Faculty of Electrical and Electronic Engineering Technology

Development of Health Monitoring System

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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Development of Health Monitoring System

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A project report submitted
in partial fulfillment of the requirements for the degree of
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DECLARATION

I declare that this project report entitled “Development of an IoT-Based Health Monitoring System is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

Signature :

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Date : 6/2/2022

DEDICATION

In this dedication, I would like to thanks to my Parents, fellow friends, supervisor and all the lecturers through whole semester to gives me a lot of learning process in order to complete the Final Year Project task. All the good things came from Allah SWT. and to Him I always pray for the better to increase my passion in completing the task given.

ABSTRACT

This project is proposed to build a health system that can help patients and health officials to observe the level of health of a person. The idea to develop this prototype was because of the problem the patient faced in going to the hospital to see a doctor. This matter is raised because when the patient does not have a vehicle or there is no one can send him to the hospital. In addition, this project can also reduce the burden of doctors when they want to treat patients like this. This is because doctors can only monitor these patients through the portal that has been provided. This portal will display a few things about the patient. The matter is the patient's body temperature and heartbeat. Through these two things, the doctor can analyze and decide whether the patient needs further treatment or whether the patient is in a normal condition. The system uses the Internet of Things (IoT) to connect data to a portal that will be used by doctors. The main material in this project is an Arduino which acts as the brain for this system and is equipped with several sensors to identify the patient's body temperature and heart rate. The sensors used in this project are a pulse sensor and a GY-906 sensor that acts to measure the patient's body temperature. ESP8622 is also used in this project. This tool is intended as a network module for connecting hardware and software.

ABSTRAK

Projek ini dicadangkan adalah utuk membina suatu sistem kesihatan yang dapat membantu pesakit dan pegawai kesihataan untuk memerhatikan tahap kesihatan seseorang itu. Idea untuk mengembangkan prototaip ini adalah kerana masalah yang dihadapi oleh pesakit itu untuk pergi ke hospital untuk berjumpa dengan doktor. Perkara ini di bangkitkan kerana apabila pesakit itu tidak mempunyai kenderaan ataupun tidak ada siapa yang boleh menghantarnya ke hospital. Selain itu juga, project ini sekaligus dapat mengurangkan beban doktor apabila hendak merawati pesakit seperti ini. Ini kerana para doktor hanya boleh memantau pesakit ini memalui portal yang telah disediakan. Portal ini akan memaparkan beberapa perkara mengenai pesakit. Perkara tersebut adalah suhu badan dan degupan jatung pesakit tersebut. Melalui dua perkara ini doktor boleh meganalisis dan membuat keputasan adalah pesakit terseut perlukan rawatan lanjut ataupun pesakit itu dalam keadaan normal. Sistem ini menggunakan Internet of Thing (IoT) untuk menghubungkan data ke portal yang akan digunakan oleh doktor. Bahan utama di dalam projek ini adalah Arduino yang bertindak sebagai otak untuk sistem ini an di lengkapkan oleh beberapa sensor untuk mengenalpasti suhu badan dan degupan jantung pesakit. Sensor yang digunakan di dalam projek ini adalah sensor nadi dan GY-906 sensor yang bertindak untuk mengukur suhu badan pesakit. ESP8622 juga digunakan dialam project ini. Alat ini bertujuan sebagai modul rangkaian untuk menghubungkan perkakasan dan perisian.

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I would like first of all to thank Allah S.W.T for his blessing and to give me the opportunity to successfully complete my final year project. And I would like wish to express my highest gratitude to my supervisor, Ts. Mohd Razali Bin Mohamad Sapiee for supervising and assist me throughout the semester. His encouraging advises and generous guidance had contributed lots to the completion of this project.

Next, I would also wish to express my deepest because of my beloved father, Mohd Ithnin Bin Mohd Ithnin and my beloved mother, Maizatul Akmam Binti Mansoruddin for His and Her love, moral supports that always pray for my success during throughout the whole semester. Last but not least, this especially because of the support of all my friends during this project, either the learning process in directly or indirectly.

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℃	-	Celsius

LIST OF ABBREVIATIONS

V	-	Voltage
BPM	-	Heartbeat Per Minutes

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CHAPTER 1

INTRODUCTION

1.0 Introduction

The increased usage of mobile technologies and smart devices in the field of health has had a huge impact on the world. Wellbeing experts are increasingly using the advantages that these advancements provide, resulting in a significant shift in clinical wellness care. Furthermore, innumerable traditional clients benefit from the advantages of portable wellbeing applications and wellbeing treatment boosted by ICT to make advances toward improving their wellbeing.

According to the World Health Organization (WHO) constitutions, a person's right to the highest possible level of well-being is a fundamental right. As we are really propelled by this, we endeavor to propose an imaginative framework that puts forward a shrewd wellbeing checking framework that employments sensors to screen persistent crucial parameters and employments web to overhaul the specialists so that they can help in case of any issues at the most punctual anticipating passing rates.

Health observing utilizing IoT could be an innovation to empower observing of patient's exterior of customary clinical such as at domestic, which may increment get to care and diminish healthcare conveyance costs. This could essentially move forward an individual's quality of life. It permits patients to preserve autonomy, anticipate complications, and minimize individual costs. This framework encourages these objectives by conveying care right to the domestic. In expansion, patients and their family individuals feel consolation knowing that they are being observed and will be upheld if an issue emerges (Valsalan, Baomar and Baabood, 2020).

1.1 Problem Statement

In today's social welfare framework for patients who stay home throughout post-operational days checking is finished, medical caretaker. This project is to develop of the health monitoring system for medical applications using sensors and Arduino. This monitoring system has been become new wireless support innovation developed for human and provide good access and effective environment. Health is an important part of our lives. We need a healthy body to do daily things or go to work. Therefore, we need to take care of our health by constantly monitoring the level of health of the body. We need someone to monitor our health. However, doctors or health officials do not need to come home or we ourselves go to the hospital for a health check-up. We can do self –examination at home and doctors and health officials can receive such health reports through certain applications to assess our level of health. In this project, Arduino was used as the microcontroller for this project. The Arduino software is a program for controlling and fulfilling the system requirements developed in this project.

1.2 Objectives

In this study, there are a few objectives that will archive.

a) To develop a smart health monitoring system using multi-sensors.
b) To detect pulse and body temperature using pulse sensor and GY-906
c) To analyze the effectiveness of the system using IoT.

1.3 Scope of the study

In order to archive the target of the project, there was many vital criteria that require to think about:

The monitoring system can display the vital parameters of a temperature sensor and a pulse sensor via the Android APP in real-time when a Wi-Fi connection is established. Therefore, nurses or doctors use this app monitoring system through their smartphones. Using ESP8266 as module Wi-Fi and Arduino as microcontrollers.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This section discusses and summarizes the overall development of the health system concept and theory of the project. This chapter will explain past research and existing research. This chapter discussed the theory and concept used to solve this project's problem. Journals, articles, and case studies are the main sources of information. These sources have been selected based on the project scope similarity.

2.1 Review of Current Situation

Nowadays, an ever-increasing number of healthcare professionals are making full use of these electronic devices. Internet of Things (IoT) devices are widely used in the medical field. The scope of this study is almost a health control framework.

Particularly in the provinces for cardiac patients, persistent high blood pressure, hypertension issues, diabetes silence, and so on, because the number of specialists in the provinces is lower than in the city. Therapeutic hardware is not available in the provincial range; nevertheless, government clinics are. As a result, there are more patients than at the government clinic. In many instances, the gear is ended. As a result, if a crisis call is necessary, this equipment gadget will immediately transmit the report to the specialists or helper specialists. Specialists will complete the remaining tasks based on their reports. Among several chronic diseases, hypertension has become a prevalent significant ailment that continues to be the leading cause of cardiac/stroke death. (Kirtana and Lokeswari, 2017).

Web-based or online framework advancements are widely expanded. Nowadays, obtaining true time is critical. When a patient is released from the clinic due to a fundamental condition, he or she must check in at a usual premise. That is why an associate degree IoT-based health monitoring system is that the ideal possibility for a country-wide scale. The Internet of Things (IoT) digital physical resources equivalent to devices, sensors, machines, portals and therefore an organization. It connects individuals to things and objects to people in real-time

(Pathak *et al.*, 2020). A typical IoT network can expand rapidly, resulting in an exponential increase in the variety, speed, and overall amount of data. This knowledge creates opportunities for important esteem development and money generation. However, the key problem for IoT situations is determining a way huge of information from all sources and act in real-time.

2.2 General IoT in Health Management

IoT changes the restorative info into bits of information for an additional intelligent understanding of care. healthcare is presently more automatically progressed and is all around interfacing things together. Hence, IoT is therefore crucial in healthcare. By leverage gadgets like associated sensors and different varieties of things that people will wear all that data are often set inside the cloud, and doctor/caregiver can effectively screen the real-time data of the patient.

IoT can support critical medical applications by gathering information from bedside devices, viewing silent data, and diagnosing the entire structure of an ongoing treatment in real time. Currently, many medical devices are being operated around the world, which leads to information problems, which in turn can lead to errors. To overcome this, the collected information is stored in the cloud.

The caregivers or specialists can effectively screen and oversee the understanding wellbeing and can spare valuable minutes each day. Without having to physically visit each quiet, the caregiver/expert or specialist can deliver an inaccessible conclusion and track the restorative resources. Utilizing the sensors and Wi-Fi, the proper division within the hospital can be found whereas recovering erotic data. IoT within the wellbeing observing framework has given us a huge advantage within the improvement of advanced restorative treatment (Li, Hu and Zhang, 2017).

Due to progress innovation, the sensors have gotten to be littler which has empowered the advancement of wearable arrangements. Due to reliable web network, the gadgets are getting to be more proficient and effective. The IoT are based gadgets continually associated to the web, the patients can be monitor or observed and fundamental measures can be taken in case of a crisis. IoT are based gadgets can hence give both discovery and crisis reaction administrations.

2.2.1 Sensor on Health Monitoring System

The sensor on health monitoring framework collects data on the patient's health status via an electronic information flag and alerts the quiet via a sound warning. Temperature sensors and heart rate sensors are two of the most used types of temperature sensors.

The majority of health monitoring devices made use of body temperature sensors, heart rate sensors, and temperature sensors. The framework is applicable in both mechanical and household settings. In every instance, the resulting architecture is wire-connected. Making the device remote would increase the framework's flexibility. Based on a keen (ICU) system that captures treatment data in real time. Framework has three layers, which is coherent layer, is physical layer and application layer. The physical layer comprises of the sensors utilized for information purposes.

An information gain from the sensors among the physical layer is ready within the consistent layer. The consistent layer handles the media get to administration assignments and go to the communication device. The applying layer takes activities supported by the prepared information created by the coherent layer. In any case, the condition and behavior of the quiet cannot be set within the checked-on framework because the framework used unimportant information.

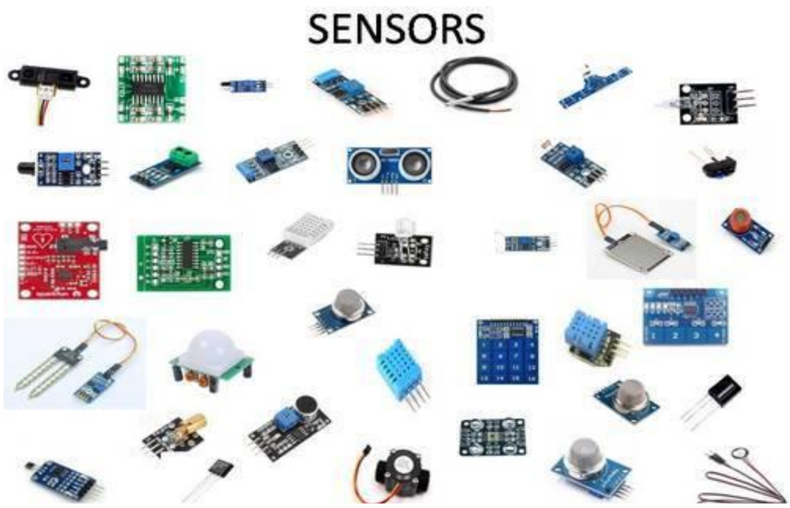


Figure 2.1: Type of Sensors

2.2.2 Microcontroller on Health Monitoring.

Microcontrollers the most widely use devices in health verification frameworks around the world MCUs an exceptionally valuable for quickly processing sensor information. between sensors. Due to the exceptionally small estimate of microcontrollers. It can be used for convenient arrangements. Nowadays, Arduino is one of the most widely used microcontroller-based tiers in wellness verification frameworks.

(Kumar and Sekhar, 2015) provided an Arduino primarily totally based health parameter checking machine controlled with the aid of using a telephone application. All sensor information is in analog format. The information is added to the Arduino Uno board. The obtained analog values are transformed to superior through an incorporated analog to the automatic converter. The received values are sent to a phone via Bluetooth. Framework made use of a Bluetooth module that does not cowl a big area. (Sabbir *et al.*, 2017) created association for diabetes patients. It can be a home surroundings framework. This tool permits a diabetic to screen his or her fitness state, bodily activity, manipulate diets, take measures, and allude to consult professionals.

In any case, the developed structure has not received clinical approval. The smart health testing framework based on the Internet of Things is proposed as a framework for smart health testing. An application framework can be divided into three layers, discovery layer, application layer, and transport layer-these are several parts. In the recognition area, a sensor is used to detect body temperature, and a heart rate sensor is used to detect the heartbeat. The information is sent from the Arduino to the cloud in the Wi-Fi module and the Ethernet expansion board through the transmission layer. Finally, the application layer receives data from the server. In any case, the microprocessor in the Arduino is not enough. So many sensors are used at the same time.

(Desai and Toravi, 5093) developed a wireless sensor network-based smart home and heartbeat monitoring system (WSN). For parallel data computing, the system utilised Spartan 3 with FPGA architecture. All of the sensors are linked to a microcontroller, and an LCD displays the MCU's output. However, the system's components are not all housed in a single device.

Figure 2.2: Microcontroller Devices

2.2.3 Remote Monitoring

In the remote health monitoring system, the general Internet of Things monitors the patient's vital indicators in real-time and responds when there is a problem with the patient's health. The patient is equipped with equipment. Send the patient's vital signs data. From location. The location of the patient. The transmitter is connected to the hospital via a telecommunications network. The hospital's remote monitoring system reads the patient's vital signs. Similarly, when the transducer is implanted in the patient, the data can be transmitted electronically. The information provided is provided safely for health and fitness.

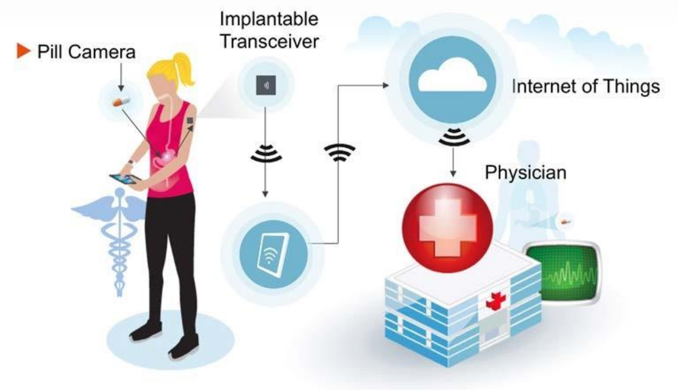


Figure 2.3: IoT Monitoring System

2.2.4 Wireless IoT connectivity

The Internet of Things (IoT) refers to the fact that billions of physical devices worldwide are currently connected to the Internet to collect and share data. With the advent of low-cost computer chips and the ubiquity of remote systems, everything from tablets to jets can now be part of the Internet of Things. With the advent of cheap computer chips and the popularity of remote systems, everything from tablet computers to airplanes can now be part of the Internet of Things. When it can connect to the Internet for work or data transmission, it becomes an IoT device.

An IoT device is a light bulb that can be replaced by a smartphone app, just like a motion sensor, a smart thermostat in a company, or a connected streetlight. Some larger objects can carry a variety of smaller IoT components, such as airplanes, which are now filled with thousands of sensors to collect data and shape it to ensure that it works properly (Haripriya *et al.*, 2016). Thoughtful city companies equip entire communities with sensors so that we can find them and monitor the surrounding environment.

The term Internet of Things is mainly used for devices that usually do not have a network connection but can connect to the system regardless of human activity. Therefore, PCs are generally not considered IoT devices. This. Smartphones, although the latter have many sensors. However, smartwatches, health bracelets, or other wearable devices are likely to be verified as IoT devices (Kaur, Gupta and Kumar, 2021).

The idea of incorporating sensors and information about essential objects was explored in the 1980s and 1990s (and there are apparently some much earlier precursors), but it peeled off from some of the first companies to report that a distribution machine was progressing with it Internet was basically moderated by innovation. The chips were also huge and bulky and there was no way for the objects to communicate successfully.

. When it became profitable to interconnect billions of devices, processors were required that were inexpensive and energy-efficient enough to be virtually disposable. The use of RFID tags with low-power processors that can communicate wirelessly, as well as the increasing availability of broadband Internet and cellular and wireless networks, have partially alleviated this problem. The introduction of IPv6, which, among other things, should provide enough IP. It also required addresses for all the devices the world (or even this galaxy) would need to scale the IoT.

One of the initial IoT uses was to attach RFID tags to pricey pieces of equipment to assist track their position. However, the cost of adding sensors and an internet connection to items has continued to decline, and experts believe that this basic capability will one day cost as little as 10 cents, allowing practically everything to be connected to the internet.

IDC, a technology analysis firm, expects that by 2025, there will be 41.6 billion linked IoT devices, or "things." It also says that industrial and automotive equipment provide the greatest possibility for connected "things," but that smart home and wearable gadgets will see rapid adoption in the short term.

According to technology analysts, the corporate and automotive industries will account for 5.8 billion devices this year, up nearly a quarter from 2019. Utilities will be the most active users of IoT, owing to the ongoing implementation of smart metres. The second most common application of IoT devices will be security devices such as intruder detection and cellular antennas.

2.2.5 Education Application in Internet of Things (IoT)

This simple journal was written by (Kamarudin *et al.*, 2019) from the School of Computing and Creative Media, University College of Technology, Sarawak. The reason I reviewed this journal was because it shows the issues and proposes a significant framework for application offering educational support in the Malaysian. So, I have gained some knowledge on the levels of using mobile apps among Malaysian students especially on education purpose which is quite related to my project.

These are among of the substance of the diary. It has been recommended that the troubles in executing STEM integration in Malaysia are related to the trouble in joining instruction over urban and provincial areas. Numerous understudies accept that as it were shinning understudies can advance their think about in science and innovation. Such feeling proposes a noteworthy difference between urban and rustic areas, especially in terms of civilities and other assets. This dissimilarity has come about in an awkwardness in logical and mechanical accomplishments over the nation, influencing individual and national improvement. As a cure to this issue, up and coming portable instruction applications might serve as middle-tier innovation, overcoming the negative utilization condition and helping understudies, educates, and guardians.

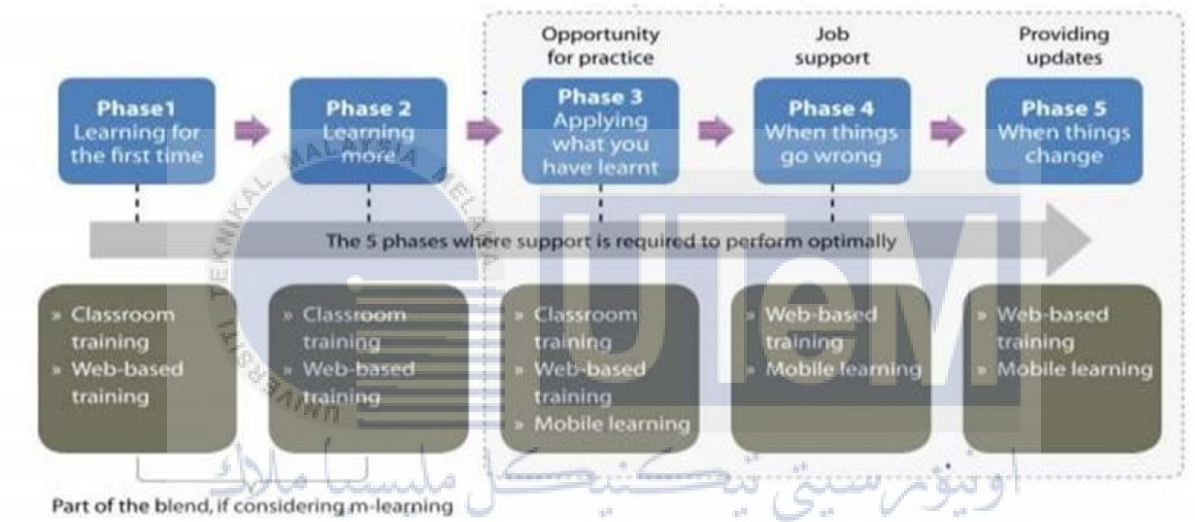


Figure 2.4: Phase of IoT

Mobile device use can now be integrated into learning; however, core instructional content should be supplied through traditional means. The reinforcement of basic information and abilities for learners is the focus of phases 3, 4, and 5 in Fig. 1. These phases highlight the potential to demonstrate practical skills, reinforce the notion of timely information updates, and lengthen learners' attention span to absorb a huge amount of information. The notion of stages three through five encourages the distribution of material via portable or mobile devices.

2.3 IoT Based Patient Monitoring

Several health monitoring systems have been created in recent years to monitoring the health of patients. We are looking at the of the most current works in this discipline. The primary goal of this IoT is to improve an ontology-based solution with the capacity to monitor health status. During this evaluation, the system will keep track of two major aspects of health:

a) Heartbeat

b) Body Temperature.

2.3.1 Heartbeat

The number of times a person's heart beats per minute is known as the pulse rate. Normal heart rate varies from person to person, but a normal range for adults is 60 to 100 beats per minute. Normal heart rate is also affected by the individual's age, body size, heart condition, whether they are sitting or moving, medication usage, and even air temperature. Emotions, such as excitement or fear, can cause the heart rate to accelerate. A well-trained athlete may have a normal heart rate of 40 to 60 beats per minute, according to the American Heart Association (AHA).

There are 4 steps to measure heart rate:

1. Writs
2. Inside of an elbow
3. Side of the neck
4. Top of the foot

Put two fingers over one of these ranges and count the number of beats in 60 seconds to degree 20 seconds and raise by three, which is less strenuous than the first phase. Resting heart rate: The best time to measure pulse is when a person is at rest. The average heart rate for adults and older people is between 60 to 100 beats per minute, according to the American Heart Association (AHA) (bpm). However, a heart rate of less than 60 beats per minute (bpm) does not imply that the individual has a health problem. A person's ideal heart rate zone is between 50% and 85% of his or her maximum heart rate. According to the American Heart Association, a 30-year-old person should be between 50 and 85 percent of his or her maximum heart rate.

Maximum and target heart rate

AGE	TARGET HEART RATE ZONE 50–85%	AVERAGE MAXIMUM HEART RATE, 100%
20 years old	100–170 bpm	200 bpm
30 years old	95–162 bpm	190 bpm
35 years old	93–157 bpm	185 bpm
40 years old	90–153 bpm	180 bpm
45 years old	88–149 bpm	175 bpm
50 years old	85–145 bpm	170 bpm
55 years old	83–140 bpm	165 bpm
60 years old	80–136 bpm	160 bpm
65 years old	78–132 bpm	155 bpm
70 years old	75–128 bpm	150 bpm

Source: American Heart Association INSIDER

Figure 2.5: Range Heart rate of normal person

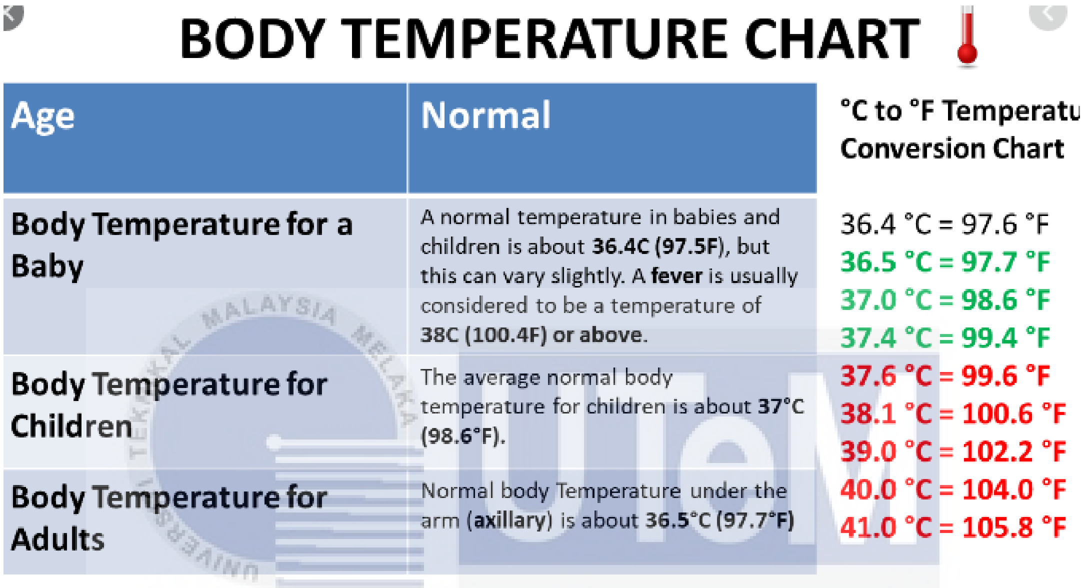
2.3.2 Body Temperature

Temperature may be a physical amount that communicates hot and cold. It is the appearance of warm vitality, show in all matter, which is the source of the event of warm, a stream of vitality, when a body is in contact with another that is colder or more smoking. Temperature is measured with a thermometer.

In this project, LM35 will be used as measuring component. The foremost common scales are the Celsius scale (once in the past called centigrade, indicated as °C), the Fahrenheit scale (signified as °F), and the Kelvin scale (signified as K), the final of which is transcendently utilized for logical purposes by traditions of the Universal Framework of Units (SI).

The lowest possible temperature is absolute zero, at which no more warm life can be extracted from a body. Tentatively, it can be drawn unusually close (100 pK), but not come to, as established by the third law of thermodynamics.

Temperature is vital in all areas of normal science, counting material science, chemistry, Soil science, space, science, medication, science, environment, fabric, science, metallurgy, mechanical designing and geology as well as most viewpoints of day-by-day life.



BODY TEMPERATURE CHART

Age	Normal	°C to °F Temperatu Conversion Chart
Body Temperature for a Baby	A normal temperature in babies and children is about **36.4C (97.5F)**, but this can vary slightly. A **fever** is usually considered to be a temperature of **38C (100.4F) or above**.	36.4 °C = 97.6 °F 36.5 °C = 97.7 °F 37.0 °C = 98.6 °F 37.4 °C = 99.4 °F
Body Temperature for Children	The average normal body temperature for children is about **37°C (98.6°F)**.	37.6 °C = 99.6 °F 38.1 °C = 100.6 °F 39.0 °C = 102.2 °F
Body Temperature for Adults	Normal body Temperature under the arm **(axillary)** is about **36.5°C (97.7°F)**	40.0 °C = 104.0 °F 41.0 °C = 105.8 °F

Figure 2.6: Normal Temperature

2.4 Connection between Hardware and Software

This project makes use of serial data transfer hardware and software. There are two techniques for serial data transfer.

a) Synchronous
b) Asynchronous

In this case, the synchronous technique sends a single block of data at a time. Asynchronous methods only transport one byte at a time. It is feasible to develop software that employs either strategy. Many manufacturers produce dedicated IC chips for serial data transfer since the software might be complex and lengthy. These chips are known as Universal Asynchronous Transmitter / Receiver (UART)

2.5 Summary

Conclusion from the research findings of all the previous projects, the emphasis is more on recent work and the results for this current project, as can be seen. The study of the literature started to ignore the method used to develop this project for a variety of applications. This project uses an Arduino as a main controller in this project which I choose it because it more comparable and easier for make a code just using C++. Besides, improving the following system that is related to this project may help other researchers do their research and innovate more methodology for this project.

CHAPTER 3

METHODOLOGY

3.0 Introduction

The system content five (5) major electronics components.

1. Pulse Sensor
2. ESP8266 Wi-Fi Module
3. Arduino UNO.
4. LCD Display.
5. Body Temperature sensor (GY-906)

For supply, a 12-volt adapter with associate Arduino and a 5-volt device is connected. The patient can build contact with the GY-906 device. After a few seconds, the result is uploaded, and therefore the vital sign reading will be displayed on the LCD. Similarly, by pressing the push button, the recipient will get the worth as an internet web, or a golem application The Pulse sensor feature will be enforced by attaching the sensor to the patient' finger. Meanwhile, the pulse curve will be generated. The curve will then be uploaded to the online page

3.1 Flowchart

Explanation of the sequence of the process carried out. Therefore, the flow chart of the overall project is shown in Figure 3.1 and the subtopics of the implementation of this project are explained in detail in a summarizing order.

3.1.1 Main Process

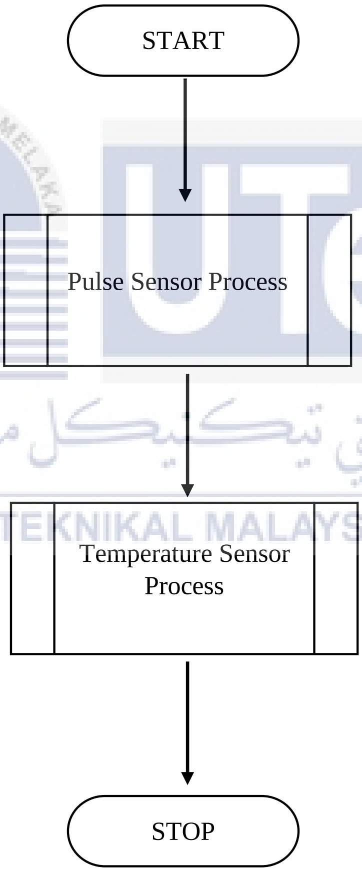


Figure 3.1: Project Main Process

3.1.2 Pulse Sensor Process

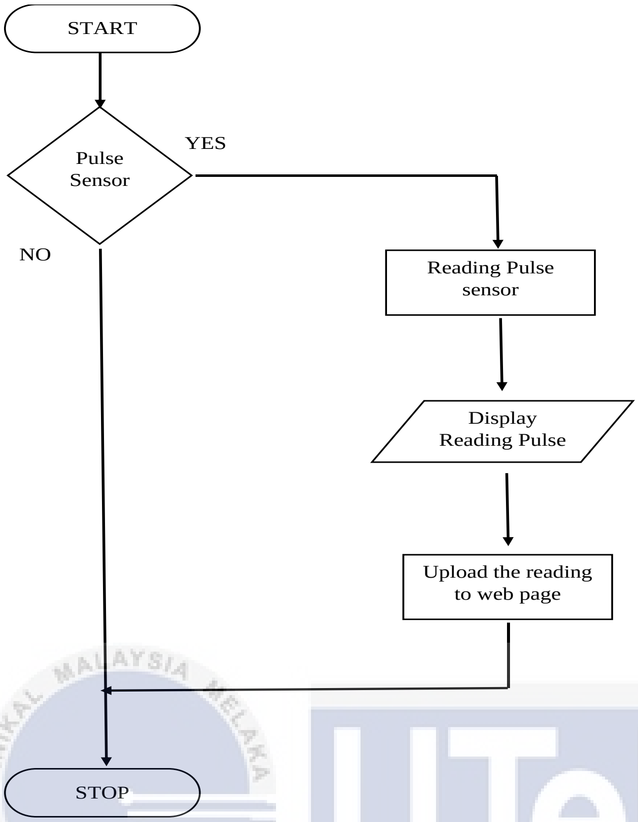


Figure 3.2: Pulse Sensor Process

3.1.3 Temperature Sensor Process

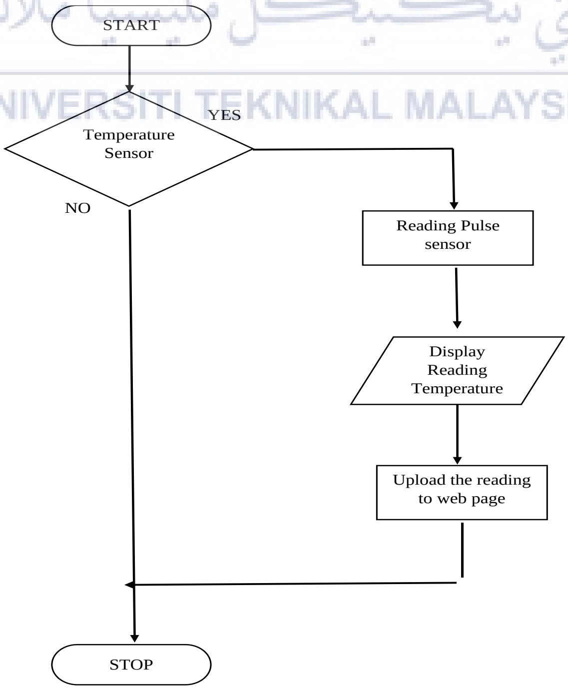


Figure 3.3: Temperature Sensor Process

3.2 Workflow Component Control Unit

Arduino is the main control unit, we must first connect it to the power source before we can start the system. We have a GY-906 detector, a pulse sensor, and several other manual buttons on the input side. The output, on opposite hand, it will show on the LCD display. Furthermore, the Wi-Fi Module permits United States of America to transfer data to the cloud, and once the information is uploaded, we are able to read the results on a laptop computer work into the server. Begin, a finger must place within the pulse sensor and a push button is ironed to permit the system to browse data. The result is then shown on the LCD panel. It can also upload the output to a site and an app, as well as send text messages via the Wi-Fi module, by pressing another push button. The GY-906 sensor is subjected to a similar procedure.

3.3 System Model

This project includes both hardware and software. The pulse sensor and the GY-906 sensor are employed in the hardware. As a result, Arduino is integrated with the Wi-Fi Module. When the temperature and pulse are measured, the Wi-Fi module assists in uploading the data to a mobile messaging, Web, and APP server. Furthermore, the pulse result is displayed on the LCD.

3.3.1 Pulse System Model

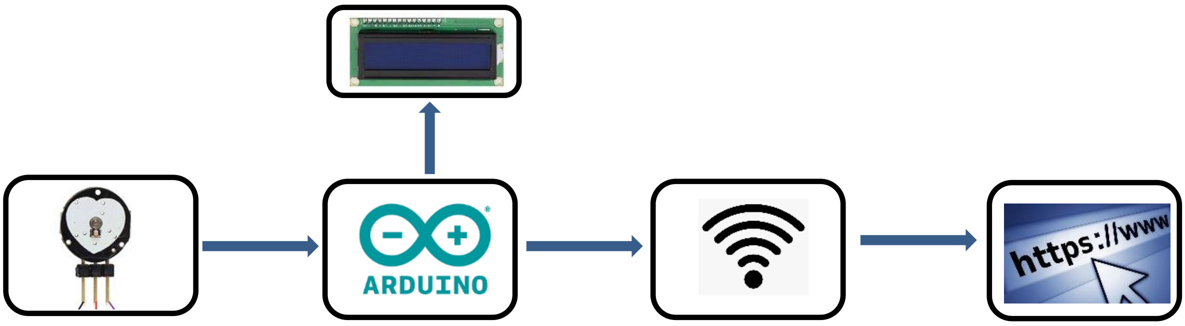


Figure 3.4: Model System Pulse Sensor

3.3.2 Body Temperature System Model

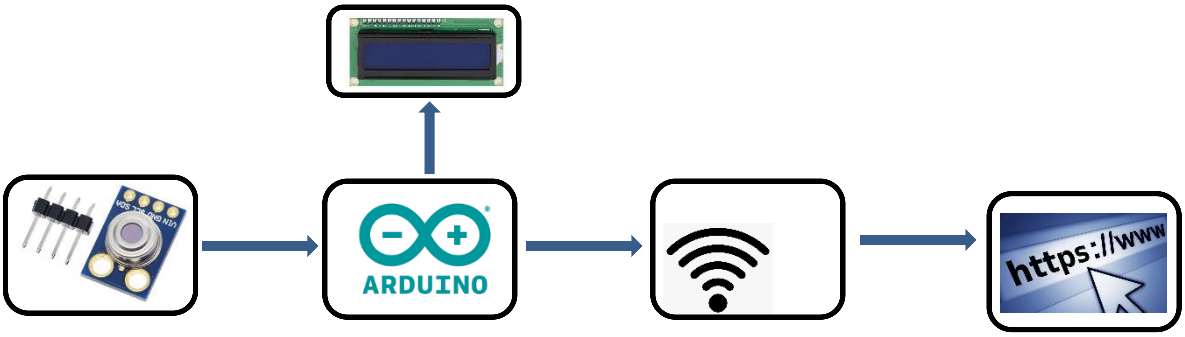


Figure 3.5: Model System Temperature Sensor

3.4 Block Diagram

In Figure 3.6, it show the IoT Based Patient Health Monitoring System that combines the ESP8266 and Arduino. BPM and body temperature are measured thru the Pulse Sensor and the GY-906 Temperature Sensor, respectively. Arduino processes the code and displays it on a 16 * 2 LCD screen. The WLAN module ESP8266 connects to WLAN and sends the info to the IoT device server. The IoT server used here is Thingspeak. Finally, the data will be monitored from any part of the globe by work into the Thingspeak channel.

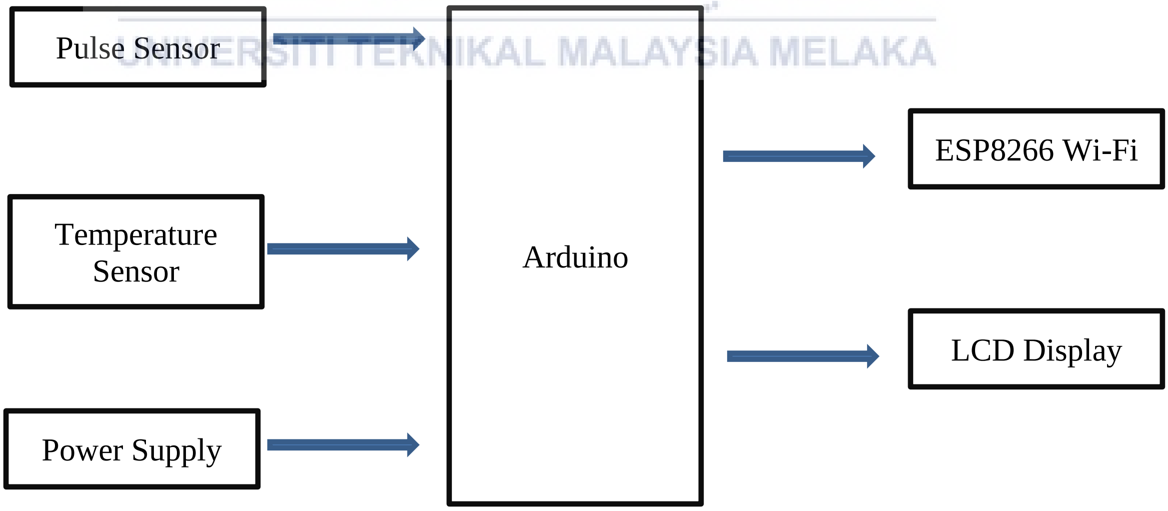


Figure 3.6: Block Diagram

3.5 Review on Selected Component

There are some components that used to build this project. All of this component are important to make this project work to achieve the objective of this project.

3.5.1 Pulse sensor

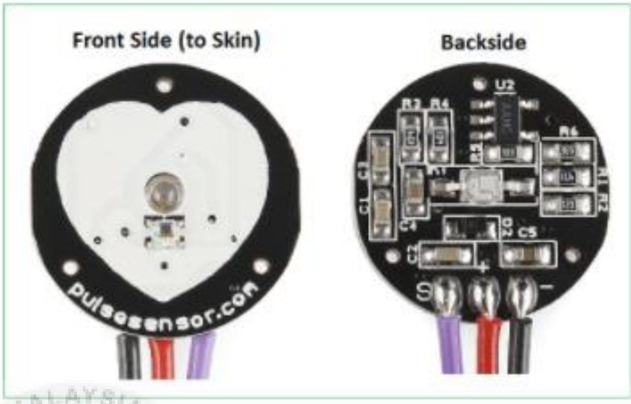
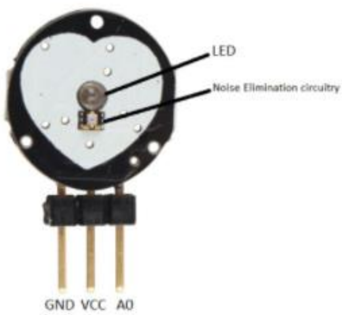


Figure 3.7: Front and Back Pulse Sensor

The Pulse Sensor is associated Arduino-compatible heart-rate sensor. Students, artists, athletes, makers, and game and smartphone developers who want to include live heart-rate knowledge into their work will utilize it. The essential consists of an integrated optical amplifying circuit and a noise-reducing circuit sensor. Once you connect the Pulse Sensor to your lobe or tip and plug it into Arduino, you'll be able to browse your pulse rate. It additionally comes with an Arduino sample code that produces it straightforward to use. the heartbeat sensor has 3 pins: VCC, GND & Analog Pin.



. Figure 3.8: Pulse Sensor

This sensor module also has an LED in the middle that helps with heartbeat detection. A noise suppression circuit is located under the LED and is intended to prevent noise from affecting the readings.

3.5.2 ESP8266 Wi-Fi Module

The ESP8266 could be an affordable Wi-Fi module from the ESP family that will be wont to manage physical science comes from any place on the planet. It contains an inherent microcontroller and a 1MB non-volatile storage that allows Wi-Fi connectivity. Modules can communicate with Wi-Fi signals using the TCP/IP protocol stack. Because the module's maximum working voltage is 3.3 volts, you cannot use 5 volts because it will damage the module. The ESP8266 is linked to a local Wi-Fi hotspot, allowing it to connect to the internet and provide data and a verification number to Blynk's servers.

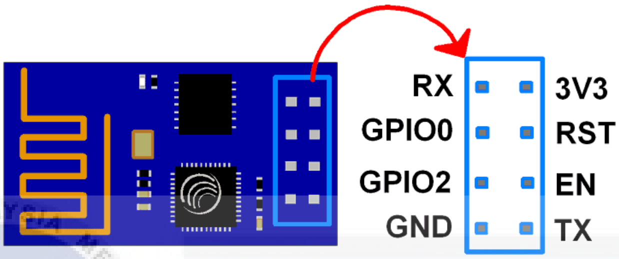


Figure 3.9: ESP8266 Wifi Module

The ESP8266 module works with 3.3V only, something over 3.7V would kill the module hence be cautious along with your circuits. Here is its pins description.

Table 3.1: Pin for ESP8266 Wi-fi Module

Pin Number	Pin Name	Description
1	Ground	Connected to the ground of the circuit
2	Tx	Connected to Rx pin of programmer
3	GPIO – 2	General purpose Input/output pin
4	CH_EN	Chip Enable/Active high
5	GPIO – 0	General purpose Input/output pin
6	Reset	Resets the module
7	RX	General purpose Input/output pin
8	Vcc	Connect power supply

3.5.3 GY-906

An I2C interface and 5V or 3.3V operation was a module with GY-906 MLX90614 that is a high-precision, non-contact infrared temperature measurement.

Figure 3.10: GY-906 Temperature Sensor

The GY-906 is a precession Infrared Temperature detector whose output voltage fluctuates with temperature. it's a compact and cheap microcircuit that may measure temperatures starting from -70°C to +380°C. it's merely interfaced with any ADC-capable microcontroller or programming environment, such as Arduino. The sensor's quality varies is roughly 0.5 degrees Celsius. This module has 4 pin connections.

Table 3.2: Pin for Gy-906 Temperature

Pin Number	Pin Name	Description
1	Vcc	Input voltage is +5V for typical applications
2	Ground	Connected to ground of circuit
3	SCL	For I2C Clock
4	SDA	For I2C Data

3.5.4 Arduino

Arduino is a software system and hardware-based electronics platform that's open-source. Arduino boards will take inputs to appreciate a sensor lightweight or a finger button and convert them to outputs by turning on the motor and lighting the LED. With a group of directions on the microcontroller board, you'll assert what to try and do to the board. You utilize the Arduino programming language (which is predicated on wiring) and therefore the Arduino software system (which is based on processing) (IDE). 40 thousand projects, starting from everyday objects to stylish scientific apparatus, are created with Arduino throughout the years. This open-sourcing network has attracted a worldwide cluster of teachers, hobbyists, musicians, programmers, and practitioners, who have supplementary huge usable info which will be of tremendous profit each for beginners and experts.

a) Digital input/output pins from 0 to 13.
b) Analog inputs / outputs from 0 to 5.
c) Support ISP download's function.
d) Input voltage: No external power supply when connected to the computer or Laptop USB
e) External power supply 5V ~ 9V DC voltage input.
f) Output voltage: 5V / 3.3V DC.

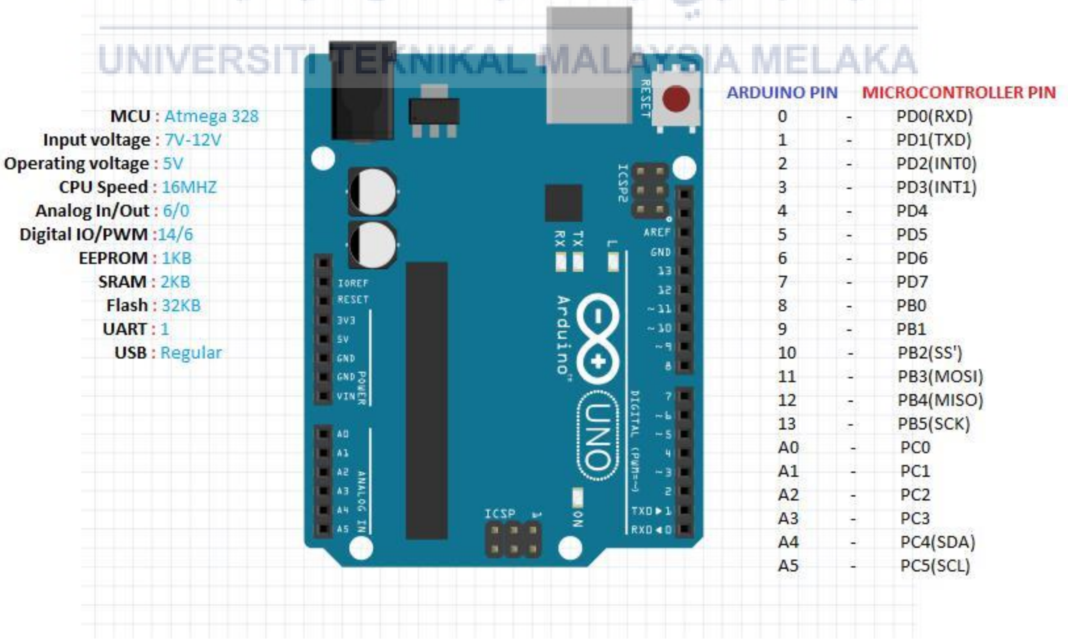


Figure 3.11: Arduino UNO

3.5.5 Power Adapter

To power up this project, we need a power adapter. A control connector is an associate electrical contraption that provides electric control to an electrical stack. The essential work of a controlled offer is to vary overcurrent from a supply to the correct voltage, current, and return to regulate the stack. As a result, control supplies are a number of the days alluded to as electric control converters. a number of control supplies are isolated standalone items of gear, whereas others are engineered into the stack apparatuses that they control. Cases of the last-mentioned incorporate control supplies found in desktop computers and client hardware gadgets.

Other capacities that control supplies might perform incorporate proscribing this drawn by the stack to secure levels, move off the current at intervals the occasion of electrical blame, control acquisition to avoid electronic commotion or voltage surges on the input from coming back to the stack, power-factor redress, and putting away energy, therefore, it will proceed to manage the load within the occasion of a quick intrusion within the supply control. For this project, a power adapter accustomed power up Arduino to operate.

Figure 3.12: Power Adapter

3.5.6 LCD Display.

LCD (Liquid Crystal Display) could be a sort of flat panel show that operates primarily using liquid crystals. LEDs supply a large variety of applications for consumers and companies since they will be found in smartphones, televisions, laptop displays, and instrument panels.

For this project LCD display, 20 x 4 is going to be used. A 20x4 LCD display could be a comparatively straightforward module that's wide utilized in a spread of devices and circuits. A 20x4 LCD can display 16 characters per line and has two such lines. every character is given in an exceedingly 5x7 pixel matrix on this LCD. The intelligent alphameric matrix display incorporates a 20x4 resolution and might show 80 characters in a time. This LCD contains two registers: Command and Data.

Figure 3.13: Liquid Crystal Display (LCD)

3.6 Software Development

3.6.1 Arduino IDE Software

The Arduino integrated development environment (IDE), called Arduino software, includes a text editor for writing code, a message box, a text terminal, a toolbar with basic operation buttons, and a series of menus. Upload the program to Arduino and real hardware is how it communicated.

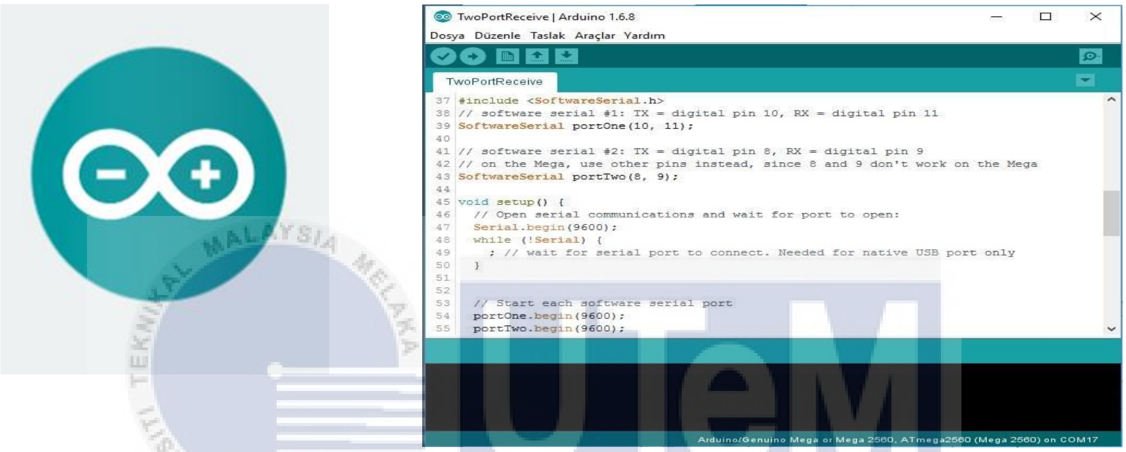


Figure 3.14: Arduino Software

3.6.2 Proteus Design Suite

Proteus Design Suite is a proprietary software toolkit primarily used for electrical engineering automation. Electronics designers and technicians use the program primarily to develop electronic circuit diagrams and prints for making printed circuit boards.

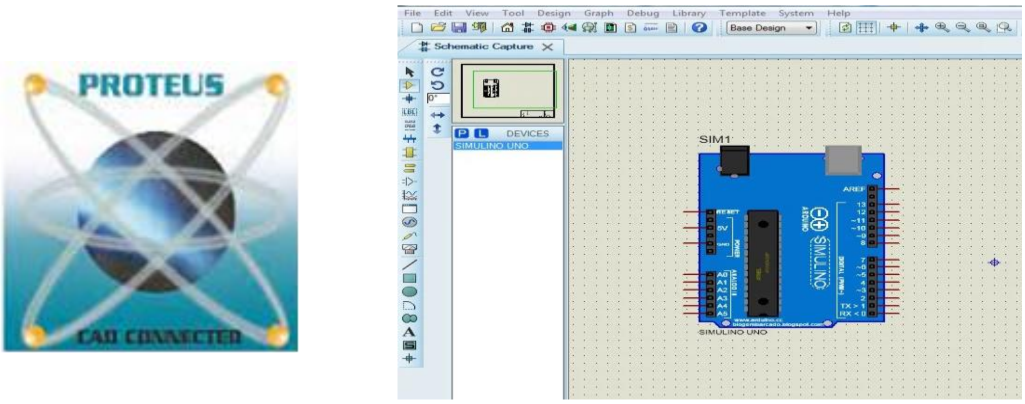


Figure 3.15: Proteus Design Suite Software

3.7 Summary

This project will focus on two semester project palning, with the first and second semester focuseed on projecr growth, the conclusion of this methodolagy chapter. Project presentation, literature analysis and methodology must all be included in the plan preparation. The establishment oh the project will entail the development of software and hardware equibment, as well as an evaluation of the results collected in order to execute and achive the project’s objective.

CHAPTER 4

RESULT AND DISCUSSIONS

4.0 Introduction

This chapter presents the results and analysis on the development of an IoT-based Health Monitoring System for Covid-19 patient in quarantine. This Chapter will focus on the Data Analysis for strengthening the objective of the project with some discussion based on the data received from the the reading data of the conducted analysis that is used to complete the results for objective of the project.

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4.1 Project Development

In completing the project, two experiment had been carried out in order to achieve the objective of the project to analyze the performance of the health monitoring system in terms of its detection effectiveness of Patient's Heartbeat, Blood Pressure and temperature via an Open-source IoT cloud. The Hardware implement the three main sensor that used for data reading, Heart Rate Pulse and Temperature connected with Arduino Uno board as a microcontroller and the data will be transmitt to IoT cloud that is Thingspeak through ESP8266 that are built-in with Arduino board. The result will be determine the accuracy of the sensor and the percentage error from the data reading by comparing the project device to commercial device that are used to get a person parameter of heartbeat, blood pressure and temperature. This data will conclude the performance of the system to be use as commercially in the industry.

4.2 The Setup of Product Model

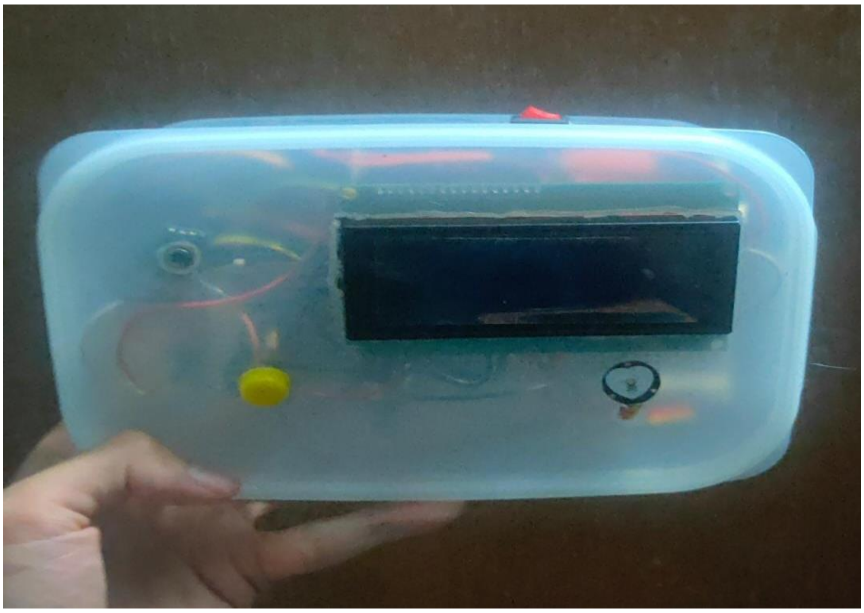


Figure 4.1: Product Model

In this product model, Tupperware is use as casing. From the figure above, the model has a heartbeat sensor, temperature sensor, push button and LCD 20x4. On the top of casing, it has on/off switch. For this product model, two batteries of 9V are used to power up the Arduino. It is because if only one 9V battery is use, the power form that battery is not enough for support all sensors and LCD in this model. The function of push button is to hold the value of heartrate and temperature at the lcd do that easy to consumer to see their heartrate and temperature.

4.3 Comparison of Project Model and Commercial Device

In this experiment, the Commercial Device for heartbeat and temperature sensor are used to compare with the Project Device. The purpose of this experiment is to enhance the analysis with calculation for percentage of error and accuracy of the sensor. To make it real, a couple of tests had been done to verify whether this method can be used in detecting unhealthy patient.

4.3.1 Procedure to use Product Model.

In general, all product has their own procedure how to use it. Same goes to this product model. There has some procedure or guideline that must be follow.

I. Switch on the on/off button
II. Put right thump to heartbeat sensor.
III. Close your forehead into the temperature
IV. Use your left thump to push the push button
V. Release all the finger and observe the value of heartbeat and temperature.
VI. Turn off the product model

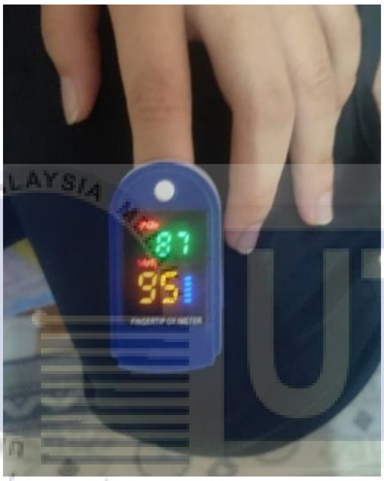
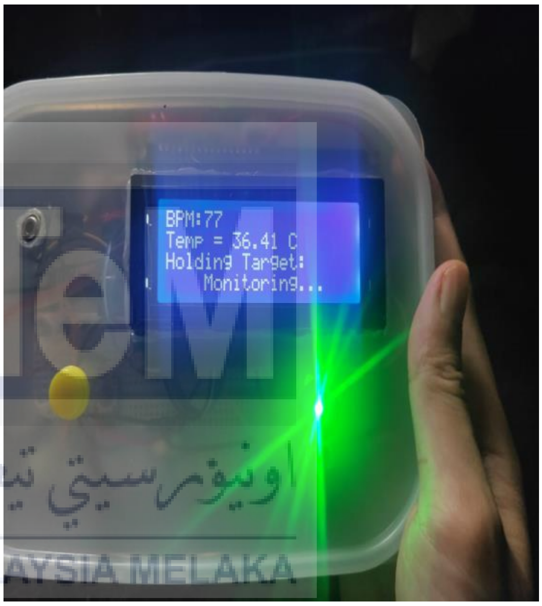
Figure 4.2: Procedure using Product Model

4.3.2 Result of Comparison

This is the result taken by using the Project Devices and Cormasial product for collection data from 4 different person with 4 different ages. The age is 17, 24, 53 and 56 respectively with Person A, Person B, Person C and Person D.

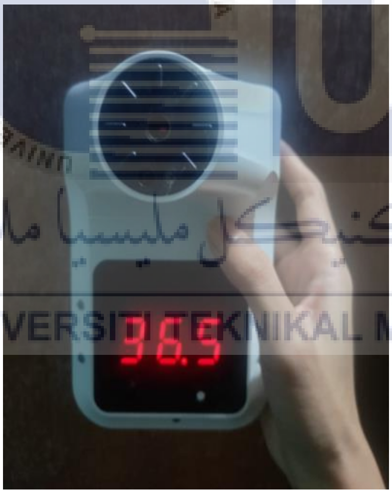
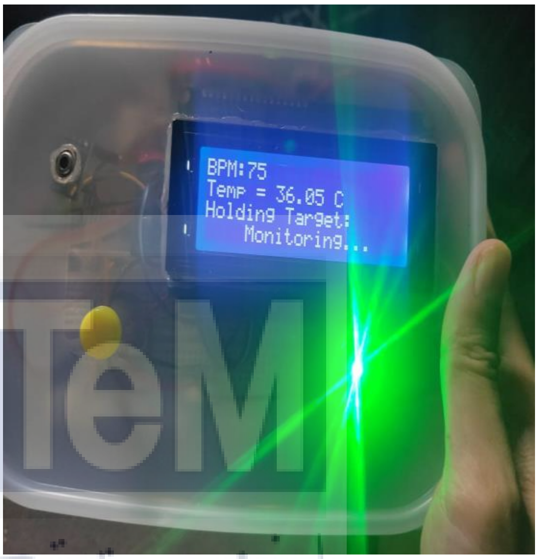
Person A

Table 4.1: Comparison Person A

Age	Sex	Commercial Product	Product Model
17	Female		
Date and Time		31/12/2021	31/12/2021
		10.30 am	10.32 am

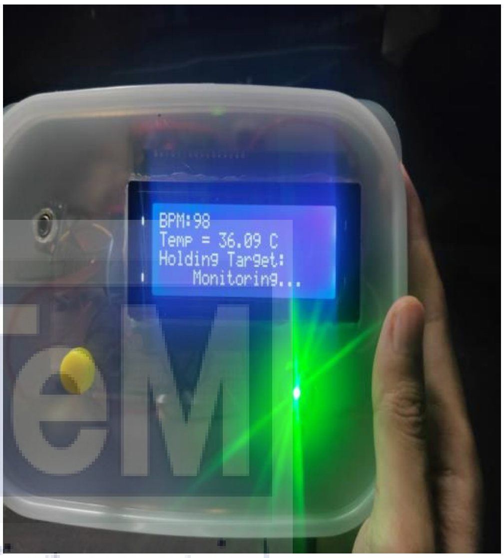
Person B

Table 4.2: Comparison Person B

<table>
<tr><td>Age</td><td>Sex</td><td>Commercial Product</td><td>Product Model</td></tr>
<tr><td>24</td><td>Male</td><td>
</td><td></td></tr>
<tr><td rowspan="2">Date and Time</td><td colspan="2">5/1/2022</td><td>5/1/2022</td></tr>
<tr><td colspan="2">11.32 am</td><td>11.35 am</td></tr>
</table>

Person C

Table 4.3: Comparison Person C

<table>
<tr><th>Age</th><th>Sex</th><th>Commercial Product</th><th>Product Model</th></tr>
<tr><td>53</td><td>Female</td><td>
</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Date and Time</td><td>6/1/2022</td><td>6/1/2022</td></tr>
<tr><td>9.30 pm</td><td>9.32 pm</td></tr>
</table>

Person D

Table 4.4: Comparison Person D

<table>
<tr><td>Age</td><td>Sex</td><td>Commercial Product</td><td>Product Model</td></tr>
<tr><td>56</td><td>Male</td><td>


</td><td>
</td></tr>
<tr><td colspan="2" rowspan="2">Date and Time</td><td>6/1/2022</td><td>6/1/2022</td></tr>
<tr><td>3.21 pm</td><td>3.25 pm</td></tr>
</table>

4.3.3 The Percentage of Error

For the percentage error, the formula from percentage of error will be used. The value of compression is between project model data and commercial device data. The commercial data as a landmark for this project.

The percentage of error =

$$\left| \frac{Project\ model\ data\ - Commercial\ device\ data}{Commercial\ device\ data} \right| \times 100$$

Person A

Table 4.5: Percentage Error of Person A

	Commercial Device data	Project Model Data	Percentage of error (%)
PULSE (bpm)	87	77	11%
TEMPERATURE (°C)	36.4	36.41	0.02%

Person B

Table 4.6: Percentage Error of Person B

	Commercial Device data	Project Model Data	Percentage of error (%)
PULSE (bpm)	74	75	1.35%
TEMPERATURE (°C)	36.5	36.05	1.23%

Person C

Table 4.7: Percentage Error of Person C

	Commercial Device data	Project Model Data	Percentage of error (%)
PULSE (bpm)	94	98	4%
TEMPERATURE (°C)	36.8	36.89	0.24%

Person D

Table 4.8: Percentage Error of Person D

	Commercial Device data	Project Model Data	Percentage of error (%)
PULSE (bpm)	87	84	3.44%
TEMPERATURE (°C)	36.9	37.05	0.04%

Based on table 4.1 until table 4.8 analysis took 4 people with the same room temperature. This data analysis was taken to enhance the strength for objective project. The body temperature sensor, GY-906 and heartbeat sensor is used to measure body temperature and BPM. We can observe that, the data form project model almost the same with commercial product. So, we can conclude that the accuracy of this model is high.

4.4 Monitoring Result in ThingSpeak

For the IoT part, this product model uses an application called ThingSpeak. ThingSpeak is a IoT analytics platform that service that allows to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak also provides instant visualizations of data posted by your devices to ThingSpeak. In this monitoring system 4 persons will collect 10 reading for both temperature and heartbeat. This IoT will record as a real-time so, the doctor can read the statistic of both parameters. Form that data the doctor can decide to make an appointment for the patient if the condition is worse.

4.4.1 Patient's Data from ThingSpeak

Person A

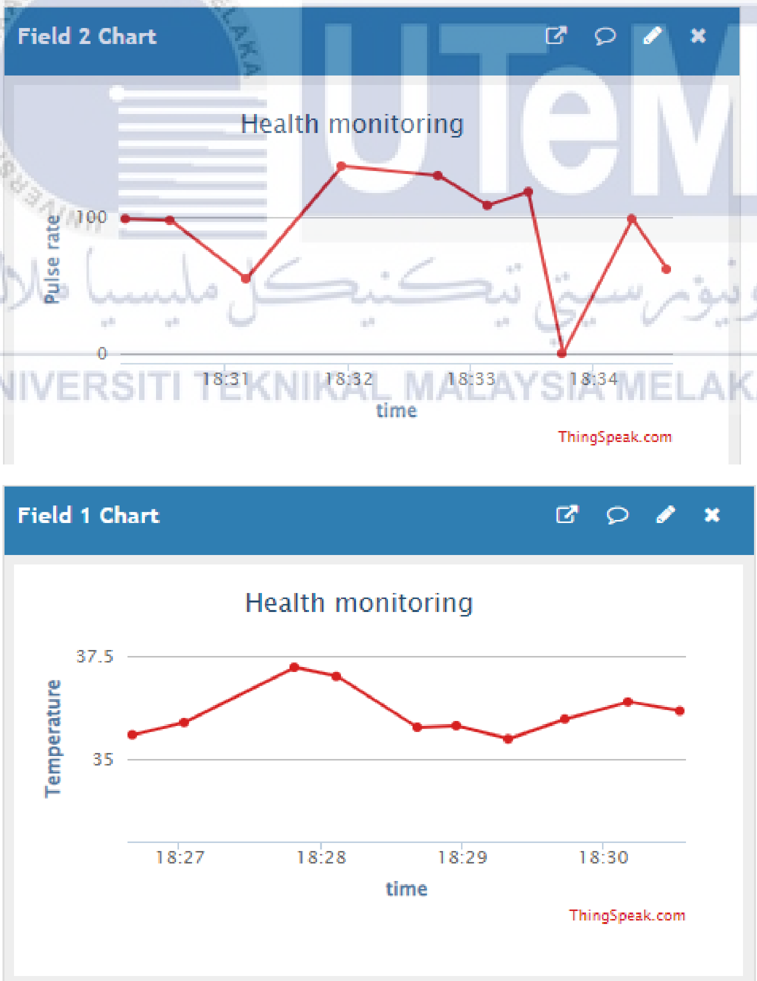


Figure 4.3: ThingSpeak for Person A

Person B

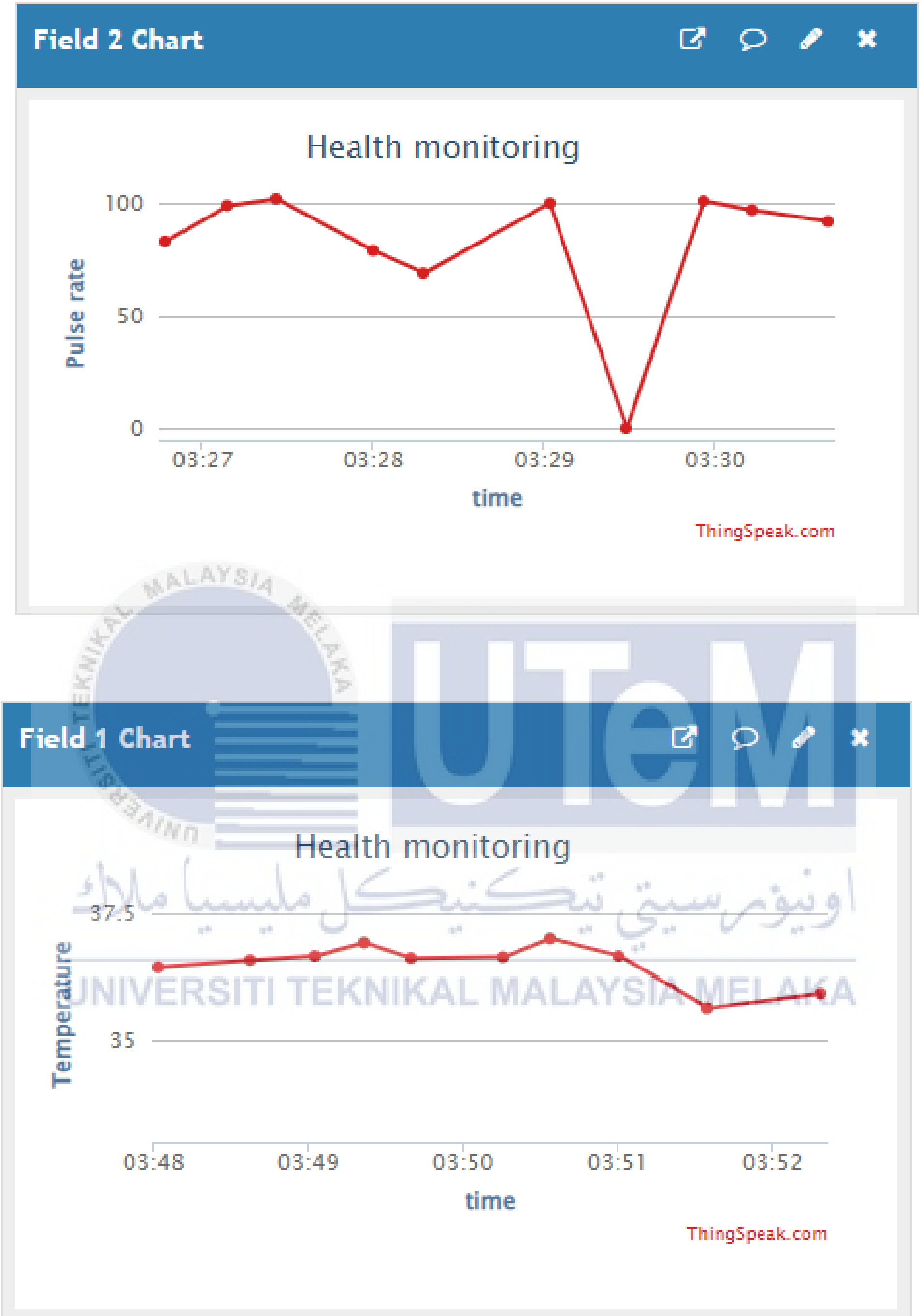


Figure 4.4: ThingSpeak for Person B

Person C

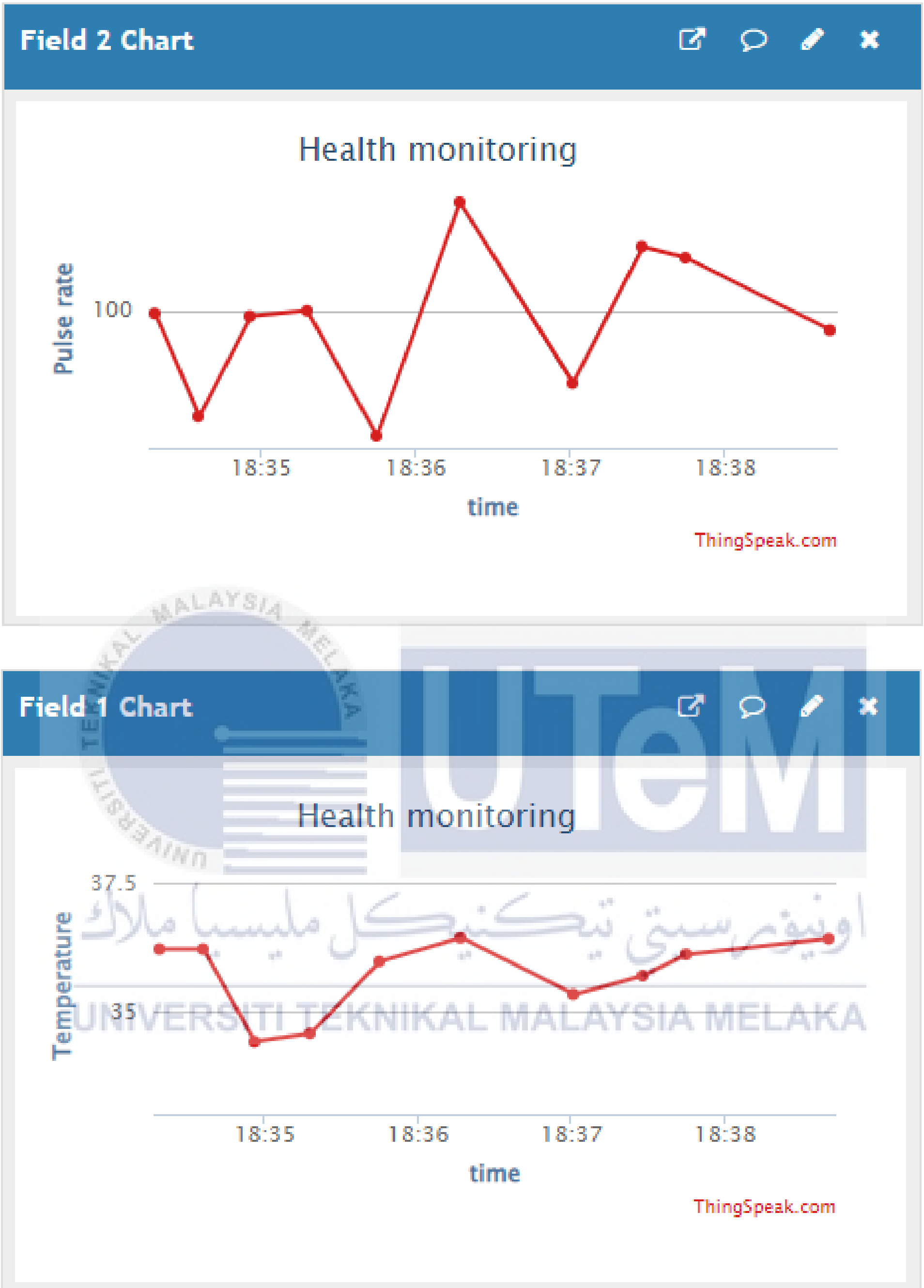


Figure 4.5: ThingSpeak for Person C

Person D

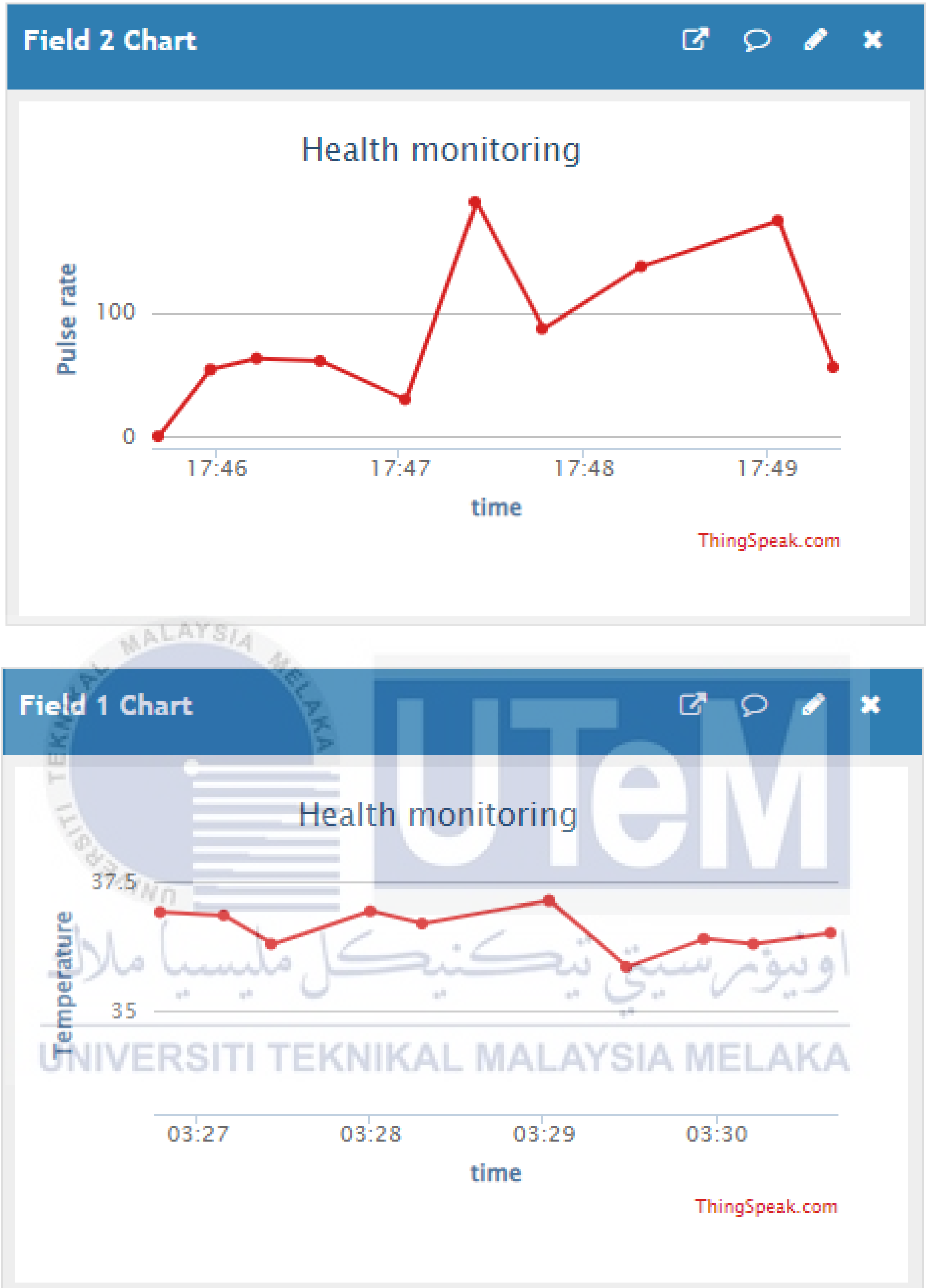


Figure 4.6: ThingSpeak for Person D

4.5 Data from Arduino UNO

During running the project model, from software side which is Arduino Ide also can read and monitor the data that came from both sensors.

Figure 4.7: Output From Arduino IDE

4.6 Summary

According to the data result and analysis observed form project model, the value that came from both sensor, temperature sensor which is GY-906 and heartbeat sensor are pretty accurate with real product. Product model also success in IoT part. In ThingSpeak data can be receive and can be shown to the doctor for further action.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter conclude about the overall process of Development of Health Monitoring by using some sensor and Arduino. Furthermore, the propose of this chapter is to give suggestion and recommendation to improve and develop the system to become more efficient that can be done for the future expansion.

5.1 Conclusion

In general, an IoT-based health care platform that communicates with smart sensors attached to the human body for everyday health monitoring. We spoke about an IoT-based patient monitoring system in this study. The system technologies that are now employed by smart phones or devices, as well as the benefits, problems, and possibilities. It is because critical to observe medical patients, continual remote monitoring is required. Our project work provides the option to continually monitor patients using online and app services, as well as a live monitor. This study also contrasted the early medical system to modern health monitoring. The current epoch marks a period reduction, with a focus on lowering health-care costs, particularly for persons living in rural areas.

5.2 Recommendation

A lot of time and effort was required to achieve objective in this project which is makes the project model and both sensor, GY-906 and heartbeat sensor. Successful results were achieved based on the plans and schedule accompanied, but here are a few recommendations for upcoming improvements to be made it much more efficiency. Different type of sensors could be used such as MAX30100. This sensor may be more flexible, and it also has a device that can measure oxygen inside body. For the casing, it can be replaced by a 3D print casing by follow the parameter and sensors in this project. In IoT part, this project can send a massage to smartphone by using number phone. Moreover, buzzer also can be added to this project. The function on this buzzer is to ring up went the temperature is above 37.5 ℃. Lastly, this project model can upgrade to rechargeable battery. Rechargeable battery is very useful because just only need USB cable to charge and power up project model. This might also save you time when purchasing a replacement battery at the shop.

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APPENDICES

Appendix A

Cording for the Heath Monitoring System

```
#include <Wire.h>
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>


String agAdi = "maizatul_2.4G@unifi";
String agSifresi = "zaq12wsx";

String ip = "184.106.153.149";
int rxPin = 5;                                          //ESP8266 RX pini
int txPin = 6;

char telemetry[100];

SoftwareSerial esp(rxPin, txPin);

#include <Adafruit_MLX90614.h>

#define USE_ARDUINO_INTERRUPTS true    // Set-up low-level interrupts for most acurate BPM math
#include <PulseSensorPlayground.h>     // Includes the PulseSensorPlayground Library

const int buttonPin = 2;     // the number of the pushbutton pin
int buttonState = 0;         // variable for reading the pushbutton status

const int PulseWire = A0;       // 'S' Signal pin connected to A0
int Threshold = 550;           // Determine which Signal to "count as a beat" and which to ignore

LiquidCrystal lcd(13, 12, 11, 10, 9, 8);

Adafruit_MLX90614 mlx = Adafruit_MLX90614();
double temp_obj;

PulseSensorPlayground pulseSensor;  // Creates an object
```

```
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);

  pinMode(buttonPin, INPUT);

  Serial.println("Started");
  esp.begin(115200);                                         // We are starting serial communication with ESP8266.
  esp.println("AT");                                        // We do the module control with the AT command.
  Serial.println("AT  sent ");
  while (!esp.find("OK")) {                                  // We wait until the module is ready.
    esp.println("AT");
    Serial.println("ESP8266 Not Find.");
  }
  Serial.println("OK Command Received");
  esp.println("AT+CWMODE=1");                                // We set the ESP8266 module as a client.
  while (!esp.find("OK")) {                                  // We wait until the setting is done.
    esp.println("AT+CWMODE=1");
    Serial.println("Setting is ....");
  }
  Serial.println("Set as client");
  Serial.println("Connecting to the Network ...");
  esp.println("AT+CWJAP=\"" + agAdi + "\",\"" + agSifresi + "\""); // We are connecting to our network.
  while (!esp.find("OK"));                                   // We wait until it is connected to the network.
  Serial.println("connected to the network.");
  //delay(1000);

  pulseSensor.analogInput(PulseWire);
  pulseSensor.setThreshold(Threshold);

  if (pulseSensor.begin()) {
    Serial.println("PulseSensor object created!");
  }
  pulseSensor.sawStartOfBeat();
  mlx.begin();
  lcd.begin (20, 4);
  lcd.home ();
  lcd.setCursor(5, 1);
  lcd.print(" Health ");
  lcd.setCursor(3, 2);
  lcd.print(" Monitoring ");
  delay(3000);;
```

```
  lcd.clear();
}

void loop() {
  // put your main code here, to run repeatedly:
  int myBPM = pulseSensor.getBeatsPerMinute();      // Calculates BPM
  buttonState = digitalRead(buttonPin);

  temp_obj = mlx.readObjectTempC();
  temp_obj = temp_obj + 3.0;

    if (pulseSensor.sawStartOfBeat()) {
    Serial.println("♥  A HeartBeat Happened ! "); // If true, print a message
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("BPM:");
    lcd.setCursor(4, 0);
    lcd.print(myBPM);

    if (buttonState == HIGH) {
      // turn LED on:
      lcd.setCursor(0, 2);
      lcd.print("Holding Target: ");
      Serial.print("Holding Target= ");
      Serial.println(temp_obj);
      delay(3000);
    }
  }

  lcd.setCursor(0, 1);
  lcd.print("Temp = ");
  lcd.print(temp_obj);
  lcd.print(" C");

  lcd.setCursor(4, 3);
  lcd.print("Monitoring...");

  Serial.print("BPM: ");                        // Print phrase "BPM: "
  Serial.println(myBPM);                        // Print the value inside of myBPM.
  Serial.print("Object temp = ");
  Serial.println(temp_obj);
```

```
esp.println("AT+CIPSTART=\"TCP\",\"" + ip + "\",80");        // We connect to Thingspeak.
if (esp.find("Error")) {                                      // We check the connection error.
  Serial.println("AT+CIPSTART Error");
}

String telemetry = "GET https://api.thingspeak.com/update?api_key=L1BG3W8W0RT7OEVR";
telemetry += "&field1=";
telemetry += String(temp_obj);// The temperature variable we will send
telemetry += "&field2=";
telemetry += String(myBPM);// The moisture variable we will send
telemetry += "\r\n\r\n";
esp.print("AT+CIPSEND=");                             // We give the length of data that we will send to ESP.
esp.println(telemetry.length() + 2);
//delay(2000);
if (esp.find(">")) {                           // The commands in it are running when ESP8266 is ready..
  esp.print(telemetry);                            // We send the data.
  Serial.println(telemetry);
  Serial.println("Data sent.");
  //delay(1000);
}
Serial.println("Connection Closed.");
esp.println("AT+CIPCLOSE");                              // we close the link
//delay(1000);
Serial.println(telemetry);
delay(1000);
}
```