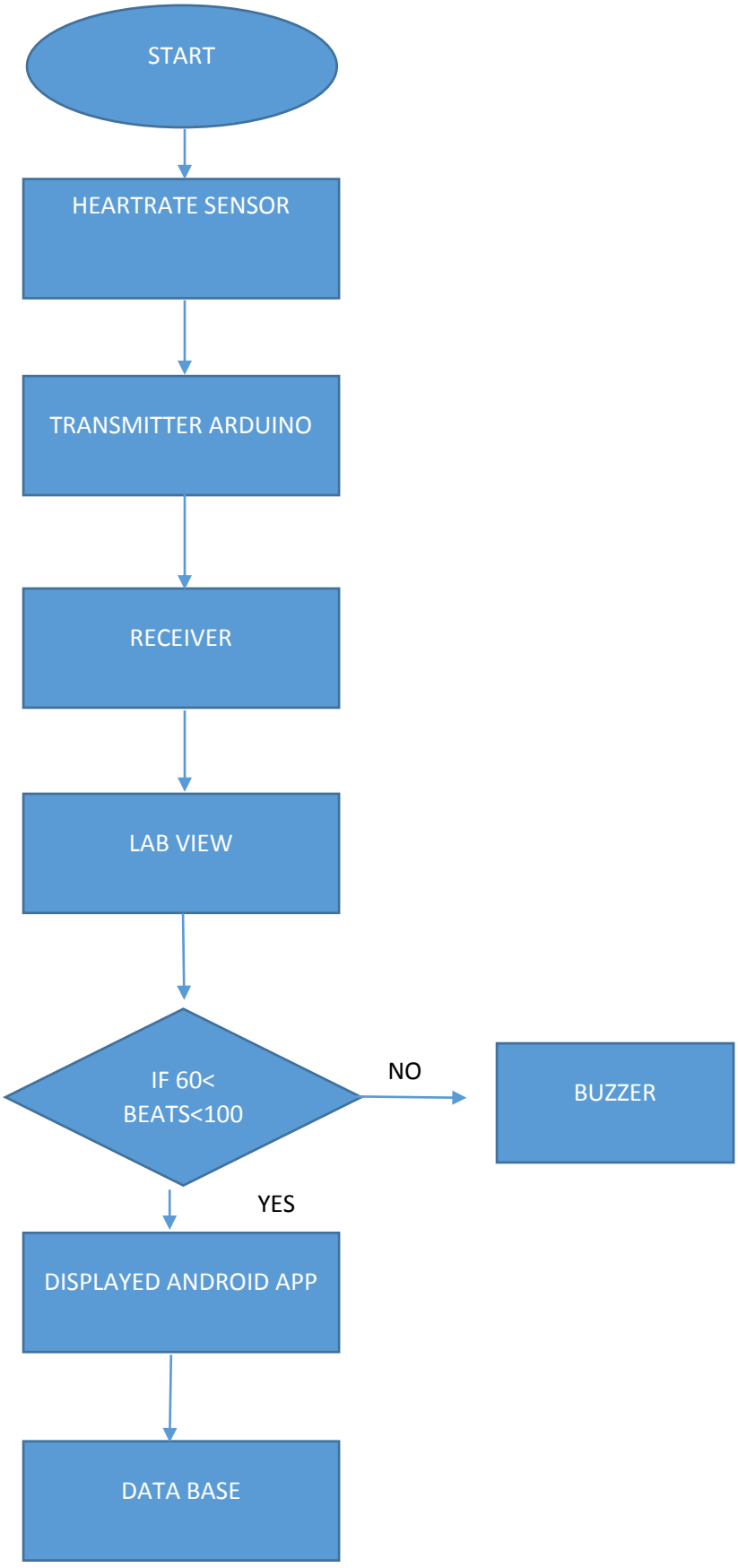
App Inventor for Android is a web-based open-source application originally provided by Google and now maintained by the Massachusetts Institute of Technology (MIT).

This helps beginners to computer programming to build Android operating system (OS) software applications. It uses a graphical interface which is very close to Scratch and the Star Logo TNG user interface, enabling users to use it.

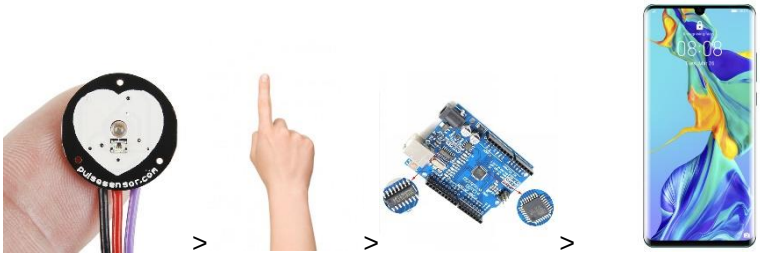
BLYNK

Blynk was created for Internet of things. It can remotely monitor equipment, view sensor data, store and vizualise data. Blynk operates over the Internet. That means you should be able to connect to the internet with the hardware you want. Most of the boards would require an Ethernet or Wi-Fi Shield to communicate, like Arduino Uno. The Blynk App is a well thought-out system creator. It works on both iOS and Android.

FLOWCHART


START
HEARTRATE SENSOR
TRANSMITTER ARDUINO
RECEIVER
LAB VIEW
IF 60< BEATS<100
NO
BUZZER
YES
DISPLAYED ANDROID APP
DATA BASE

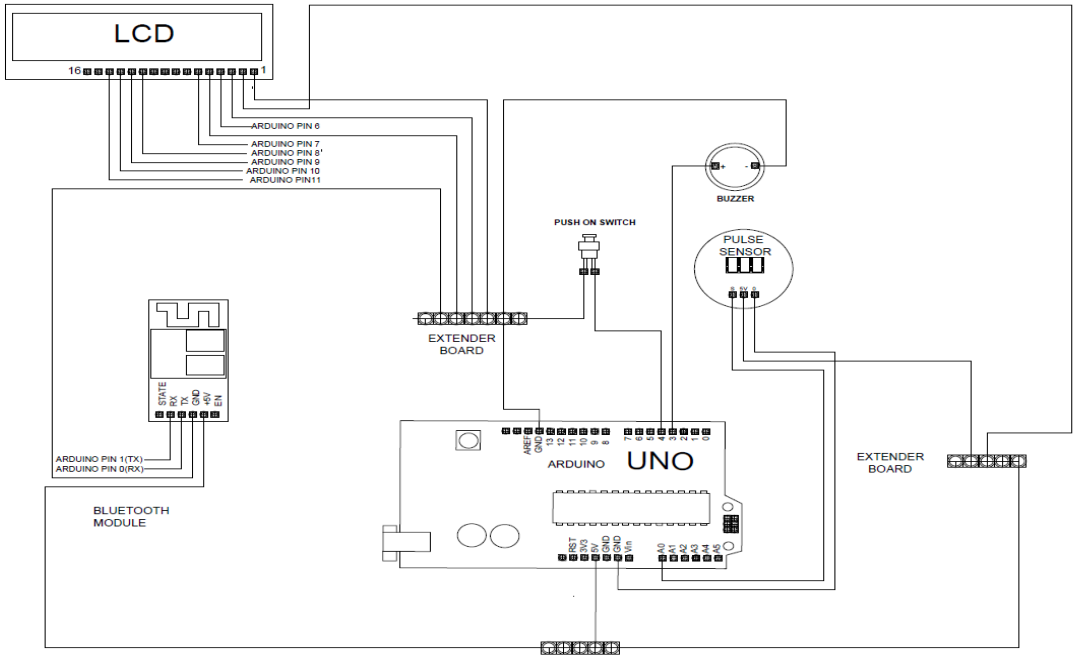
BLOCK DIAGRAM



Pulse sensor > Finger > Arduino > Mobile apps

- Pairing and connect the sensor to the phone using Bluetooth module
- If it is not connected, the light will blink then you have to do it again
- If it is success download the Cholesterol Apps
- Click button ‘connect’ Bluetooth
- Place the sensor at your skin
- Click ‘read’ button
- The cholesterol level will be calculated
- The result will display and the sound will heard
- Save the data at the pho

CIRCUIT

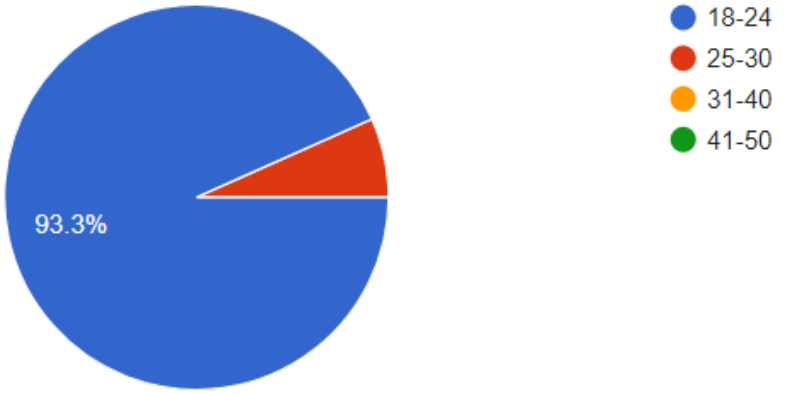

LCD
16
1
ARDUINO PIN 6
ARDUINO PIN 7
ARDUINO PIN 8
ARDUINO PIN 9
ARDUINO PIN 10
ARDUINO PIN 11
BUZZER
PUSH ON SWITCH
PULSE SENSOR
EXTENDER BOARD
STATE
RX
TX
GND
+5V
EN
ARDUINO PIN 1(TX)
ARDUINO PIN 0(RX)
BLUETOOTH MODULE
ARDUINO UNO
EXTENDER BOARD

CHAPTER 4

DATA ANALYSIS AND RESULT

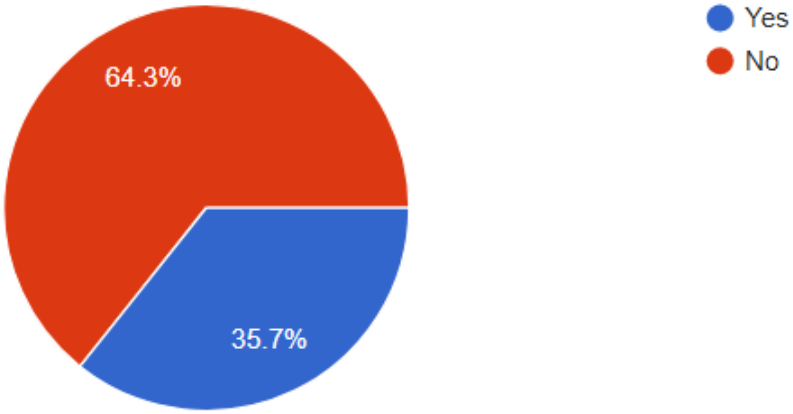
Choose your age range

15 responses



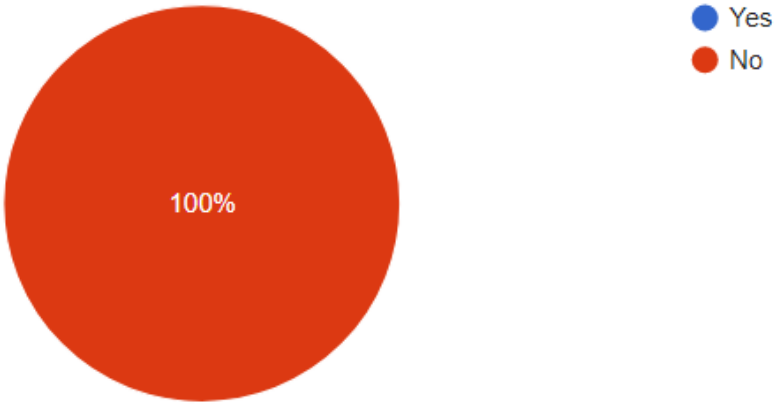
Do you have a Heart Rate monitor ?

14 responses



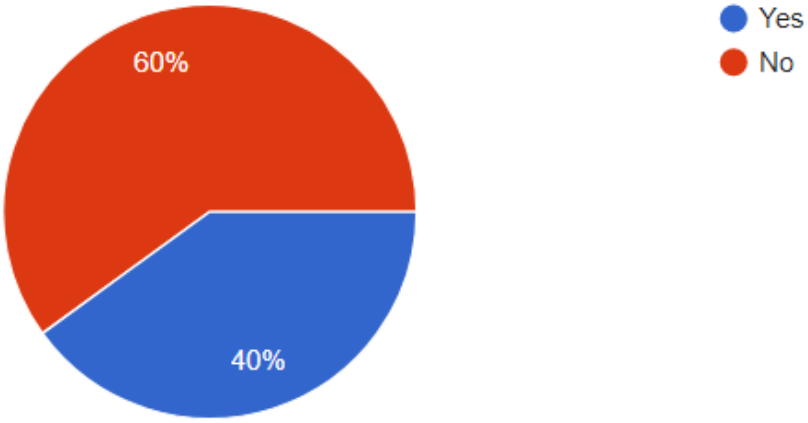
Do you calculate your Resting Heart Rate in the morning?

15 responses



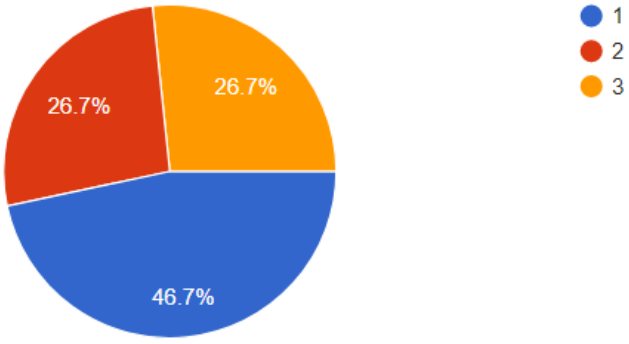
Do you know how to measure your heart rate accurately?

15 responses



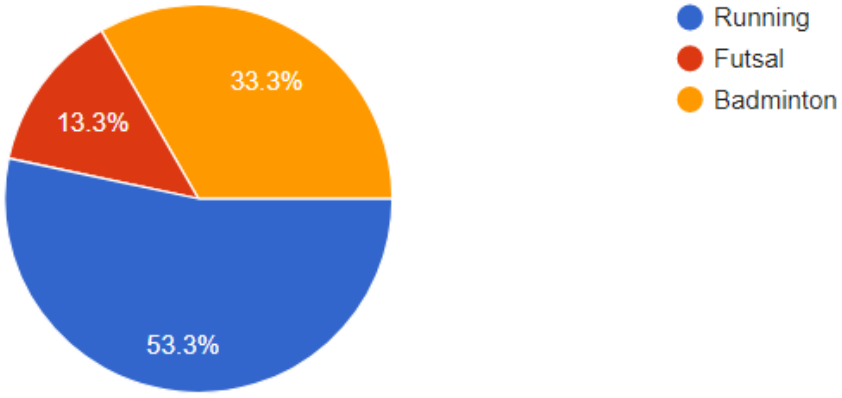
If you have a device monitoring, how often you check your Beat Per Minute in 1 day ?

15 responses



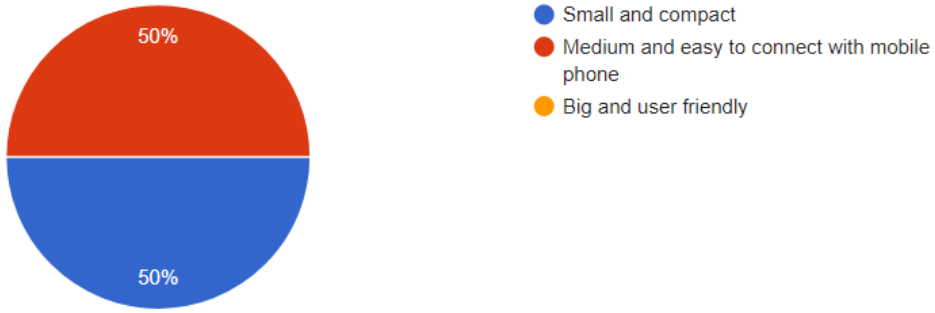
Which one you most involved and regular sport

15 responses



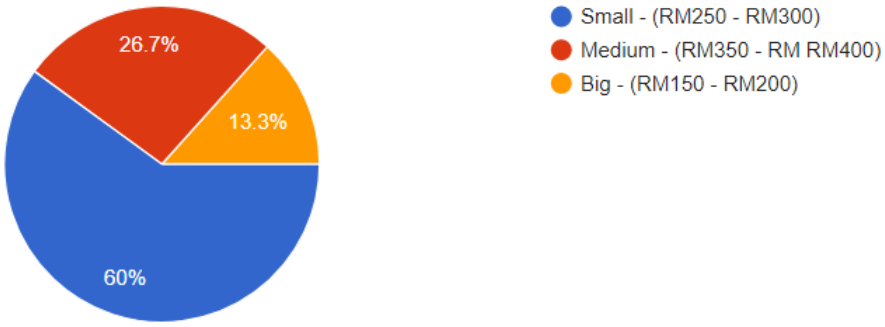
What is the criteria that you want in your monitoring device ?

14 responses



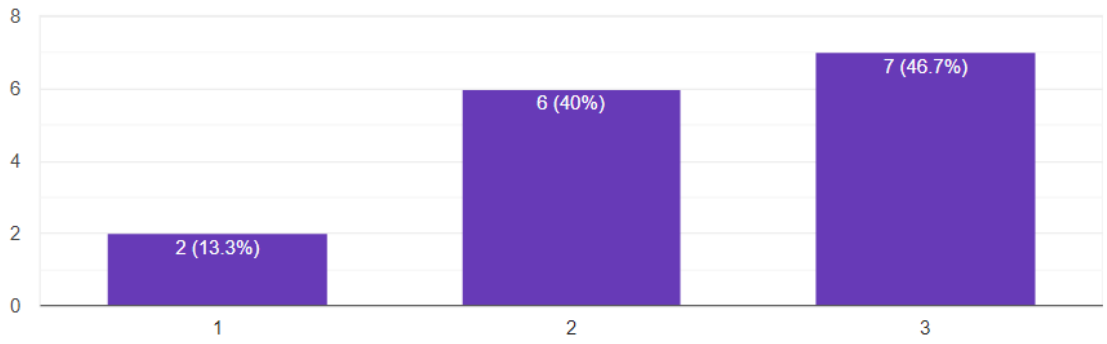
About the pricing, how much you afford spend to 1 device from your answer in last question ?

15 responses



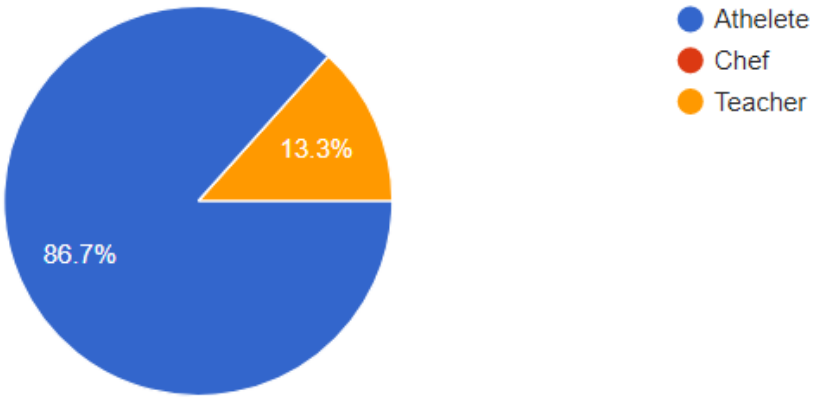
How much do you trust local Malaysia product ?

15 responses



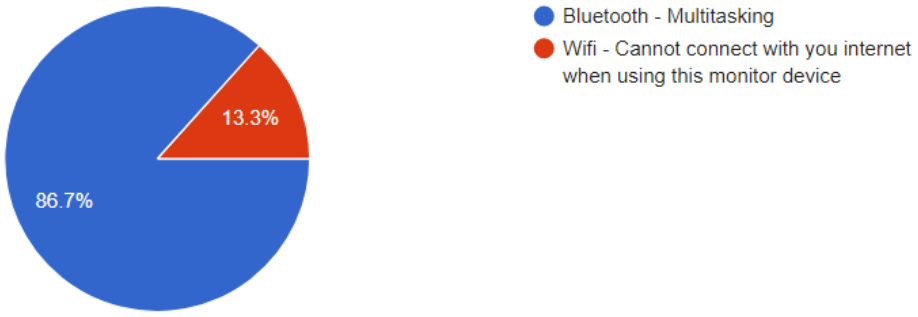
Who do you thing needed buying this monitoring ?

15 responses



Which one you prefer for connecting the monitor with mobile phone ?

15 responses



CHAPTER 5

CONCLUSION

A pulse sensor which considered as an infrared sensor that has a response to variations in light intensity instead was used. The key objective of developing this project with the help of Android Open Source platform is to immediately alert Medical Emergency and the patient's emergency contacts about the health condition of patient. We are developing prototype of this application using the continuous monitoring of parameters to detect and predict the heart attack and generate an alarm. The buzzer will turn ON when body temperature and heart rate exceeds or goes below specified threshold level. This objective is met with measuring the heart rate and body temperature. It is helpful where continuous monitoring is required under critical condition. In addition it is very usable device due to its portability which means the patients can carry it with him therefore no need to stay at hospitals because the Heart Rate Monitor is applicable almost everywhere. Along with the Heart Rate Monitor, we developed an Android Application that allows both doctors and patients to interact with each other, records the data received from the heart monitor via Bluetooth as well as enable access to these records by the doctor.

REFERENCE

https://www.medicalnewstoday.com/articles/235710.php

https://www.healthline.com/health/dangerous-heart-rate#fast-beats

https://www.electronicshub.org/heartbeat-sensor-using-arduino-heart-rate-monitor/

https://create.arduino.cc/projecthub/technopaths/heart-rate-monitor-using-iot-ddafca

https://www.how2electronics.com/heartbeat-pulse-bpm-rate-monitor-using-arduino-pulse-sensor/

SUPERVISOR

This report has been reviewed and validated as it fulfils the requirements if the final project design as set fourth

Disclaimed by

Signature :

Signature’s name :

Date :