

# HEALTH MONITORING SYSTEM ANALYSIS VIA MOBILE PHONE AND DATABASES

SHAMIRA BINTI SUHAIRI

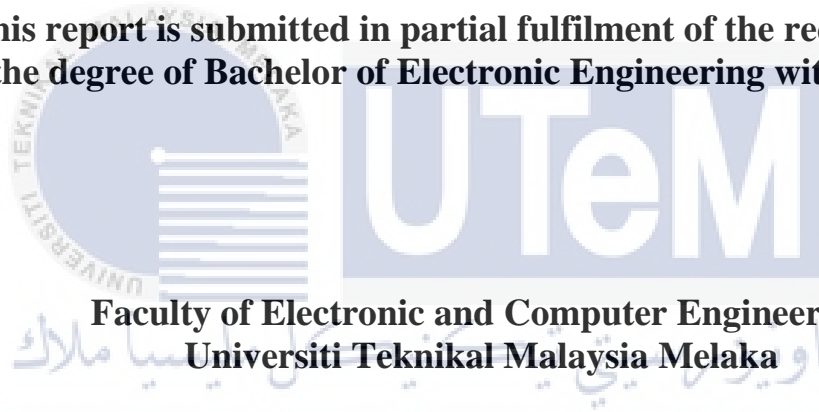


UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**HEALTH MONITORING SYSTEM ANALYSIS VIA MOBILE  
PHONE AND DATABASD**

**SHAMIRA BINTI SUHAIRI**

**This report is submitted in partial fulfilment of the requirements  
for the degree of Bachelor of Electronic Engineering with Honours**



**Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : HEALTH MONITORING SYSTEM ANALYSIS  
VIA MOBILE PHONE AND DATABASED  
Sesi Pengajian : 2021/2022

Saya SHAMIRA BINTI SUHAIRI mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

**SULIT\***

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

**TERHAD\***

(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.)

**TIDAK TERHAD**

Disahkan oleh:



(TANDATANGAN PENULIS)



(COP DAN TANDATANGAN PENYELIA)

**DR AFIFAH MAHERAN BINTI ABDUL HAMID**

Pensyarah Kanan

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer

Universiti Teknikal Malaysia Melaka

76100 Durian Tunggal, Melaka

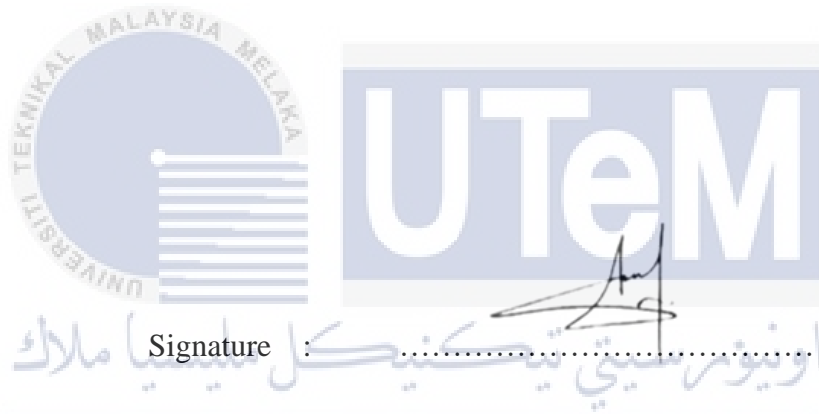
Alamat Tetap: NO 17 JALAN  
AMAL 17, TAMAN  
HALIJAHTON 42500  
TELOK PANGLIMA  
GARANG

Tarikh : 10 JUN 2022

Tarikh : 10 JUN 2022

# DECLARATION

I declare that this report entitled “HEALTH MONITORING SYSTEM ANALYSIS VIA MOBILE PHONE AND DATABASED” is the result of my own work except for quotes as cited in the references.

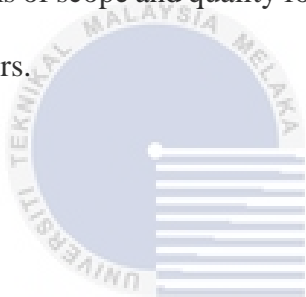


Signature : .....  
Author : SHAMIRA BINTI SUHAIRI

Date : 10 JUN 2022

## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.



اونيورستى تیکنیکل ملیسيا ملاک

Signature : 

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Supervisor Name : DR. AFIFAH MAHERAN BINTI ABDUL HAMID

Date : 10 JUN 2022

## DEDICATION

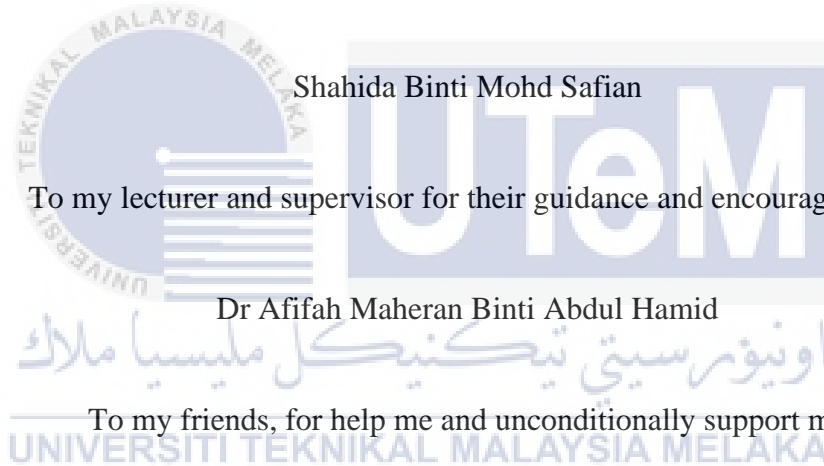
To my beloved mother who always supporting me

Shahida Binti Mohd Safian

To my lecturer and supervisor for their guidance and encouragement

Dr Afifah Maheran Binti Abdul Hamid

To my friends, for help me and unconditionally support me



## ABSTRACT

Health monitoring system at home, offices or hospital ward have grown significantly. Since the pandemic of Covid-19 which is now have been declared as endemic, portable healthcare monitoring tool such as thermometer and oximeter with rising technologies are becoming a major concern for many governments across the world. Patient in this country bringing the cumulative total to 4,448,004 (last updated in April 30,2022) and there are 45,506 active cases with 97.2% observing home quarantine [1]. This project presents the health monitoring system with databased that monitor the basic health sign where two sensors have been involved in this project which is to body temperature detection, heart pulse rate and oxygen content in body. Six sample has been used to compare and analyze the accuracy of prototype and market product that involve sample of the temperature average of six sample measured by the by the project prototype shows that the accuracy of the system at  $\pm 0.1$  compared to selected existing product in the market by the system displayed generally accurate and functionality. Furthermore, the accuracy of the prototype for pulse rate shows the accuracy of  $\pm 0.5$  compared to the market product the pulse rate and blood oxygen of six people in actual data is similarly to the observed. It concludes this system monitoring will provide the daily healthcare in good management with the constructed prototype that ideally suited for healthcare monitoring, as evidenced by the system's usefulness.

## ABSTRAK

*Sistem pemantauan di rumah, pejabat atau wad telah berkembang dengan ketara. Sejak wabak penyakit Covid-19, peralatan penjagaan kesihatan mudah alih seperti thermometer dan oksimeter dengan teknologi yang semakin meningkat menjadi kebimbangan utama bagi kebanyakan kerajaan di seluruh dunia. Pesakit di negara ini menjadikan jumlah kumulatif kepada 4,448,004(dikemaskini pada 30 April 2022) dan terdapat 45,506 kes aktif dengan 97.2% berkuarantin di rumah [1]. Kertas kerja membentangkan sistem pemantauan kesihatan dengan pengkalan data yang memantau tanda kesihatan asas dengan menggunakan dua sensor iaitu MLX 90614 bagi mengukur suhu dan MAX 30102 bagi mengukur kadar nadi dan oksigen darah. Dalam sistem ini, data analisis membentangkan enam orang yang menggunakan peralatan lain (data sebenar) dan system projek (data diperhatikan). Purata suhu enam orang yang diukur dengan thermometer menunjukkan bahawa data yang diperhatikan oleh system dipaparkan amnya tepat dan berfungsi. Tambahan pula, kadar nadi dan oksigen darah enam orang dalam data sebenar adalah serupa dengan data yang diperhatikan oleh system mengikut garis panduan perubatan. Peratusan ralat system binaan adalah (<5%) setiaporang yang telah diuji. Ia menyimpulkan pemantauan system ini akan menyediakan penjagaan kesihatan harian dalam pengurusan yang baik dengan prototaip yang dibina sesuai untuk pemantauan penjagaan kesihatan seperti yang dibuktikan oleh kegunaan sistem.*



## ACKNOWLEDGEMENTS

First and foremost, praises and thanks to the Allah SWT the Almighty, for His shower of blessings throughout my project to complete the thesis successfully.

I would like to express my deep and sincere gratitude to my project supervisor, Dr Afifah Maheran Binti Abdul Hamid, lecturer of Faculty of Electronic Engineering and Computer Engineering, Universiti Teknikal Malaysia Melaka, for giving me the opportunity to do this project and providing the invaluable guidance throughout the thesis. Her vision, genuineness, and vitality have influenced me much. She has taught me how to carry out the technique and has encouraged me to convey this research as simply as possible.

Then, a big thank to my friend for contributed data, because without their participation this thesis could never have been completed. Last but not least, I would like to thank my family especially my mother, Shahida Binti Mohd Safian for giving birth to me at the first place, sacrifices for educating and supporting me spiritually throughout my life.

## TABLE OF CONTENTS

<b>Declaration</b>	
<b>Approval</b>	
<b>Dedication</b>	
<b>Abstract</b>	<b>i</b>
<b>Abstrak</b>	<b>ii</b>
<b>Acknowledgements</b>	<b>iii</b>
<b>Table of Contents</b>	<b>iv</b>
<b>List of Figures</b>	<b>viii</b>
<b>List of Tables</b>	<b>xi</b>
<b>List of Symbols and Abbreviations</b>	<b>xii</b>
<b>List of Appendices</b>	<b>xiii</b>
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background of Project	1
1.2 Problem Statement	4
1.3 Objective	4

1.4	Scope of Project	5
1.5	Report Outline	6

## **CHAPTER 2 BACKGROUND STUDY**

2.1	Health Monitoring System Overview	7
2.2	Human Vital Sign	11
2.2.1	Body Temperature	12
2.2.2	Ambient Temperature Computation	14
2.2.3	Heart Pulse Rate	14
2.3	How Health Monitoring System Works	16
2.4	How Oximeter Works	17
2.5	System Overview	20
2.5.1	Framework CodeIgniter	20
2.5.2	Hypertext Preprocessor	22
2.5.3	MySQL	23

## **CHAPTER 3 METHODOLOGY**

3.1	Introduction	24
3.2	Financial Consideration	26

3.2.1	List of Component or Equipment	26
3.2.2	List Of Pricing	27
3.2.3	Estimation of Future Profit	29
3.2.4	Financial Implication	31
3.3	Flowchart	32
3.4	Component Used	33
3.4.1	Raspberry Pi 3 Microcontroller	33
3.4.2	I2C Liquid Crystal Display (LCD)	34
3.4.3	MLX90614 IR Temperature Sensor	35
3.4.4	RC522 RFID Module with RFID Tag	36
3.4.5	MAX30102 Pulse Oximeter and Heart Rate Pulse Sensor	37
3.5	Software Development	37
3.5.1	XAMPP	37
3.5.2	Putty	38
3.5.3	MySQL Databased	41
3.5.4	Framework CodeIgniter	42
3.5.5	Autodesk Fusion 360	44
3.6	Schematic Design	46
3.7	PCB Layout	46

3.8	Prototype Design	48
3.8.1	Connection using Breadboard.	49
3.8.2	3D printing	50
<b>CHAPTER 4 RESULT ANALYSIS AND DISCUSSION</b>		
4.1	Introduction	52
4.2	Software Operation Result	52
4.3	Prototype Operation Result.	55
4.4	Project Analysis and Troubleshoot	56
4.4.1	Troubleshoot	58
4.4.2	Project Analysis	59
<b>CHAPTER 5 CONCLUSION AND FUTURE WORK</b>		
5.1	Introduction	63
5.2	Environment and Sustainable	63
5.3	Conclusion	65
5.4	Recommendation	67
<b>REFERENCES</b>		<b>68</b>
<b>APPENDICES</b>		<b>73</b>

## LIST OF FIGURES

**Figure 1.1** Oximeter principle

**Figure 1.2** Flow scope of the project

**Figure 2.1** MLX90614 temperature connection

**Figure 2.2** Heart Rate connection

**Figure 2.3** Oximeter Schematic Diagram

**Figure 2.4** MVC Architectures.

**Figure 2.5** Features of PHP

**Figure 2.6** Process of MySQL environment

**Figure 3.1** Flowchart of the project.

**Figure 3.2** Flowchart of Health Monitoring System.

**Figure 3.3** Raspberry Pi 3 Microcontroller

**Figure 3.4** I2C Liquid Crystal Display (LCD)

**Figure 3.5** MLX90614 IR Temperature Sensor

**Figure 3.6** RC522 RFID Module with RFID Tag

**Figure 3.7** VL53L0X Time of Flight Distance Sensor

**Figure 3.8** MAX30102 Pulse Oximeter and Heart Rate Pulse Sensor

**Figure 3.9** XAMPP Control Panel layout.

**Figure 3.10** Putty Configuration

**Figure 3.11** Raspberry Pi software configuration tool

**Figure 3.12** FileZilla layout

**Figure 3.13** Hostname, username and password for MySQL

**Figure 3.14** : Log in MySQL databased.

**Figure 3.15** Reading table in databased

**Figure 3.16** Web flow for user.

**Figure 3.17** Web flow for staff.

**Figure 3.18** Code in Visual Studio Code

**Figure 3.19** Top display of design

**Figure 3.20** Final Design of project prototype

**Figure 3.21** Schematic Design of Health Monitoring System

**Figure 3.22** PCB Layout of Health Monitoring system Analysis Via Mobile Phone and Databased

**Figure 3.23** Breadboard connection

**Figure 3.24** 3D design

**Figure 3.25** Filament 3D printing

**Figure 3.26** 3D printing machine

**Figure 3.27** Process of 3D Printing

**Figure 4.1** Dashboard website

**Figure 4.2** Mobile site

**Figure 4.3** Email notification display

**Figure 4.4** Scan Badge Id

**Figure 4.6** Reading temperature.

**Figure 4.7** Reading Bpm and sPo

**Figure 4.8** Status invalid

**Figure 4.9** Website and mobile site for monitoring.

**Figure 4.10** Notification send by an email.

**Figure 4.11** Solder failure and undetected leg of component.

**Figure 4.12** Fail save data in databased.

**Figure 4.13** Show the result test of temperature between three different equipment

**Figure 4.14** Show the result test of blood oxygen between actual and developed system

**Figure 4.15** Show the result test of heart rate between actual and developed system

**Figure 4.16** Show the result of error rate between bpm and SPO<sub>2</sub>

**Figure 4.17** Show the error rate between developed system and actual data





## LIST OF TABLES

**Table 2.1** :Other researchers have developed other forms of health monitoring systems.

**Table 2.4** : Oxygenation status

**Table 3.2.1** :The list of component or equipment that need to be used

**Table 3.2.2** : List of pricing every component.

**Table 4.1** :Table of heart rate and oxygen data collected by other equipment (actual) and developed system (observed)

**Table 4.2** : Table of heart rate and oxygen data collected by other equipment (actual) and developed system (observed)

## LIST OF SYMBOLS AND ABBREVIATIONS

SMS	:	short messaging service
BPM	:	Beats per minute
RFID	:	Radio Frequency Identification
LCD	:	Liquid Crystal Display
IoT	:	Internet Of Things
ECG	:	Electrodiogram
CO <sub>2</sub>	:	Carbon Dioxide
UI	:	User Interface
SpO <sub>2</sub>	:	Oxygen Saturation
PWM	:	Pulse Width Modulation
I2C	:	Inter-Intergrate Circuit
VDC	:	Voltage Direct Current
DC	:	Direct Current

## LIST OF APPENDICES

Appendix A: Data Sheet MLX 90614.....	73
Appendix B: Data Sheet MAX 30102.....	76
Appendix C: Accuracy performance of Oral Thermometer.....	79



# CHAPTER 1

## INTRODUCTION



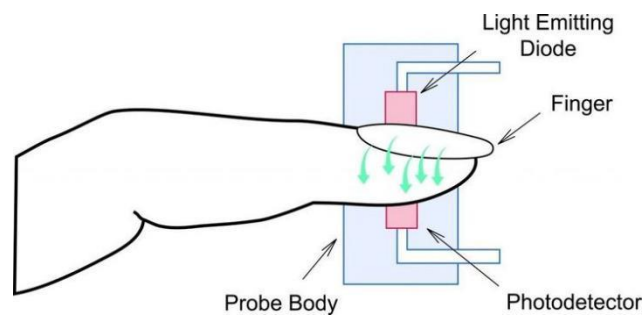
### 1.1 Background of Project

This project is generally about developing a system analysis and database for health monitoring. This chapter introduces the background information that related to the project and the reason for developing it. This chapter contains the following sections: project background, problem statement, objectives, project scope, and report outline.

Health is defined as a complete condition of physical, mental, and social well-being, not only the absence of sickness. Nowadays, people's aspiration get a healthy life. During the pandemic of Covid-19, the world got a poor health services, and physician and nurse unavailability during the most difficult times[2].

Advances in mobile technology and apps are driving a global change in health-care delivery. The utilization of voice conversations, short messaging service (SMS), wireless data transfer, and mobile phone application to enhance health supply is referred to as mobile health [3]. The mobile technology can analyze each user's phone. Currently, health monitoring system very common and important due to this pandemic. Modern technologies also offer a flexible interface, accessibility features, and mental health management to help individuals in live a better life. [4].

Heart rate and body temperature are the two most significant indicators of human health. The pulse rate, is the number of heart beats per minute. Calculating the pulses may be used to estimate the pulse rate by increasing the blood flow volume. For healthy persons, a normal heart rate varies between 60 to 100 beats per minute. Adult males typically have a resting heart rate of 70 bpm, whereas adult females have a restful heart rate of 75 bpm [5]. Females above the age of 12 have greater incidences of cardiac disease than males. The heat of the body is simply the temperature of the human body, and the total of heat generated by the body is scientifically established. A lot of factors influence a normal person's body temperature, ambient temperature, gender, and eating habits. The temperature is between 36.5 °C and 37.2 °C in healthy people. Body temperature changes can be caused by a variety of circumstances, including the flu, low-temperature hypothermia, or any other illness. Fever is a common symptom of practically all diseases [6]. Heart rate and body temperature may be measured in a variety of ways, both invasive and noninvasive. Noninvasive procedures have shown to be accurate and convenient for the user. Figure 1 show the oximeter principle [3]



**Figure 1.1**

This project is to develop the health monitoring which comes with sensors to detect body temperature, detect a heart pulse rate and oxygen of users and database to store all data automatically by using Raspberry Pi 3 with sensor MLX90614, MAX30102 and database. One application that used sensor MLX90614 are using in this project. As known, it used at forehead thermometer because easy to monitor and record the body temperature automatically without contact with others. It is to avoid users from the virus at risk of continuing to spread by sharing the pens provided. Then, sensor MAX30102 using to get the data of pulse rate and oxygen. To detect correctly, this sensor requires the user's finger.

RFID module is used to detect user identity before used a device. Then, this RFID number used for log in to database that user used for monitoring. This system can be used by many users. The prototype started with scanned the identity card or token to RFID module, then sensor detect the temperature, heart pulse rate and oxygen. The data will then show on the LCD and be instantly sent to a database and internet dashboard, making it easy for the user to monitor all of the measured data. The 3D printed design will be built for this project.

## 1.2 Problem Statement

The project proposed give more priority to the user in home. This is because the lack of hospital staff to check and monitor temperature, blood oxygen and heart pulse rate due to increasing number cases of Covid-19 patient. This problem will increase the risk for other people because of slow take an action. Other than that, the data from other health monitoring was not have a database. This problem was approached to get a solution to be build a database for help the user to self-monitor from their home and get the medical consent if the user go to clinic. Besides that, the current features for health monitoring system for home is not complete. Therefore this project will add the feature to be user friendly. For the outside market, the monitoring device and system to user get not affordable.

## 1.3 Objective

The aim of this research is to create a health monitoring system that can save data and analyze it using a mobile phone. As a result, the following aims are pursued in this study:-

- i. To develop health monitoring system for body temperature, heart pulse rate and blood oxygen by using IoT network.
- ii. To analyze the accuracy performance of the MAX30102 and RFID Temperature sensor.
- iii. To display the information in the website and mobile platform.

#### 1.4 Scope of the Project

The scope of projects is to develop the health monitoring system for body temperature, pulse rate and blood oxygen by using IoT network. This project is divided software and hardware implementation. It suggested to be implemented at home, offices or hospital ward. This project need to select a suitable and affordable component such as Raspberry Pi 3 with sensor MLX90614 range of detection in 36°C and above and MAX30102 detect in normal range at 95% and above. It will design the suitable circuit for the monitoring system and preparing a program that made the system run according to its requirement. This project need to analyze the accuracy performance of the MAX30102 and RFID Temperature sensor by using mobile phone through the received data. Final prototype will be soldering after the testing circuit success and design the 3D printed to get the appropriated finishing of the project. The preparation of thesis will be done once the project objective achieved. Figure 1.2 show the flow cope of the project.

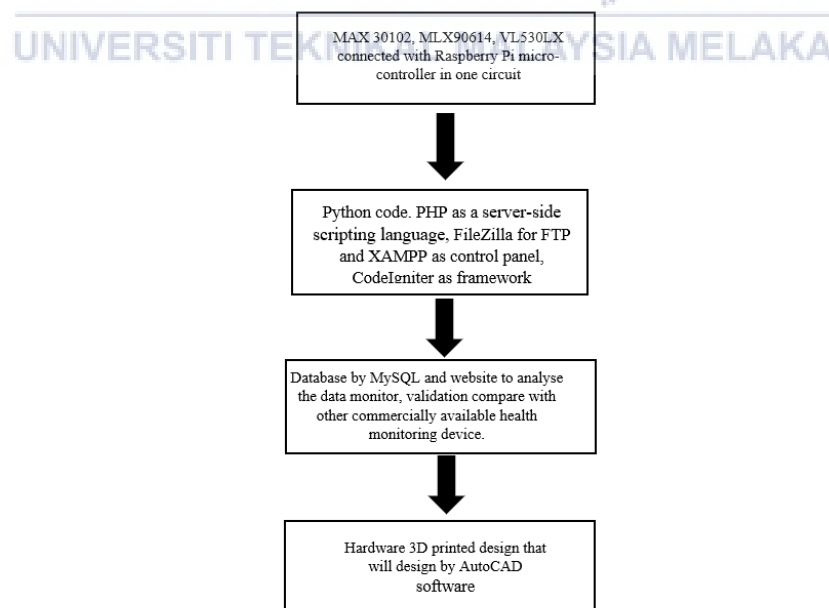


Figure 1.2