MEDCARE REMINDER SYSTEM

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MEDCARE REMINDER SYSTEM

MIRA AZRINA BINTI SHUKOR @ ABDUL SHUKOR

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Bachelor of Computer Science

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I hereby declare that I have checked the thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer Systems & Networking)

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DEDICATION

To my dearest self

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Last and most important, a special thanks to my beloved parents for their ever-lasting understanding, love and financial support. Especially for bringing me into this world and make myself capable of doing the unthinkable.

ABSTRAK

Ubat adalah penting dan berfaedah kepada kita jika kita benar-benar tahu bagaimana dan bila untuk mengambilnya. Terutamanya jika kita menghidap penyakit kronik seperti tekanan darah tinggi, penyakit jantung dan kencing manis. Sistem Peringatan Medcare adalah satu sistem yang memberitahu dan mengingatkan pesakit mengenai jadual mereka berdasarkan preskripsi pil yang diberikan. Selain daripada itu, ia adalah untuk menguji fungsi dan keberkesanan sistem yang dicadangkan ke atas pengguna yang dipilih. Masalah pematuhan pada preskripsi ubat timbul dalam kalangan warga emas kerana mereka mengalami kesukaran untuk mengingat. Medcare adalah cara untuk diri sendiri memantau kesihatan mereka agar menjadi lebih baik. Dalam memastikan projek ini berjaya, metodologi Pembangunan Aplikasi Rapid (RAD) lebih sesuai kerana fokusnya adalah ke arah keperluan pengguna, kepuasan dan prototaip. RAD adalah satu kaedah yang pantas dalam meningkatkan prestasi sistem dan memaksimumkan pengalaman pengguna. Berdasarkan projek ini, ia boleh membantu untuk meningkatkan kadar pematuhan terhadap jadual preskripsi ubat dan dengan itu membawa kepada tubuh yang lebih sihat. Pengguna juga boleh mengelakkan diri mereka daripada kesan sampingan yang serius disebabkan pengambilan ubat yang tidak betul dengan bantuan Sistem Peringatan Medcare.

ABSTRACT

Medicine is important and beneficial to us if we really know how and when to consume them. Especially if we are suffer with chronic diseases such as, high blood pressure, heart disease and diabetes. MedCare Reminder System is a system that notifies and reminds patient about their pill consumption based on their given prescription. Other than that, it is to test the functionality and effectiveness of the proposed system on selected user. Medical adherence problem arises among the elderly people because they have difficulty in remembering. MedCare is a way for themselves to monitor their health better. In making this project a success, Rapid Application Development (RAD) methodology is preferred because of its focus are towards user requirements, satisfaction and prototyping. RAD is a method that rapidly enhances the system performance and maximize user experience. Based on this project, it could help to extend the medical adherence and thus leading to more healthy people. User can also prevent themselves from serious side effects due to improper medication consumption with the help of MedCare Reminder.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Health is important to everyone and it is the greatest gift that we could ever asked for. Healthy is when our body and immune system are not harm by any disease. People with high cholesterol, epilepsy, high blood pressure are usually the ones whom are tied with medicine prescription.

What is medicine? Medicine is a drug that help cures and prevents one's disease. Based on a research by Australian Prescriber, it states that 80% of people misses their dose of medication regularly [1]. Later, some of the patient will consume twice level of dosage prescribed which can harm their body.

Australian Prescriber also states that, according to their studies, younger adults are likely to remember to take medication when they are busy and this happens the other way around to older adults. Older adults tend to remember their medication when they are less busy.

Older people are the ones whom likely to consume several medicine and it had made medications harder for them. This will result in memory impairment and thus leads to non-adherence. Nowadays, pill dispenser have a new way of combining both pill storage and reminder in one suitable system.

1.2 Problem Statement

Patients especially among the elders have difficulties when it comes to medical adherence, this results on one's health and could waste more costs and time. Some of the current reminder system uses a wireless communication that requires the presence of Internet. This propose system will help more in mobility so that no matter where the person is, they will always be reminded about their prescription.

1.3 Objectives

The following are the objectives of the project:

- To develop a mobile application systems that sends notification to patient whom regularly have to consume medicine.
- To develop a system that allows patient to set their time of prescription (MedCare).
- To locate medicine bottle in Bluetooth range when time arrived

1.4 Scope of Project

This mobile application focuses people aged 47-65 years old that regularly have to consume medicine. The system involves the use of mobile phone, LED light, Arduino and Bluetooth as the hardware required to help connecting with one another, while an application development software are needed to develop the application that allows connection with the hardware.

1.5 Thesis Organization

This thesis consists of 5 chapters. The first chapter, is the introduction, where the scopes, objectives and problem statement of the project are being discussed. Next, Chapter 2 is the literature review. This chapter compares the project with three other existing systems which have similar objectives. Chapter 3 will be the methodology, which discusses the methods use in delivering this project while Chapter 4 explains the implementation of the project. The last Chapter is the conclusion, where the statement of problem, objectives have been solved and achieved.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter, discusses the existing systems that have similar technologies with the propose system (MedCare). The three selected systems (uBox by Abiogenix, GlowCaps by Vitality and Medminder Jon by Medminder) are examined and compared on whether they have the success features based on previous works recommendations . Further discussion is made on several development methodologies and theoretical part of the existing systems. Tools associated with the development of the systems are also discussed to provide a better perspective on choosing the right tools to be used in the development of the proposed system.

2.2 Existing Systems

The following are three current systems being reviewed which will provide a better understanding on the requirements of the system

2.2.1 uBox by Abiogenix

uBox is a medical tool by Abiogenix, created by Sara Cinnamon and Goutam Reddy. It was created in 2007 and originally used to treat Tuberculosis in India (Figure 2.1).

Figure 2.1 Different colours of uBox by Abiogenix

Features

Based on Figure 2.1, uBox is a round pillbox, that have a spinning mechanism and connected to an app that include schedules of prescription and able to notify family members if missed dose. Besides that, it includes a locking mechanism that helps to prevent from children getting pills. The battery life is up to 5 days and only took 2 hours for full charge. They use the technology of Li-ion battery. Have 14 compartments [2] with each compartment can be filled up to 15 pills each. The materials used are FDA-approved plastic, ROHS-compliant electronics and its net weight are less than 400g. [3].

Figure 2.2 shows the interface of uBox application. The application are compatible with Apple Devices with iOS 8.3 and above. For Android, the application is compatible with OS 4.1.2 and above. [3] The application can include family member that concerns with patient's healthcare for results and schedule. [4]

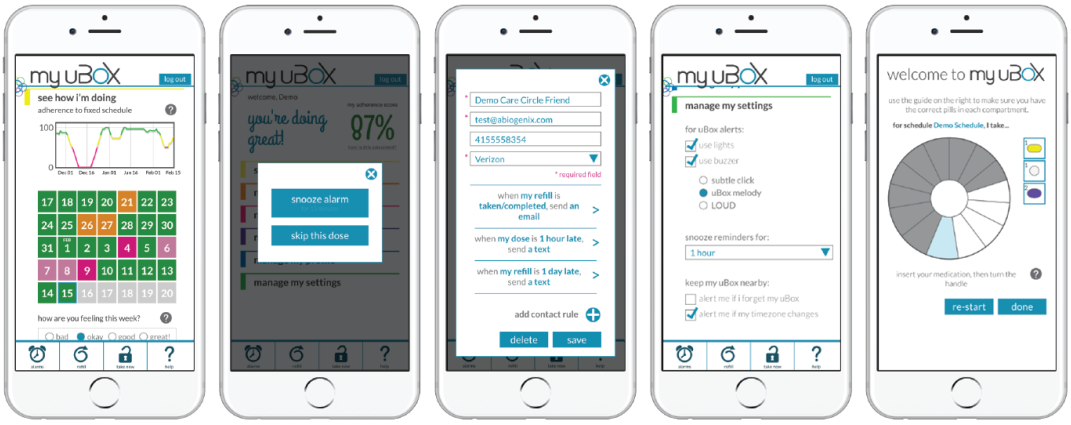


Figure 2.2 Interface of uBox application on iPhone

Advantages

uBox has a locking mechanism which prevents from harming children.

Disadvantages

The process of refill may took some time because it is quite difficult.

2.2.2 GlowCaps by Vitality

As uBox, GlowCaps by Vitality has similar objectives, that is to help patient's medical adherence (Figure 2.3).

Figure 2.3 GlowCaps bottle and plugin reminder

Features

GlowCaps require Internet connection and it uses Wi-Fi. The range of wireless are from 30-40 feet [5]. The GlowCaps are connected through AT&T network but does not require one to activate any network plan. GlowCaps bottle will light up and produces sound notification, the plugin reminder will also lights up in case if we are far from the bottle. This reminder will continue up to one hour, and if the cap of the bottle still have not been removed, it will continue blinking and sends out sound notification for another 6o minutes. If still there is no changes, the blinking will stop, the system will send alert to GlowCaps centre and patient will received an e-mail and phone call notification stating a dose have missed [6].

Based on Figure 2.4, the button for refill call are placed underneath the cap of bottle. Once the button-for-refill is pressed, it will directly sent requests to your registered pharmacy. Later, you will receive a call from your pharmacy for confirmation and you can simply go to the pharmacy for pick up [7]

Figure 2.4 Refill button that connects to pharmacy

Advantages

The advantages of GlowCaps are it will continuously remind you to keep consuming medicine based on prescription. The notification include sound, orange light blinking, email and phone call. Will flash an orange light and sound when the pill bottle is correctly close.

Disadvantages

The GlowCaps bottle must be in the range of 30-40 feet from the plugin, otherwise the reminder will not work. Next, GlowCaps can only take up to twice doses a day. If patients require a medicine to be taken thrice a day, GlowCaps is not a suitable reminder.

2.2.3 Jon Medminder by Medminder

Medminder is a medical-related company that have designed four kinds of pill dispenser that are Jon™, Jon+alert™, Maya™ and Maya+alert™. In this subtopic, we will discuss about one pill dispenser, named Jon™ for further literature review. Figure 2.5 shows a model type Jon™.

Figure 2.5 Jon™ Medminder by Medminder pillbox

Features

Jon™ have 28 compartments which include seven days of a week and four times of dose per day [8]. This pill dispenser has a locking mechanism which only allows patient to have the right dose at the right time. When it is time to consume medicine, the respected compartment will light up. Jon™ pill dispenser has no buttons and is electronic, and can also fill up to dozen kinds of pills. This device have to be registered on MedMinder website along with your prescription schedule and can include your loved ones for report and notification if missed a dose. Connected through satellite to ease consumers. [5]

The pill dispenser are easy to refill, based on Figure 2.6 and Figure 2.7, it shows how to remove the compartment from its base and we can start refilling.

Figure 2.6 Separating of Jon™ pill compartment with its base

Figure 2.7 Refill for Jon™

As stated in Figure 2.8, there are numerous ways of notification. Firstly, light and beeping sound will produced to alert patient. If we missed these notifications, it will send a text message or a phone call to patient. Each prescription will be recorded and an automated report will be sent through email. Family member will received monthly reports from Medminder. This helps the respective family member to keep up-to-date with patient's progress monthly [9].

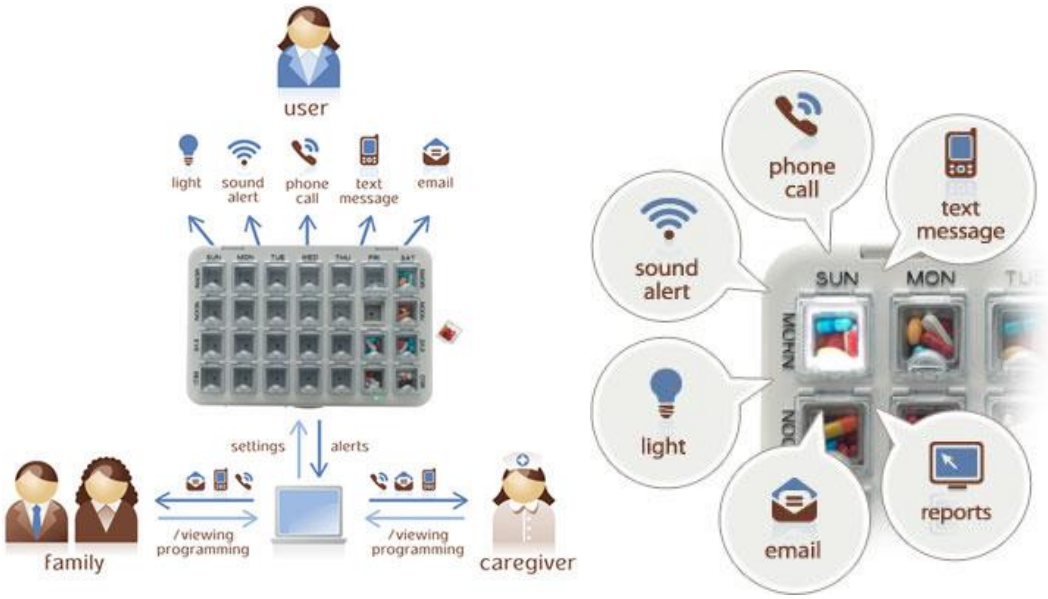


Figure 2.8 Ways of notification for Jon™ pill dispenser

Advantages

Jon™ pill dispenser can fill up to four doses per day and for one week. Next, we can choose the medminder notification and are allowed to disable some of the notifications. Does not require wi-Fi connection, user only need to plugin, register on MedMinder's official website and the device is ready to use. Includes, beeping sound which could help patient to stay alert.

Disadvantages

The pillbox are large, difficult to bring elsewhere.

2.3 Comparisons of Existing Systems With Respective Specifications

The three existing systems discussed are simplified and being translated as in Table 2.1 below. In Table 2.1, a number of specifications have been highlighted for detail review. uBox™, GlowCaps™ and Jon™ have similar mission but each system varies based on their method of notifications, GlowCaps have the Wi-Fi technology while uBox and Jon did not use Wi-Fi. Jon Medminder can took up until 4 doses per day and as for uBox and GlowCaps both can only take up to two doses per day. For MedCare Reminder System, LED will lights up as an indicator of reminding user. The wireless communication used are Bluetooth instead of Wi-Fis and can take up to two doses per day.

Table 2.1 Comparison between uBox, GlowCaps and Jon Medminder

Specifications	uBox™ by Abiogenix	Glowcaps™ by Vitality	Jon™ Medminder by Medminder
Use of Wi-Fi	No	Yes	No
Sound, light, email, phone call notification	Yes, except phone call	Yes	Yes
Dose per day	2	2	4
Use of official website for pill dispenser and schedule registration	No	Yes	Yes
Provides an application	Yes	No	No
Includes caregiver in sending monthly result of progress	No	Yes	Yes
Has an additional device	No	Yes, a plugin reminder	No

2.4 Comparisons of Existing Technologies for MedCare

2.4.1 Arduino Uno R3 and Raspberry Pi 2 Model B

Features

Arduino Uno as shown in Figure 2.9, is a microcontroller and in most cases, it handles devices and sensors. This Revision 3 Model, has 14 digital pins that can be both output or input. Arduino Uno is a programmable circuit board with the presence of its own software. [10]

Figure 2.9 Arduino Uno

Advantages

The fun part of Arduino Uno is they are easy to compute with minimal lines of codes. This microcontroller can be turned on and off safely at any time without damaged. [11] This microcontroller does not require the use of any operating systems.

Disadvantages

Arduino Uno could not multitask and it is slow (16MHz).

Features

From Figure 2.10, Raspberry Pi, on the other hand, is a full functional computer. It runs on Linux operating system and can run on any Linux-based software.

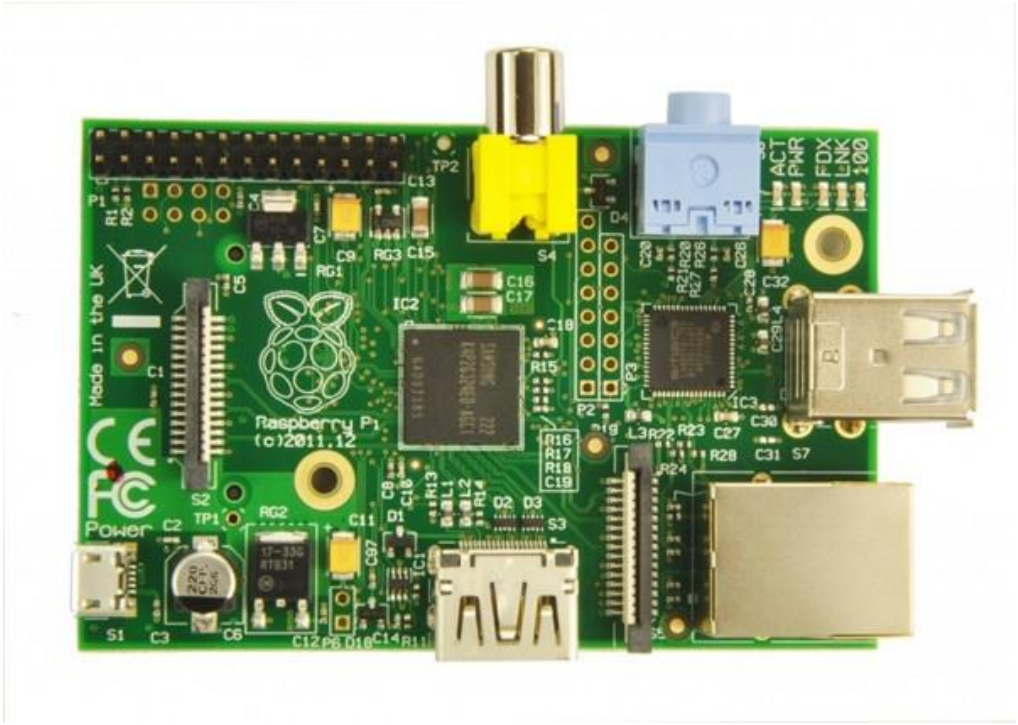


Figure 2.10 Raspberry Pi Model B

Advantages

This chip can handle multitasking.

Disadvantages

Model B can get easily damaged if improperly shut down.

Table 2.2 shows the comparison between Arduino Uno and Raspberry Pi Model B. As shown in the table, Arduino have a smaller size compared to Rasberry Pi. From the architecture and speed of both proposed chips, Raspberry Pi have overtaken Arduino. In developing MedCare system, Arduino Uno are chosen based on its simplicity on programming language even though Raspberry Pi's speed are faster compared to Arduino. Other than that, MedCare Application is only a simple application, therefore smaller architecture is considered enough for the development.

Table 2.2 Specifications between Arduino Uno and Raspberry Pi

	Arduino Uno	Raspberry Pi Model B
Size	2.95" x 2.10"	3.37" x 2.125"
Operating System	-	Linux
Architecture	8 Bit	32 Bit
Speed	16MHz	700 MHz
Programming	C++	Python, C
Processor	ATMEGA328	BCM2835(ARM)

2.4.2 Use of Bluetooth and IEEE 802.11 (Wi-Fi)

Features

Bluetooth uses a 802.15.1 IEEE standard with a 2.4GHz band. It may work either in slave or master mode with a maximum of eight devices together **[12]**. Figure 2.11 shows the international mark of a Bluetooth

Figure 2.11 Bluetooth logo

Advantages

The advantages of this communication tool is the device are cheap. Bluetooth also consumes about approximately 1-35mA **[12]**.

Disadvantages

Bluetooth loses when it comes to speed, it only able to support up to 780kb/s. Other than that, the distance for its coverage are only as far as 10m **[13]**.

Figure 2.12 Wi-Fi logo

Features

802.11 is a reserved IEEE standard for Wi-Fi. Its frequency band is the same as Bluetooth technology, that is 2.4GHz.

Advantages

Wi-Fi serves faster, with the speed data rate of 31.4Mb/s. This wireless technology could cover as wide as 100m from its access point **[12]**.

Disadvantages

Unfortunately, 802.11 costs more pricey because of its advancement and sophistication of technology.

Table 2.3 shows several distinctive features of Bluetooth and 802.11 (Wi-Fi). The coverage of both Bluetooth and Wi-Fi differs in 10m and 100m. Wi-Fi have a faster transfer rate but more consumption of power. In this reminder system, Bluetooth is chosen instead of Wi-Fi because it is more portable. For example, if a place is not equipped with Wi-Fi, then the reminder system will hardly functions.

Table 2.3 Comparison of Bluetooth and Wi-Fi

Specifications	Bluetooth	Wi-Fi
IEEE Standard	802.15.1	802.11
Frequency	2.4GHz	2.4GHz
Data transfer rate	780Kb/s	31.4Mbp/s
Maximum signal rate	1Mb/s	54Mb/s
Power consumption	1-35mA	100-350mA
Authentication	Shared secret and pairing	Shared secret
Coverage Range	10m	100m

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will discuss on the methodology used for developing MedCare system. The justifications of the chosen methodology will also be discussed. Other than methodologies, the selected hardwares and softwares that are needed in developing Medcare Reminder System will be explained.

3.2 Methodology

After consideration and research, it was found that Rapid Application Development (RAD) Model is the best solution in planning and developing this project. This project is a short term project and requires frequent change based on patients' needs. MedCare is a medical

reminder system for patients. Some patients consumes more medicine per day compared to others. Therefore, this difference may involve change of requirements. In this methodology, there are four phases required to complete the project.

3.2.1 Phases in Rapid Application Development (RAD)

Four crucial phases in developing a system through RAD Model are Planning of Requirements, Design, Rapid Construction and Transition. (Figure 3.1)

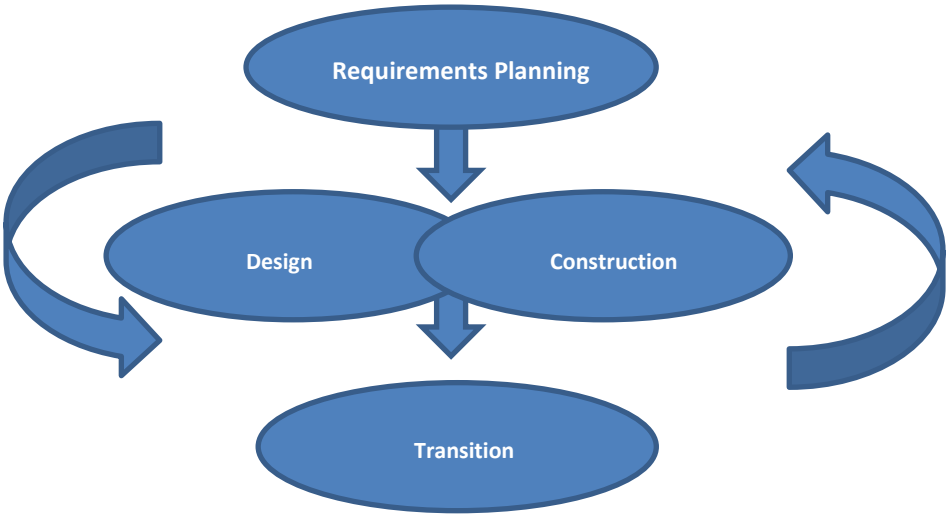


Figure 3.1 RAD cycle

3.2.1.1 Planning of Requirements

The foundation phase of this model is the planning. It is where research of current situation were done to familiarize with user needs, requirements of the project were identified, the goals and problem statements are made. This stage are where all the planning being carried out. Last stage of this business model phase is to finalize every requirements. Therefore, the scope must be well-fined and achievable. In this stage the system is defined by producing the details and outlines of the system. Strategies of implementation have been carried out to ensure that the system will soon runs as planned. Analysis of this project has been done through a set of questionnaires that has been distributed among patients whom suffered from diabetes, high blood pressure and heart attack. From the questionnaire, 60% of the respondents have no problem to take their medication according to prescription but with the help of people around them i.e. their family members and friends. Stated that they are delighted to have a reminder system that could help with their adherence to prescription. 40% of the respondents are afraid to let people know that they have to consume medicine and thus results in non-adherence towards medication.

3.2.1.2 Design

This phase shows the diagrams and designs of the sketch system. The diagrams included are Context Diagram, Class Diagram, Entity Relationship Diagram, Data Flow Diagram Level 1 and Use Case Diagram. Each of the diagrams holds an important use in order to complete the system. The design must be user-based. This is because RAD focuses more on outcome for future use of user.

3.2.1.3 Rapid Construction

Third phase includes the rapid construction where the detailed design are done and start to generate the system according to its level of performance. From here, additional of documentation will involve as to make the system parallel with its proposed application. Next, is to make necessary steps to prepare for any conversion of from system and documentation.

3.2.1.4 Transition

Last phase will be the transition. The system will be tested based on its performance and deliverables. The prototype of the system will be tested to selected users based on scope. Guidance and training will be provided to ease them in operating the reminder system.

3.3 System Development Diagram

This subchapter will discusses on the diagrams mentioned, that will help in the development of this MedCare project.

3.3.1 Use Case Diagram

Use case diagram is used to describe the overview of MedCare Reminder System. It is also use to identify factors related with the system. Figure 3.2 shows the use case diagram of MedCare where there are two actors that play an important role in this system; that are patient and system administrator. The patient will input time needed for prescription and later it will be reminded by the system. Later, the system administration will make a report of medication based on number of pills taken.

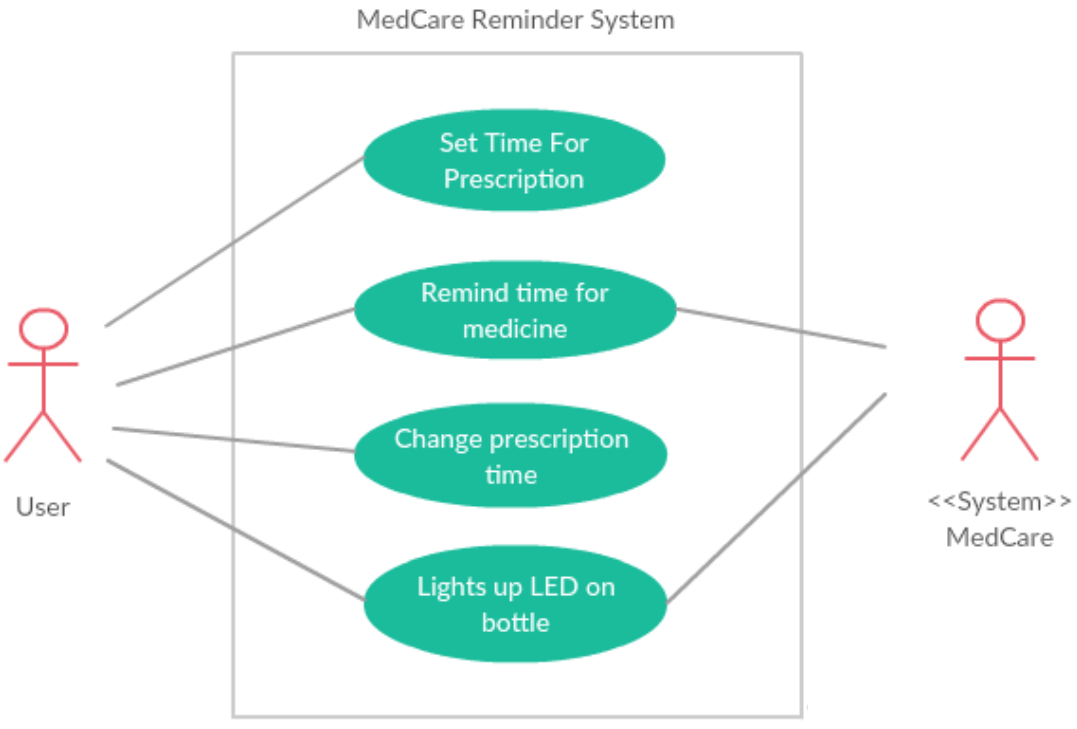


Figure 3.2 Use Case Diagram of MedCare Reminder System

3.3.2 Context Diagram

Context Diagram is used to show the flow of data related. It is one of the important element in the development of structured-system. Three input/output include user, handphone and pill bottle as the backbone of the reminder system as shown in Figure 3.3. The MedCare Reminder System will then stores the time based on what user have set. An alert will be sent to user's handphone to notifies them through a built application.

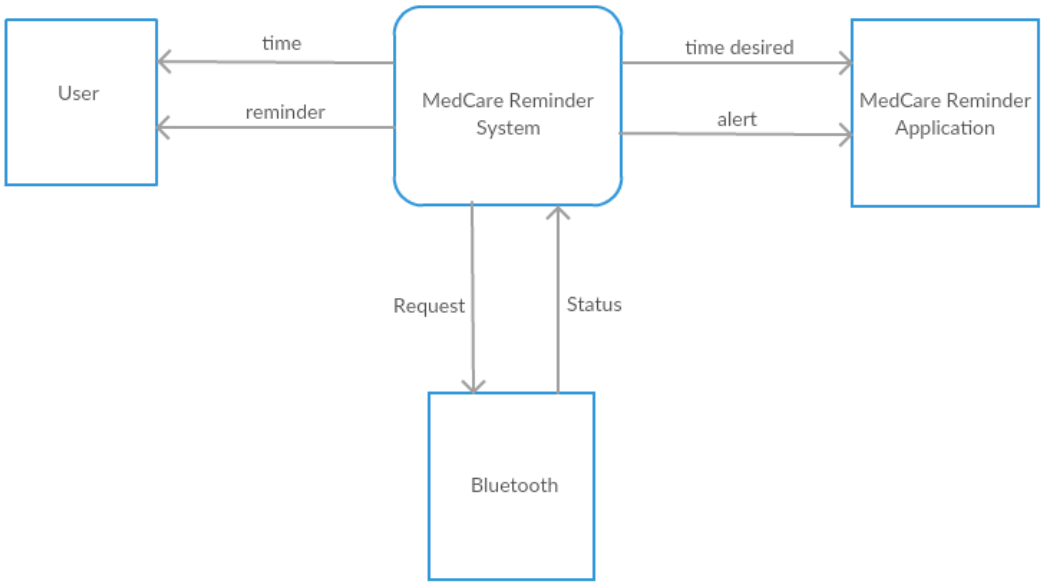


Figure 3.3 Context Diagram of MedCare Reminder System

3.3.3 Data Flow Diagram 1

Data Flow Diagram Level 1 is the extended version of Context Diagram. In this diagram the process of the system is expanded for further details. As in MedCareReminder system, there are 2 additional processes. First is the Log In process, where username and password are needed. Secondly, will be the Prescription Time. Data collected will be stored (Figure 3.4).

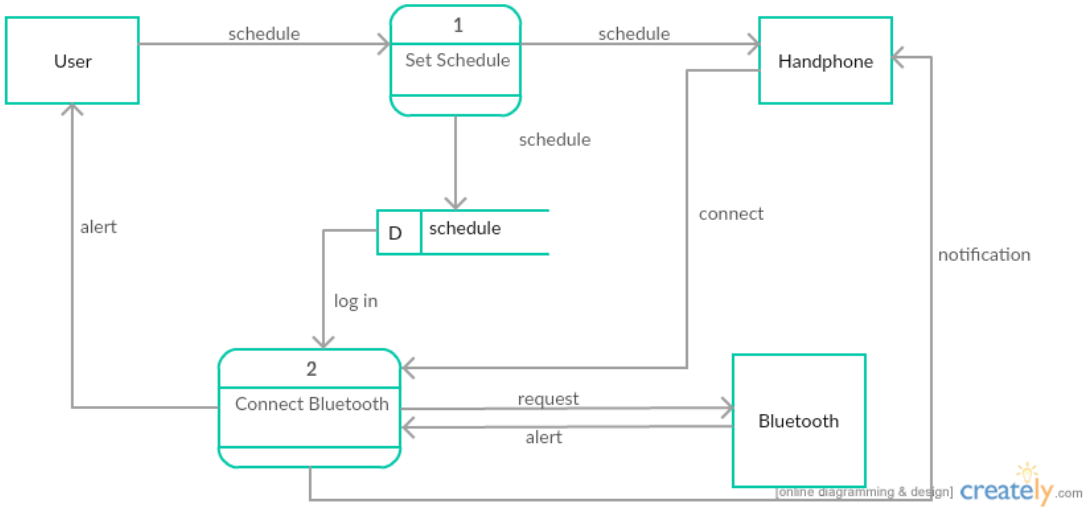


Figure 3.4 Data Flow Diagram Level 1

3.3.4 Dialog Diagram

Dialog Diagram is the storyboard with correct sequence of the system. It shows how interfaces are connected and explains how user could interact with the system application. The connection are link together without arrow and this make dialog diagram differ from other diagram. Arrows can also be used, only when the interface could only be accessed one-way. There are three boxes in this diagram. The upper box shows the specialized number for the interface. The middle box describes about the interface and the third box shows the references of where user can go from the current screen. MedCare system consists of 8 screens starting with main menu, set schedule, notifications, reminders, result, frequencies and medical description. (Figure 3.5)

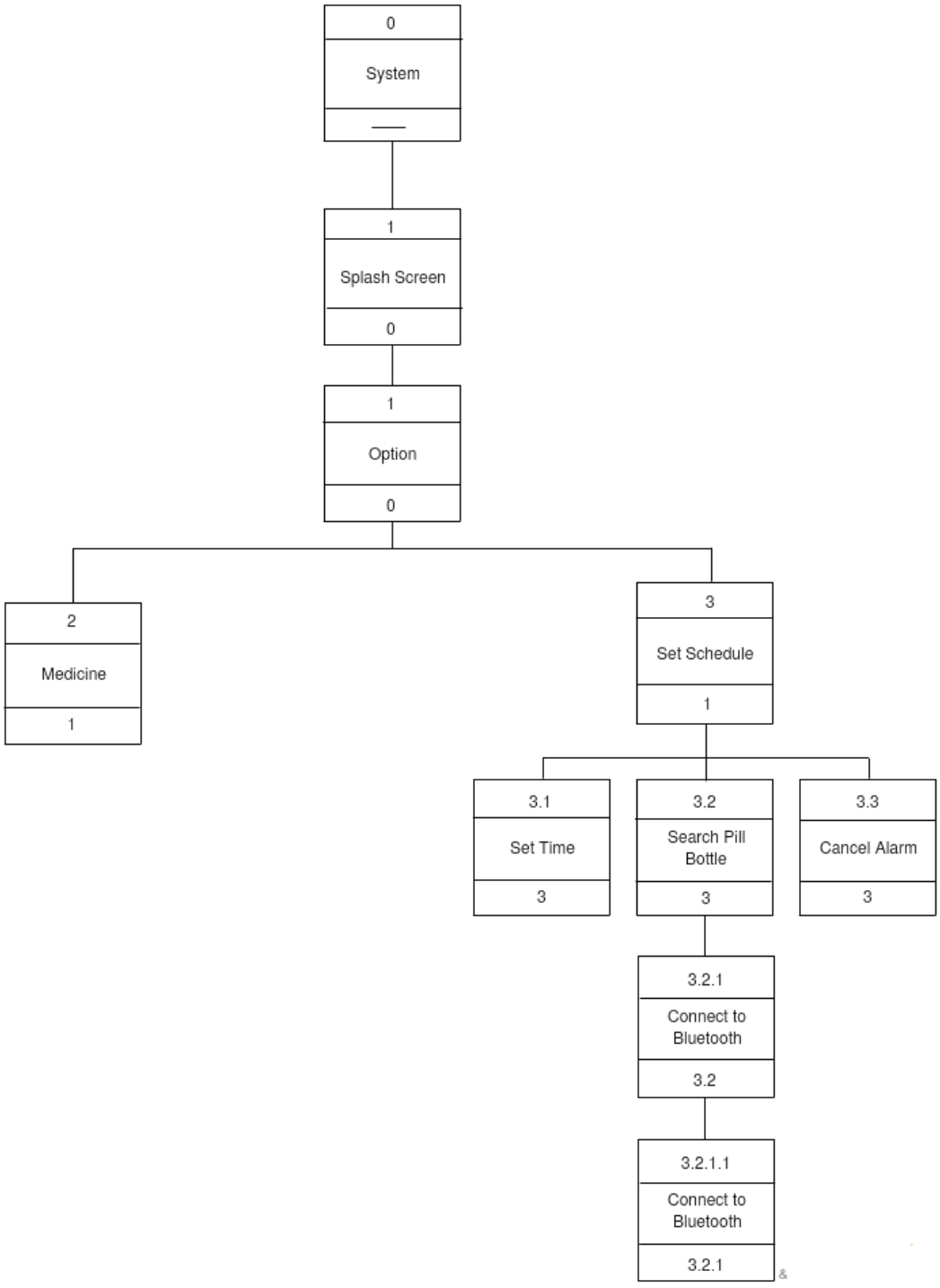


Figure 3.5 Dialog Diagram of MedCare Reminder System

Entity Relationship Diagram represents graphical information of this system that includes entity, attributes and relationships. In this system, there are two related entitites, which are

3.4 Interface Design

The first screen of this application is a splash screen that shows the logo of the application. The splash screen will be shown for 2 seconds. The second interface is the main interface of the application will which appear immediately after splash screen.(Figure 3.6)

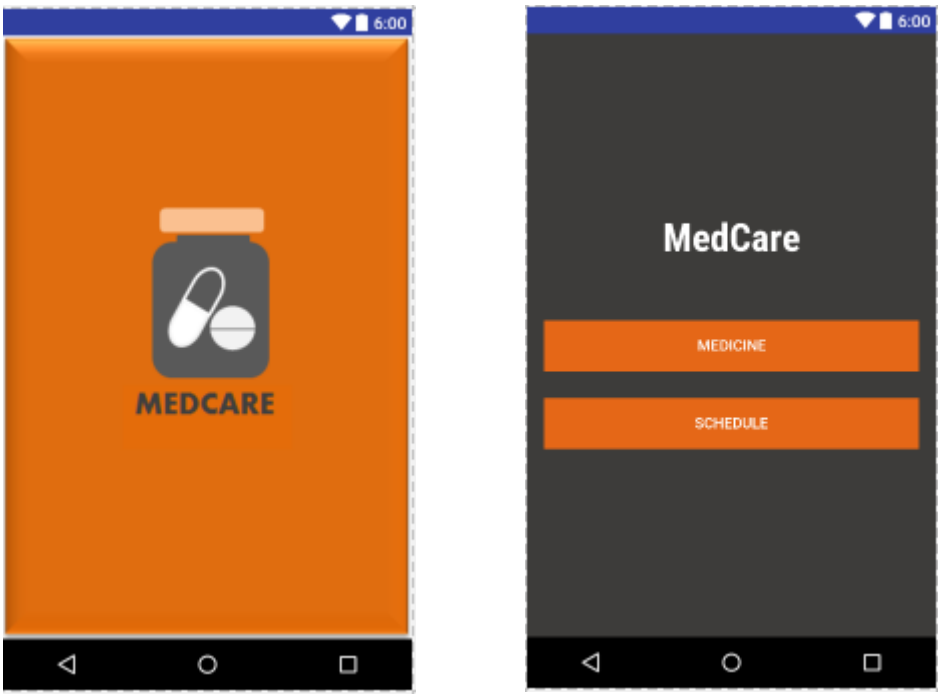


Figure 3.6 Main screens of the MedCare application

Figure 3.7 shows how user can insert name of medicine that they will consume when the reminder starts. The second interface allows user to input time of alarm and the option to look for pill bottle.

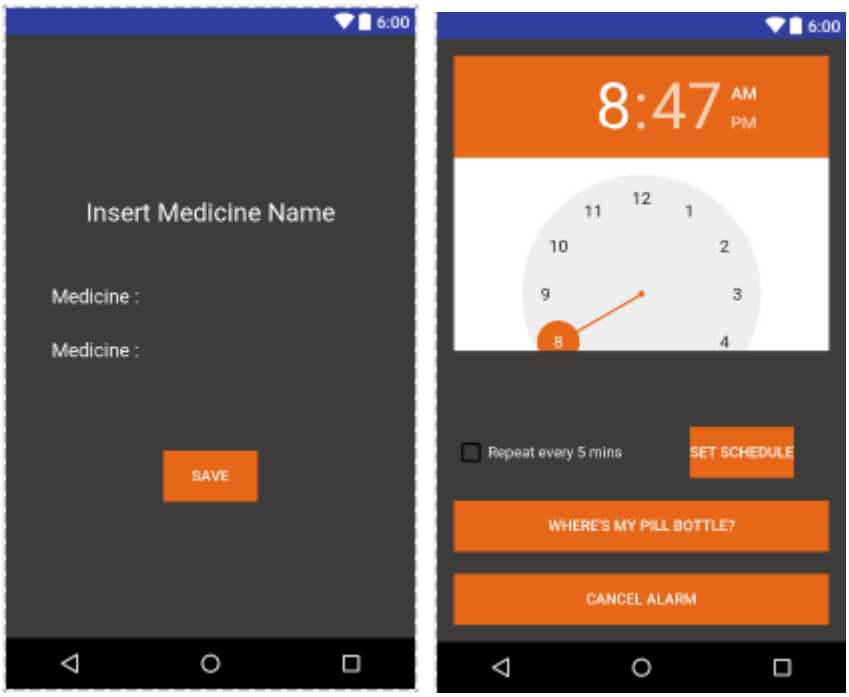


Figure 3.7 How user can insert their medication name and alarm time

Other than that, user can locate their pill bottle in bluetooth range and they can turn on and off the LED according to their usage. This interface will show devices that have paired with Android. (Figure 3.8)

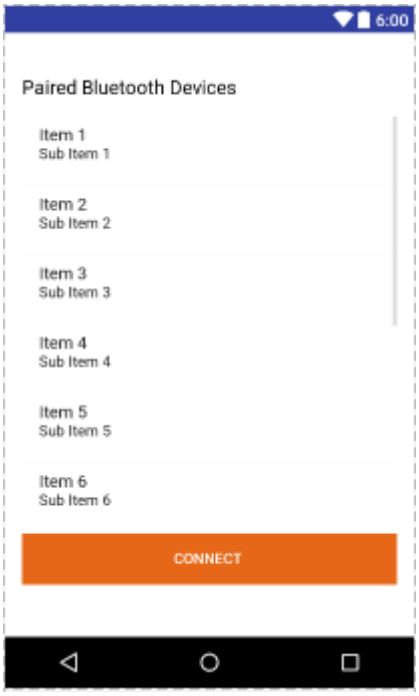


Figure 3.8 Interface of Bluetooth function

Figure 3.9 below shows how user can turns “ON” or “OFF” the LED in order to locate their pill bottle. Once they have found their pill bottle, user can disconnect their Android device will pill bottle.

Figure 3.9 LED Function

3.5 Hardware and Software Requirements

In developing the system, there are several hardware and software used in order to achieve success of the system. Without one another, the MedCare Reminder System will not successfully run.

3.5.1 Hardware

Hardware is any kind of tools that can be physically touched and configured. This includes electronic, machines and equipment. The hardware requirements for developer are (Table 3.1) :

Table 3.1 Hardware Requirements

No	Hardware	Function
1	TOSHIBA Laptop Computer Model s40t-a • Intel® Core™ i5-3337U CPU @ 1.80GHz • 64-bit Operating System, x64-based processor	Documentation of report, research of existing system, creating diagrams and interfaces
2	EPSON L210 Printer	Printing document
3	Arduino UNO	To implement code and lights up LED
4	USB Cable	Intermediary device between board and laptop
5	Bluetooth Module HC-05	Connect with LED and handphone wirelessly
6	Arduino 7 Colour LED	Lights up as configured
7	220Ω resistor	To help lighting LED
8	Sorderless breadboard	Board for connecting electronics
9	Jumper wire	Connect resistor with LED
10	Handphone	To run MedCare application

3.5.2 Software

Software are programs that can not be physically touched. Software serves specific utilities that can carry out specific functions. Software requirement for developer are (Table 3.2) :

Table 3.2 Software Requirements

No	Software	Function
1	Android Studio 5.2.2	Develop Android application
2	Arduino Application	To code Arduino board
3	Microsoft Word 2013	Create document
4	Creately.com	Create related diagram
5	Moqups.com	Make interface design
6	Smartsheet.com	Designing project timeline
7	ERDPlus.com	Design ERD Diagram

3.6 Project Plan

Gantt chart shows the timeline of the whole Medcare Reminder System project.For PSM 1, the related phases include the planning, gathering of requirements and design. The duration of this PSM 1 took up of an approximate of 100 days including public holidays and weekends.

CHAPTER 4

IMPLEMENTATION

4.1 Introduction

This chapter discusses on MedCare reminder system that runs on Android and used Java and Extensible Markup Language in its development. In other hand, the limitation, advantages and challenges of this system will be concluded in this chapter.

4.2 Technologies Included

In developing this system, Arduino, Android Studio software and HC-05 bluetooth module are being used to connect user to the system. The Android Studio are used to develop the application to be used only for Android-platform mobile phones.

Next, the Arduino is used to connect to the pill bottle to light the LED. Lastly, the HC-05 bluetooth module is used to give wireless connectivity between the mobile phone and the pill bottle.

4.3 Interfaces

In developing the system, the main part of ensuring the level of user satisfaction depends on the interfaces. Interfaces are made to enable user to interact with the application easier. Behind each interfaces, there are codes of Java and XML to ensure the effectiveness of the each interfaces.

4.3.1 Splash Screen

Figure 4.1 shows the splash screen interface of MedCare Reminder Application that will appear for 2 seconds upon launching the application. The theme colour of this application is dark grey, orange and white. In the splash screen, the logo of the application appears along with “MEDCARE”.

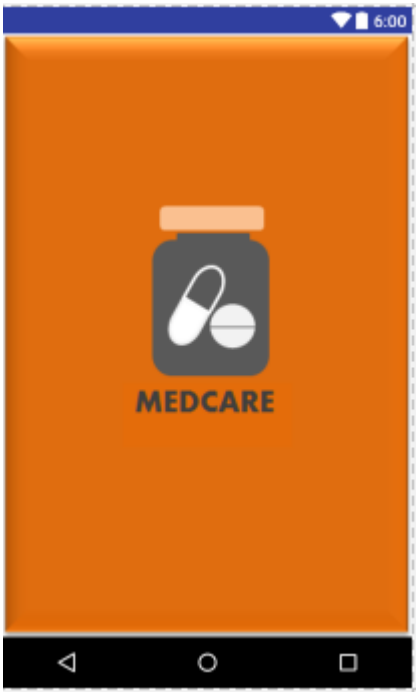


Figure 4.1 Splash Screen Interface

4.3.2 Option Interface

In the option interface as shown in Figure 4.2, there are two buttons : MEDICINE and SCHEDULE. This is the first interface that requires user to click on any button. The buttons are orange-coloured to make it more obvious and attractive. The background and colour are in dark grey and white respectively. The option interface will appear immediately after splash screen.

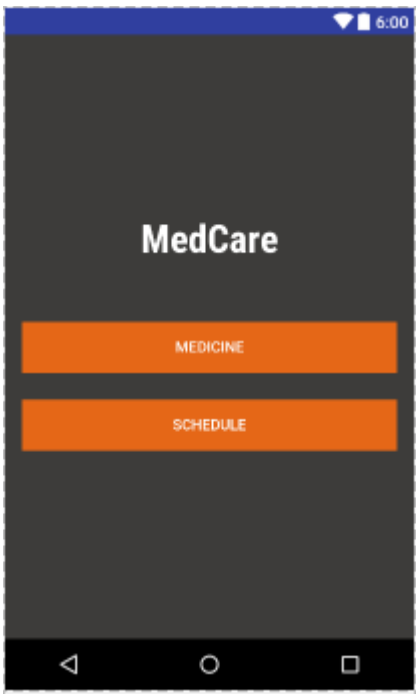


Figure 4.2 Option Interface

4.3.3 Medicine Interface

The medicine interface (Figure 4.3), provide two text field where user can insert their medicine name. The button "SAVE" will store information that user inserts using SharedPreferences(). Similar in option interface, the button is orange to attract and guide user.

Figure 4.3 Medicine Interface

4.3.4 Interface of User Area

User Area interface is one of the crucial part of the application because in this interface is where user can set schedule according to their prescription. On opening this interface, the time picker will automatically appear together with buttons. Once user picked time, they will press “Set Schedule” button. If they wish to cancel the alarm, the can click “CANCEL ALARM” button. After the alarm rings, if they are not able to locate their pill bottle, they will track their bottle in Bluetooth range using “WHERE’S MY PILL BOTTLE” button.

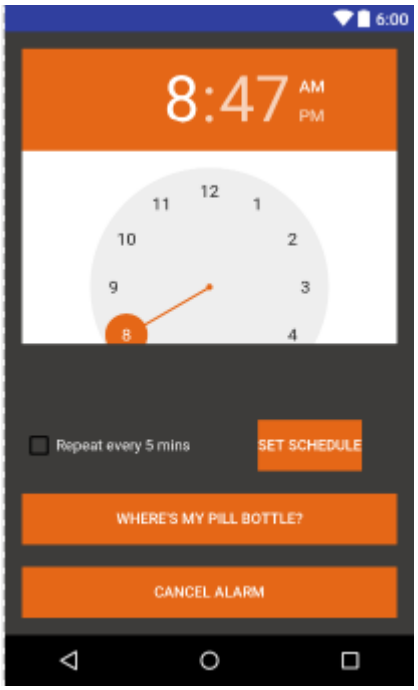


Figure 4.4 User Area Interface

4.3.5 Device List

The Device List interface will show a list of paired bluetooth devices that have been paired ith the android before. It will also include each device's MAC address. The list will appear once the "CONNECT" button is clicked. Later, user will click on HC-05 (bluetooth module that connects with Arduino) and it will be automatically redirected to LED Control interface. The background of this interface is white to make it easier to user to see and pick the bluetooth module.

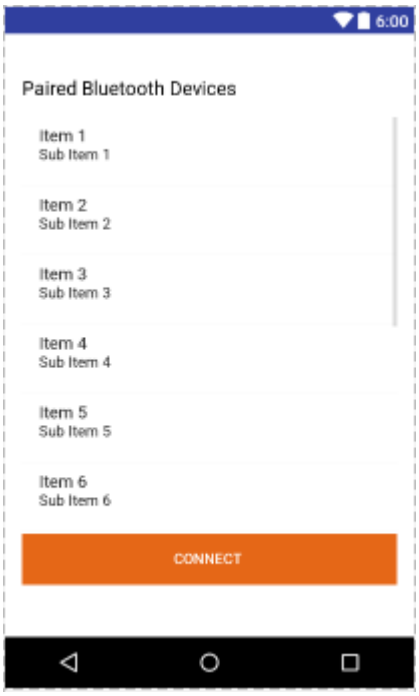


Figure 4.5 Device List Interface

4.3.6 LED Control Interface

This interface role as shown in Figure 4.6 is to let user locate their pill bottle in Bluetooth range. There are three(3) buttons in this interface. The “ON”, “OFF” and “DISCONNECT” button. The “ON” button will turns on LED and the “OFF” button will turns on LED light. The “DISCONNECT” button are used for disconnecting Bluetooth module with application.

Figure 4.6 LED Control

4.4 User Acceptance Testing

This test is taken after the application has been fully developed and tested by developer. The client of this system is people aged 45-65 years old that requires constant medication monitoring. Questionnaires are distributed to client for them to give evaluation. Several questions are being tabulate as below:

4.4.1 Question 2

Question: Adakah anda mempunyai masalah untuk memakan ubat mengikut jadual yang telah ditetapkan? (Do you have any problem in taking your medication based on prescription?)

Based on Figure 4.7, it indicates that most patients have no difficulties in taking their medication based on prescription.

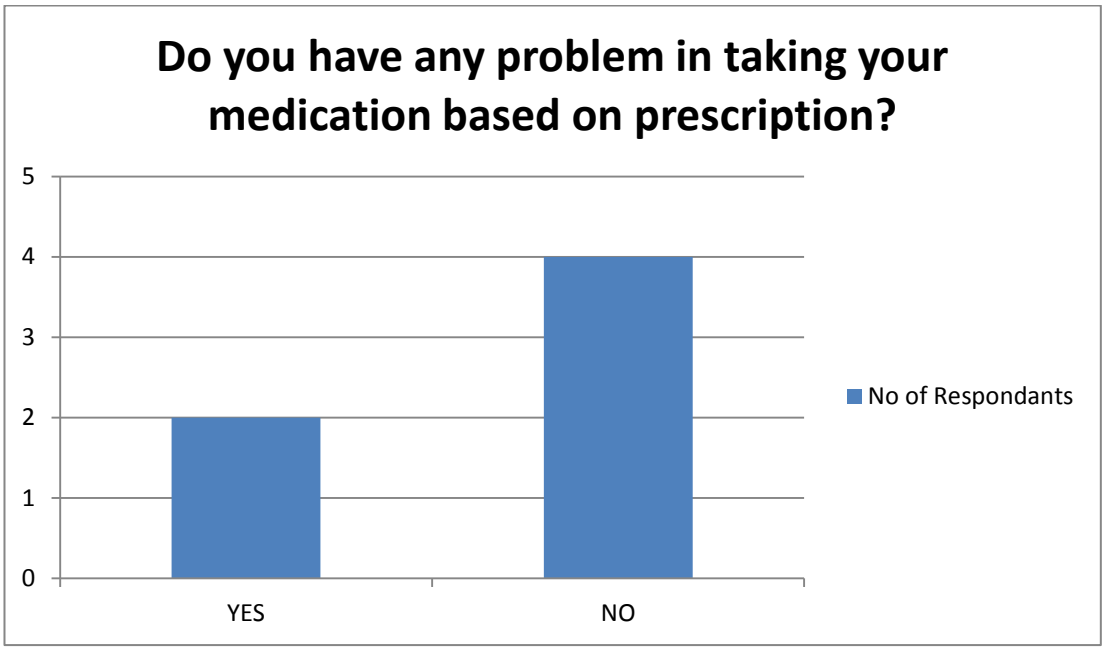


Figure 4.7 Bar chart for second question

4.4.2 Question 3

Question: Punca tidak mengambil ubat mengikut jadual (Causes of non-adherence towards medicine schedule)

Based on the results obtained in Figure 4.8, majority of patient stops consuming their medication when they feel healthy. Two of the patients have difficulties in remembering their medication schedule and one patient do not want people to know that she is medicine-dependent.

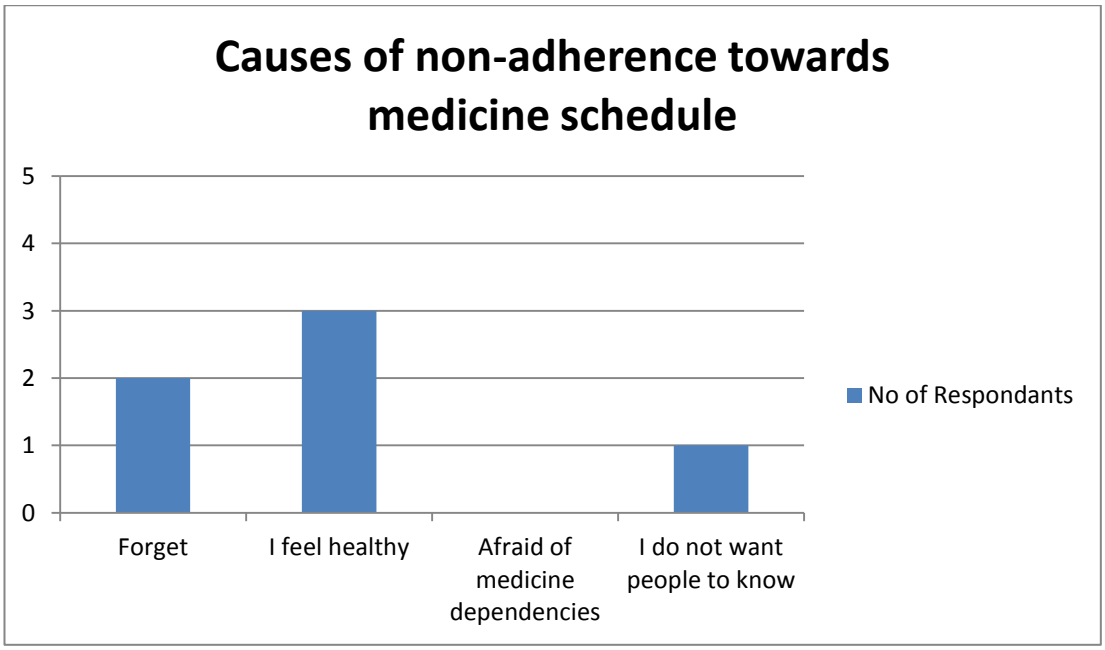


Figure 4.8 Bar chart for third question

4.4.3 Question 4

Question: Bantuan (Help)

Figure 4.9 shows how patients being help in getting reminded to consume their medicine. 4 patient from respondents consume their medication with the help of family members. One of the patients still able to remember their medicine schedule.

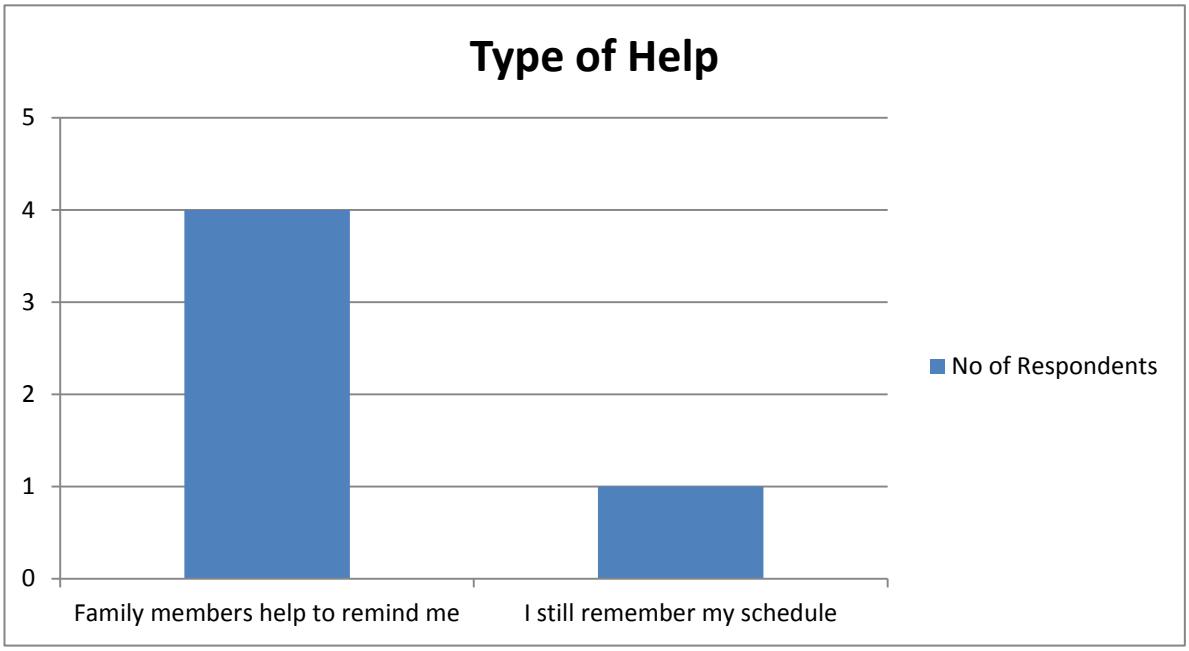


Figure 4.9 Bar chart for question four

4.4.4 Question 5

Question: Adakah anda mahu alat untuk bantu mengingatkan masa untuk makan ubat?(Do you want a tool that could help in reminding for medicine schedule?)

Most patients have chosen that they would be pleased to have a tool that could help them in reminding for medication time(Figure 4.10). Therefore, by gaining the results as shown, it is proven that MedCare Reminder System is helpful.

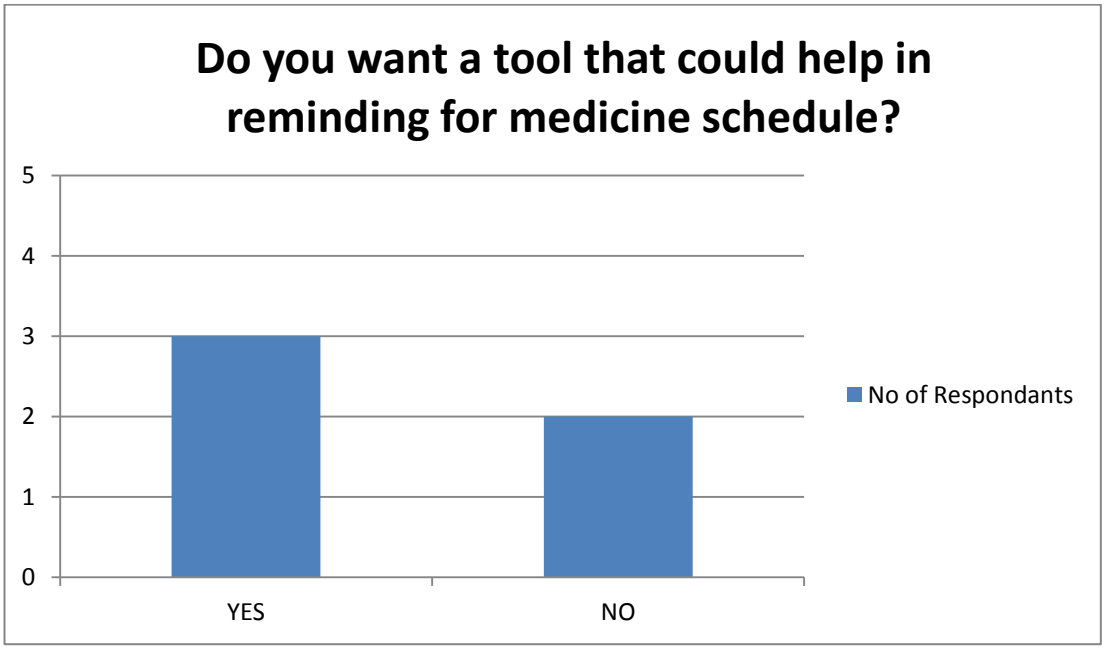


Figure 4.10 Bar chart for question five

4.4.5 Alarm & Notification

Figure 4.11 shows the feedback of user after experiencing MedCare Reminder System. Every function on notification appear on functions properly.

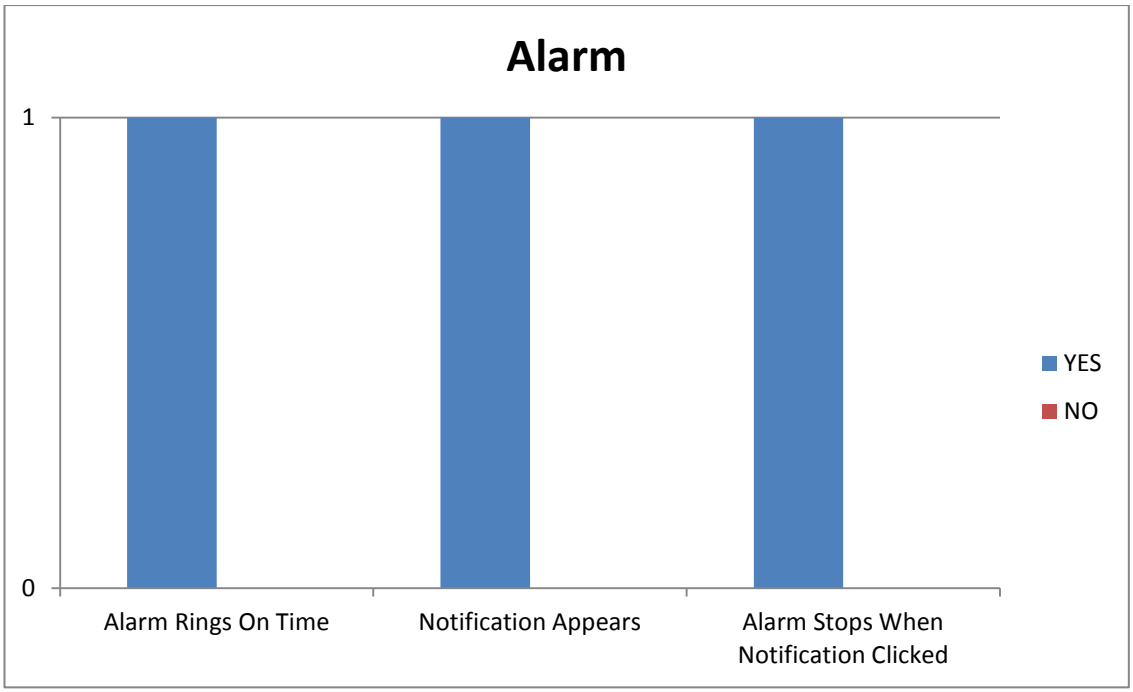


Figure 4.11 Bar chart on question six

4.5 Strength in MedCare Reminder System

MedCare is a mobile application that helps to remind user to consume their medication on time. The interfaces in this system are user-friendly because it is easy to be understood. Most of the text are in medium size which in readable by people between 50-60 years old and the chosen colour are attractive for user. The designed buttons in this application are also in the right size for user to click. The wireless connection will make user to be hassle-free with wires which is much more convenient. MedCare application can be used offline, everywhere and anywhere.

4.6 Limitation in MedCare Reminder System

First and foremost, the application is mainly and emphasized to only Android user. This means that the application could not run on other platforms than Android. Other than that, the problem with wireless connectivity is its range. Since this system use Bluetooth, the range between the mobile phone and the pill bottle are limited. If the pill bottle are too far from the mobile phone, user will not be notified through their mobile phone.

4.7 Challenges in Development

One of the difficulties in building this system is versioning of software. All of the software installed have to be updated and compatible with device in order to make the system work. Other than that, user satisfaction is the crucial criteria in this development. To have every user satisfaction is difficult but to have a system working properly and achieved the objective of this project is more crucial. Next, even though Java is a widely-used programming language, but it requires more time to study and understood its language.

4.8 Conclusion

In conclusion, this chapter shows every aspect that counts in the development of this system. This includes the strength, limitation and challenges during its development.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter discusses the conclusion and result of this system. It will show how this system will meet the objectives of this system, the progress of the system in running parallel with its methodology. Other than that, the user experience and expected result is tested.

This project has achieved its objective in developing a reminder application that helps in reminding user to consume medication based on time scheduled and helps to locate pill bottle in Bluetooth range.

The whole project uses Rapid Application Development (RAD) methodology. This methodology is found to be the most suitable because the phases design and contruction are repeated in order to achieve user satisfaction.

5.2 Future Works

Future work is about enhancement and suggestion that can be implemented in the future development of MedCare Reminder System. Below is how the system can be enhanced :

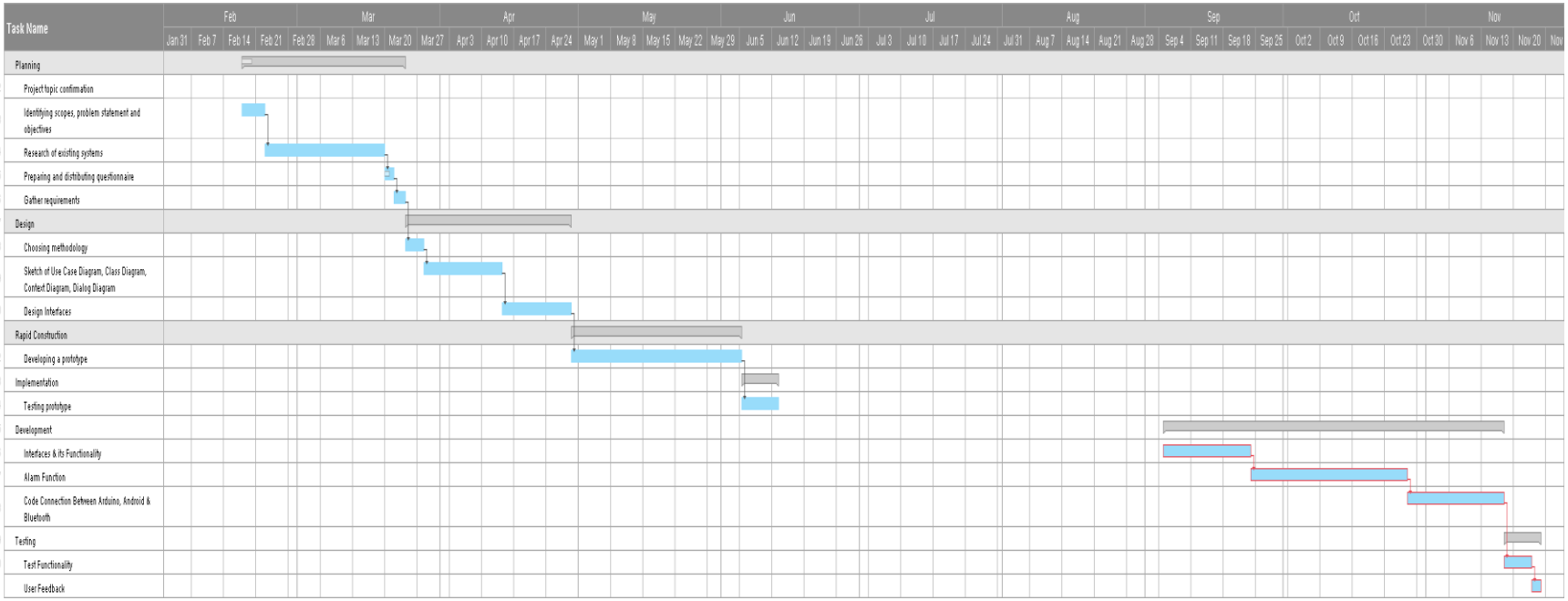
1. MedCare Reminder System application should be able to run on other OS than only Android such as iOS, Blackberry OS, and Windows Mobile. This will allow more user to use and experience this system.
2. MedCare Reminder System should be able to remind patient on their prescription more than once per day.

5.3 Conclusion

In conclusion, throughout its development, a lot of methods and techniques found in order of completion of this project. this MedCare Reminder System is found to be helpful in keeping track of one's medication schedule. Above all, this system only helps reminding patient to consume medicine on time, the discipline towards prescription schedule is basically the main key to a healthy life in the future.

APPENDICES

APPENDIX A GANTT CHART



APPENDIX B (USER SURVEY)

Adakah anda mempunyai masalah untuk memakan ubat mengikut jadual yang telah ditetapkan (bulatkan)?

Ya Tidak

PUNCA TIDAK MENGAMBIL UBAT MENGIKUT PRESKRIPSI

SEBAB	YA	TIDAK
1. Lupa		
2. Ubat terlalu mahal		
3. Saya ingin mengelakkan sebarang kesan sampingan		
4. Saya takut jikalau saya akan mengalami masalah kebergantungan ke atas ubat		
5. Saya berasa sihat		
6. Saya tidak mahu orang tahu bahawa saya memerlukan ubat setiap hari		
7. Saya mempunyai masalah dengan jadual pemakanan ubat		

BANTUAN

	YA	TIDAK
1. Saya mempunyai ahli keluarga yang membantu untuk mengingatkan saya untuk memakan ubat		
2. Ianya amat baik sekiranya saya mempunyai satu alat yang dapat membantu untuk mengingatkan saya apabila tiba waktu untuk makan ubat		
3. Saya sentiasa ingat untuk memakan ubat tanpa bantuan sesiapa		

APPENDIX C (USER ACCEPTANCE TEST)

1.0 Testing

The main objective of this report is to record all tests run during testing process. User will experience each interfaces and function followed by steps given.

1.1 Interfaces

Test	Steps	Expected Result	Pass/Fail
activity_splash_screen.xml	Open application	Application opens and splash screen shows	
activity_option.xml	None	Shows two button (Medicine & Set Schedule)	
activity_medicine.xml	Click button medicine	Save name of medicine	
activity_user_area.xml	Click button Set Schedule	Will be redirected to Set Schedule interface	
activity_device_list.xml	Click 'Where's My Pill Bottle?' button	Will appear a list of Bluetooth devices nearby to be connected to	
activity_led_control.xml	Click button Connect	Will be redirected to page with "On", "Off" and "Disconnect" button	

1.2 Connection

Bluetooth Connection	Pass/Fail	LED Light (On/Off)
HC-05		

1.3 Alarm

Please circle for the correct answer :-

1) Did the alarm rings according to time set? Yes No
2) Did notification appears when alarm rings? Yes No
3) Did the alarm stop when notification is clicked? Yes No

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