



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT WALKING STICK WITH HEART ATTACK
DETECTION**

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

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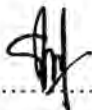
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.....
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ABSTRAK

Penyakit Kardiovaskular adalah penyakit jantung yang melibatkan jantung atau pembuluh darah. Penyakit Kardiovaskular boleh membawa kepada serangan jantung, sakit dada atau strok. Dalam kertas ini, Tachycardia dikaji kerana salah satu dari panyakit jantung. Selalunya kadar denyutan jantung untuk penyakit ini diantara 100 dan 300. Objektif utama untuk projek ini adalah untuk membagunkan tongkat berjalan dengan pengesan serangan jantung. Sistem ini boleh menganalisa kadar denyutan jantung dan boleh menunjukkan keadaan tidak normal kadar denyutan jantung. Projek ini direka kerana kekurangan kesedaran dan kekurangan memberi amaran awal kepada warga emas dan pesakit jantung. Selain itu, dengan menggunakan Sistem Global untuk Komunikasi Mudah Alih (GSM) modul, projek ini boleh memendekkan masa untuk pasukan perubatan tiba. Projek ini mengesan kadar jantung dengan menggunakan sensor nadi Infra-red dan menghantar data ke microcontroller untuk dianalisis keadaan untuk kadar jantung. Kemudian, microcontroller akan menentukan keadaan kadar jantung samada normal ataupun tidak. Jika mikrocontroller menunjukkan kadar jantung pada risiko tinggi, kemudian buzzer dan GSM modul akan aktif untuk memberitahu kepada warga emas dan orang di sekeliling. Kemudian, GSM akan menghantar mesej kecemasan kepada pasukan kecemasan.

ABSTRACT

Cardiovascular disease was a heart disease that involved heart or blood vessel. Cardiovascular disease can lead to a heart attack, chest pain or stroke. In this paper Tachycardia disease was research because this disease was an early or late complication of a heart attack. Usually heart rate pulse for this disease between 100 and 300. The main objective for this project is to develop walking stick with heart attack detector. This system can analyze heart rate pulse and can indicate abnormal heart rate pulse. This project was developed because of unawareness and lack of early warning for senior citizen and heart attack patient. Furthermore, by using Global System for Mobile (GSM) module this project can shorten the time for emergency arrived. This project detected heart rate by using Infra-red pulse sensor and send the data to the microcontroller for analyze condition for heart rate. Then, microcontroller decided condition for heart rate either normal or not. If microcontroller indicated heart rate at high risk, then buzzer and GSM module activate to aware the senior citizen and people surrounding. Then, GSM send an emergency message to the emergency response team. The objective of this project had been achieved as well the circuit walking stick with heart attack detection was built and the operation met the coding conditions. By designed alert system, so the patient can get earlier alert before it happen and patient can rest and prevent from this disease.

DEDICATION

This report is dedicated to my beloved parents who educated and supported me throughout the process of doing this project.

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Final year project is like a bridge between theoretical and practical working. With this willing I joined this particular project. However, this project could not finish without the kind support and help of many individuals and organizations. First of all, I would like to thank the supreme power the Almighty God for gave a good health to me and grace to this project become a reality. I would like to extend my sincere to Mr. Mohd Saad Bin Hamid head of department of JTKEK, for providing me with all the necessary facilities for the lab and research. I am feeling obliged in taking the opportunity to sincerely thanks to Assoc. Professor Mohd Rahimi Bin Yusoff, Dean of the Faculty of Engineering Technology. My special thanks to my worthy Project Supervisor Madam Norain Binti Rahim. I express my thankful for the patient guidance, encouragement and advice she has provided throughout my time as her student. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded to my questions and queries so promptly. I am feeling obliged in taking the opportunity to sincerely thanks to all of the Department faculty members for their help and support. I must express my gratitude to my parent for continued support and encouragement. I also place on record, my sense of gratitude to one and all, who directly or indirectly, have lent their hand in this venture.

TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	vii
List of Figures	viii
List Abbreviations, Symbols and Nomenclatures	x
CHAPTER 1: INTRODUCTION	1
1.0 Introduction	1
1.1 Project Background	6
1.2 Problem Statement	7
1.3 Project Objective	7
1.4 Scope Of Project	7
1.5 Organization Of Thesis	8
CHAPTER 2: LITERATURE REVIEW	11
2.0 Previous Project	11
2.0.1 Walking Stick with Heart Attack Detection	11
2.0.2 Heart Attack Detection Using Smart Phone	12
2.0.3 Real-Time Monitoring and Detection of Heart Attack Using Wireless Sensor Network	14
2.0.4 A Self-Test to Detect a Heart Attack Using a Mobile Phone and Wearable Sensors	14
2.1 Microcontroller Review	15
2.1.1 Arduino	15
2.1.2 Arduino Uno	16
2.1.3 8051 Microcontroller	17

2.1.4	Raspberry Pi	18
2.2	Infra-red Pulse Sensor	19
2.3	Mobile Phone	20
2.4	Global System for Mobile Phone	21
2.5	I ² C LCD Display	23
2.6	NEO- 6 GPS Module	23
2.7	Proteus Software	24
2.8	Arduino IDE	25
 CHAPTER 3: METHODOLOGY		27
3.0	Project Planning	27
3.1	Project Block Diagram	30
3.2	Hardware Implementation	31
3.2.1	Project Connection Input and Output	32
3.3	Software Implementation	34
 CHAPTER 4: RESULT & DISCUSSION		38
4.0	Overall Implementation	38
4.1	Project Analysis	43
4.2	Device and Module Testing	47
 CHAPTER 5: CONCLUSION & RECOMMENDATION		52
5.0	Conclusion	52
5.1	Recommendation and Future Work	53
 REFERENCES		55
 APPENDICES		
	Gantt Chart	
	Circuit connection	
	Circuit Schematic	

LIST OF TABLES

1.1	Heart Rate for different ages.	5
1.2	Statistics percentage adults with heart disease and stroke risk factor in 2005-2006.	5
2.1	Technical Specification Arduino Uno.	17
2.2	Example type of 8051 Microcontroller Technical Specification	19
2.3	Technical Specification for Pi 1 B+	21
4.0	Operation of Project	41
4.1	Analysis Voltage against Time (Sensor not detect)	43
4.2	Analysis Voltage against Time (Sensor detect)	45

LIST OF FIGURES

1.1	Top 50 causes of death in Malaysia in 2014	2
1.2	Statistic total death by cause and percentage in Malaysia 2014	2
1.3	Normal heart and heart failure	3
1.4	Supraventricular Tachycardia	4
2.1	Holding index finger on camera lens	12
2.2	Mobile Stethoscope & Human body with Mobile Stethoscope	13
2.3	Arduino Uno R3	16
2.4	Schematic Diagram Raspberry Pi 1 B+	19
2.5	Infra-Red (IR) Pulse Sensor	19
2.6	Evolution of Mobile Phone	21
2.7	GSM modem	22
2.8	LCD Display with I ² C Backpack	23
2.9	NEO-6 GPS Module	23
2.10	Block Diagram NEO-6 GPS Module	24
2.11	Proteus Software	25
2.12	Arduino Software	26
3.1	Project Flow Chart	28
3.2	Simple project concept	29
3.3	Project operation through block diagram	29
3.4	Overall Project Block Diagram	30
3.5	Design Prototype of the Project	31
3.6	Project Connection	32
3.7	Schematic Circuit	33
3.8	Coding Flow Chart	34
3.9	Initialize Sensor	35

3.10	Initialize LCD	35
3.11	Detect Heart Beat	35
3.12	LCD Display Heart Beat	35
3.13	Tachycardia Condition	36
3.14	Supraventricular Tachycardia Condition	36
3.15	Send Message Condition	37
3.16	Program to Send Message	37
3.17	Content Message	37
4.1	Normal Heart Beats Condition	38
4.2	Tachycardia Condition	39
4.3	Supraventricular Tachycardia Condition	40
4.4	GSM Module Send Text Message	40
4.5	Front View Prototype	42
4.6	Back View Prototype	42
4.7	Back View of Circuit Prototype	43
4.8	Front View of Circuit Prototype	43
4.9	Graph voltage versus time (Sensor not detect)	44
4.10	Graph voltage versus time (Sensor detect)	46
4.11	BPM Value Display on Serial Monitor	47
4.12	Testing GPS Module	48
4.13	Latitude and Longitude Output from GPS	48
4.14	Location Based on Longitude and Latitude	49
4.15	Test Sending SMS on LED to GSM Module	49
4.16	Output LED Follows Command from GSM Module	50
4.17	Sending SMS off LED to GSM Module	50
4.18	Output LED Follows Command from GSM Module	51

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternating Current
A/D	-	Analogue/Digital
AVR	-	Million
CDC	-	Central Data Centre
CISC	-	Complex Instruction Set Computing
CPU	-	Central Processing Unit
CPR	-	Cardiopulmonary Resuscitation
CTM	-	Cellular Text Telephone Modem
DC	-	Direct Current
ECG	-	Electrocardiogram
FLASH	-	Not Used
FCC	-	Federal Communication Commission
GSM	-	Global System for Mobile
ICSP	-	In Circuit System Programming
IR	-	Infra-Red
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MHz	-	Megahertz
PCB	-	Printed Circuit Board
RAM	-	Random Access Memory
SoC	-	System on a Chip
SPICE	-	Simulation Program with Integrated Circuit Emphasis
TDMA	-	Time Division Multiple Access
USB	-	Universal Serial Bus
VSM	-	Virtual System Modelling
WHO	-	World Health Organization
WWSS	-	Wearable Wireless Sensor System

CHAPTER 1

INTRODUCTION

This chapter aims on the project's introduction, background, problem statement, objectives and project's scope based on the project. Problem statement was the main reason why this project was developed. Last but not least, of the chapter the organization of the thesis will be explained in details.

1.0 Introduction

Cardiovascular disease was a classes of disease that involving heart or blood vessels. This condition can lead to a heart attack, chest pain or stroke. Heart attack happens when the plaque is built up with the coronary arteries. This plaque will restrict the flow of blood to the heart muscle. Function the arteries are supply the oxygen rich blood to the heart muscle that are important substance needed for heart to continue beating. Once the arteries blocked by the plague, hearts fails to function with efficiently in order to keep person alive. In worst case scenario, plaque that's build up will become atherosclerosis where this substance grow after year will cause damaging effect will lead to death. In Malaysia, the top killer in terms of diseases and health problem is coronary heart disease. Based to the data from World Health Organization (WHO) in May 2014 Coronary Heart Disease Deaths in Malaysia reached 29,363 or 23.10% of total deaths.

The age adjusted Death Rate is 150.11 per 100,000 of population ranks Malaysia 33 in the world. (World Life Expectancy, 2014).

TOP 50 CAUSES OF DEATH		
	Rate	World Rank
1. Coronary Heart Disease	150.11	33
2. Stroke	80.59	97
3. Influenza and Pneumonia	61.07	59
4. Lung Disease	36.47	15
5. Road Traffic Accidents	25.25	34
6. Diabetes Mellitus	23.59	95
7. Breast Cancer	19.88	54
8. Lung Cancers	19.14	60
9. HIV/AIDS	17.36	58
10. Other Injuries	15.51	63

Figure 1.1: Top 50 causes of death in Malaysia in 2014

	Deaths	%
1. Coronary Heart Disease	29,363	23.10
2. Stroke	15,497	12.19
3. Influenza and Pneumonia	11,773	9.26
4. Road Traffic Accidents	6,813	5.36
5. Lung Disease	6,797	5.35
6. HIV/AIDS	4,840	3.81
7. Diabetes Mellitus	4,760	3.74
8. Lung Cancers	4,088	3.22
9. Other Injuries	3,804	2.99
10. Kidney Disease	2,768	2.18

Figure 1.2: Statistic total death by cause and percentage in Malaysia 2014

Heart is made up of four chambers that are two upper chambers (atria) and two lower chamber (ventricles). The rhythm normally controlled by a natural pacemaker called the sinus node. This sinus node located in the right atrium. This sinus node produces electrical impulses normally start heartbeat. Sinus node made an electrical impulse across the Atrial muscles to contract and pump blood into the ventricles. This electrical impulse arrived at a cluster of cells called Atrioventricular (AV) node. This is the only pathway for signal to travel. AV nodes will slow down the electrical signal before send to the ventricles. Then, electrical impulses reached the muscle of ventricles then start to contract and caused muscle to pump blood to the rest of body. When this

operation disrupts, can caused heart beat become fast (Tachycardia), low (Bradycardia), or with an irregular rhythm.

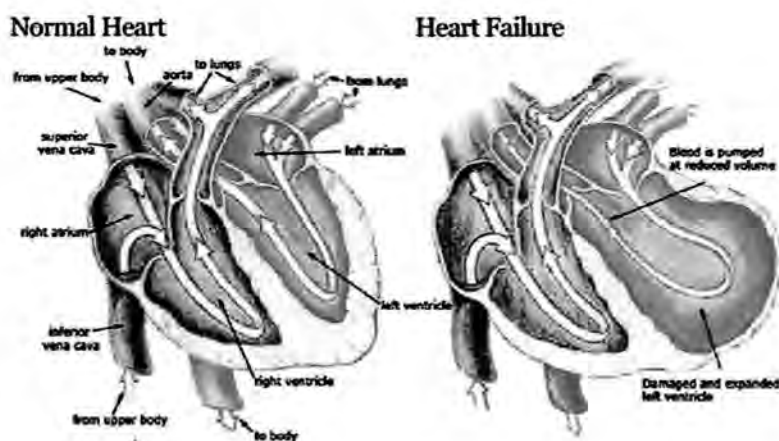


Figure 1.3: Normal heart and heart failure

In figure 1.3 shows the condition of normal heart with heart failure. Heart failure would damages and expanded left ventricle and blood is pumped at reduced volume. Irregular heart beat or arrhythmia is one the symptoms of heart disease. According Yayasan Jantung Malaysia (2016) arrhythmia referring any changed from normal sequence of electrical impulses. This condition can cause heart rate too slow or too fast. Heart rate more than 100 beats per minute called Tachycardia. For heart rate less than 60 beats per minute called Bradycardia. There are three type of Tachycardia that is Supraventricular Tachycardia (SVT), Sinus Tachycardia and Atrial Flutter. 100 beat per minute to 140 beats per minute at rest is called Sinus Tachycardia. Then, heart rate 140 beats per minute to 200 beats per minute is called Supraventricular Tachycardia. Atrial Flutter is about 150 beats per minute once it happens. Rarely case, the rate may reach 300 beats per minute. According to WebMD (2014) Supraventricular Tachycardia (SVT) refers atrial tissue or the atrioventricular node is necessary for sustaining an arrhythmia in a range of conditions. When the SVT occurs, the heart electrical system doesn't attempt right, this can caused the heart to beat very fast.

Supraventricular Tachycardia

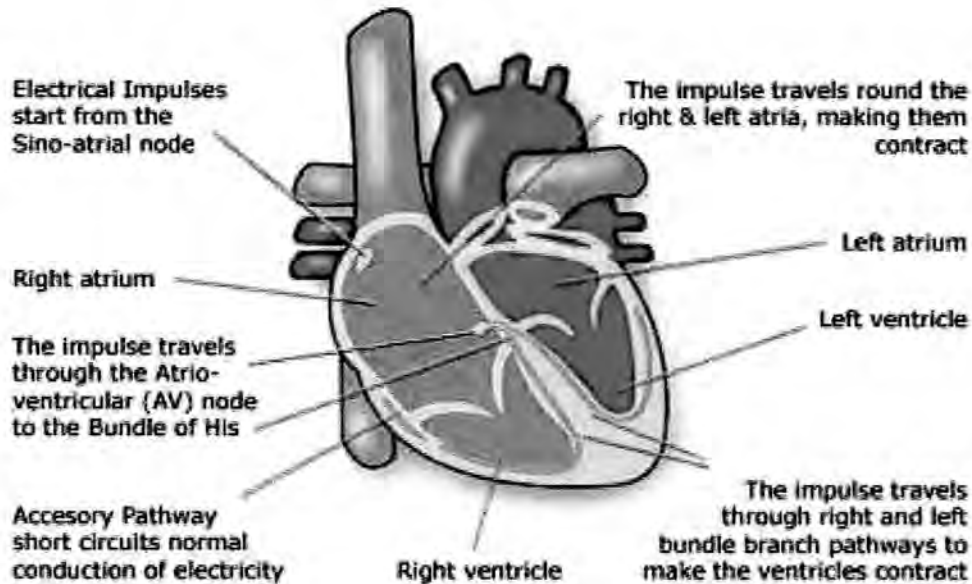


Figure 1.4: Supraventricular Tachycardia

According Table 1.1 below, shows normal heart rate for adult was between 60 and 100 beats per time. In figure 1.4 shows condition of heart when Supraventricular Tachycardia occurs. Supraventricular Tachycardia was a very serious arrhythmia initiated in ventricles. According The Heart Center (2016) the range of heart rate for Supraventricular Tachycardia between 140 to 200 beats per minute. When the heart rate rapidly beats, this can cause pumps less efficiently and blood flow to the rest of body. This higher heart beat means increase demand for oxygen at the heart muscle. Heart rate was controlled by electrical signals which sent across heart tissues. The symptoms of tachycardia included shortness of breath, lightheadedness, rapid pulse rate, heart palpitations, chest pain and fainting.

Table 1.1: Heart Rate for different ages

Age	Heart Rate(Beats/min)
Newborn	100-160
0-5 months	90-15
6-12 months	80-140
3-5 years	80-120
6-10 years	70-110
11-14 years	60-105
14+ years	60-100

Table 1.2: Statistics percentage adults with heart disease and stroke risk factor in 2005-2006

Risk Factor	%
Inactivity	39.5
Obesity	33.9
High Blood Pressure	30.5
Cigarette Smoking	20.8
High Cholesterol	15.6
Diabetes	10.1

In table 1.2 above shows statistics percentage adult with heart disease and stroke risk factor in 2005-2006. The risk factor for inactivity, obesity and high blood pressure has a large percent for heart disease and stroke. Nowadays, by using computer science component medical technology had rapidly developed. Many of scientists had developed

various algorithms, programs and device to detect heart attack of patients early. Mostly scientist used conventional medical equipment to produce result and detect heart attack accurately. Besides that, most basic function called Vital signs can be measured, which indicates physical condition from the patient. This signs can measure the normality and abnormality by using the physical status. With this sign, medical condition can be diagnosed and confirmed with help from some special test of these signs. Each vital sign measure by using different of specialized equipment. There are four vital signs that are standard in medical setting that is pulse rate, respiratory rate, blood pressure, and temperature. (Md. Ashrafuzzaman et al., 2013)

In medical science field, pulse was defined as rhythmic expansion and contraction of the arteries corresponding to each beat of heart. For human heartbeats, pulse rate is used for measurement of the heartbeats. The prominent spots for measured the pulse are wrist (Radial artery), neck (Carotid artery), inside of the elbow (Brachial artery), behind the knee (Popliteal artery) and ankle joint (Posterior tibial artery). Pulse rate is important to determine problem of human body but cannot used for diagnosis. The pulse rate is varies depends on age, physical and psychological effect on body. (Md. Ashrafuzzaman et al.,2013).

1.1 Project Background

Harsha and Kataria (2014) said that The National Heart, Lung, and Blood Institute suggest that “everyone should know the warning sign of a heart attack and how to get emergency help”. Symptoms of the heart attack can be detected by using Rate Pulse. An electrical impulse initiates muscle contraction, which results in heart beating. The senior citizens are more probability to have heart attack than young people. The walking stick with heart attack detection is design specially to help the senior citizens who need walking aids with heart attack detection. For information, when heart attack comes, the patient cannot do anything because most heart attacks involve discomfort the center of

the chest that lasts more than a few minutes. So this project will read the heart rate for patient. Then, it will analyze the reading of heart rate either it normal or not. Then alert system will have two condition, low risk and high risk. These two conditions will be indicated with two Light Emitting Diode (LED) and buzzer. When the patient reaches the high risk, LED will indicated and buzzer will operate to alert nearby people to get help. Then Global System for Mobile (GSM) module will send an emergency message through to the emergency response team when the LED reaches the high risk.

1.2 Problem Statement

Generally, senior citizen and heart attack patient did not aware with .the heart rate too rapidly or not. Some of them die in their sleep because not aware with their problem with their heart. Heart attack usually comes suddenly and silently. The symptoms vary from individual to individual and the most common reason for a critical delay is medical treatment is patient unawareness and lack of early warning. It is possible to detect the onset of a heart attack and inform the doctor or person concerned. The people surrounding of the senior citizens and heart attack patient did not know what actually happens to senior citizens and heart attack patient. So that, people takes time to call emergency for help. After a heart attack, the first few hours are critical in saving much of dying heart muscle which are starving due to lack of oxygen supply and preventing permanent heart damage. When people surrounding knows these symptoms so they can take action by gives cardiopulmonary resuscitation (CPR) when the senior citizens and heart attack patient unconscious before the emergency help arrived. This is because, when the patient unconscious it only have 3 minutes to make CPR before it can occurs permanent heart damage.

1.3 Project Objective

This proposed project that is the development of walking stick with heart attack detection was developed by using the latest technologies to give early detector before heart attack. Instead, there are several objectives as follows:

- I. To develop a walking stick with heart attack alert and indicator for emergency help
- II. To analyse the rate of heart pulse.

1.4 Scope Of Project

The scope for this project is to develop a walking stick with heart attack alert and indicator for emergency help. This project focuses on tachycardia disease that can lead a heart attack. Tachycardia disease information is investigated to understand the symptoms and sign of the disease. Tachycardia disease can diagnose by heartbeat. Normal heart rate of human is about 80 to 100 beat per minute. Tachycardia happen when heart rate reach 100 and above beat per minute. There are 3 types of tachycardia which is sinus tachycardia, Supraventricular tachycardia and Atrial flutter. This project focuses on Sinus and Supraventricular tachycardia. Atrial Flutter is eliminated from this project because it was a rare case of tachycardia. Heart rate pulse sensor is used to give early detector before heart attack. Heart rate is an important parameter of human body. Heart rate also is one from the diagnostic test to diagnose heart attack based on the sign and symptoms of the patient. In this project, heart pulse sensor module is used to sense the heart beat upon putting a finger on the sensor module. This module contains an IR sensor that can detect heart beat form the flowing of blood. When a human heart works to pump the blood to whole body, the concentration of the blood will changes. The changes of the concentration blood will makes sensor module generate voltage or pulse electrically. In this project, heart rate can be monitor from LCD display. Furthermore,

Development of Walking Stick with Heart Attack Detection implementing the technology Global System For Mobile Communication (GSM) and Global Positioning System (GPS). This technology is used to send an emergency message and location of the patient to emergency team.

1.5 Organization Of Thesis

Organization of thesis is divided into five chapter that is explain about all procedure and method for complete these project. Each of the chapter separately because of the different tittle for completed this project. This thesis covered on the introduction, literature review, research methodology, discussion, conclusion and recommendation.

For the first chapter, this thesis covered with the overview of the project. This means, people know about this project without follows its progress for development of this project throughout overview. Then, overview covered by introduction of the project, problem statement which are the reasons this project should develop, project objective, and scope of work. The purpose of objective are created because this project based from the problem statement to develop a solution. Then, this project will follow the objective to make this project successfully. Then scope of project that is the methodology has been use in order to complete this project. It consist usage of software and hardware.

Chapter 2 focuses on the literature review. Literature review is information that has been used as references by researching in journal, books, internet and many more. Literature review contains all the facts, methodology, scopes project, idea and view of the author about research. Furthermore, this literature review also explains about the basic knowledge of Arduino, infrared sensor, buzzer and many more.

Chapter 3 focuses about the methodology that has been used to complete this project. This part is elaboration and details about the usage of hardware and software.

Methodology is important part because it consist the flow of the project. If it not organized correctly it will causes problem to achieve in this project.

Chapter 4 consists of the results were obtained from the testing and modification process in order to complete this project. This part it should have simulation, testimony and many more result from the test to this project. Furthermore, this result important because it can determine the circuit and component correctly before the hardware were in process. From this part component can buy based on the simulation thus can save the money from waste by build the wrong circuit.

Lastly chapter 5 is made after through all process and methodology to achieve the objectives for this project. This part is the conclusion that has been concluded based on the final stage of project. Furthermore, this part will explain and discuss detail about this project. Then, a future recommendation for this project also include to improve this project by using the latest technology or can adding some features to make it more usage for this project.