Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AUTOMATED PREMISE CHECK-IN WITH SIMULTANEOUS TEMPERATURE CHECKER SYSTEM USING RASPBERRY PI

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Bachelor of Electronics Engineering Technology with Honours

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DEVELOPMENT OF AUTOMATED PREMISE CHECK-IN WITH SIMULTANEOUS TEMPERATURE CHECKER SYSTEM USING RASPBERRY PI

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours

Faculty of Electrical and Electronic Engineering Technology

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2021

DECLARATION

I declare that this project report entitled "Development of Automated Premise Check-in with Simultaneos Temperature Checker System Using Raspberry Pi" 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.

Signature : Huzaimah

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Date : 11/01/2022

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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 Electronics Engineering Technology with Honours.

Signature : 

Supervisor Name : PUAN DAYANASARI BINTI ABDUL HADI

Date : 11/01/2022

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DEDICATION

BISMILLAHIRAHMANIRAHIM

Special for

Beloved Mother and Father, Raziah Binti Abdul Rani and Charishun Bin Haji Bardom. All your sacrifices, prayers, blessing and love are the backbone of this struggle.

To my respected supervisors and co supervisor,

Puan Dayanasari Binti Abdul Hadi and Ts. Ahmad Fairuz Bin Muhammad Amin. Most thankful and appreciation for all valuable knowledge and expertise sharing throughout the production of this undergraduate project.

To all my friends,

I would like to lead my gratitude for them that have contributes to my final year project either it is directly or indirectly. I would like to acknowledge their comments and suggestions, which are crucial for the successful completion of this research.

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ABSTRACT

Nowadays, the existence of dangerous diseases that can be spread in various way such as physical contact, air vapour and air from coughing and sneezing such as Covid-19, MERS, SARS and Ebola is currently of great concern. Patient that carried this disease will have symptoms such as fever above normal temperature that is 37.5°C, cough, dry throat and difficulty breathing. However this disease can be prevented by monitoring human body temperature. To resolve this issue, various methods have been implemented such as 1 meter social distancing, self-check in and even body temperature checking before entering a premise. Nevertheless, the implementation of the premise check-in and the temperature inspection that has been carried out are separate. This matter caused difficulty for the authorities to track users who have high body temperature symptoms because there is no temperature reading recorded and only user information and the name of the premise visited. To solve this problem, the development of an automated premise check-in system with simultaneous temperature checking using Raspberry Pi was carried out. The usage of pen while manually registering during the check-in process at a premise were about to be eliminated. In addition, the functional monitoring of the combined automatic premise check-in system and the temperature inspection device should function simultaneously. The system will use an open source software, Kodular application as the basic of the android application maker that could generate QR code of user information so that user can use on their smartphone and Firebase as the database platform that will store the information obtained from the Raspberry Pi and Android application. This system will detect user's face at the monitor by using Raspberry Pi camera that attached with the Raspberry Pi as microcontroller and when it successfully detected the face it will scanning temperature of face by using AMG8833 IR thermal camera sensor that was also used together with the Raspberry Pi controller. Next user need to show the QR code that have been generated in the Android application before. In conclusion, with the existence of this project is able to help to prevent and reduce the spread of infectious diseases.

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ABSTRAK

Kewujudan penyakit berbahaya yang boleh tersebar melalui sentuhan, wap udara dan udara dari batuk dan bersin seperti Covid-19, MERS, SARS dan Ebola pada masa kini amat merunsingkan. Pesakit yang menghidapi penyakit ini akan mempunyai simptom seperti demam melebihi suhu badan normal iaitu 37.5 ^{o} C, batuk, kering tekak dan kesukaran bernafas. Walaubagaimanapun penyakit ini boleh dicegah dengan memantau suhu badan manusia. Bagi menyelesaikan isu ini, pelbagai kaedah telah dilaksanakan seperti penjarakan sosial 1 meter, mendaftar masuk kendiri dan juga pemeriksaan suhu badan sebelum memasuki sesuatu premis. Akan tetapi pelaksanaan daftar masuk premis dan pemeriksaan suhu yang wujud ketika ini telah dilaksaankan secara berasingan. Ini telah menyukarkan pihak berkuasa untuk menjejaki pengguna yang menpunyai simptom suhu badan tinggi kerana tiada rekod suhu yang disimpan dan hanya maklumat pengguna serta nama premis yang dikunjungi sahaja. Bagi menyelesaikan masalah ini, pembangunan sistem daftar masuk premis automatik dengan pemeriksaan suhu badan serentak dengan menggunakan Raspberry Pi telah dijalankan. Penggunaan pen semasa mendaftar secara manual semasa proses daftar masuk di premis akan dihapuskan. Di samping itu, pemantauan fungsi gabungan sistem daftar masuk premis automatik dan peranti pemeriksaan suhu berfungsi secara serentak. Sistem ini akan mengunakan perisian dari sumber yang terbuka iaitu aplikasi Kodular sebagai asas pembuatan aplikasi android yang mampu untuk menjana kod QR maklumat pengguna supaya pengguna boleh menggunakannya melalui telefon pintar mereka dan Firebase sebagai platform pangkalan data yang akan menyimpan maklumat yang diperoleh daripada Raspberry Pi dan aplikasi android. Sistem ini akan mengesan muka pengguna pada monitor dengan menggunakan kamera Raspberry Pi yang dipasangkan dengan Raspberry Pi sebagai mikrokontroler dan apabila ia Berjaya mengesan muka ia akan mengimbas suhu muka menggukansensor kamera termal AMG8833 IR yang telah dijana dalam aplikasi Andoid sebelum ini. Kesimpulannya, dengan adanya projek ini mampu memban tu mencegah dan mengurangkan penularan penyakit berjangkit.

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My highest appreciation goes to my parents and family members for their love and prayer during the period of my study. An honourable mention also goes to Charishun Bin Haji Bardom and Raziah Binti Abdul Rani as my parents for all the motivation and understanding. And to my friends, thanks for always be there with me through hard and smooth pressure to complete our project.

Finally, I would like to thank all the staffs at the UTeM, fellow colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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LIST OF SYMBOLS

$^{\circ}c$	-	Celcius
m	-	meter
s	-	second

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LIST OF ABBREVIATIONS

$Covid-19$	-	Coronavirus
SARS	-	Severe Acute Respiratory Syndrome
MERS-Cov	-	Middle East Respiratory Syndrome Coronavirus
QR code	-	Quick Response code
EVD	-	Ebola virus disease
EHF	-	Ebola hemorrhagic fever
WHO	-	World Health Organization
IOT	-	Internet Of Thing
v	-	Voltage
IR	-	Infrared
RAM	-	Random Access Memory
ROM	-	Read-Only Memory
CPU	-	Central Processing Unit
PWM	-	Pulse Width Modulation
USB	-	Universal Serial Bus
ICSP	-	In Circuit Serial Programming
GPU	-	Graphical Processing Unit
HDMI	-	High-Definition Multimedia Interface
UART	-	Universal Asynchronous Receiver/Transmitter
EDP	-	Engineering Design Process

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain the background of this developing an automated premise check-in simultaneous temperature checker system using Raspberry Pi. This chapter include brief background study, problem statement, objective and scope of the project.

1.2 Background

Recently the world has been rocked by a phenomenon that was no longer weird to be heard since 2019 that is coronavirus. This Coronavirus or also called Covid-19 were started in Wuhan, China and end up spread to all around the world. This new coronavirus is a different type of virus in the coronavirus family that was also responsible for previous outbreaks such as SARS in 2002 and MERS-Cov in 2012. Coronavirus is a virus that can spread through water droplets from coughing or sneezing on infected people. The symptom of high-risk person will face is fever over 37.5^{o} C, coughing, dry throat and breathing disorders. People that positive will need to be isolate from other people so that the virus will not evolve. This coronavirus novel could be avoided by monitoring the body temperature. So that person with body temperature over the normal temperature should beware of their condition so that they are not spreading any virus to the others.

All country around the world have their own ways to reduce this virus infection such as blocking any movement out and in to the country and state, social distancing, register one's details before entering any premises and also temperature checking. This method also

have been implemented in Malaysia whereby Malaysian's citizen need to download a mobile application named MySejahtera and register their details such as name, phone number and address in the application. Then, they are required to scan the QR code of the premises that they want to enter. Nowadays, almost each person has their own smartphone that have the function to scan QR code and Play Store that allow user to install various application. Therefore, they invented the application that allow user to sign in and scan QR code so that user no need to write their information in the logbook that have been prepared by the premise and save more time to line up waiting for the others finishing to write their information in the logbook. The data of the user and the QR code that they have scan will be sent to authorities for them to keep track of the people with symptom and close contact of patient with coronavirus. People also need to scan their forehead temperature as requirement to check whether their temperature is normal or not as an experiment has been done to detect which region of our body have the accurate reading of the body temperature. Other than forehead, arm skin also is sensitive part of body that temperature could be taken. But the problem is the temperature checking data were not save in any database and just display at the device on that time only. This method is not very efficient because the authorities were difficult to tracking back the customer that has close contact with the coronavirus patient.

As for a step to improvise the existed method, a mobile application that hold user information by generating QR code and a device that could scan face temperature with QR code should be combined and make them work simultaneously so that the virus infection could be reduced while it can be more efficient to save time and work done can be simplify as the authorities can track people of high risk immediately.

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1.3 Problem Statement

Nowadays, to enter any premises people need to check-in via mobile application or write their information in logbook provided and then scanning temperature separately. This method caused the authorities difficult to track down people with the symptoms of infectious diseases that occur at a time that can be analysed through human body temperature due to several people were avoid to scan their temperature and there is no record for the temperature because the temperature that they scan were the real time temperature only that not save in any database.

Besides, having the method to scan QR code before entering a premise actually quite inconvenient to some people. Not everyone can afford a smartphone with good camera especially B40 and poor families' background and sometimes people are having their smartphone broken or not working properly. When this problem occur, the people who not having their smartphone during entering a premise, they are required to use the common pen to write their information manually in the logbook that was provided in the store, which this method could increase the possibility for the virus to spread through touching the pen.

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Throughout a pandemic that could easily spread through contact, we need to avoid close contact between people. Therefore, the suitable solution to this problem is to develop an automated premise check-in with simultaneous temperature checker system that able to operate premise check-in application which is able to generate QR code of user information and a temperature checker device that could scan user face temperature work simultaneously while all of the data will be save in the database.

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1.4 Project Objective

The main aim of this project are as follows:

a) To develop automated premise check-in with simultaneous temperature checker system.

b) To eliminate the manual registration using pen during the check-in process at the premise.

c) To monitor the functionality of the combination system of the automated premise check-in and the temperature checker device to work simultaneously.

1.5 Scope of Project

The scope of this project are as follows:

a) Targeted premise is collage or institution.

b) Developing Android application to generate QR code of personal information such as name, phone number and ID, so that people who do not have smartphone can have QR code to check-in with the help of family members or trusted person.

c) The temperature of the user were recorded with personal information in the system so there will be no user that entered premise without temperature scanning and QR Code scanning while all the data will be send through the cloud to be recorded in database which is only accessible by one with credentials.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the differences of previous studies to explain in more detail matters related to the product that will be developed. Besides, this chapter also will discuss the explanation of the temperature checker and application of self-check-in product design so that the understanding of the concept theory is strong. In this chapter also will give detail knowledge on the research that will be going through.

2.2 Disease Monitored Through Body Temperature

Disease is an abnormal condition of the body or mind that causes discomfort, dysfunction or stress to the person involved or in close contact with him[1]. Some disease can be monitor through body temperature. In medication world, the measurement of body temperature is important due to some diseases are come with changes in body temperature. Besides, certain diseases history can be monitored through body temperature monitor and the treatment can be evaluate by the doctor effectively. The most symptom that can be detect through temperature checking is fever. Fever is a natural reaction of the body that tries to fight a virus or infection[2]. Fever is not considered as a disease but usually a symptom of a health disorder that can lead to a certain disease or virus[3], the brain will increase the body temperature to increase the ability of the immune system to fight back the infection. There are some serious diseases and virus that can happen due to symptom of fever.

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2.2.1 Ebola

Ebola is a virus that exist around February 2014 in Guinea. Ebola virus disease (EVD) or Ebola haemorrhagic fever (EHF) is a human-borne disease caused by the Ebola virus[4]. This virus is recognized as one of the most dangerous disease in the world[5]. Ebola is highly contagious can be deadly. This virus causes patient to become weak, short of breath, lethargic and fell confused. Common symptoms start from day two to three weeks later infected with the virus, fever, sore throat, muscle aches and headache. Then usually followed by nausea, vomiting and diarrhoea as well as deterioration of liver and kidney function.

2.2.2 Covid-19

The COVID-19 pandemic, also known as the coronavirus pandemic or coronavirus outbreak is an ongoing 2019 global coronavirus disease pandemic caused by severe acute respiratory syndrome. The outbreak was initially detected in mid-December 2019 in the city of Wuhan, Hubei, China and was recognized as a pandemic by the World Health Organization (WHO) on March 11, 2020[6]. The virus is mostly transmitted between people in a manner similar to influenza, through respiratory droplets from coughing or sneezing. Common symptoms include fever, cough and shortness of breath. Complications may include pneumonia and acute respiratory distress syndrome. So far there are no specific vaccines or antiviral treatments. Recommended preventative measures include hand washing, covering the mouth when coughing, maintaining distance from others (especially those who are unhealthy), and 14 day monitoring and isolation for people who suspect they are infected.

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2.2.3 H1N1 Influenza

H1N1 influenza is a subtype of influenza virus A. The common symptom of this disease is flu among human. This virus is actually came from birds and pigs. Around June 2009, World Health Organization (WHO) has announce this influenza pandemic as an official disease during that time. This pandemic is typically characterized by abrupt on-set of fever, non-productive cough, sore throat, headache and myalgia and the illness is usually self-limited, with relief of symptoms within 5 to 7 days[7]. This influenza could be slowed down by monitoring and controlling the fever faster. So the influenza not able to move to it next step which make it hard to cured.

2.3 Non-Contact Self-Check-In System

Non-contact self-check-in system is a system that invented so that people easier to use it while all the data of the user can be user can be save in the cloud so that the data will not easily to lose. Other than that it can ensure and health of the users by reducing the physical contact to its minimum. This system usually used at hotel for customer check-in due to reduce of receptionist at the hotel and customer need to fill in them self if they want to check-in in the hotel easily without any contact with human. Besides, it also had been used at the airport for customer print out their flight ticket and check in. Nowadays, this self-check-in system is used in today pandemic that is known as Coronavirus (Covid-19). With the main function that is self-check-in, this is system is used for user to do self-check-in to enter any premises so that the authorities can easily tracked movement of the citizen.

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2.4 Internet of Thing (IoT) In Industrial 4.0

The revolution of the industrial now is entering is fourth phase which is a new revolution that will provide more convenience to human life while increasing the

productivity of the economy, hospitality, services and other sectors. In this revolution the 9 key pillars in developing technology towards innovation and being smarter as nowadays we heard of smart technology such as 'smart home', 'smart car' and many more. Among the pillars, there is one pillar called smart device technology industry (Internet of Things). It can be described as a network devices that have their own intelligence, which allows communication between machines or devices. This is because during Industry 3.0 they success build machine and devices but the machine and devices cannot communicated between them. That is why in this Industrial 4.0 the target is to allow the communication. It combines machine learning, big beta technology, sensor data, and machine for communication and automation technology. Compared to human, connected smart machines can collect and process large data sets more accurately and consistently.

2.5 Types of Internet of Thing (IoT) Module

As we know, Internet of Thing (IoT) is about communication between two devices while IoT module is a small electronic device embedded in objects, machines and things connected to wireless network and send and receive data.

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2.5.1 ESP8266 Wi-Fi Module

ESP8266 Wi-Fi module is a hardware development based on a very cheap On Chip System (SoC) called ESP8266. ESP8266 has been dominating the world of IoT projects. This module is the best choice for developing project based on Internet of Thing (IoT). This Module operating voltage is 3.3V which is need to give extra care when making connection to any other board that use operating voltage 5V. ESP8266 Wi-Fi module can operate simultaneously with Arduino as a connector between microcontroller and cloud. The wiring

connection of ESP8266 can be parallel to Arduino or in a shield form where it is placed on top of the Arduino.

Figure 2.1 ESP8266 Wi-Fi Module

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2.5.2 Bluetooth

Bluetooth module or known as HC-05 is a module that has a two-way wireless communication function (full-duplex). You can use this module to communicate between two microcontroller or communicate with any device that has Bluetooth functionality[8]. This module communicate using the UART series communication protocol at a rate of 9600 or 38400 baud rate while facilitating the connection to microcontroller that mostly have UART series communication function.

Figure 2.2 Bluetooth Module

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2.6 Types of Non-Contact Thermometer Sensor

There are many types of sensor that can sense temperature and the most suitable sensor that can sense body temperature is thermometer sensor. To design a temperature checker that can be used to monitor body temperature during a pandemic that can spread easily through touch, a non-contact temperature checker is the suitable type to use. As for the thermometer sensor also need to use the non-contact type. There are several type of non-contact thermometer sensor also need to use the non-contact type. There are several type of non-contact thermometer sensor.

2.6.1 AMG8833 Thermal Camera

AMG8833 thermal camera is used to measure temperature of object between 0°C to 80°C with distance up to 7m apart[9]. It can be connected to any microcontroller and communicated over I2C. This thermal camera is an array of 8x8 of IR thermal Sensor. This camera could connected to various microcontroller such as Arduino Uno, ESP8266 and also Raspberry Pi. This component module is equipped with camera and can display the heat area detection through a screen. It can operate with voltage supply 3.3V or 5V. This type of non-contact using AMG8833 thermal camera and face detection[9] with the functionality as a non-contact temperature checker using thermal camera and the system will produce the temperature data and detect human identity that the camera detect and then save it to the database[9].

Figure 2.3 AMG8833

2.6.2 MLX90614 Infrared Thermometer

Infrared thermometer is a temperature sensor that can measure temperature from a distance without making direct contact with the object to be measured[10]. This sensor uses infrared to measure or detect the thermal radiation of an object. This sensor determines the temperature of an object by knowing the thermal radiation (sometimes called black radiation) emitted by the object. Any object or material that has an absolute temperature the faster the movement of the molecules. As it moves, the molecules will emit infrared radiation, which is a type of electromagnetic radiation below the light spectrum. As the temperature of the object increases or becomes hotter, the infrared radiation it emits will also increase, even the infrared emitted will also be able to reflect light if the temperature of the object is very high. Therefore if there is a heated metal it will appear reddened or even whitened. The pyrometer will measure the amount of infrared radiation emitted by the objective. The application that used this module are Design of Non-Contact Thermometer Based on the Sensor of MLX90614[11]. Non-Contact Thermometer Berbasis Infra Merah[12] and also Infrared thermometer on the wall (iThermowall)[13].

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Figure 2.4 MLX90614

2.7 Types of Microcontroller

Microcontroller is a small computer package in the form of an IC (Integrated Circuit) chip and is designed to perform certain tasks or operations[8]. Basically, a Microcontroller IC consists of one or more Processor Cores (CPU), Memory (RAM and ROM) and programmable INPUT and OUTPUT devices. In its application, the Microcontroller which in English is called a Microcontroller is used in products or devices that are automatically controlled such as car engine control systems, medical devices, remote controls, machines, electrical equipment, toys and devices that use other embedded systems.

2.7.1 Raspberry Pi

The Raspberry Pi is a single-board computer or SBC the size of a credit card [14]that can be used to run office programs, computer games and as a media player to high resolution videos [15]. Raspberry Pi was developed by a non-profit foundation, the Raspberry Pi Foundation with the aim of learning programming. Raspberry Pi has components that are almost similar to computer in general. Such as CPU, GPU, RAM, USB port, Audio Jack, HDMI, Ethernet and GPIO [9]. For data storage and the Raspberry Pi operating system, the Raspberry Pi does not use a hard disk drive (HDD) but uses a Micro SD with a capacity of at least 4 GB, while the power source comes from micro USB power with a recommended power source of 5V and a minimum current of 700mA. Raspberry Pi can be used like a conventional PC, such as for typing document or just browsing. But the Raspberry Pi can also be used to come up with innovative ideas such as making a robot equipped with a Raspberry Pi and a camera, or maybe it can make super computer made from several Raspberry Pi fruit. The completeness of the Raspberry Pi includes a port or connection for a display in the form of a TV or monitor and a USB connection for the keyboard and mouse [16].

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Figure 2.5 Raspberry Pi

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2.7.2 Arduino Uno

The Arduino Uno board is the most popular microcontroller board of the century [17]. Although it is not the first board released by Arduino or the most sophisticated board ever released by Arduino, this board remains the most frequently used and shared board by designers especially in the virtual world. The Arduino Uno is a microcontroller board or control device in a single ship that is capable of controlling inputs and outputs according to pre-encoded instructions. The Arduino Uno board is equipped with an ATMEGA328P microcontroller. The Arduino Uno board has 14 digital input and output pins (Pin 0 to13) while 6 from the pins digital input output pins can be configured to PWM (Pulse Width

Modulation) mode. Other that than, has 6 analog input pins that is Pin A0 to A5. The Arduino Uno board can be coded using Arduino IDE software that is an open source software easier to get. The code used is a simple English language called the Arduino language which is inherited from C++ language. This board can be connected to Dragino LoRa shield [18].

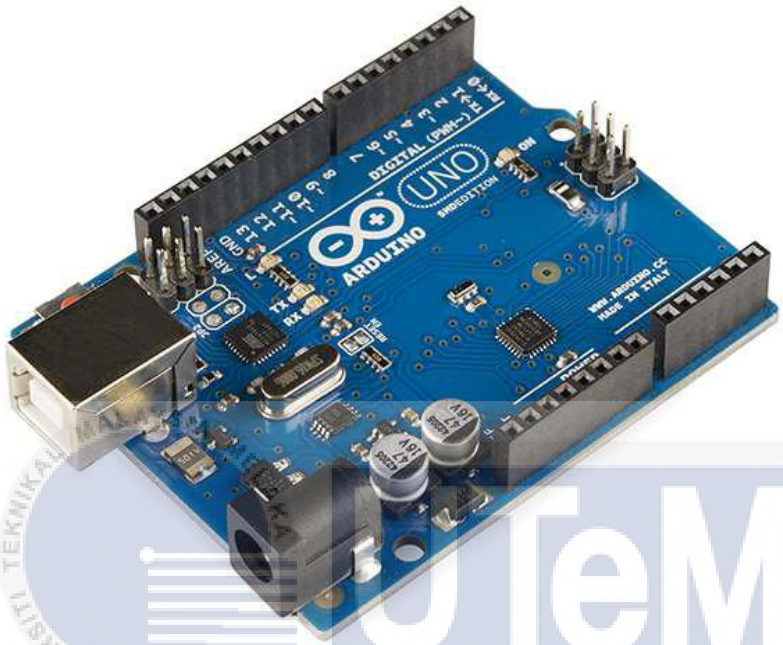

Figure 2.6 Arduino Uno

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2.7.3 Arduino Mega

Arduino Mega 2560 is a microcontroller board based on Atmega 2560 [19]. Arduino Mega 2560 as shown in Figure 1.1 has 54 digital input / output pins, of which 15 pins can be used as PWM output, 16 pins as analog input, and 4 pins as UART (hardware serial port), 16 MHz crystal oscillator, USB connection, power jack, ICSP header and reset button. This is all it takes to support the microcontroller. Simply connect it to a computer via a USB cable or power plugged in with AC-DC adapter or battery to start enabling it. Arduino Mega2560 is compatible with most of the shields designed for Arduino Duemilanove or Arduino

Diecimila. Arduino Mega 2560 is the latest version that replace the Arduino Mega version[20].

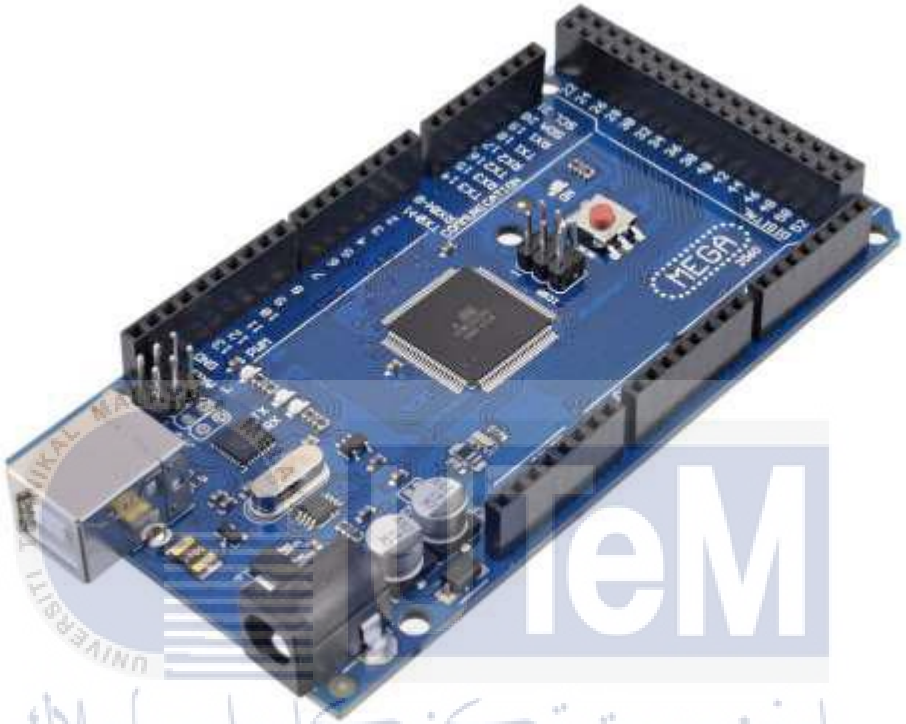

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Figure 2.7 Arduino Mega

2.7.4 CT-Uno

CT-Uno is a product of Cytron Technologies. CT-Uno functions that same as Arduino [21]but its USB port used a USB micro-B socket. The CT-Uno also has more socket pins that are the same distance as the stripboard. Therefore, it is easier to connect with homemade shields. User could solder the female header to the additional pin socket so that it would be easier to be use with the male header on the shield prototype. This microcontroller have been used by a group of developer with the title “Design of a

contactless body temperature measurement system using Arduino [22]where the controller is used together with ESP-Wi-Fi shield to control some sensor as temperature sensor LM-35 and temperature sensor MLX90614[21].

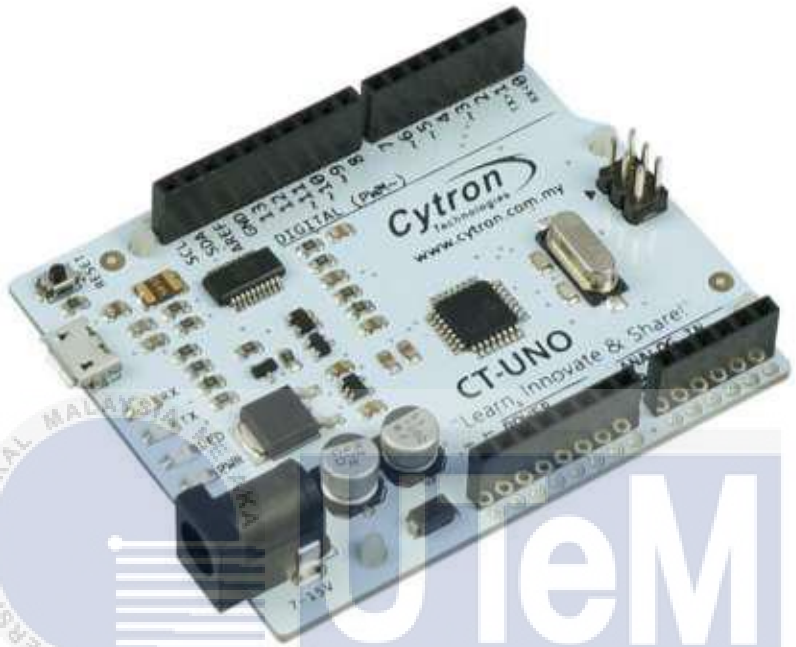

Figure 2.8 CT-Uno

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2.7.5 ESP8266 NodeMCU V3

ESP8266 NodeMCU V3 is a compact board with various feature such as a microcontroller + Wi-Fi access capability as well as a USB to serial communication chip[23]. So to program it only requires the exact USB data cable extension that is used as the data calbe and charging cable for the Android smartphone. A project title “Alat Pengukur Suhu Tubuh Berbasis Internet of Thing (IoT) menggunakan ESP8266 and Firebase Measuring” [24]have uses the ESP8266 NodeMCU as the microcontroller to measure the temperature and send the data of the temperature the Firebase server[25].

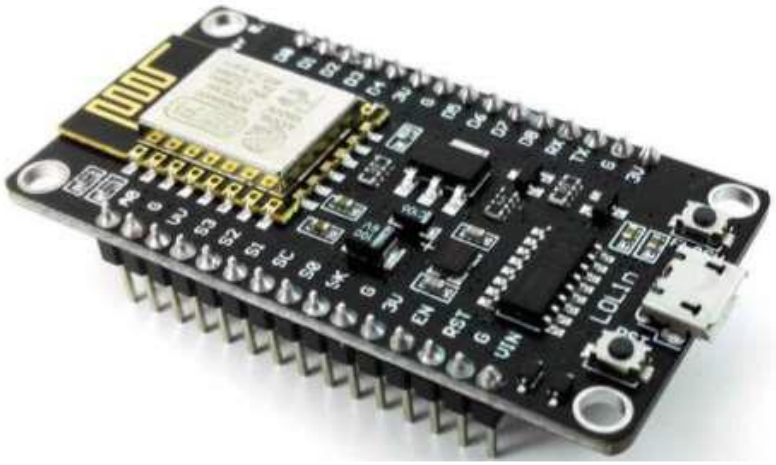

Figure 2.9 ESP8266 NodeMCU V3

2.7.6 Arduino Nano

Arduino Nano is a part of Arduino family which is come in as a small board that is compatible with Atmega328[13]. This Arduino Nano also can be connected to sensor and other module[26]. As a microcontroller, it can operate as same as other Arduino board to act like a brain in a circuit [12].

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Figure 2.10 Arduino Nano

2.8 Types of Database

Database can be defined or interpreted as a collection of data stored systematically on a computer that can be processed or manipulated using software programs or applications to produce information [27]. Database definition includes specifications in the form of data types, data structure and also limitations on the data that is then stored. The database is a very important aspect in information systems because it functions as a data storage warehouse for further processing. Database are important because they can organize data, avoid duplication of data, avoid unclear relationships between data and also complex updates [28].

2.8.1 Relational Database

Relational Database or relational database that is organized based on a data relationship model. Lots of software that use this system to organize and maintain databases through each data connection. Generally, all systems use Structured Query Language (SQL) as a programming language for database maintenance and queries. One of the database is MySQL that is a system for relational database management [29]. Lots of IT products are made using MySQL's main components. Several application like WordPress, Google, Flickr, YouTube, Facebook, Joomla, phpBB, Drupal and MODx use this system.

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2.8.2 NoSQL Database

Any database that does not use SQL as its primary data access language is classified as NoSQL. Non-relational databases are a term used to describe these sorts of databases. Because data in a NoSQL database does not have to comply with a pre-defined schema, unlike data in relational databases, these databases are ideal for storing unstructured or semi-structured data. One benefit of NoSQL databases is that they allow developers to make

changes to the database on the fly without disrupting apps that use it. There are four different types of NoSQL databases. First, there's key-value storage, which is the most basic sort of database storage, in which each item is stored as a key (or attribute name) that holds its value. A document-oriented database, on the other hand, is a database that stores data as JSON-like documents. It facilitates data storage for developers by utilizing the same document-model format as the application code. Graph databases, on the other hand, are used to store large volumes of data in a graph-like form. The graph database is most typically used by social networking websites. Fundamentally, data stored in wide-column storage is comparable to data stored in relational databases. Instead of storing data in rows, data is kept in a big column. The advantage of a NoSQL database is that it allows for increased efficiency in application development because data does not have to be stored in a structured way. For managing and handling massive data sets, it is a preferable alternative. It has a lot of scalability. Through key-value searches, users may easily obtain data from the database. For instance, firebase is a NoSQL database that may be used to store data in a Real-time Database. Data is not kept in the tables and rows seen in relational database management systems (RDBMS) such as Oracle Database or Microsoft SQL Server, as the name implies. Neither SQL statements nor structured query language (SQL) statements are used to retrieve the data. Instead, the information is saved as a JSON object. JSON stands for JavaScript Object Notation, and it is a syntax for transmitting data in a format that is both lightweight and simple to read, write, and interpret for both people and software.

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2.9 Comparison on Study on Previous

Table 2.1 Comparison of previous work study

Reference	Application	Controller	Sensor	Database
2020, [9]	Premise temperature screening with face detection	Raspberry Pi3	AMG8833 thermal camera	Python and MySQL
2020, [30]	Premise temperature screening	NodeMCU Esp8266	MLX90614	Python with Opencv
2020, [19]	Hospital and clinic for patient monitoring	Arduino Mega 2560 microcontroller with ESP8266	MLX90614 and LM35 temperature sensor	Blynk
2020, [31]	Mobile parking	Arduino Uno with Bluetooth module	HC-SR04	MySQL
2021, [25]	Contactless temperature checker with smartphone	ESP8266 NodeMCU V3	MLX90614	Firebase
2020, [21]	Contactless body checker device	CT-Uno with ESP Wi-Fi Shield	MLX90614 and LM35 temperature sensor	-

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Table 2.1 shows the related previous work study to this project. The first study is a project developing monitoring body temperature non-contact using AMG8833 thermal camera and face detection with Raspberry Pi 3 as the microcontroller and MySQL as the database platform[9]. The purpose of this development is to prevent the spread of Covid-19 and the advantage of this development is it detect temperature of human and produce the data with face detection[9]. The disadvantage of this development the thermal camera pixel is not enough to detect the face clearly.

For the second study is contactless thermal detection system using NodeMCU 8266 as the microcontrolled, MLX90614 as the contactless temperature sensor and python with

Opencv as the database of face detection and temperature record. The advantage of this development is a contactless temperature detection is success, low cost, energy efficient and easy to install, east to use even for playgroups student or illiterate worker and proper database record of everyone that use this system [30].

N.S.Mohamad Hadis had develop a device of IoT based patient monitoring system for hospital usage with Arduino Mega as the microcontroller that combined together with ESP8266 as the Wi-Fi module, MLX90614 and LM35 as the temperature sensor and Blynk Application as the platform to monitor the patient condition[19]. Based on this paper, MLX90614 temperature sensor have the accurate reading result.

A Mobile Parking application by using Arduino Uno with Bluetooth HC-05 Module to wireless the data to the database platform that is MySQL and the sensor used is Ultrasonic sensor HC-SR04[31]. The result of the development is an Android application that produce QR code was the input that have been connected to the hardware and functioning well pass through Bluetooth module to send and store the data.

Another temperature checker development by using ESP8266 NodeMCU V3 as the microcontroller with MLX90614 sensor but with other type of database that is firebase. Based on this paper, the temperature sensor, MLX90614 is able to read the most effective reading object temperature with ranger from 5 to 10 with accuracy about 95% to the standardize thermometer reading and the output of this sensor to the monitoring device could receive as fast as 3 second[25].

In the sixth paper a development of contactless body temperature measurement by using CT-Uno as microcontroller and ESP Wi-Fi Shield to display the data at computer and also used LM35 and MLX90614 temperature sensor to sense the temperature measurement[21]. The target of measurement is for oral measurement, axillary measurement

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and rectal measurement. This development is a low cost product and real time data collection.

2.10 Summary

Overall, this chapter discusses on how, the temperature checker and application of self-check-in system work simultaneously. This chapter also discusses the technologies and important components in developing this product in term of hardware and software based on the previous work had done. Through literature review, it can assist in the development of temperature checker with self-check-in system. In the next chapter will describe the methodology used to develop the product in details.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter discusses the methodology that will be used to develop and test the functionality of automated premise check-in with simultaneous temperature checker system using Raspberry Pi device. The explanation of this methodology covers product design aspects as well as step in developing automated premise check-in simultaneous temperature checker system using Raspberry Pi device. The development of this product is guided by the Process Design Engineering (EDP) model which has five processes will be described in the next section.

3.2 Project Implementation Flow Chart

The simulation development process that will be done is illustrated in the form of a simulation development flow chart to facilitate the process to be implemented. Figure 3.1 sgows the flow chart for the entire simulation implementation.

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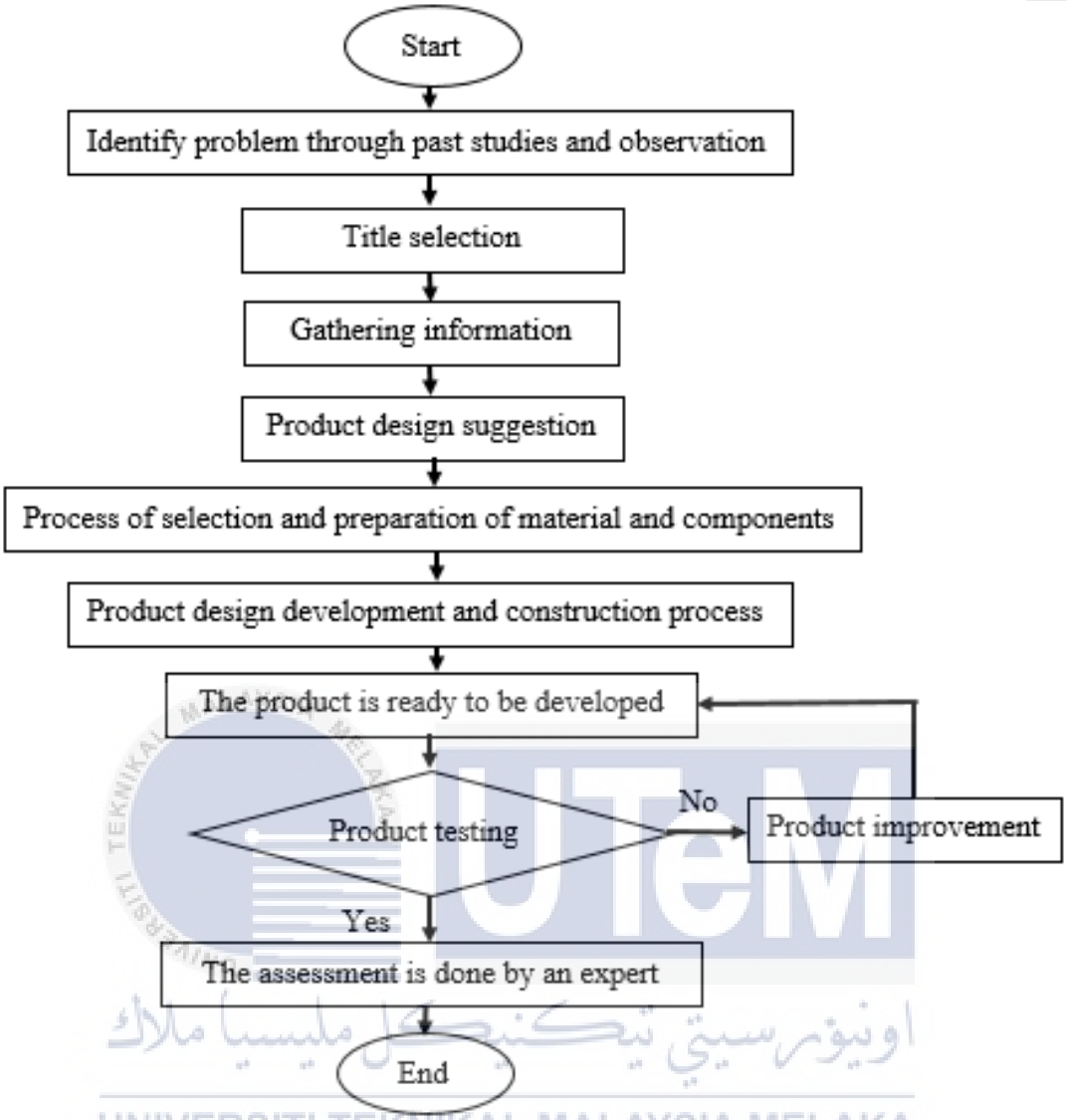

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Figure 3.1 Simulation execution flow chart

3.3 Product Design

The design for the development of this project is guided by the Engineering Design Process (EDP) model. EDP is a process of designing a system, components and equipment the meet current needs[32]. The model includes five main phases namely analysis phase, design phase, development and implementation phase, testing phase and evaluation phase.

Through the systematic procedures available on the EDP model can help students and professional to know the starting and end point before developing a product[32]. Moreover, it is also a systematic method that can develop creativity and provide technical problem solving skill that produce satisfactory results[33]. Figure 3.2 shows the arrangement of the phases in the EDP model.

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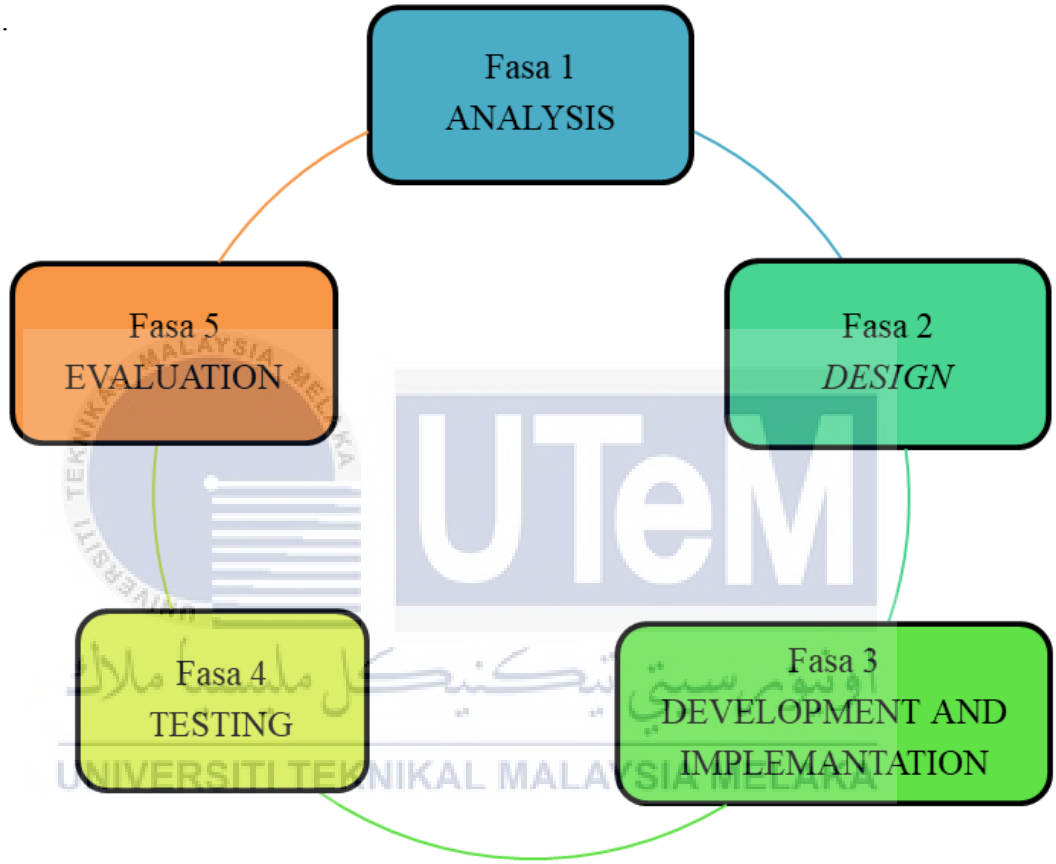

Figure 3.2 Adapter EDP model

To achieve the objectives of the development study, the sequence of phases found in the EDP model is aligned with the objectives to be achieved. The first objective is to develop an automated premise check-in with simultaneous temperature checker system will involve two phases namely the analysis phase and the design phase[34]. In the analysis phase, the problem is identified and based on that, the project's objective and scope are set

as explained in Chapter 1. The design phase, on the other hand, identified solutions to problems and selects solution s that are appropriate for designing circuits, building programming and hardware for this project. In to achieve this, a background study or Literature Review was done in Chapter 2. Next, the second objective which is to determine the equipment requirements in terms of hardware and software will involve the development phase that will be explained in details later in this chapter. In the testing and evaluation phase is to use for development in real situations by performing engineering analysis and obtaining expert validation for simulations that have been developed to achieve the third objective of installing and testing the functionality of intelligent suspension system using microcontrollers. This phase will be conducted in next semester once the product prototype is completed. Table 3.1 shows a summary of the methodology for development of automated premise check-in with simultaneous temperature checker system according to the phases of the EDP model and aligned with the project objectives.

Table 3.1 Summary of methodology

PHASE	OBJECTIVE	METHODOLOGY
Analysis phase Design phase	Design self-check-in system with temperature checker application	○ Identify problems and user demand ○ Identify the solution and solution selection. ▪ Development design ▪ Selection of components ▪ Product specifications ▪ Technology used
Development and implementation phase	Develop automated premise check-in with simultaneous temperature checker system.	○ Development with appropriate technology as needed ○ Execute and explain the process involves in development. ▪ Determination of components and materials ▪ Develop programming ▪ Develop product hardware ▪ The cost of the product

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Test and evaluation phase	Monitor the functionality of the combination system of the automated premise check-in and the temperature checker device work simultaneously.	○ Testing the effectiveness of the product ○ Evaluate the product according to aspects related to product quality, originality, user friendliness and neatness. ○ Obtain evaluation and validation relevant experts.

3.3.1 Analysis Phase

The initial planning done before starting the development process is to analyse all matters related to the development of self-check-in system and temperature checker device that want to be developed such as finding problems that arise that cause the need for the development of the automated premise check-in with simultaneous temperature checker system through the analysis performed are after conducted a document analysis on the development of self-check-in system and temperature checker device, which has the same operational concept, there are several objective that have been identified in accordance with the development of automated premise check-in simultaneous with temperature checker using Raspberry Pi, who want to be developed. The setting of these objective is important to ensure the project developed does not run away from its original purpose. Before the product design process is done it is identified the scope of the project that have been stated in Chapter 1 available on the automated premise check-in simultaneous with temperature checker using Raspberry Pi developed so that this design product can fit the scope of the project which is developing android app to generate QR code so that people who do not have smartphone can have their own QR code to check-in in the premise while the temperature of the customer were recorded with their personal information in the system. The problem studied are related to the need for the development of automated premise check-in simultaneous with

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temperature checker using Raspberry Pi which is capable of solving the problem of self-check-in system and temperature checker work individually. Next, product safety and durability needs to be analysed to ensure the development automated premise check-in simultaneous with temperature checker using Raspberry Pi produces not only work but provides good security to users as well as being able to function for a long period of time. Cost of production of development of automated premise check-in simultaneous with temperature checker using Raspberry Pi should be taken into account to ensure that consumer can afford it when it is marketed.

3.3.2 Design Phase

This design phase involves the process of identifying solution to problem that arise and the selection of appropriate solution such as production of development design sketch of the automated premise check-in simultaneous with temperature checker to be developed, the selection of the most suitable design and the selection of materials and equipment appropriate to the chosen design. The design process is the application of technical information and imagination which refers to the initial sketch. Fields such as electronic, mechanics, art and materials are involved in the design process.

This design process is an important element for ensuring the automated premise check-in simultaneous with temperature checker produced can function well and meet the first objective of the project which is to design this project using a microcontroller. This phase also takes into account several aspect such as selection of the project materials that are appropriate to the cost, durability and safety of the materials.

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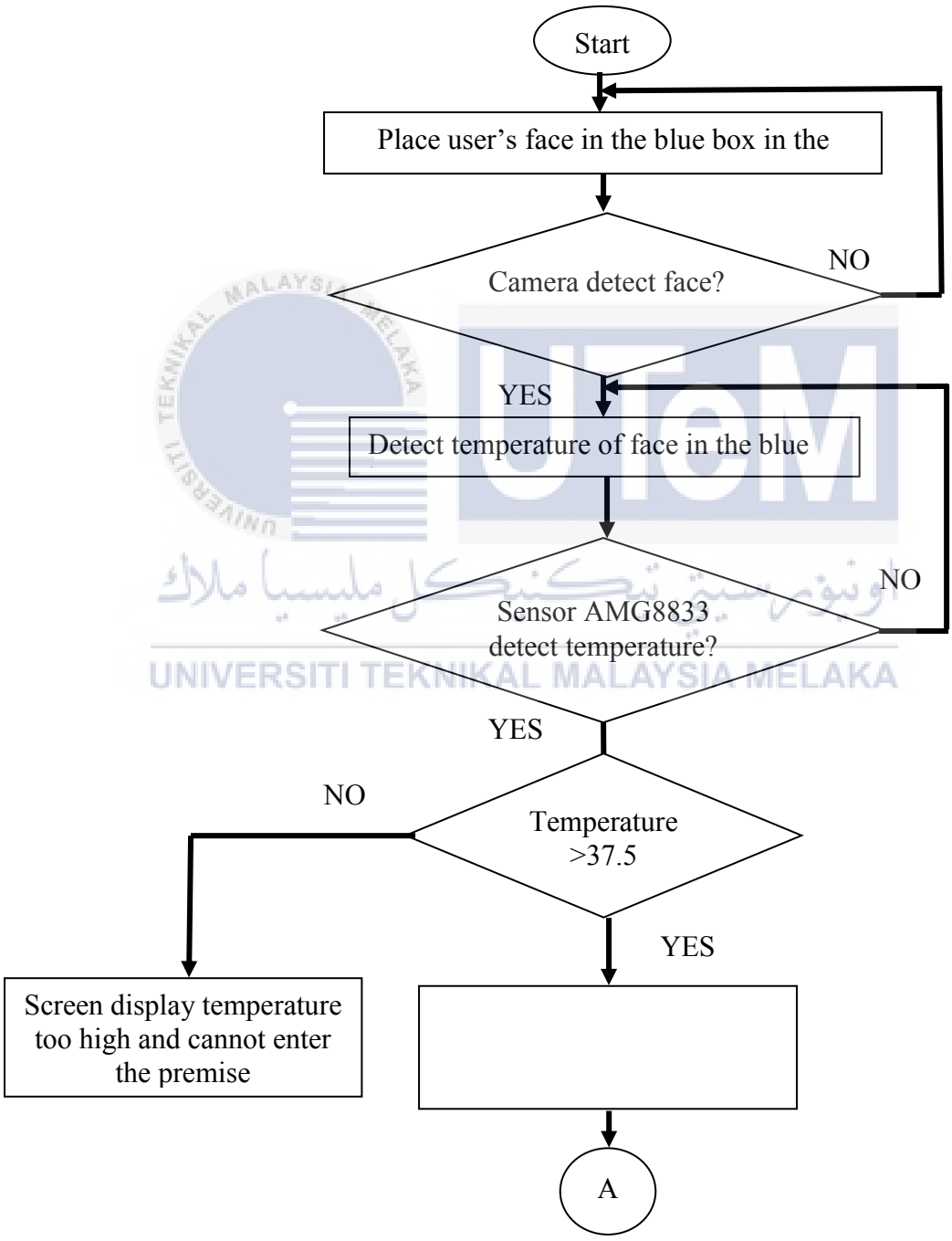
3.3.2.1 Hardware Specification

The development of a temperature checker requires details to determine the specification requirement required, the standard of components required and the appropriate hardware based on its scope. As a result of previous studies, a flow chart for determining the hardware specifications to build this project is a follows:



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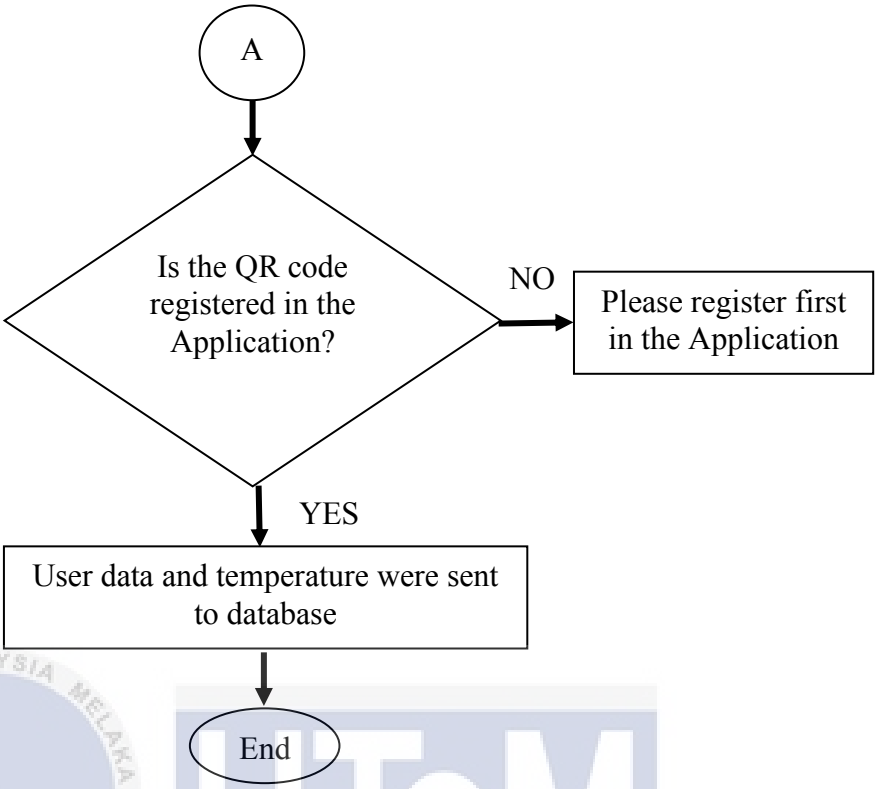

Figure 3.3 Flowchart of hardware project

Figure 3.3 shows the overall flowchart of the project. This flow is started with user reach at the premise. Then they need to place their face in the blue box at camera. Next, the will detect user face and if it not detect the face it will search the face until it recognize it. Move to next step, it will scan the temperature of that face and see either the temperature exceed 37.5°C or not. If it exceed it will display temperature high and user cannot enter the premise. If the temperature is below 37.5°C, it will display normal temperature and next user need to show their QR code information in the blue box. Next the system will check either the QR code has registered in the android application or not. If it was not registered yet, user need to registered first in the android application and generate their QR code. They also could print out the QR code and keep in their wallet just in case their smartphone were

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not with them. If the QR code were registered and successfully read by the camera, the user data and temperature will send to the database together with the temperature reading.

The selection of the hardware component is an important thing to be looked, as tabulated in Table 3.2.

Table 3.2 Hardware Component List

Component	Specification		
	Operating Voltage	Supply Voltage	Pin
Rapberry Pi 4b	• 5V via Type C (3A) • 5V via GPIO header (3A)	5V 3A	• 40 pin General-Purpose Input/output Header • 2 Micro HDMI Ports • MIPI CSI Camera Port • 2 USB 3.0 • 2 USB 2.0
Raspberry Pi Camera 5Mps	Raspberry Pi board	-	Insert at Raspberry Pi Camera Port
AMG8833 Thermal Camera	5V	-	• VIN • GND • SCL • SDA • INT • ADO
DC Adapter 5V 3A	5V 3A	240V-220V	Power Jack Raspberry Pi 4b

Table 3.2 is the table of hardware component list that are needed for this project. Raspberry Pi 4b as the microcontroller that is selected due to its characteristic that have clearer camera that could be used together with the camera. This is because the can the face and QR code, clearer camera are required. Besides, this model 4b have been upgraded from model 3 with current supply is 3A so it much stable. This microcontroller also have the characteristic as mini CPU or minicomputer with function can connect to Wi-Fi, connected

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to monitor, mouse keyboard and many more. Next, combined with the microcontroller is Raspberry Pi camera 5Mps. With the function to detected face and QR code this type of camera is very suitable to be used. Besides, AMG8833 Thermal Camera is used to detected temperature because of it accuracy to detect thermal heat of face in the box at the camera. To operate this project, Adapter 5V 3A Type C is used due to Raspberry Pi supply specification.

Table 3.3 Component Price List

Item	Quantity	Price per unit	Price
Raspberry Pi 4b with SD Card	1	RM 253	RM 253
Raspberry Pi Camera 5Mps	1	RM 40	RM 40
AMG8833 Thermal Camera	1	RM 138.06	RM 138.06
DC Adapter 5V 3A	1	RM 15	RM 15
		Total price	RM 446.06

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Table 3.3 is the table of the component price list that to be used in this development hardware. As what have been decided, this project will used 1 unit each of Raspberry PI 4b with SD Card, Raspberry Pi Camera 5Mps, AMG8833 Thermal Camera and DC Adapter 5V 3A.

3.3.2.2 Software Specification

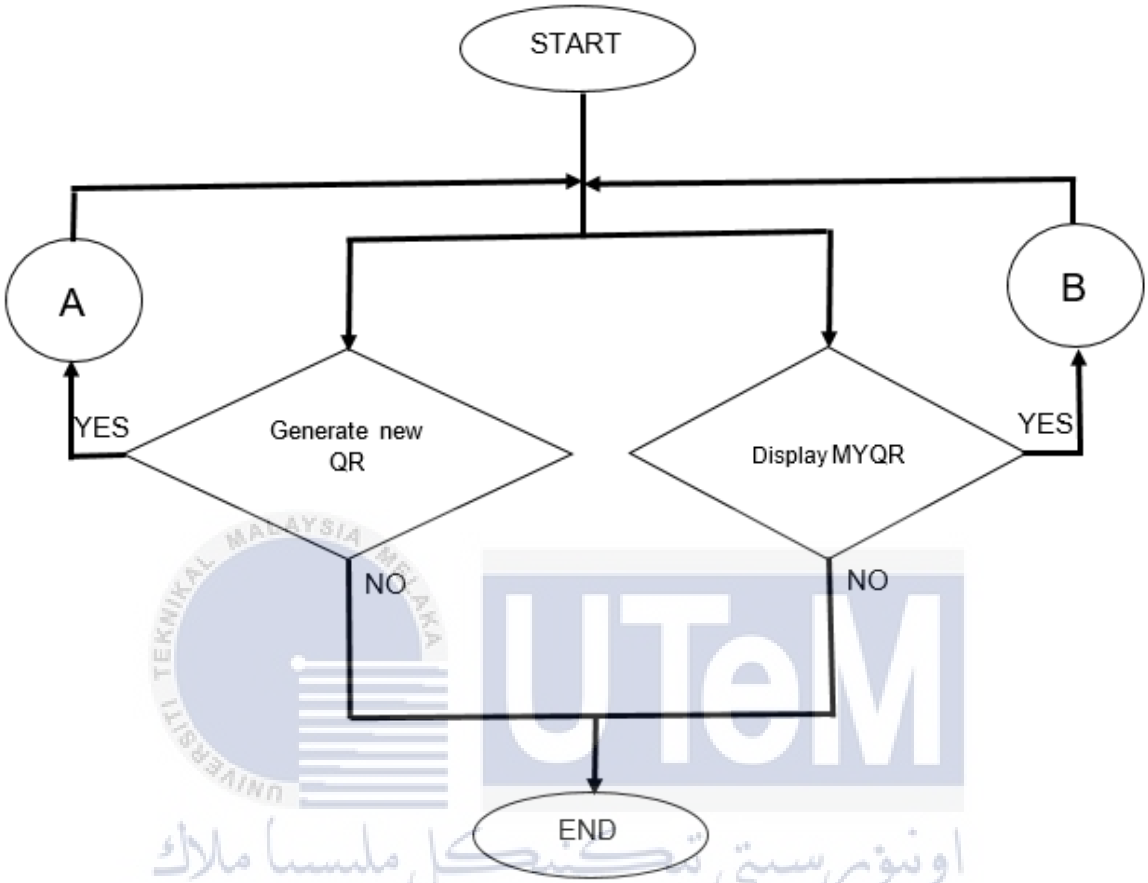

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Figure 3.4 Flowchart of software project Main Screen

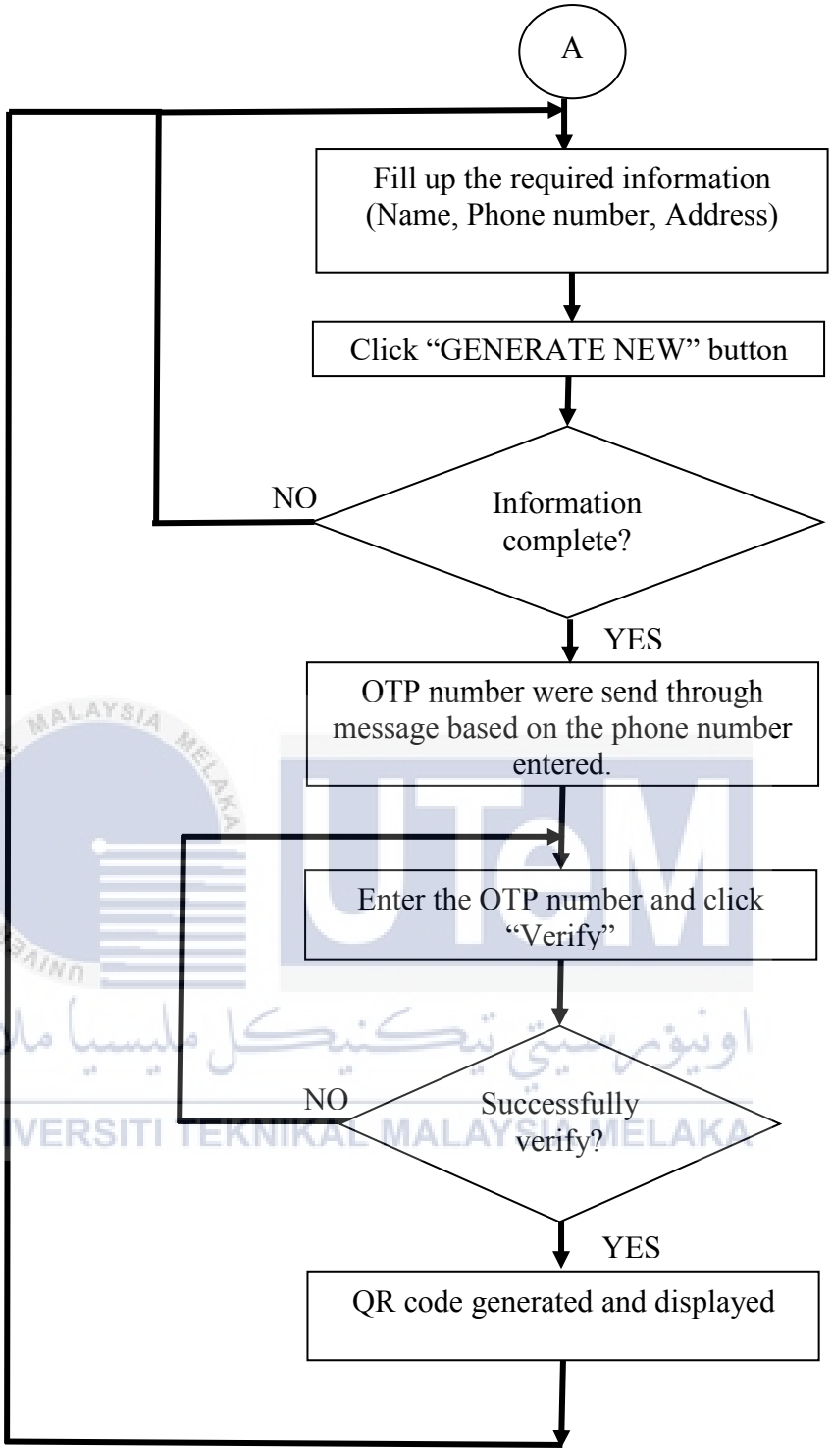

Figure 3.5 Flowchart of software project Generate New QR Screen

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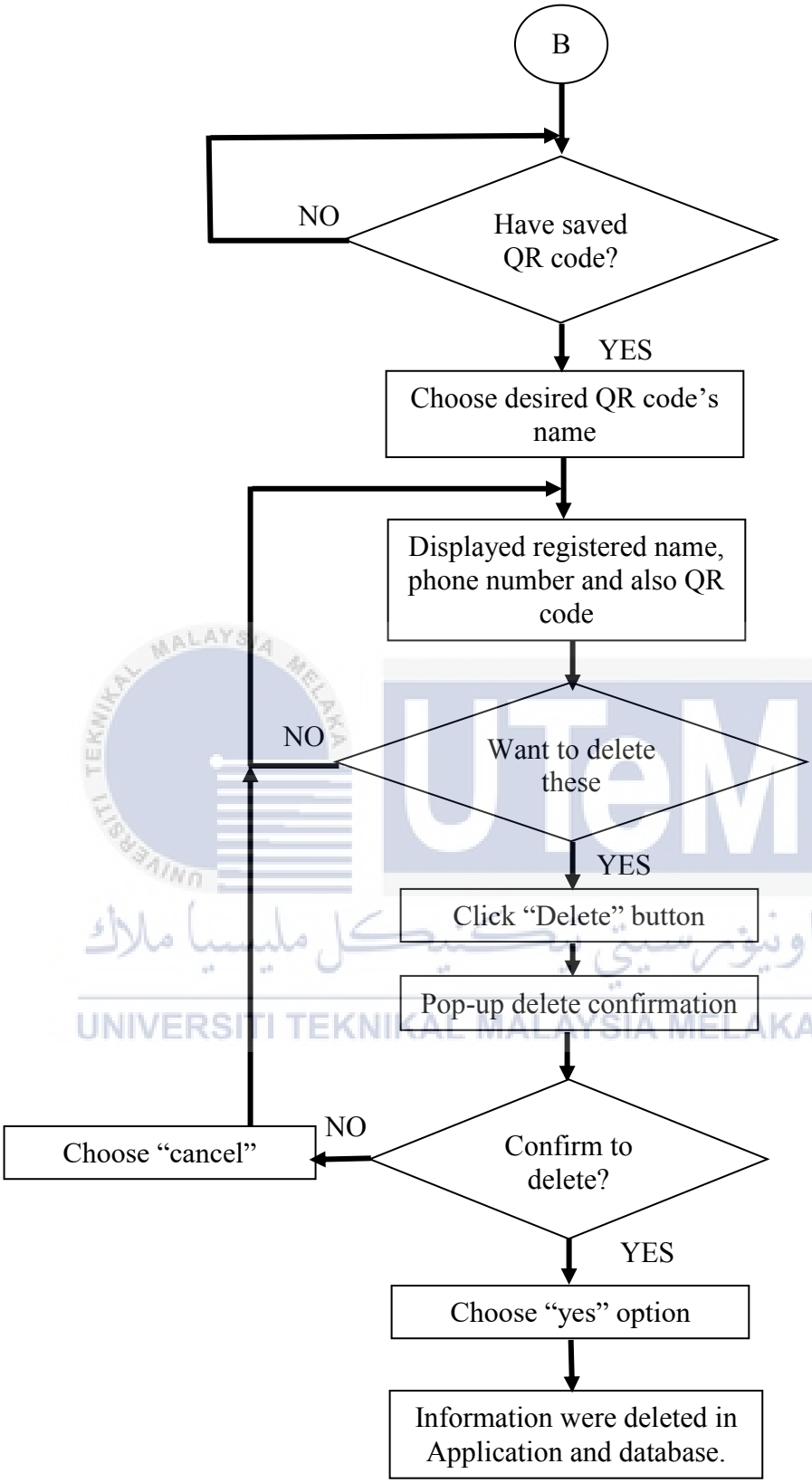

Figure 3.6 Flowchart of software project Generate New QR Screen

Software that used in developing this automated premise check-in system simultaneous with temperature checker is involved in the making of the hardware and the system of self-check-in with temperature data. The first software is used Kodular software that is an open source software for development of android application so that developer could make their own application. In this project, this software is used to make the application for the user to register their personal information, generate QR code of their information, save the QR code and also could delete the QR code.

Next software is python with Opencv that is used in the Raspberry Pi. This software is used to make the microcontroller work as per project's requirement by uploads the python code. Then the microcontroller will execute the code to interact with inputs and outputs. Opencv is the library used to detect and recognize face.

The other software used is Firebase where it is a database platform for storing data as well as for data of this project. Firebase has high capacity database management system and also as open-source database so that it is more user friendly. To operate Firebase, it required to have an account with the Firebase. Then the API key that generate while setting up the database will be shared with the android application and python in Raspberry Pi. This Firebase were used because it make the data more organize and easier to be handle

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3.3.2.3 Block Diagram Design

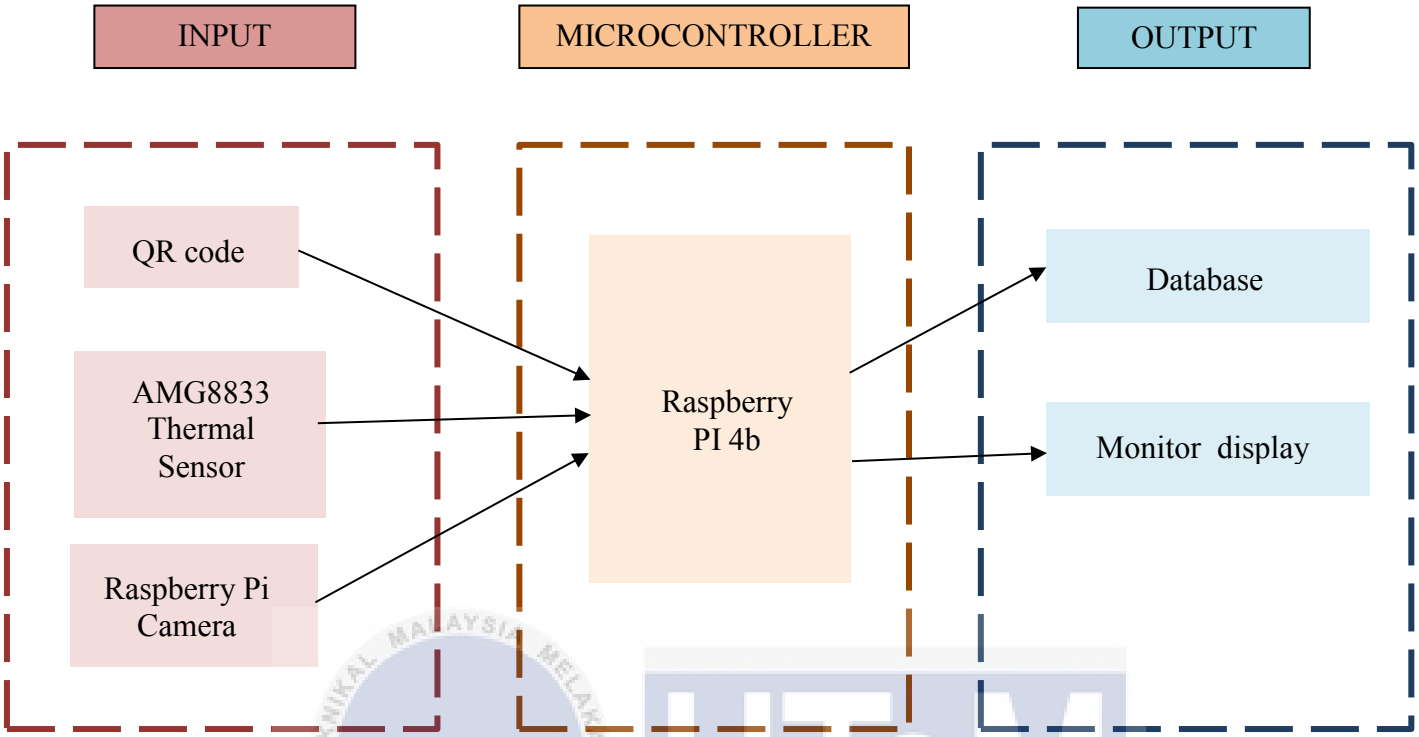

Figure 3.7 Block Diagram Design

Figure 3.4 shows the block diagram design of this project that is the operation for this project. It divided into three important segment that is input, microcontroller and output. From the Figure 3.4, the input used is QR code which is contain user information that is generated using the Android application while the AMG8833 Thermal Camera is sensing the temperature of the user face and the Raspberry Pi Camera is recognized the face and also scanning the QR code. All of this input data will be pass through and process through the microcontroller that is Raspberry Pi 4b and the output that have been gathered will displayed at the monitor and also send to the database of Firebase and Google Sheet Sprea that can be access by one credential.

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3.3.2.4 Prototype Design

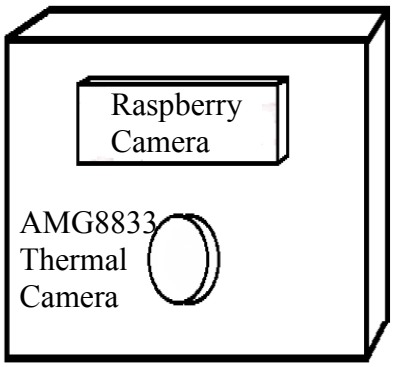

Figure 3.8 Prototype Design

Figure 3.5 illustrated the prototype design that involved the temperature checker only. This is because at the premise only required to place the device at the premise while the QR code user can use their smartphone or print out the QR code. This design is combination of casing box that hold the circuit of the temperature checker while at the outside box are the Thermal Camera and Raspberry Pi Camera.

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3.3.2.5 Prototype Design

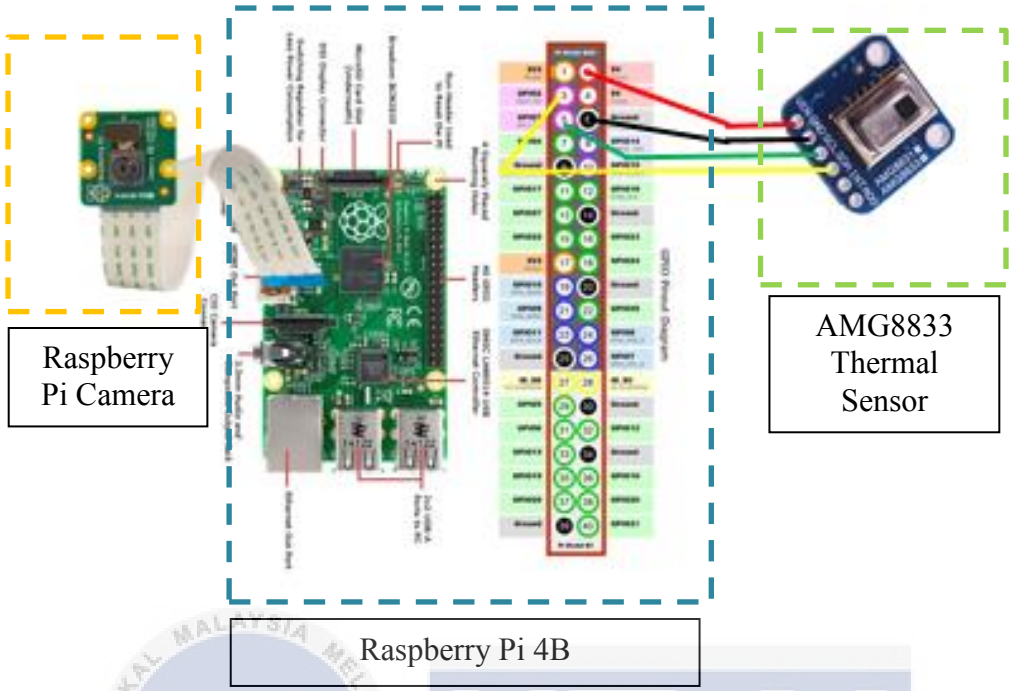

Figure 3.9 Prototype Design

Figure 3.6 shows the circuit diagram of the hardware used in this project. Due to non-existed component of the Raspberry Pi, Raspberry Pi Camera and AMG8833 Thermal Camera, this component connection were shown as above. In the middle is the main microcontroller, Raspberry Pi 4b, on the left is the Raspberry Pi Camera and on the right AMG8833 Thermal Camera

3.3.3 Development and Implementation Phase

At the development and implementation phase, an automated premise check-in with simultaneous temperature checker system are developed using the predefined design. The development phase is divided into two, namely hardware development and software development. The scope of functionality of the development product includes a system able

to record to the self-check-in system and the temperature reading. The main hardware required is a thermal sensor (AMG8833 Thermal Camera), Raspberry Pi Camera.

3.3.4 Test Phase

In this phase, each developed part that has been completed will be tested starting from testing to the circuit that is developed along with the programming up to the actual product output produced. Emphasize is given to Raspberry Pi 4b as microcontrollers that act as brains to calculated and display the temperature and then supported with the Firebase database platform which is connected through Kodular software developed to ensure it really works.

3.3.5 Evaluation Phase

At this stage the system of premise check-in temperature checker application, the product will be evaluated by experts consisting lectures in electronic or electric field and one from manufacturing field. The evaluation will be done based on four main aspects such as product quality, functionality, user friendly, and neatness and so on. This phase will be included in Chapter 4.

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3.4 Summary

This chapter has discussed the phases that will be involved in the development of automated premise check-in with simultaneous temperature checker system based on the Engineering Design Process (EDP) model. Expected system simulation products of premises check-in with simultaneous temperature checker can be developed according to the phases found on the EDP model.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter present all the result outcome of the whole system to achieve the objective of the study and to solve the problem statement. It consist the Android Application Interface by using Kodular software to generate Qr code that linked to Firebase and the circuit design for face detector with temperature checker and QR code scanner.

4.2 Results and Analysis

The result obtained is the whole system result. It come in with three part which is circuit design of the hardware part, software part of the Android application interface and database.

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4.2.1 Android Application Interface

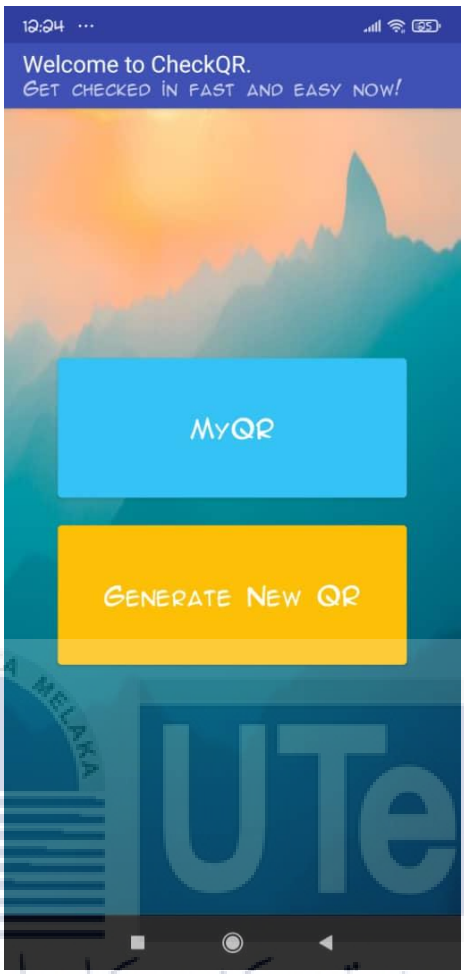

Figure 4.1 Main Interface Android Application

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Figure 4.1 shows the first page when running the application is the Main page. This page display welcome to the application named “CheckQR”. It also come with two button which is to generate new QR code by clicking “GENERATE NEW QR” button and to view back the saved QR code by clicking “MYQR” button. Then it will directed the user to the desired function that they need.

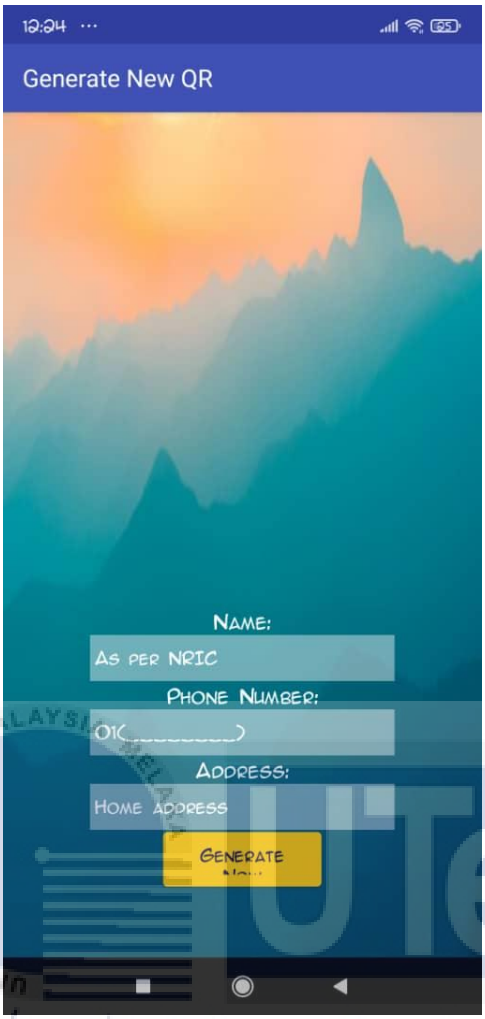

Figure 4.2 Generate New QR Interface Android Application

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Figure 4.2 shows the page for the option “GENERATE NEW QR” where new user register their information such as name, phone number and address. After finished enter all the information, user need to click the yellow button “GENERATE” at the botttom of the page.

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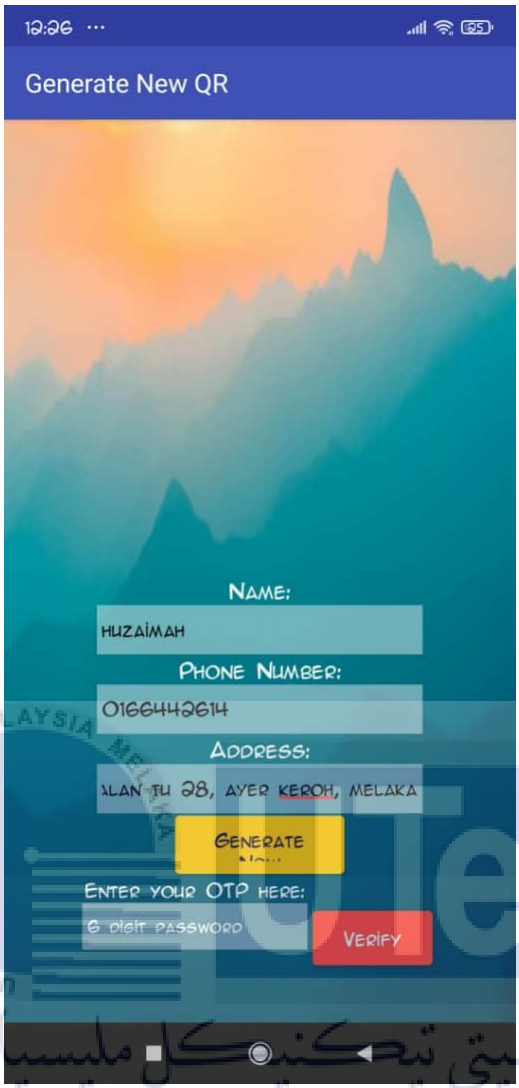

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Figure 4.3 Generate New QR Interface Android Application (Verification)

Once the yellow button is clicked, an OTP number for verification will be send through user registered phone number and the OTP number willbe entered in a given box as displayed in Figure 4.3 for security purposes. So user need to entered a valid phone number so that the OTP number will be send successfully.

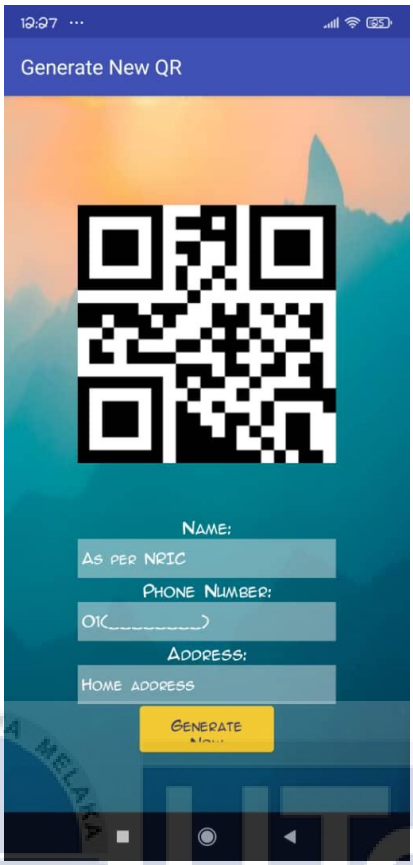

Figure 4.4 Generate New QR Interface Android Application (Successfully generated)

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Once successfull registed, a QR code will be generated as shown in Figure 4.4.

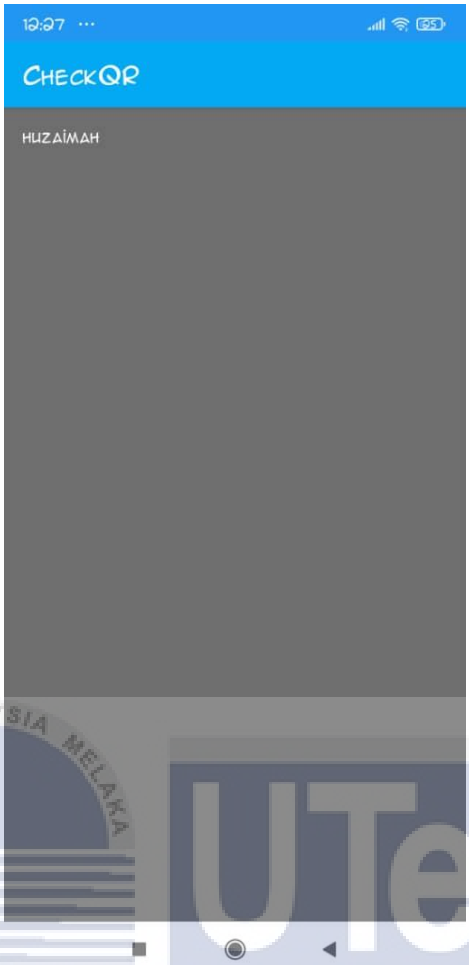

Figure 4.5 MYQR Interface Android Application

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Figure 4.5 shows the page for the option “MYQR” at the main page where it will directed the user to this page CHECKQR so that user could open their saved QR code by clicking on user name.

Figure 4.6 MYQR Interface Android Application (QR code)

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A specified QR code together with users' detail will be displayed as described in Figure 4.6 when user clicks on thier user name in page as shown in Figure 4.5. In this page also the QR code for user to scan at the device later were displayed with their information, name and phone number. User also could delete unwanted QR code by clicking the red button of "Delete" and user will be directed to MYQR page after delete confirmation.

4.2.2 Analysis of the Hardware Implemenation

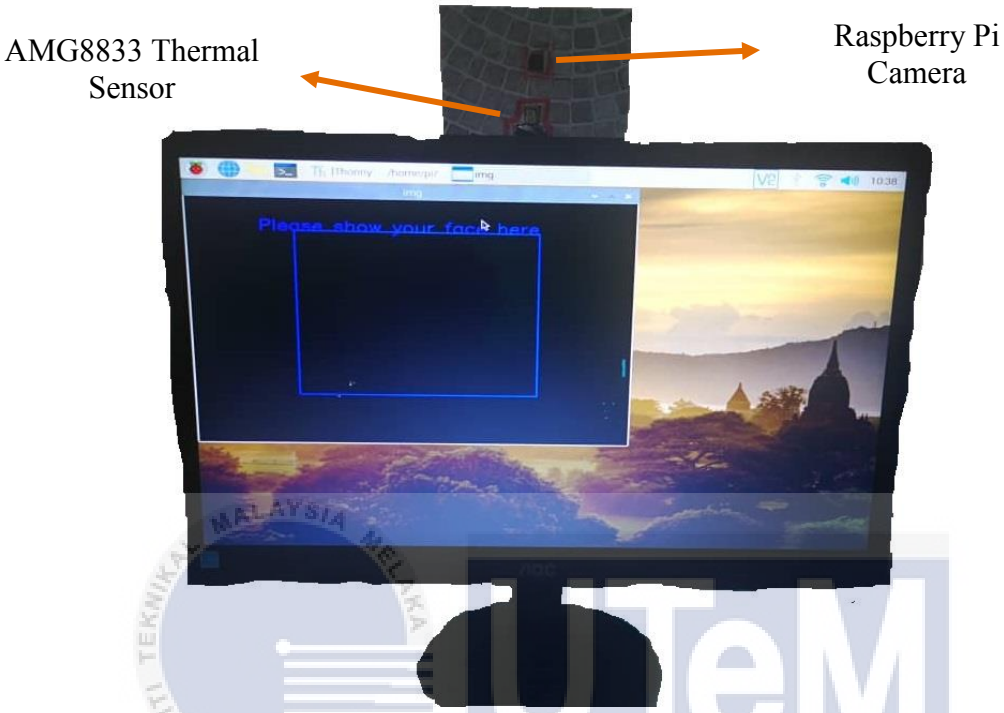

Figure 4.7 Hardware circuit of the project

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Figure 4.7 is the hardware circuit that have been developed for this project. It consist three part that is input, microcontroller and output. In the input, it contain Raspberry Pi Camera 5mp and AMG8833 Thermal Snesor. The microcontroller used is Raspberry Pi 4B and the output is the monitor.

This circuit works when the user stand in front of the device shaowing their face for the camera to detect the face and read the temperature. If the temperature is higher than 37.5, the user cannot proceed with QR code scanning which means they cannot enter the premise. If the temperature is normal below 37.5, the user need to proceed with QR code scanning which they have registered in the Android Application and the screen will display “Thank you” as the process is completed.

The result analysis for this study have been taken in term of distance between user and device so that the afectiveness reading of temperature sensor and camera to detect face can be determine. Besides, the duration for the data taken at the device and reveiced at the database also recorded.

Table 4.1 Time taken to detect face based on distance

Distance (cm)	Time taken detect face (s)										
	1	2	3	4	5	6	7	8	9	10	Average
15	5	6	6	6	6	5	5	5	5	6	5.5
30	5	5	6	6	5	5	5	6	5	5	5.3
45	6	6	6	6	7	7	6	6	6	6	6.2
60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Table 4.1 the tabulates average time taken in second for the camera to detect face with 3 different distance variation which is 15cm, 30cm, 45cm and 60cm. It shows that the fastest average time taken to detect face is at distance of 30cm and no face deteced when distance is at 60cm. For distance 45cm, the reading take 1 second longer at certain part of reading. So from here, 15cm and 30cm are the best for the camera to detect face because the average time difference between these two distance is small that is around 0.2 second.

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Table 4.2 Temperature reading based on distance

Distance	Temperature reading (°c)									
	1	2	3	4	5	6	7	8	9	10
15cm	37.1	37.1	37.1	36.9	36.9	36.9	36.9	36.9	36.9	36.9
30cm	36.5	36.5	36.7	36.7	36.7	36.7	36.5	36.5	36.5	36.5
40cm	35.7	35.7	35.7	35.2	35.7	35.7	35.7	35.7	35.7	35.7
60cm	34.5	34.5	34.5	35	34.5	34.5	35	34.5	34.5	34.5

Table 4.2 shows the temperature reading in celcius of the user face by varied the distance which is 15cm, 30cm, 40cm and 60cm. The further the distance of user from the device the reading is decreasing due to surrounding temperature effect and this is time for all 10 points taken. The accuracy of the thermal sensor is when user at distance of 15cm as it gives 70% of the frequency of 36.9°C data among the 10 point taken.

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Table 4.3 Duration to receive data

	Time at monitor	Time stamp in Firebase
1	2:17	02:17:21
2	2:17	02:17:58
3	2:18	02:18:19
4	2:19	02:19:08
5	2:21	02:21:43
6	2:22	02:22:08
7	2:22	02:22:38
8	2:23	02:23:43

	Time at monitor	Time stamp in Firebase
9	2:25	02:25:29
10	2:26	02:26:02

Table 4.3 shows duration of the time at monitor when the data is received and time stamp at the Firebase database. From the table, it clearly shows that there is no delay between the data from device to firebase database.

4.2.3 Firebase Database

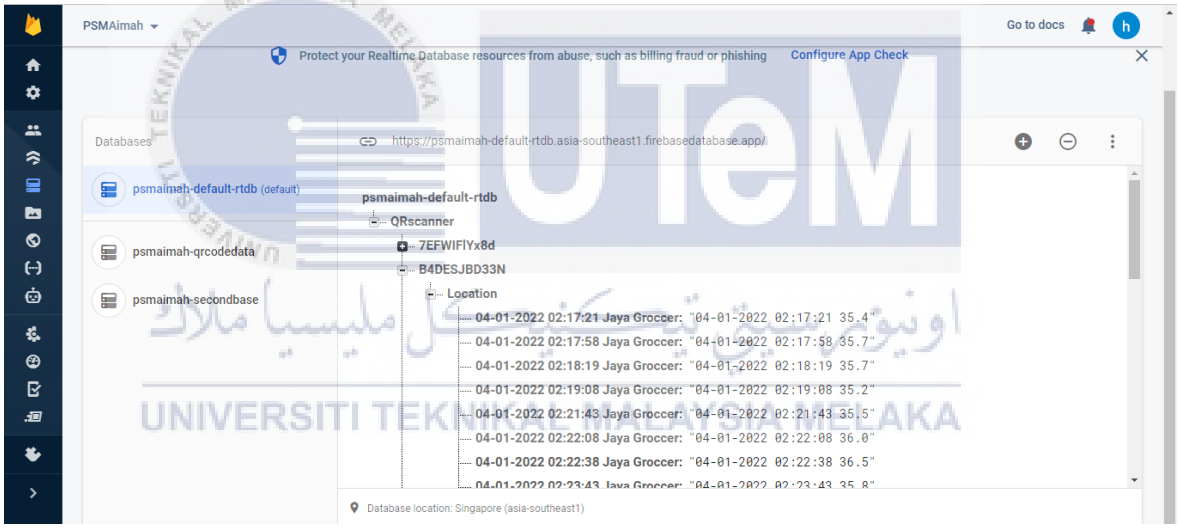

Figure 4.8 Database of temperature, time and place at device.

Figure 4.10 is the database platform in Firebase from the device which it record the place where the user enter with temperature, time and date. This database is arrange according to user uniqe ID that generated when the QR code were generate.

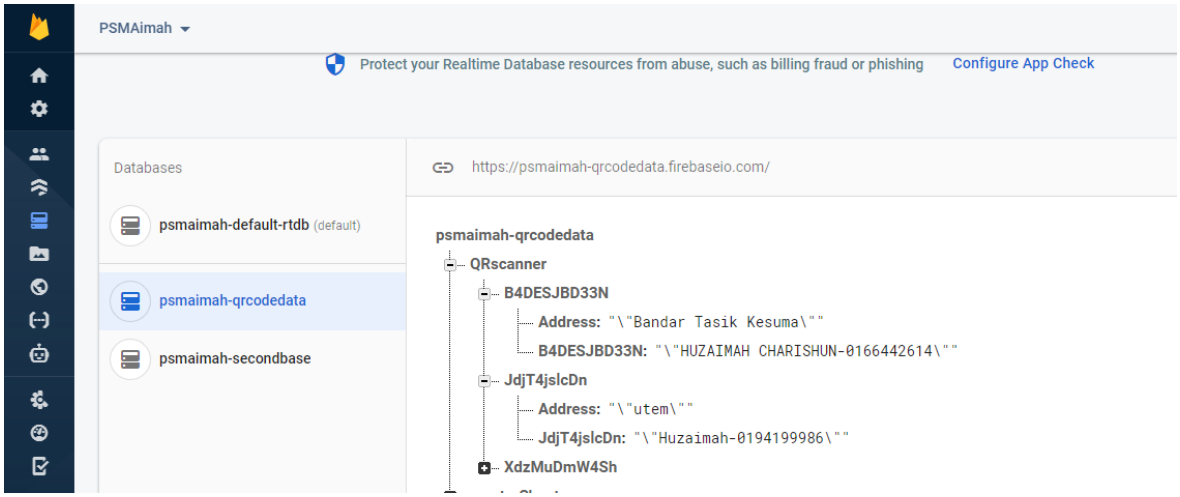

Figure 4.9 Database of Android Application

Figure 4.11 is the database platform in Firebase when the user is successfully registered using the Android Application. It generate uniqe ID for user and save the information of the user of thier name, phone number and also address.

4.3 Summary

By the end of this study, the premise check-in system and temperature checker were able to work simultaneously. The premise check-in system that is the Android application were able to link to the database for generate QR code and save user information while the temnperature checker device were successfully scanning user face and read the temperature and also able to read the QR code of registered user. It also able to communicate with the database by able to send the data real time to the database.

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CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In the conclusion, this Automated premise check-in with simultaneous temperature checker system were successfully developed as the user could use the Android application to register their information and genereted the QR code while the temperature device were also successfully detect user face while reading temperature and could scan the user QR code. Due to objective 1 is achieved, next objective that is to eliminate the manual registration using pen during the check-in process at the premise were also achieved. The functionality of the combination system of the automated premise check-in na dthe temperature checker device to work simultaneously were successfully function as have been monitored through the analysis result at Chapter 4. This device application also logically could be installed at collage and instituition.

The development of the Android application using Kodular open source software to generate QR code of user personal information could help people who do not have smartphone or having problem with their smartphone to help thier family member or their trusted person. At the device hardware, it is mandatory for the user to scan their face at the camera so that the camera detetc thier face while scanning their temperature to check whether their temperature is normal or high. If normal the QR code information will be send to the database in Firebase.

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5.2 Future Works

For future improvements, the delay for the camera to detect face and temperature could be minimize by a few second more using much more clearer camera with higher mega pixel because the higher the mega pixel, the more efficient the camera work to detect face then could move to temperature checking much more faster. Next, in term of database, this project database can be improve the interface for gathering the database such as google sheet or anything that have almost same function with it. The google sheet were actually tried to be used in this project but due to Firebase upgrade it make the link firebase to Google sheet also cahnge and no one had explored it. So, for the next improvement could try something new for this issue. Besides, multiple language at the monitor display should be consider to improve this project so that user with other language could understant what is display at the screen monitor. Other than that, the casing of the project could be upgrade by using 3D print casing so that it can be use as waterproof product.

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APPENDICES

```
from googleapiclient.discovery import build
from google.oauth2 import service_account #enter service and import service account
from datetime import datetime
from pyzbar.pyzbar import decode
import numpy as np
from Adafruit_AMG88xx import Adafruit_AMG88xx
import cv2
from pygame import mixer
import firebase_admin
from firebase_admin import credentials
from firebase_admin import db

qr=0
fqr=0
record1=0
s=0 #tab numbering
cell=2 #cell position to write in googlesheet
zz=0 #control sequence of face detector and qr code scanning
cc=0 #counter for face detection
mm=0 #scan qr audio
mme=0 #thank you audio
mma=0 #alarm audio
too=0 #temp too high audio
time=0
max_temp=0
calculate=0


def playqr():
    mixer.music.load('joined.mp3')
    mixer.music.play()
    return 0

def playtq():
    mixer.music.load('thank.mp3')
    mixer.music.play()
    return 0

def alarm():
    mixer.music.load('alarm.mp3')
    mixer.music.play()
    return 0

def qrunrecog():
    mixer.music.load('unrecognize.mp3')
    mixer.music.play()
    return 0

def createnewtab(date):
    request_body = {
        'requests': [{
            'addSheet': {
                'properties': {
```

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```
                'properties': {
                    'title': date
                }
            }
        }]
    }
    return request_body

def currenttime():
    time=datetime.now()
    timestr=time.strftime("%d-%m-%Y %H:%M:%S")
    return timestr

cred = credentials.Certificate('FirebaseKey.json') #######need to download the json file from
#cred1 = credentials.Certificate('qrstore.json') #######need to download the json file from y

#Initialize first database
userdb=firebase_admin.initialize_app(cred,{'databaseURL':'https://psmaimah-default-rtdb.asia-
#Initialize second database, add name='' at last to differentiate with the default database
storedb=firebase_admin.initialize_app(cred,{'databaseURL':'https://psmaimah-secondbase.asia-s

SCOPES = ['https://www.googleapis.com/auth/spreadsheets']
SERVICE_ACCOUNT_FILE = 'SheetKey.json' #file is in the same folder as the JSON file, credenti

creds = None
creds = service_account.Credentials.from_service_account_file(SERVICE_ACCOUNT_FILE, scopes=SC
        ##### generate credentials that we need

        # The spreedsheet ID
SAMPLE_SPREADSHEET_ID = '1RvO5F7-eD5jXpw9CL4tBJsFNpYhgAchJS82kCKeLa0M'

service = build('sheets', 'v4', credentials=creds)

sheet = service.spreadsheets()

initial = currenttime()
store = 'Jaya Groccer' #storename

ref1 = db.reference('/QRscanner', userdb) ######Database main (refer to attached picture)
ref2 = db.reference('/QRstore', storedb) ######Database main (refer to attached picture)

#Create new spreadsheet
time = datetime.now()
date = time.strftime("%d-%m-%Y")
initial = time.strftime("%d-%m-%Y %H_%M")
req = createnewtab(initial)

storenameref = ref2.child(store)
dateref = storenameref.child(date)

try:
    addnew = sheet.batchUpdate(spreadsheetId=SAMPLE_SPREADSHEET_ID, body=req).execute() #crea
except:
    pass

#initialize sensor
sensor = Adafruit_AMG88xx()

#initialize pygame mixer
```

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```
mixer.init()

#load classifier
face_cascade = cv2.CascadeClassifier('/home/pi/opencv/data/haarcascades/haarcascade_frontalfa

#video pipeline
cam = cv2.VideoCapture(0)
cam.set(3,640);
cam.set(4,480);

while True:

    ret, img =cam.read()
    img = cv2.flip(img, 0) # Flip vertically
    gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)

    if mme==1: #thank you sound
        playtq()
        mme=0

    if mm==1: #qr scan sound
        playqr()
        mm=0

    if mma==1: #alarm sound
        alarm()
        mma=0

    if qr==1:
        qrunrecog()
        qr=0

    if aa!=0: #thank you box
        cv2.rectangle(img, (150,60), (500, 380), (0,255,0), 2)
        cv2.putText(img,'Thank you!',(100,60),cv2.FONT_HERSHEY_SIMPLEX,0.9,(0,255,0),2)
        aa-=1

    if too!=0: #too high box
        cv2.rectangle(img, (150, 60), (500, 380), (0, 0, 255), 2)
        cv2.putText(img, 'Temperature too high!', (80, 60), cv2.FONT_HERSHEY_SIMPLEX, 0.9, (0
        too-=1

    if fqr!=0:
        cv2.rectangle(img, (150,60), (500, 380), (31,95,255), 2)
        cv2.putText(img,'QR unrecognise, please register through apps.',(80,60),cv2.FONT_HERS
        fqr-=1

    gray1 = cv2.GaussianBlur(gray,(51,51), 0) #Use Gaussian to reduce details
    #region = img[60:380, 150:500] #specify ROI

    #gray = cv2.cvtColor(region, cv2.COLOR_BGR2GRAY) #convert RGB to grayscale

    faces = face_cascade.detectMultiScale(gray1, 1.03, 5) #set parameters to detect face

    if(aa==0 and too==0 and fqr==0): #if no alarms, restart to first
        if (zz==0): #Control so that detect face first
            cv2.rectangle(img, (150,60), (500, 380), (255,0,0), 2)
            cv2.putText(img,'Please show your face here',(100,60),cv2.FONT_HERSHEY_SIMPLEX,0.

            if (cc<15):
                if len(faces)==0: #if there is no face/face is not static in the box
                    cc=0
                for (x,y,w,h) in faces: #if face is present, nparray is returned, draw box ba
                    pixels = sensor.readPixels()
                    thermistor = sensor.readThermistor()
                    print(np.amax(pixels))
```

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```
                print(thermistor)
                max_temp += (thermistor-27.0)+ 4.3 + np.amax(pixels)
                calculate+=1
                cv2.rectangle(img, (x,y), (x+w, y+h), (0,255,0), 2)
                cv2.putText(img,'Detected',(x+150,y+60),cv2.FONT_HERSHEY_SIMPLEX,0.9,(0,2
                cc+=1
        else: #when face is successfully detected, proceed to qr code
            zz = 1
            mm = 1
            maxtemp = float(max_temp/calculate)
            print(maxtemp)
            if maxtemp>37.5:
                zz=20


    if zz>0 and zz<10:# and max_temp<37.5: #Proceed to scan QR if face is detected
        temp = "{0:0.1f}".format(maxtemp)
        cv2.rectangle(img, (150,60), (500, 380), (255,234,0), 2)
        cv2.putText(img,'Temperature normal! Show QR code.',(80,60),cv2.FONT_HERSHEY_SIMP
        cv2.putText(img,"Temperature = "+ temp,(150,400),cv2.FONT_HERSHEY_SIMPLEX,0.9,(0,
        count=15
        for barcode in decode(img): #detect from gracyscale, unable to detect from blurre
            myData = barcode.data.decode('utf-8') #extract data using utf-8
            if len(myData)!=11:
                fqr=15
                qr=1
                zz=0
                cc=0


            else:
                childref = ref1.child(myData)
                number = childref.child(myData)
                addr = childref.child('Location')
                dateh = currenttime()
                addr.update({dateh+' '+store: dateh+' '+temp})

                #record1 = number.get()
                #record1.split(' ')

                #datesecond = datetime.now().strftime("%H:%M:%S")
                #dateref.update({datesecond: record})

#               ss=str(initial) #convert googlesheet parameters to strings
                #i=str(cell)

                #record.insert(3,str(datetime.now())) #insert time for log
                #insert_temp=record.insert(2,temp) #insert maximum temperature of peoples
                #final=[record] #convert everything into list


                    #request to write into googlesheet
                #request = sheet.values().update(spreadsheetId=SAMPLE_SPREADSHEET_ID, ran

                cell += 1
                mme = 1
                aa = 15
                cc = 0
                zz = 0
                calculate=0
                max_temp=0

                if (cell > 1000): #if maximum of cell is reached, create another tab with
                    ss = currenttime()
                    request_body = {
                            'requests': [{
                            'addSheet': {
                                'properties': {
                                    'title': ss
                                }
```

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```
        cc=0
        calculate=0
        max_temp=0

    if k==ord('z'): #to close the application
        break

cap.release()
cv2.destroyAllWindows()
       too = 15
       mma = 1
       cc = 0
       zz = 0


cv2.imshow('img',img) #show video streams
#cv2.imshow('blur', img)

k = cv2.waitKey(10) & 0xff #waits key from user for 1ms

if k==ord('q'): #escape plan if system having problem
    aa=0
    too=0
    zz=0
    cc=0
```

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