SMART COOLING PAD SYSTEM

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ACKNOWLEDGEMENTS

ABSTRAK

Pada zaman moden sekarang ini, penggunaan laptop kerap digunakan oleh para pelajar dan pekerja pejabat. Hal ini kerana mereka perlu untuk menyiapkan segala kerja yang ditugaskan. Penggunaan laptop yang kerap boleh menyebabkan penghasilan haba yang tinggi oleh laptop. Perkara ini boleh menyebabkan laptop mereka cepat rosak. Perkara ini boleh menjadi lebih bahaya jika mereka jarang membersihkan system penyejuk di dalam laptop mereka. Dengan bantuan system penyejuk tambahan seperti pad penyejuk, kadar haba yang terkumpul pada laptop dapat dikurangkan. Oleh yang demikian, idea untuk membangunkan sistem pad penyejuk telah dikemukakan dalam projek ini. objektif sistem ini adalah dapat memudahkan menggunaan sisem pad penyejuk dengan kawalan aplikasi mobile. Sistem ini juga dapat menjimatkan elektrik kerana ianya boleh berfungsi dengan sistem automatik. Dengan menggunakan sistem aplikasi mobile ini, pengguna dapat mengawal sistem pad penyejuk ini dari jauh apabila menerima mesej amaran. Ini dapat membantu apabila laptop pengguna dalam keadaan panas apabila ditinggalkan dari jarak jauh.

ABSTRACT

Todays, the use of laptops is often used by students and office workers. This is because they need to complete all assigned work. Frequent use of laptops can cause high heat generation by laptops. This can cause their laptop to break down quickly. This can be more dangerous if they rarely clean the cooling system inside their laptop. With the help of an extra cooling system such as a cooling pad, the heat rate accumulated on the laptop can be reduced. Therefore, the idea of developing a cooling pad system has been presented in this project. The objective of this system is to facilitate the use of cooling pads with the control of mobile applications. This system also saves electricity as it works with automated systems. By using this mobile application system, users can remotely control this cooling pad system when receiving a warning message. This can help when a consumer's laptop is hot when it is left off.

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LIST OF ABBREVIATIONS

WBS	Work Breakdown Structure
SDLC	System Development Life Cycle
OS	Operating System
CPU	Central Processing Unit
IDE	Integrated Development Environment

CHAPTER 1

INTRODUCTION

1.1 Background of study

In modern era, almost every aspect of modern life involves a computer. As technology progresses, the scale of computer usage is increasing. Computers are efficient and reliable, they are relieving the burden of the public through software and specialized applications for those who offer convenience. Moreover, the computer allows the user to generate the right information quickly, holding the information so that it can be found at any time. Computers and technologies affect how we live, work and entertain ourselves. From powerful voice personal assistants such as Siri and Cortana to more fundamental and fundamental technologies such as behavioural algorithms and inspiring searches.

Nowadays, student and worker are recommended to use personal computer such as laptop in their daily work. I think it's fair to say that personal computers have become the most empowering tool we've ever created. They're tools of communication, they're tools of creativity, and they can be shaped by their user (Bill Gates, 2017).

However, regular and rugged laptop uses can make it produce much heat and will heat up the whole system. This can make hardware inside the laptop like a chip and other component are in danger and at risk for damage. The use of laptop's accessory such as cooling system to reduce operating temperature and to cool the laptop is strongly encouraged. The implementation of cooling pad significantly helps its user to ease them. This cooler was intended to protect both the laptop from overheating and the user from suffering heat related discomfort.

The purpose of this project is to develop the Smart Cooling Pad System that can be used by users of Android smartphone. This project still implements the same version of the previous cooling pad, but a few special features are added into the system such as

the digital thermometer to detect the temperature of the laptop and integrate with mobile application. User's will use mobile application to command Arduino to run its process based on data given from digital thermometer. This system can be used by users at a certain distance while in the range of the System. So, users can still leave their laptops in a working condition and if their laptop is in overheat, they can easily set to turn on Smart Cooling Pad System manually or automatically with their phone.

1.2 Problem statement

Nowadays, many student and workers used laptop on their daily live. They usually used laptop to finish their work or assignment. Regular and rugged laptop uses can make it produce much heat and will heat up the whole system. The implementation of cooling pad will help to reduce the heat in the laptop. These cooling pad however have disadvantages and not efficient enough to be used to cool the laptop.

First, the current cooling pad is consuming to much electricity because of its continuous function. This cooling pad will continuously function even when the temperature of laptop decreasing. When the temperature of the laptop is decreasing, we need to manually unplug the cooling pad's switch to turn it off.

The second problem is the current cooling pad do not have temperature sensor. Temperature reader such as thermometer is very important to read the temperature level of the laptop. If user is not around and the cooling pad system in off mode when suddenly the temperature of the laptop increase, this will put the laptop in danger and at risk for damage.

1.3 Objective

The goal is to develop smart cooling pad system controlled by mobile application for android user to control the cooling system. To achieve the project goal, we need to fulfil the objective. The objectives are as follow:

i.   To study the process of existing cooling pad system.

ii.   To develop a prototype that use Arduino system and mobile applications.

iii.   To evaluate the prototype of cooling pad system.

1.4 Scope of project

The project's scopes:

User's scope:

    i.   The mobile applications running on Android for the end user, that involve only the user's phone

    ii.   This system has digital thermometer to detect heat produce by user's laptop.

System's scope:

    i.   This system provides Arduino that capture the laptop heat using heat sensor.

    ii.   This mobile application system able to receive the input from the Arduino.

    iii.   The smart cooling pad system able to receive a command from the mobile application to control the speed and to turn off or on the cooling pad system.

Development's scope:

    i.   This system implements Arduino system to receive a command the mobile application to control cooling pad system.

    ii.   This system is developed by using software such as ironic that connect with Arduino in the Smart Cooling Pad System.

1.5 Significant project

To make this project perfectly, there's an advantage on it. This study provides significant as following:

  i.   Users can control the process of the Smart Cooling Pad System via mobile application on android mobile phone.

 ii.   This mobile application able to receive the data input from the digital thermometer on Smart Cooling Pad System and send the command to the system to run its process.

iii.   This project able to act as a substitute to the existing cooling pad system because it used the mobile application to control the process of this system which are more faster and user friendly.

 iv.   Prevent laptop from overheat.

  v.   To save electricity.

1.6 Report organization

The project's thesis organization is listed as follows:

i.   Chapter 1

Explains about the introduction for Mobile Application for Smart Cooling System.

ii.   Chapter 2

Describes the literature about three existing system of cooling pad system.

iii.   Chapter 3

This will explain about methodologies, flow chart, context diagram, Gantt chart and case diagram used in this project.

iv.   Chapter 4

Explain the project constrain, conclusion and future work of the project.

LITERATURE REVIEW

2.1 Introduction

This chapter is discussing about existing cooling pad system that already been published and developed for public uses which are related to the development. The purpose of this chapter is to identify and analyse the concept of existing cooling pad system before the developing of the project. This chapter also explain on the analysis of three existing cooling pad system that can be easily obtained in hardware store.

2.2 Mobile Application

A mobile application was commonly referred as an application which is a type of application software designed to run on a mobile device such as a smartphone or tablet computer. Mobile applications frequently used to provide users with similar services to those accessed on computer. Applications are generally small and limited in function. This use of software has been popularized by Apple Inc and its App Store which sells thousands of applications for the iPhone, iPad and iPod Touch. A mobile application also may be known as an app, Web app, online app, iPhone app or smartphone app. This session will be explained on three different system to mobile applications development.

First, web applications. A website usually provides users with a lot more information than is practical to display in a mobile app. Web application however, do not need to be downloaded from app stores. Web applications load in browsers like Firefox or Chrome.

Second, Native mobile applications are the most common type of application that built for specific platforms and are written in programming languages such as Java for native Android applications and Swift and Objective-C for IOS applications. Native applications are more suitable for content creation due to performance and hardware

access (J. William, 2013, p.2). This application is also built using the specific Integrated Development Environment for the given operating. Most companies will invest in native mobile application development because of the various benefits offered in comparison to other types of applications.

Lastly, Hybrid applications behave like native applications and essentially a combination of a native application and a web application. Users can install it on their device like a native app, but it is actually a web app. These types of apps are built with HTML, JavaScript and CSS. The key difference is that hybrid applications are hosted inside a native application that utilizes a mobile platform's WebView (J. Bristowe, 2015) Hybrid application development can essentially do everything like HTML5, except it also incorporates native application features. This is possible when deploy a wrapper to act as a path between platforms to access the native features. A hybrid application consists of two parts. The first is the back-end code built using languages such as HTML, JavaScript and CSS. The second is a native shell that is using WebView.

Table 2.1 Comparison of Mobile Application Development

	Advantages	Disadvantages
Web Applications	- Easy to build application - Low cost option - Build one application such as IOS, Android and others. If it can run a browser	- Browser is needed to run. Users have to type in the URL of the app which amounts to a poor user experience - Slower than native apps - Less interactive and intuitive than native apps - No icon on mobile desktop as you would if it was downloaded from the app stores - Cannot leverage device utilities
Native Mobile Application	- Very fast and responsive because it was built for specific platform - have the best performance than others - They are distributed in application stores	- Difficult to learn which means you need experienced developers - More expensive - Not the best option for very simple applications

	• Native Applications are more intuitive, interactive and run much smoother for input and output • This application allows developers to access the full feature of the native system. • not require Internet connection. • To the user, the flow is more natural as they have standards for each platform	
Hybrid Mobile Applications	• Built on web technology CSS, HTML and JavaScript so it much easier to build • Cheaper than a native app • One app for all platforms using technology like Cordova	• Slower than native apps • Expensive than standard web apps because you have to work with the wrapper. • Less interactive than native apps • Customization will take you away from the hybrid

	• No browser needed to open this application. • Have access to the can access storage, device's internal APIs, camera and others. • Faster to develop than native apps because a single code base	model in which you may as well go native

Based on table 2.3 above, we can see that Hybrid is a good choice to develop mobile application. Hybrid used simple language such as HTML, CSS and JavaScript, so it is easier for us to build mobile application. Applications that developed using Hybrid can be used by all platform and no browser needed to run. Hybrid is faster to develop because it only uses single code base.

2.3 Review on Software

Software is one of the general terms of the program used to operate computers and other devices. It has all the information processed by computer, data and programs. Many software nowadays is written in high-level programming languages that more efficient and easier for developers to use it.

2.3.1 Android Studio

Android Studio is the software used to developed android application. This software uses java language to create mobile application. This software is available on many operating system including Linux and macOS. This software provides drag and drop functionality so that the mobile application can be easily designed and organize. Its features also provide developer an emulator to test the android application. This emulator also provides variety of device that user can use to build mobile application.

2.3.2 Android PhoneGap

Android PhoneGap uses web technology such as JavaScript, CSS and HTML for user to build mobile apps. This application supports the development for Android and IOS. There are many features that supported by this software such as quiet time, push notification and location. This feature can be used by the developer to enhance the user experience when they boot up the notification. These features allow the developer to send message to the user and this will bring convenience for both user and developer.

2.3.3 Ionic

Ionic is one of the software used for hybrid mobile application development. This software provides tools to build a hybrid mobile application using web technologies like CSS and HTML5. Mobile applications can be developed with these Web technologies and distributed through native app stores to be installed on devices by using Cordova. This software provides all the functionality which can be found in native mobile development. Users can build their own application and customize them for Android or iOS and deploy through Cordova.

2.4 Embedded System

An embedded system is a microprocessor-based system that is incorporated into a device to monitor and control the functions of the components of the device (M. Reddy, 2002). This system is embedded as a part of a complete device system that includes hardware such as electrical and mechanical components. The embedded system is engineered to manage a wide range of processing tasks. An embedded system is engineered to perform certain tasks only, optimize size, cost, power consumption, reliability and performance. Embedded systems are typically produced on broad scales and share functionalities across a variety of environments and applications.

Figure 2.1 Arduino Uno

Figure 2.1 show the Arduino Uno, it is a staple for the maker community. Arduinos come in many type of sizes and colours, but the Arduino Uno is chosen among another Arduino as an example of the prototypical Arduino. It has an easy to use development environment, an avid user base and is designed to be easy to interface all sorts of hardware.
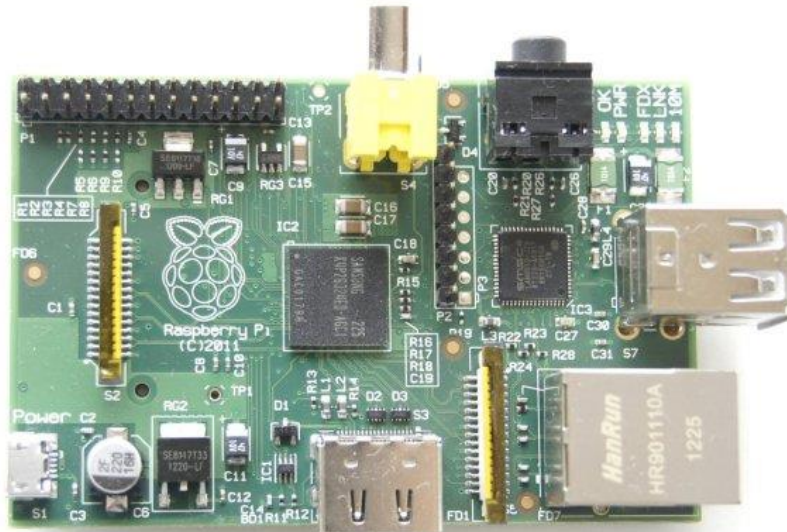
Figure 2.2 Raspberry Pi

Figure 2.2 show the Raspberry Pi system. This type of system is the newcomer to the game. It does not really an embedded computer. It is actually a very inexpensive for desktop computer. The Raspberry Pi is barebones, but at the price above RM 100 for a real computer, its worthy of note, and it is a great platform for lots of Maker projects.
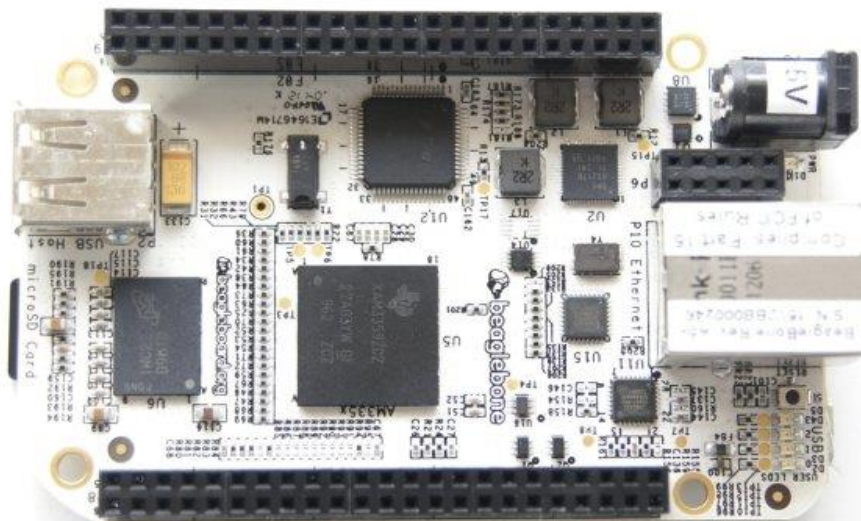
Figure 2.3 BeagleBone

Figure 2.3 show the BeagleBone system. The BeagleBone is the least known among of these platforms. But this system is incredibly capable board worthy of consideration for many projects. It is a powerful Linux computer that fits inside an Altoid's mint container.

Table 2.2 Comparison of Features for Arduino Uno, Raspberry Pi and Beagle Bone

Name	Arduino Uno	Raspberry Pi	BeagleBone
Price	RM 116	RM160	RM 365
Size	2.95"x2.10"	3.37"x2.125"	3.4"x2.1"
Processor	AT Mega 328	ARM11	ARM Cortex-A8
Clock speed	16MHz	700MHz	700MHz
RAM	2KB	256MB	256MB
Flash	32KB	(SD Card)	4GB(microSD)
Input Voltage	7-12v	5v	5v
Min Power	42mA(.3W)	700mA(3.5W)	170mA(.85W)
Analog Input	6 10-bit	N/A	7 12-bit
Digital GPIO	14	8	66

Based on the table 2.2 above shown the comparison between Arduino Uno, Raspberry Pi and Beagle Bone. The Arduino and Raspberry Pi are very cheap at under RM 200. The Beagle Bone comes in at nearly the cost of three Arduino Uno. Clock speed on the Arduino is about 40 times slower than the other two and it has less RAM. The Arduino and Raspberry Pi are cheaper, but Beagle Bone are much more powerful. For the clock speed similarities, the Beagle Bone ran about twice as fast as the Raspberry Pi. Arduino was a right choice because of its performance goes well, at least for a beginner. The reason for this is that the Raspberry Pi and Beagle Bone both run the Linux operating system. This software makes these systems into tiny computers which are capable of running multiple programs at the same time and being programmed in many different languages. The Arduino can run one program at a time and it programmed in low level C++. Its boards are easily interface with many effectors and sensors without and external circuitry, so developer doesn't need to know much about electronics if we are unexperienced about it.

2.5 Existing system

Unlike some other laptop accessories, selecting and buying a laptop cooler is not easy. We need to be aware of the factors that can heavily impact the performance of a laptop cooling pad. Some of these factors are critical like cooler size or fan speed because if your laptop is not compatible with these factors then the laptop cooling pad is simply useless.

Table 2.3 Comparison Three Existing System

Name	Zalman ZM-NC2000 Minimized Noise Cooler	Thermaltake Massive 14 Laptop Cooling Pad	Targus Space Saving Lap Chill Laptop Cooling Mat	Smart Cooling Pad System (Proposed)
Brand	Zalman	Thermaltake	Targus	Smart
No of Fan	2	2	1	2
Fan Speed	Adjustable	Adjustable	1 option	Adjustable
Fan RPM	1650 RPM	1200 RPM	2500 RPM	2000 RPM
Laptop size(inches)	Up to 17	Up to 17	Up to 17	Up to 17
Adjustable height	No	Yes	Yes	No
Heat sensor	No	No	No	Yes
Mobile Controller	No	No	No	Yes
Data Analyze	No	No	No	Yes

Based on table 2.3 above shows the comparison between three existing system which are Zalman ZM-NC2000 Minimized Noise Cooler, Thermaltake Massive 14 Laptop Cooling Pad and Targus Space Saving Lap Chill Laptop Cooling Mat. From the comparison, we can see that the proposed Smart Cooling Pad System was a right choice because of its features are more suitable for user to use it. It runs with two fan that help to cool down your laptop. The speed of the fan can be adjusted according to certain condition. This cooling pad system is power up to 2000 RPM and with this high RPM, the fan will move more air or remove more heat from the laptop or processor. However, Smart cooling pad system also provide a mobile controller app for user to controller the smart cooling pad system and this mobile application provide database for user to monitor laptop's temperature.

2.6 Summary

Based on the discussed three system which are Zalman ZM-NC2000 Minimized Noise Cooler, Thermaltake Massive 14 Laptop Cooling Pad and Targus Space Saving Lap Chill Laptop Cooling Mat. It shows that each of the system have benefits and drawbacks. The similarities of the function show that the system have core and must be implemented inside it. This chapter provide us chance to look at the existing system and study its beneficial information.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology is an analysis or the procedure of the principles in a specific field. To create the android application, we need a good software development. Many methods were considered on which of the method that have its own disadvantages and advantages that can be used to create this app. Since we will use many software to develop this system, we need to explain the details on this chapter. This chapter will explains more about the design of the system, which are shown by using the flowchart and the use case diagram. Gantt chart also provided to show the plan of developing the project.

3.2 Methodology

This section will describe the methodology that will be used to develop this system which is waterfall method. In waterfall method, the previous phase must be completed before the moving to the next phase. Five phases in waterfall method which are requirements, design, implementation, verification and maintenance. Figure 3.1 shows the five phases in waterfall method.
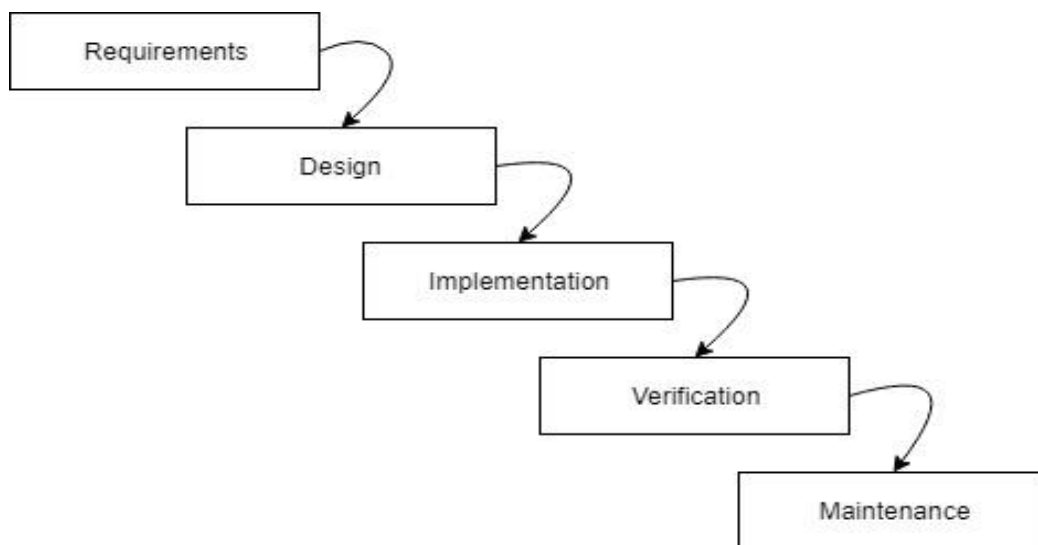

Figure 3.1 Waterfall model of System Developent Life Cycle

The reason why the waterfall model is chosen because this model is very simple to understand and use. In waterfall model phases do not overlap, each phase must be completed fully before the next phase can begin. This software development model is used for the small project and there is no uncertain requirements. At the end of each phase, we can determine if the project is on the right path or not to so that we can continue or discard the project. In this model software testing starts only after the development is complete.

3.2.1 Requirements

The first method is requirements which can reduce the time assign. The requirements and planning are also combining in similar phase. This is the phase where every discussion about requirements and the scope of the project take places which then resulted on who will generate the software and what software will be used. In this phase, developer will interview the clients on what is their requirements and how they wanted their system to function. To give some ideas on how the system operates, context diagram and use case diagram are provided. For the improvement from the current system is user able to control the smart cooling pad system by only using mobile application.

The figure 3.2, 3.3 and 3.4 below shows the questionnaire form for requirement of Smart Cooling Pad system that represent relationship between the system and the user. This questionnaire created based on the problem face by user when using existing cooling system.

QUESTIONNAIRE FORM

This question and answer form is aimed at completing guidelines for developing Smart Cooling Pad System

GUIDE TO ANSWER QUESTION FORM FOR USER

1. The purpose of this questionnaire is to obtain information on the requirements to develop Smart Cooling Pad System.
2. This questionnaire form is not a test and there is no wrong or correct answer and is not intended to test users.
3. Any information provided in this questionnaire form will be considered confidential and used for the purpose on developing the Smart Cooling Pad System only.
4. This questionnaire form only contains two page.
5. Please fill in all the information honestly and sincerely based on your actual view as the information provided is useful for developing the Smart Cooling Pad System.
6. Thank you for your cooperation.

Figure 3.2 shows the first page of questionnaire form for requirement

Questionnaire Form

Name   :   _Muhammad Danish Aniq Bin Roslan_

Age   :   _22_

Gender:

   ☑ Male

   ☐ Female

Are you?

   ☑ Student

   ☐ officer

   ☐ Others: _____

Type of laptop (Personal Computer): ___HP laptops___

How long have you been using the laptop? ___3 years___

Please tick (/) in the box provided to the given scale.

1	2	3	4
Unsatisfactory / Disagree	Satisfactory / Disagree	Good / Agree	Very Good / Strongly agree

Bil	Statement	1	2	3	4
1.	I have a problem with a laptop cooling system where the laptop temperature is often high			✓	
2.	I often browse the internet to find the information about the best cooling pad system			✓	
3.	The features of current cooling pad system do not fit my requirements			✓	
4.	The current cooling pad system is easily damaged				✓
5.	Current cooling pad system works very well		✓		
6.	I often browse the internet using my smartphone			✓	

Figure 3.3 shows the second page of questionnaire form for requirement

Requirement for you dream Cooling Pad System:

— Can control speed of the fan remotely using mobile application
— can control temperature and saves electricity
— control on and off using mobile application.

Comment:

— Upgrade from existing system

Thank you for completing this questionnaire.

your sincerely,

Client:

(muhammad Danish Aniq)

Developer:

(MUHAMMAD RIDOUAN)
BIN MOHTO JOHARI

Figure 3.4 shows the third page of questionnaire form for requirement

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3.2.2 Design

In design phase, clients can see the system and they can give their opinions for improvements. This method is to help clients get some ideas and can capture on how this system will work during the explanation, to make the clients understand, the use case diagram is provided. This phase is including in system design and will repeatedly carry until clients agree upon a prototype.

3.2.3 Implementation

The third phase is the process which is to execute the planning. The ideas of the software use to created the application are used in this phase. The implementation is the processes where the developer creates the actual system based on what was planned in the documentation. The implementation of the design are done in this third phase. The implementation is where the system is being developed from the beginning. The interface and code of the system add together ragarding with what was planned. All the error and problem that hinders the integrity of the code are fixed so that the system can run without problems.

3.2.4 Verification

The fourth process is verification. In this process, software and product is being tested and approved. This process is done so that the system can be releases to the public and able to function on what user needed. In this phase, the system is tested on a selected user ranging from different gender. Any errors and bugs occured during the testing are noted so that this problem can be fixed.

3.2.5 Maintenance

The last process for this method in System Development Life Cycle (SDLC) is maintenance. This phase is used to fix the problem after the product final release. This method is very important because it will continue to support the product when it is being release. This method very important because when the product is no longer functioning but at the same time the user still wants to continue using it and it is very helpfull to provide good customer service. The existing product also can be upgraded by developer so that its lifetime can be longer. In this project, the maintenance occur by collecting the feedback and report about any error that occur when use the Smart Cooling Pad System.

3.3 Proposed system

The project that are proposed for this project is Smart Cooling Pad System. This system is developed using Android OS and are using Android Studio to create mobile application to control and Arduino UNO to process instruction. Smart Cooling Pad System that can be used by users of Android smartphone. This project still implements the same version of the previous cooling pad, but a few special features are added into the system such as the digital thermometer to detect the temperature of the laptop and integrate with mobile application. User's will use mobile application to command Arduino to run its process based on data given from heat sensor. This system can be used by users at a certain distance while in the range of the System. So, users can still leave their laptops in a working condition and if their laptop is in overheat, they can easily set to turn on Smart Cooling Pad System manually or automatically with their phone.

3.3.1 Flowchart

Flowchart is used to show the process of the system. It is viewed by various shape such as parallelogram and square to present a system. It is also help to visualise process that are done in a system. The process of this system is divided into two part which are the flow of mobile application and the system.

The figure 3.5 below shows the flowchart of Smart Cooling Pad system that represent the flow of the system.
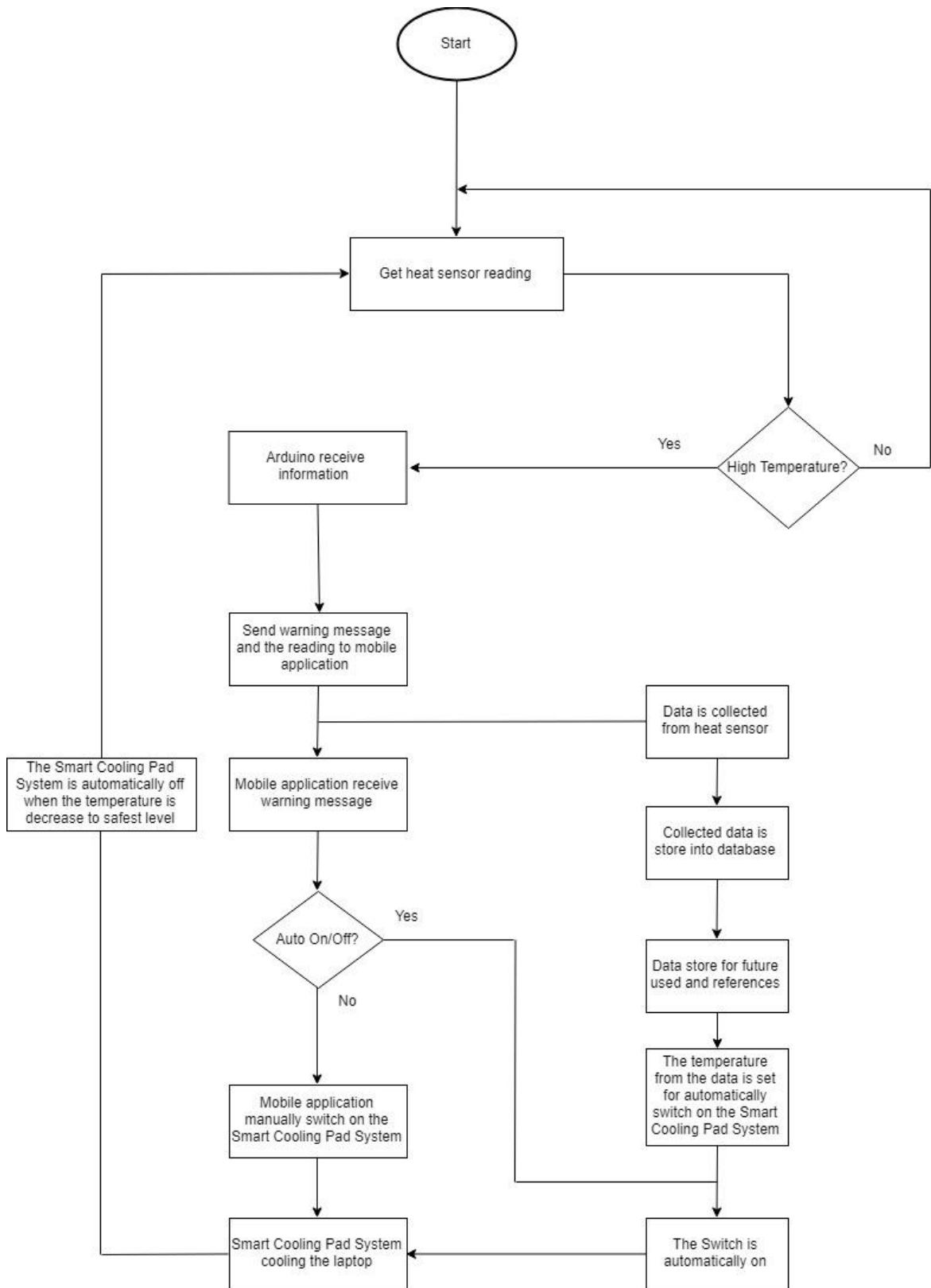
Figure 3.5 the flowchart of Smart Cooling Pad System

3.3.2 Work Breakdown Structure (WBS)

Figure 3.6 shows the work breakdown structure of Smart Cooling Pad system that represent System Development Life Cycle (SDLC).
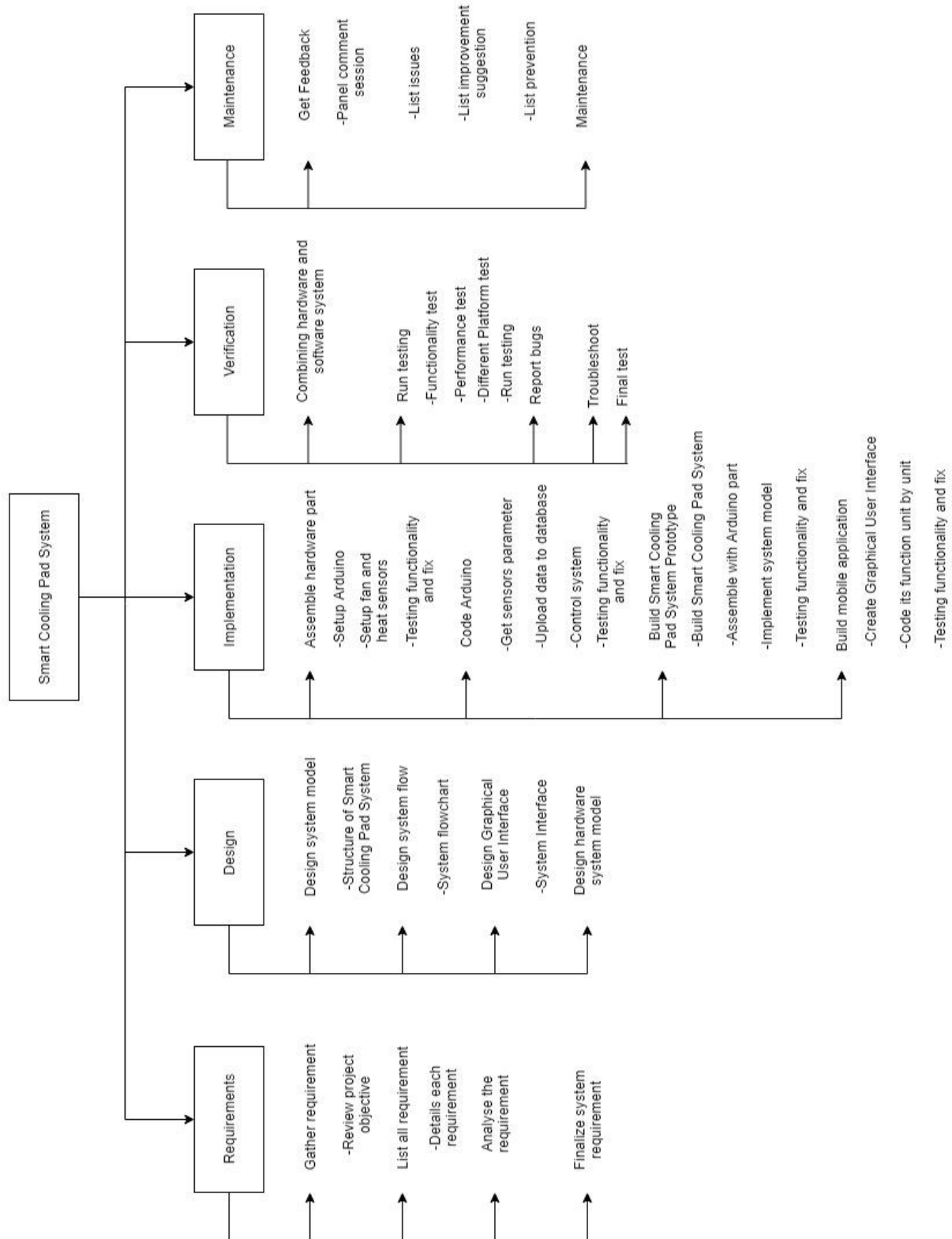

Figure 3.6 WBSof Smart Cooling Pad System

3.3.3 Use Case and Context Diagram

The figure 3.7 show the use case diagram of Smart Cooling Pad system that represent the system, user and Arduino system.
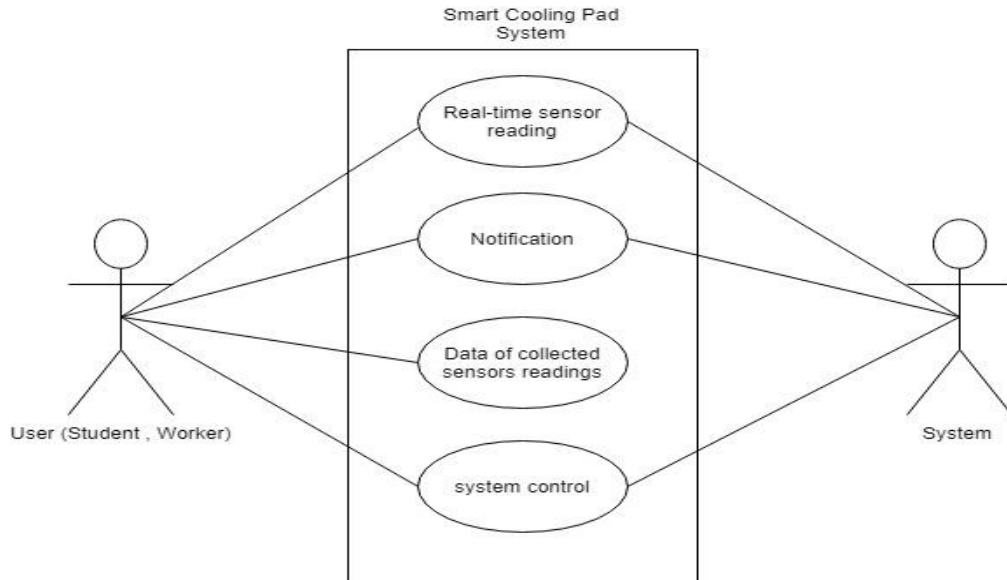

Figure 3.7 Use Case diagram for Smart Cooling Pad System

Figure 3.8 show the context diagram of Smart Cooling Pad system which describe the relationship of the entities and this system.
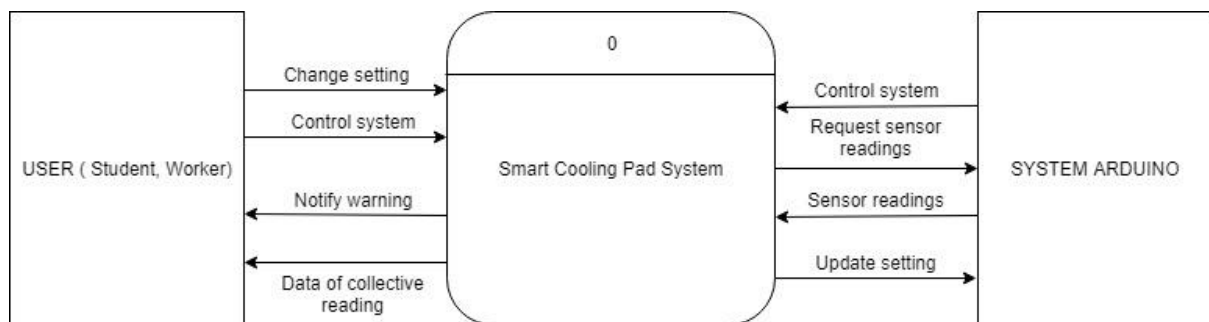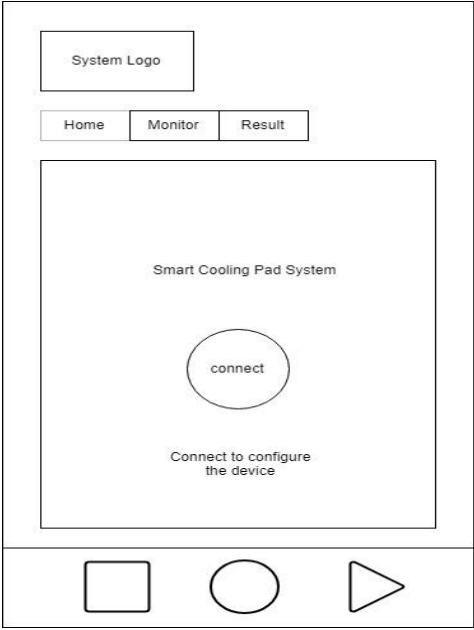

Figure 3.8 Context diagram for Smart Cooling Pad System

3.3.4 Storyboards

Table 3.1 show storyboards of the mobile applications for this system.

Storyboard	Description
Page 1 System Logo Home Monitor Result Smart Cooling Pad System connect Connect to configure the device	Title: Homepage Link from: None Link to: Page 2,3 Screen descriptions: 1. The main page of the mobile application. 2. The user (Student, worker) need to connect between mobile application and Smart Cooling Pad System to configure the device.
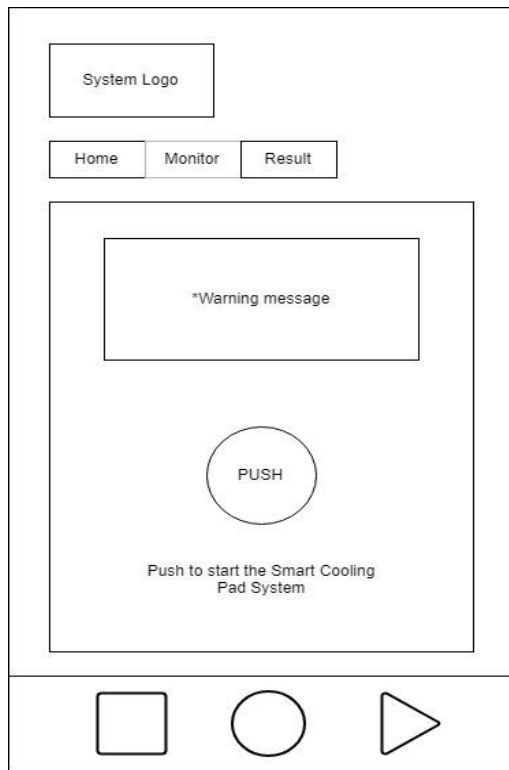
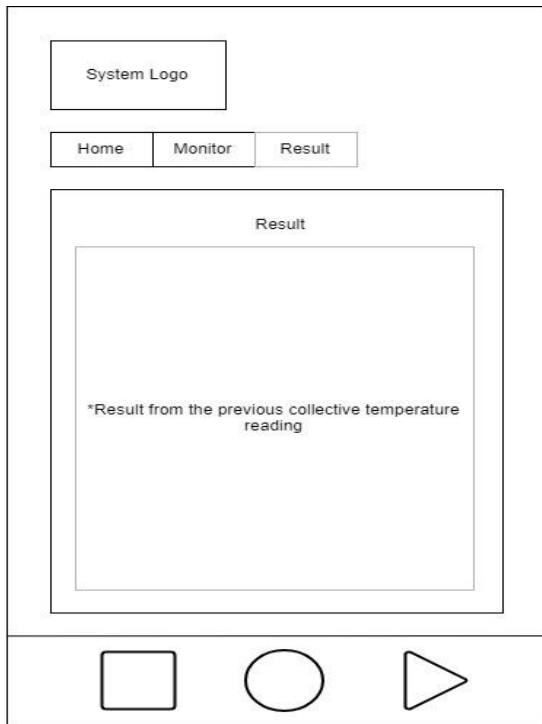| **Page 2**	Title: monitor
System Logo Home Monitor Result *Warning message PUSH Push to start the Smart Cooling Pad System	Link from: Page 1,3 Link to: Page 1,3 Screen descriptions: 1. The user (Student, worker) able to receive the warning message from the Smart Cooling Pad System. User also able to control the push button to switch on the Smart Cooling Pad System 2. The user (Student, worker) able to monitor the status of the Smart Cooling Pad System.

Page 3	Screen title: Result
System Logo	
Home Monitor Result	Link from: Page 1,2
Result	Link to: Page 1,2
	Screen descriptions:
*Result from the previous collective temperature reading	
	1. The user (Student, worker) can monitor graph of collected temperature from the Smart Cooling Pad System for future actions purpose.

3.3.5 Software and Hardware used

This section shows the specification of software and hardware that be used in developing this system will be explained. The hardware used in this project is in Table 3.1. Software that will be used are stated in Table 3.2.

Table 3.2 List of Hardware Devices

| Hardware	Minimum requirement	Purpose
Notebook ASUS X555LF	**CPU:** Intel(R) Core(M) i5-5200U CPU **OS**: Windows XP **Video Card:** NVIDIA GeForce 930M	To perform the documentation, coding and designing the system model.
Arduino Mega	**Voltage:** 5V **CPU:** Intel(R) Core(M) i5-5200U CPU **OS**: Windows 10 (64-bit versions only) **Notebook Video Card:** NVIDIA GeForce 930M	To handle and process the input and output from various sensors and hardware.

Temperature sensor DHT11	**Voltage:** 3.3Volt **Operating:** Below 20mA **Microcontroller:** Arduino Mega	To read the temperature of the laptop.
ESP8266 Remote Serial Port WIFI Transceiver Wireless Module.	**Voltage:** 3.3V or 5V **Microcontroller:** Arduino Mega	To connect the Arduino to internet through WIFI connection.
Cooling Fan 1800PRM	**Direct Current:** 12V **Microcontroller:** Arduino Mega	To lower temperature of the laptop.
Smartphone Honor 7x	**Ram:** 4GB **Rom:** 64GB	To run the mobile application for Smart Cooling Pad System.

Table 3.3 List of Software Use for Developing and Documentation

Software	Minimum requirement	Purpose
Arduino IDE	**OS:** Windows 10 version 14393.0 or higher	To code the Arduino Uno based on the system requirement.
ESP8266 Libraries	Arduino IDE	To initiate the WIFI in Arduino.
Notepad++	**OS:** Win2003, Win2000, Win7 x64, Win XP, Win Vista, Win7 x32, Win8 x32, Win8 x64, Win10 x32, Win10 x64, Windows 8, Windows 10	To code HTML, PHP, JavaScript and Bootstrap for the system.
Google Chart JavaScript library	Source code.	To view collected data.
Android Studio	**OS:** Version 1.3.3	Build mobile apps using JavaScript and XML.

3.4 Gantt Chart

The Gantt chart for Smart Cooling Pad System show the activities and progress that finish on time. Figure 3.9 shows the progress for Smart Cooling Pad System according to the deadline.
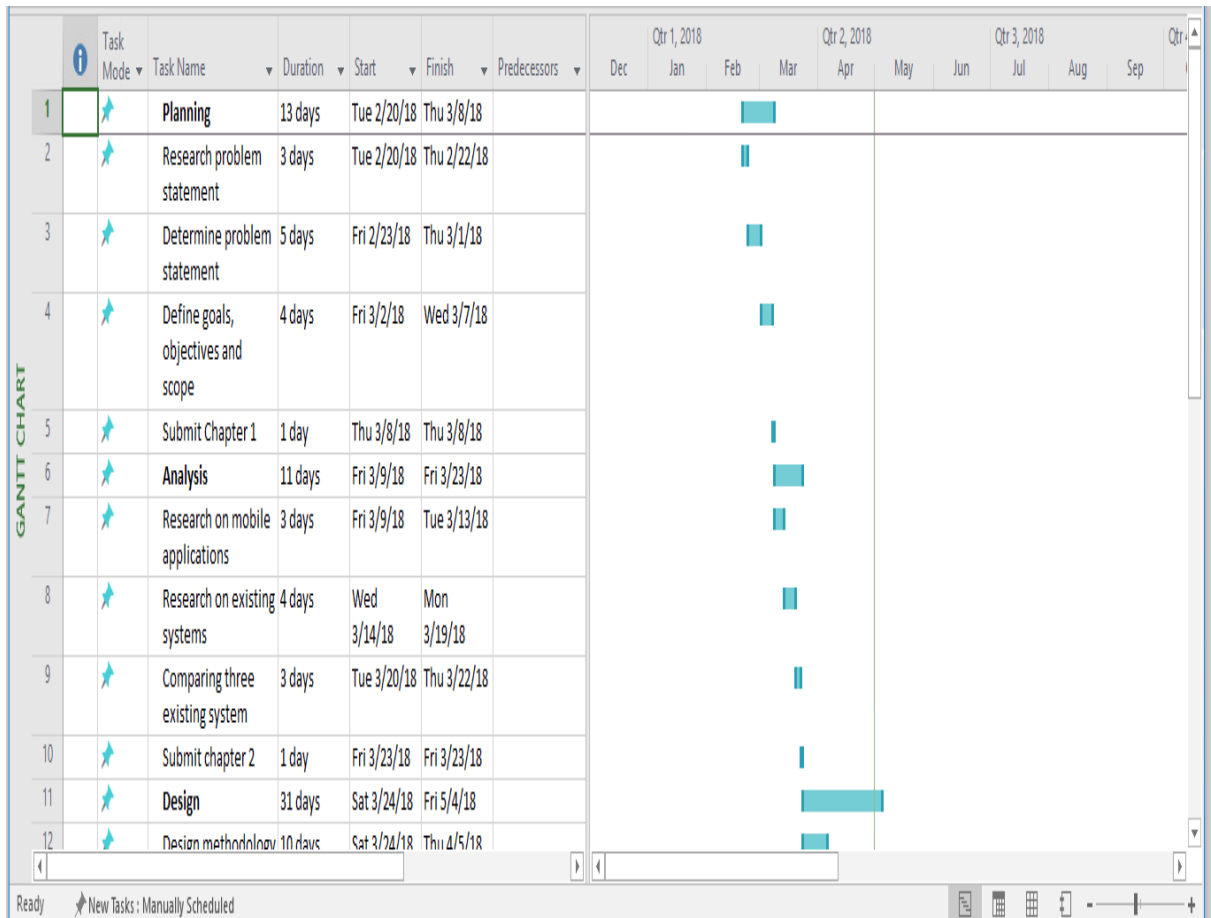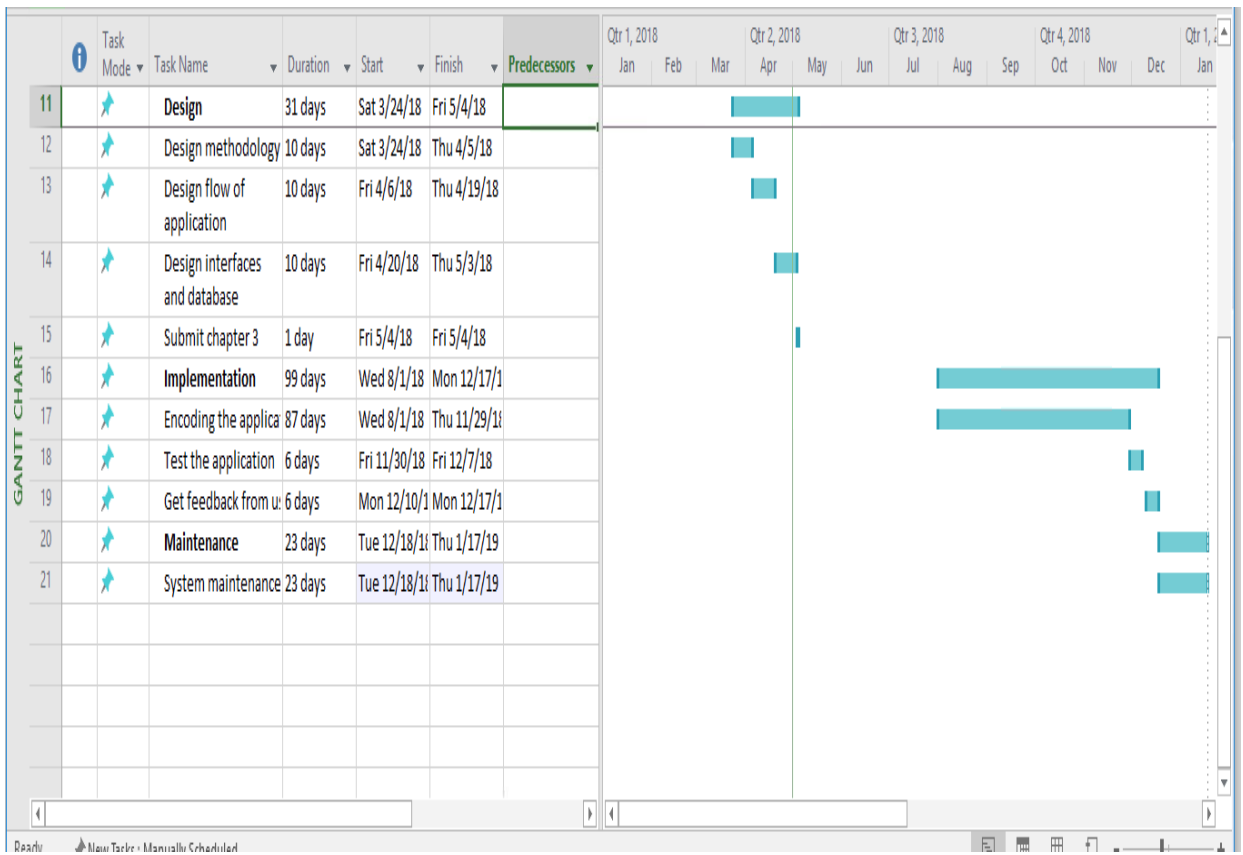
Figure 3.9 Gantt chartt of Smart Cooling Pad System

3.5 Conclusion

For the conclusion, this methodology used to explained thorougly by section of the chapter. Interaction and connection between different entities also showed in this chapter by viewed as context diagram and use case diagram. The flowchart is used to show the flow of the Smart Cooling Pad System to know on how the system will work. Lastly, the listed of software and hardware is showed for the documentation.

CHAPTER 4

RESULT AND DISCUSSION

4.1   Introduction

This chapter will describe about the implementation and development of the system that have been used in this system. The purpose of this chapter is to know on all the system's functionality by each of the phase that have been planned about in the methodology, structures and designs for any additional improvement in the future.

4.2   System Implementation

This will explain about how the implementation is done and at the end it will conclude the overall process.

4.2.1   Hardware Part

This section shows the uses of the hardware part into the system. To setup the hardware part, we need to make sure you have all the items required. Figure 4.1 show the Smart Cooling pads System Circuit implemented on Arduino.
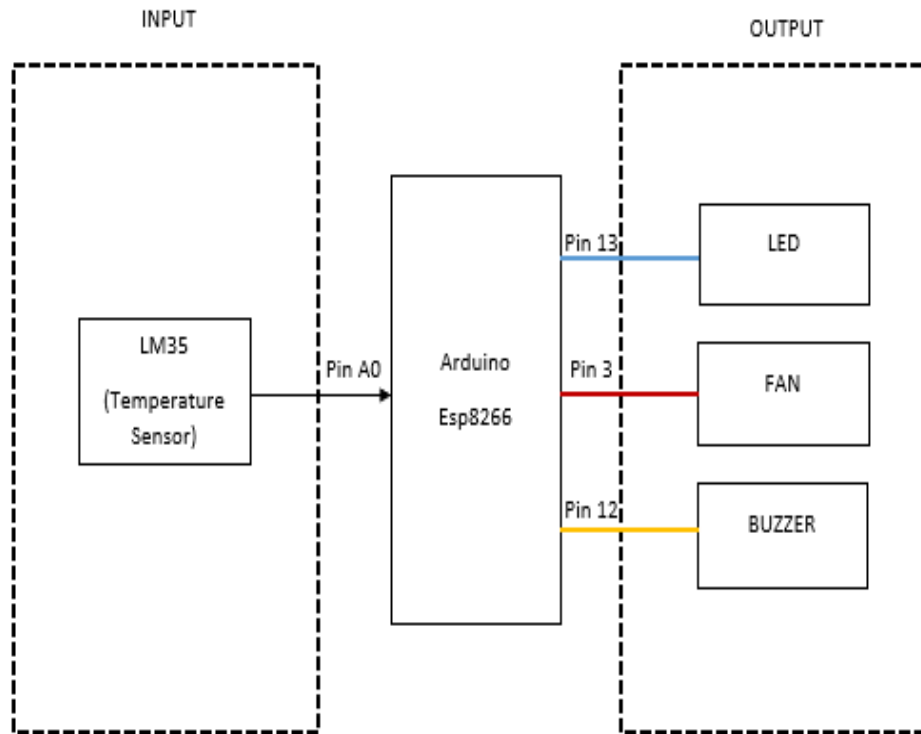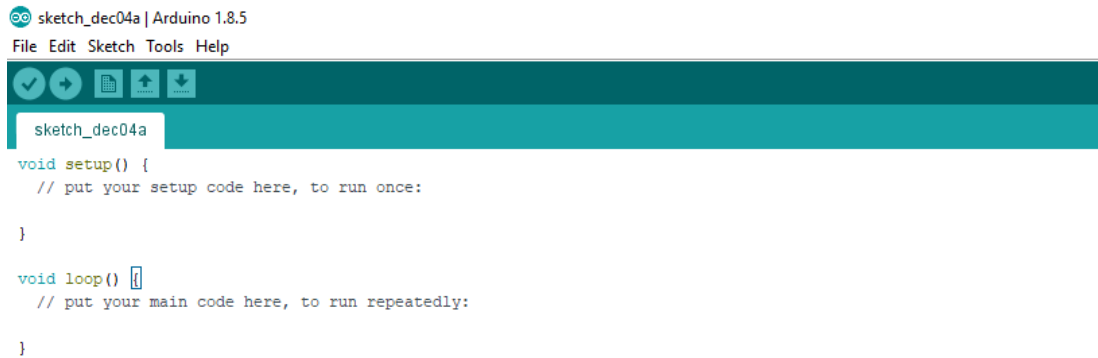
Figure 4.1 Smart Cooling Pad System Circuit

4.2.1.1 Create New Sketch in Arduino IDE

Arduino IDE is the software be used to coded. Figure 4.2 show the new sketch of Arduino IDE.

Figure 4.2 Arduino IDE new sketch

Arduino IDE consist of 2 functionality which are void setup () which the code inside this function will run once and void loop () which the code inside this function will be loop.

4.2.1.2 Setup ESP8266 Board in Arduino IDE

The ESP8266 board need to be installed manually into Arduino IDE. This is the step on how to install ESP8266 board compiler into Arduino IDE. Copy this URL http://arduino.esp8266.com/stable/package_esp8266com_index.json and change preferences URL on File > Preferences. Figure 4.3 and 4.4 shows the preferences tab that uses to install the ESP8266 board.
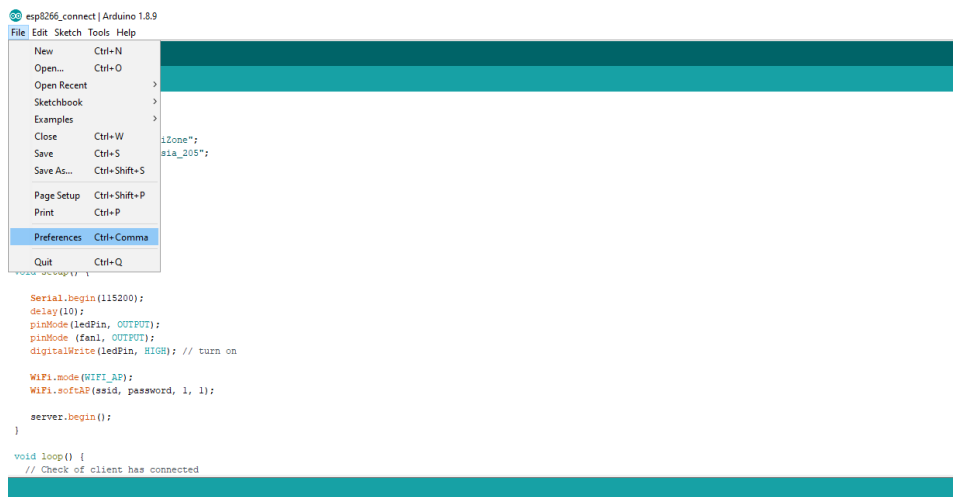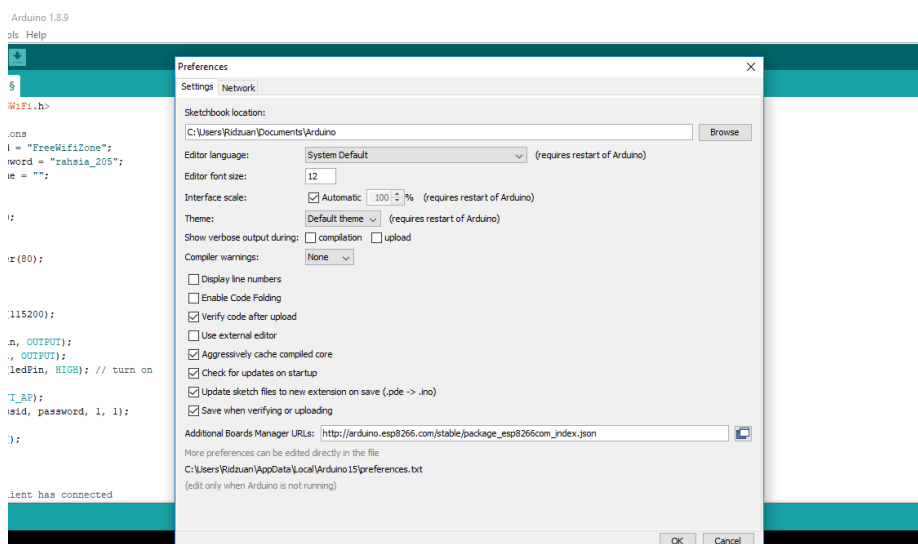

Figure 4.3 Preferences selection

Figure 4.4 Preferences tab

After that, download ESP8266 board data from ESP8266 community. Select ESP8266 on the board manager. Figures 4.5 and 4.6 shows how to install the ESP8266 board into Arduino IDE.
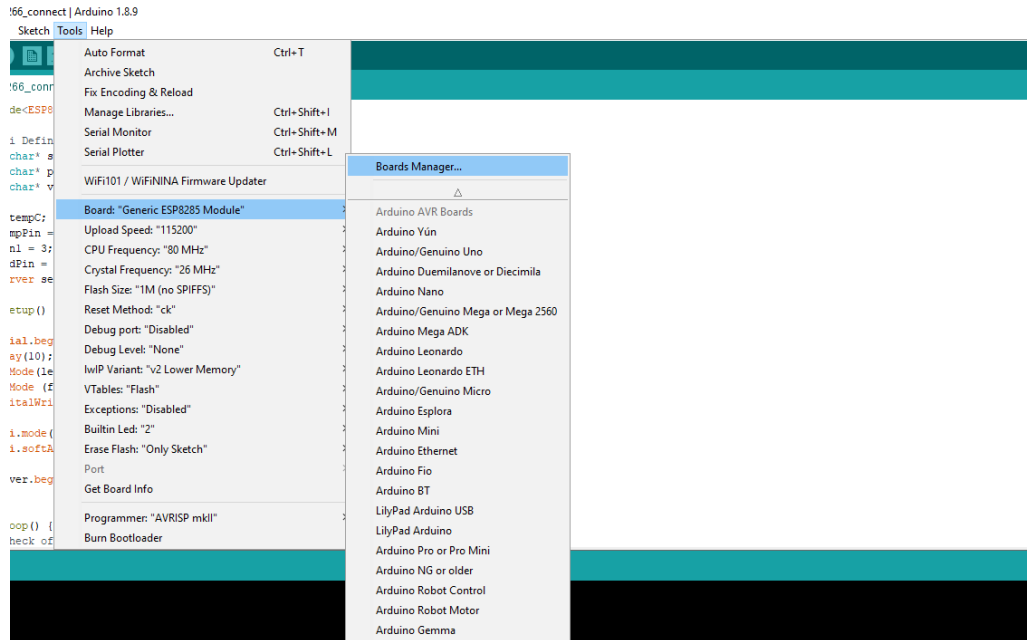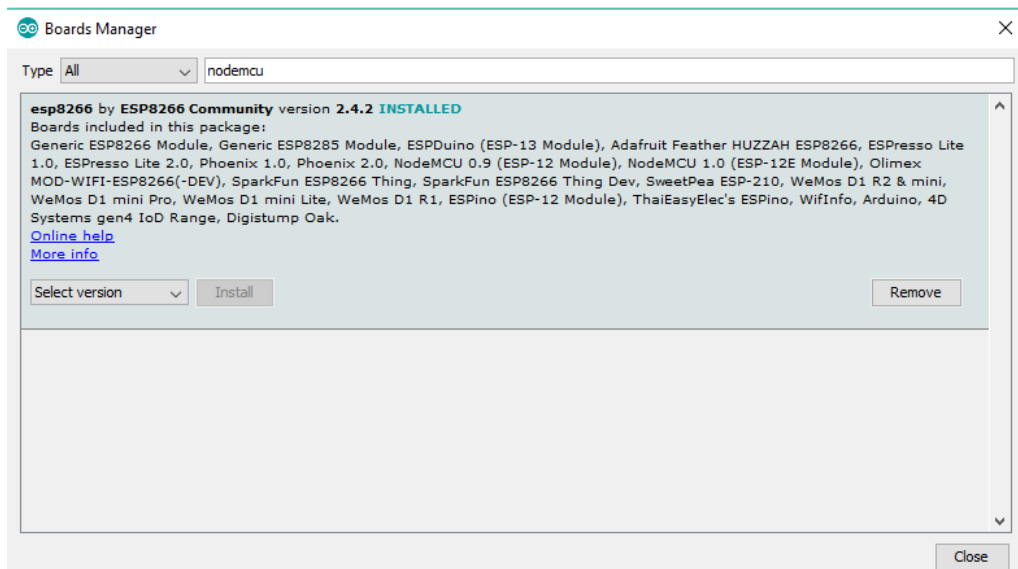

Figure 4.5 Board manager selection

Figure 4.6 ESP8266 Package downloader

4.2.1.3 Declare Input

To begin the coding, the inputs need to be declared in the sketch. This system uses only 1 inputs of sensors which are temperature sensor (LM35 Temperature Sensor). Figure 4.7 show the declaration of sensor.

const int tempPin=A0;

Figure 4.7 Declare input

4.2.1.4 Declare Output

This section will show how to declare the output of the system in Arduino IDE. This system consists of 3 outputs device which are LED, fan and buzzer. Figure 4.8 show the declaration of output.

pinMode(ledPin,OUTPUT);

pinMode(fan,OUTPUT);

pinMode(buzzer,OUTPUT);

Figure 4.8 Declare output

After that, all the pin should be initialized in setup function. The state of the output should be on OFF state which written as high. It is because the low type which low mean OFF while high mean ON. The example of code:

digitalWrite(fan,HIGH);

digitalWrite(ledPin,HIGH);

digitalWrite(buzzer,HIGH);

Figure 4.9 Declare OFF pin

The state of the output on the three output will keep changing base on the inputs data from the temperature sensors. Those changing process happen in loop functions.

4.2.1.5   Automatic Function

This section is where to write all the process of the outputs and inputs. The coded need to be written in loop function to enable the system to run automatically. Figure 4.10 show the code of automation function:

```
IF temperatureReadings > 35°C

fan (ON)

 ledPin(ON)

 buzzer(ON)

END IF

ELSE IF temperatureReadings < 35°C

fan (OFF)

 ledPin(OFF)

 buzzer(OFF)

END IF
```

Figure 4.10 Automation function

4.2.1.6 File Transfer Protocol

This project uses ESP8266 to transfer the data to server then the data can be visualizing on Mobile Application. The library used in this process to ensure that data can be sync with the server. Declaration of library should be written as in the figure 4.11.

```
#include<ESP8266WiFi.h>

// WiFi Definitions

const char* ssid = "";

const char* password = "";

const char* value = "";
```

Figure 4.11 code of file transfer protocol

4.2.2 Database

This section will discuss on the database. The system uses MSSQL database to save the data that be managed using MSSQL Webserver. The database is used to store the data of sensors reading, user and actuator state. The database of the system consists of 3 tables. Table 4.1, 4.2 and 4.3 shows the list of tables in the system database.

Table 4.1 Sensor Table

Field	Description	Data Type	Constrain
ID	Temperature's reading id number	INT (20)	PK
TEMPERATURE	Temperature readings	INT (20)	

Table 4.2 Users Table

Field	Description	Data Type	Constrain
EMAIL	Users email	VARCHAR (20)	PK
PASSWORD	Users password	VARCHAR (10)	

Table 4.3 State Table

Field	Description	Data Type	Constrain
ID	State of actuator id number	INT (3)	PK
LED	LED state	INT (1)	
BUZZER	Buzzer state	INT (1)	
FAN	Fan state	INT (1)	

4.2.3   Mobile Application

The Mobile application was developed to control the Arduino. It is friendly user and it is used MSSQL database that will manage using SQL Webserver interface.

4.2.3.1 Login Page

Log in page of the mobile application applications. The user needs to login, so they can get access of this mobile application. This system can be login by all user.
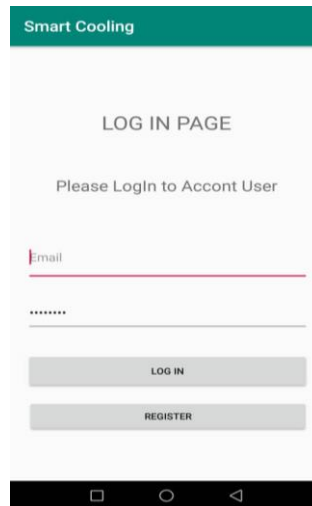

Figure 4.12 Log in Page

4.2.3.2 Register Page

This is the second page of the mobile application applications. The user needs to register to the system, so they can get access of this mobile application.
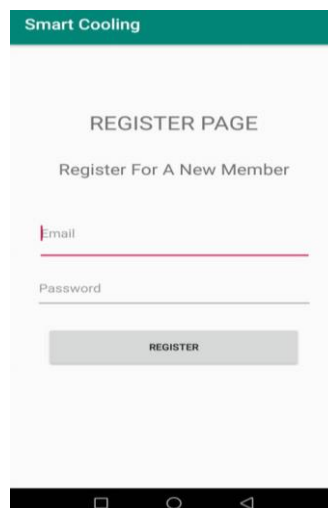

Figure 4.13 Register Page

4.2.3.3   Main Page

The main page of the mobile applications consists of three button and shows the
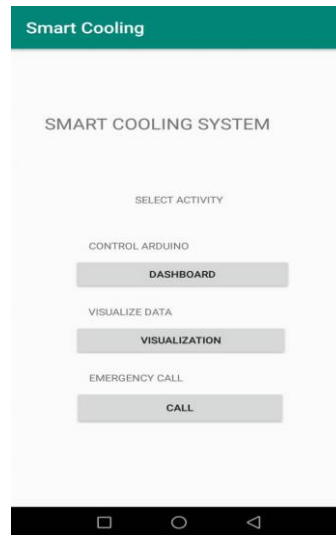information of the system. Figure below shows the main page of the system.

Figure 4.14 Main Page

4.2.3.4   Visualization Page

User can visualize the reading of the temperature sensors in Cooling System
through visualization page.

Figure 4.15 Visualization Page

4.2.3.5 Dashboard Page

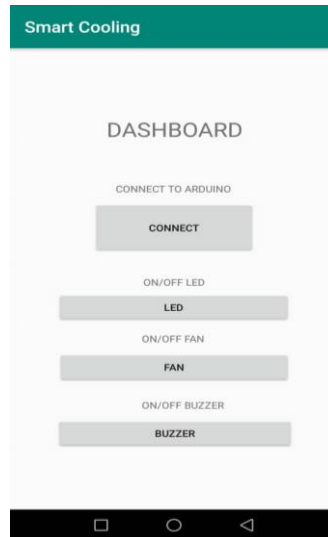Here is where the user able to control all the activity in Smart Cooling pads System.

Figure 4.16 Dashboard Page

4.2.3.6 Emergency Call Page

This page is used for user to call the emergency number regarding the Smart Cooling Pads System.
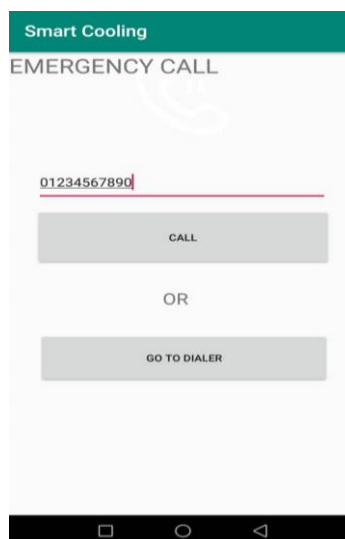

Figure 4.17 Emergency Call Page

4.3   Testing and Result

User Accepted Test (UAT) is the process to collect the information from the user on how the system work. Many criteria that need to be followed by users and this UAT will be test by the tester based on the UAT form given. The tester must follow the instruction given in the form. The UAT form was shown on APPENDIX A

CHAPTER 5

CONCLUSIONS

In chapter one, the topic is covered many important things in the beginning of the project implementation. The chapter covered is about the main purpose of the project, objectives, problem statement, thesis statement and scope. In the background project, the explanation of the important thing about the cooling system on how the flow of the system can be contribute in the technology. The other things are the concept of the system roughly explained on the introduction. In problem statement, all discussion is based on the current problem faced by the laptop user when they use their laptop. Users nowadays really like to download the big size of file such as games and software. During this period, the laptop needs always in awaken state and this will make the laptop produce more heat. Scope of the project is discussed to find limitation of this system based on system scope, development scope and user scope. Lastly, report organization is discussed the topic on every chapter

In chapter two, the discussions are based on review of the existing system that related with the project system. The system are Zalman ZM-NC2000 Minimized Noise Cooler, Thermaltake Massive 14 Laptop Cooling Pad and Targus Space Saving Lap Chill Laptop Cooling Mat. Those system were compared base on software and hardware uses, technology applied on the system. The purpose of each system is identified which can be a guideline to develop the project. To make sure that this system is the best, we need to compare the advantages and disadvantages of those system. Discussion on the android application development software which can be used to build the system. The software includes Adobe PhoneGap, Ionic and Android Studio. This software is then compared to see which are suited to develop a better and more efficient Android Application.

Chapter three discusses on development of this project. The waterfall model is discussed with each of the process are explain in detail. This chapter also show the flowchart which is used to build the process of the project. Context diagram and use case

are used to give better view about project. Software and hardware are listed on this chapter and Gantt chart is used to provide the timeline of the project.

Chapter 4 are about the discussions and the result of the system. The discussions are based on how to start the web application, setup the hardware, the transferring file protocol used and database details. The implementation of the system on how to build the system also be discussed carefully in two parts which are the hardware part and the Android application part. At the end, all of the discussion will be continued with system discussion on the results and testing.

5.1   Project Constraints

The drawback of the system are due to the lack of time, budget and resource. The constraints are list as below:

i.   Significant delay in data transfer between hardware to server due to process latency and hardware constraint.

ii.   Manual mode works if the system is online.

5.2   Future Works

Some future planning for this system list as below:

i.   Collect data of temperature decrease base on time and show it on real-time readings page.

ii.   The data and the Arduino can be viewed and controlled on web application.

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APPENDIX A

No	Test Case	Yes	No	Remarks
1	Log in Page • Insert Email • Insert Password • Button Log in • Button Register	✓		
2	Register Page • Insert Email • Insert Password • Button Register	✓		
3	Main Page • Button Dashboard • Button Visualization • Button Call	✓		
4	Dashboard Page • Button Connect WIFI • Button ON and OFF LED • Button ON and OFF Fan • Button ON and OFF Buzzer	✓		
5	Visualization Page • Temperature Reading • Button Dashboard	✓		
6	Call Page • Insert Phone Number • Button Call • Button Dialer	✓		

ID: CB 15026   SIGNATURE:

No	Test Case	Yes	No	Remarks
1	Log in Page • Insert Email • Insert Password • Button Log in • Button Register	✓		
2	Register Page • Insert Email • Insert Password • Button Register	✓		
3	Main Page • Button Dashboard • Button Visualization • Button Call	✓		
4	Dashboard Page • Button Connect WIFI • Button ON and OFF LED • Button ON and OFF Fan • Button ON and OFF Buzzer	✓		
5	Visualization Page • Temperature Reading • Button Dashboard	✓		
6	Call Page • Insert Phone Number • Button Call • Button Dialer	✓		

ID: KA 15042   SIGNATURE: