CERTIFICATION OF APPROVAL

MyHomePharmacy: Mobile Android Application

By

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15897

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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MOHAMMAD FAHMI BIN MOHD YUSOF

Abstract

Pharmacy can be define a place where the medication drugs used for treating disease are distributed or sold. It is also referred as a place where the end user or professional user such as doctors get the supplies of medicine for personal or professional uses. Does not know what the correct and suitable medicine for a particular minor disease in a critical time is a problem for most of the students and parents. It is crucial to have the accurate information regarding the correct and suitable medicine and advice particularly for minor diseases and illness. This is because the wrong consumption of medicine or drugs not only will cause minor disease to the consumers or illness, it also can cause death to them. MyHomePharmacy is an application which is developed to be used on smartphone or mobile devices that used Android as the operating system. It is designed to give correct information on selection process of medicine for the minor diseases and illness in order to make sure the end user does not consume unsuitable drugs and medicine. The application also aims to deliver suitable and correct advices and tips associated with minor disease and illness to speed up the recovery process of the patient. Interview method have been selected for requirement gathering analysis of this application, all requirement has been translated to functional and non-functional requirement and Unified Modelling Language (UML) for development purposes. Rapid Application Development was selected to be the system development lifecycle (SDLC) to ensure that the application can be delivered within the time constraints. The prototype has been developed with Adobe PhoneGap platform that provide the developer with wide range of android capabilities and features with easy to learn steps. The important reasoning element, Unified Modelling Language (UML) diagram and MyHomePharmacy prototype serve as result and outcome of this research project. The (UML) diagrams include Use Case, Activity, and Class diagram. User Acceptance Test and Application Functionality Test have been conducted. There are 60% user rated good for User Acceptance Test and 80% functionality success recorded. All the recommendations and improvements about the prototype are recorded for future reference and alteration. The future improvements include the neat and beautiful user interface and able to display wide range of diseases selected for the application.

Acknowledgment

First and foremost, I would like to express my deepest gratitude to the Almighty, for giving me the opportunity to be able to complete my FYP 1 and FYP 2 in two semesters with grace. He gave me strength and strong will when I needed the most, especially when I am having few bumpy roads along the way. Thank you, Allah.

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Last but not least, I'm giving my gratitude and appreciation to all my friends and also others who are involved throughout these 2 semesters of completing my FYP1 and FYP2. I do appreciate everything that you have all done for me. Thank you again for all of your endless support.

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Chapter 1: Introduction

1.1 Background Study

Nowadays, healthcare sectors or industry is one of the world's largest and fastest-growing industries because of the, innovation and introduction of Information Technology (IT). Introduction of IT on healthcare sector make the industry more productive and attractive thus increase the efficiency and effectiveness in business processes and activities (Goundrey-Smith, 2014). Modern healthcare industry is divided into several section and depends on interdisciplinary teams of trained professionals and paraprofessionals to meet health needs of individuals and populations.

Under healthcare knowledge, there are two categories of diseases and illness which are major and minor diseases. Minor disease covered non critical disease that need intensive and continues treatment such as fever, flu and cough. This type of disease usually can be treated with consumption of correct medicine and practices of correct advices and tips from reliable sources such as doctors and pharmacists (Kayne, 2005).

Pharmacy and pharmacist are example of section in healthcare that benefit from innovation of IT. IT utilization for pharmacy or pharmacist advance the values that the patient achieve from the services offered such as decreased in waiting time. Raising trend of smartphones and mobile applications have amplified the percentage of remunerations that the user get from pharmacy and pharmacist (Oscar, 2013). Mobile application developed aim to assist the user with the information regarding the location, type of medicine and others. The other advantages of the application is the mobility features that the application possess so the user can excess or utilize the functionality on the go as long as the user have the smartphone and the application installed.

1.2 Problem Statement

Currently, most of the systems and applications developed focus on the business process and inventory management of a pharmacy or a hospital. Khelifi et al. (2013) stated that the system links the database of a hospital and a pharmacy together for a superior coordinated inventory system. Implementation of inventory system in pharmacy have many advantages that can benefits pharmacists (Fairuz, 2005). Many systems and applications are developed to increase efficiency and effectiveness of the current pharmacy business process and activities, but they provide less focuses to assist end user and patient in managing medicine in their own inventory and selecting the suitable or correct type of medicine at home.

Based on the interview session that have been conducted with En. Mior Irwan pharmacist from Farmasi Irwan, there are several problems that have been identified. The first problems is that the user of the medicine does not know the correct and suitable type of medicine or drugs and dosage that can be consumed for particular minor disease or illness. Knowing the right type of medicine to consume when facing a specific type of minor injuries is crucial for every user of medicine.

The other problem that has been identified is that some users or patients do not know the basic and correct advices or tips that can help on recovery process. The correct and reliable tools or functionality in mobile application need to be developed to support patient in recovery process and to let them know the correct advice and tips.

As to get opinions from target user, interview session been conducted with En. Faidhi Fatkhurrozi where few issues has been arises. One of the problem is the time and cost factor when the medicine users need to refer about the suitable medicine to the local pharmacist or doctors. The process becomes inconvenient when the medicine user is in emergency or the location of local pharmacy and clinic are far and time consuming to reach to. The reliable source will able to help medicine consumer that needs to know suitable type of medicine without having to travel and spending time or cost in order to refer to the local pharmacist and doctors.

The other issue that has been identified is the potential user need to have customization features on their pharmacy mobile application. Customization enabled application is needed to increase the productivity and effects of an application to its end user. It should allow end user to select and customize the number and details of the family member and their related minor disease which will help medicine user especially parents to monitor and know what type of medicine needed when the minor injuries are affecting their children's.

Lastly, the notification functionality when the exact time that a medicine user need to consume the needed medicine or drugs is also one of the functionality or ability the current applications are lacking and need improvements. These are defined from the outcome of the interview session with the potential user.

1.3 Objectives of Study

Based on the problems that have been identified in previous sections, this project will fulfill the following objectives:

    I.   To identify important reasoning elements that will be used to produce the right recommendation for medicine issuance

    II.   To develop prototype of MyHomePharmacy: Android Mobile Application for medicine user.

    III.   To conduct User Acceptance Test and Application Functionality Test on the developed product.

1.4 Scope of Study

One of the scopes of study for this project is the medicine user which are individuals or parents that have difficulties to communicate or reach the reliable source of information such as local pharmacist or doctor. This project is to develop a customizable android application that help the end user regarding the correct type of medicine and drug or the reliable line of advices and tips in the recovery process of a particular minor disease. Customizable refers to the function that allow parent to customize the application for his/her family usage. The minor disease that will be covered for the time being in the application are fever, flu and cough. The minor disease are selected because frequency of the disease occurs based on interview session with the pharmacist and the potential end user. It is important to get the information or data that related to the end user in order to develop this application. Besides that, this application will be tested on them after the development of this application is completed in order to collect their feedbacks regarding the usage of the application.

Second, the scope of the study will cover the contents of this android mobile application. This application will contain the list of minor disease and injuries , the minor disease or injuries symptoms, suitable type of medicine, type of medicine, dosage of medicine, restriction of medicine, reliable advices and tips regarding the specifics type of minor disease that meet the specific disease symptoms. The list of medicine and the details description and related advices will be presented in this android application where it has the probability to help the application user to have the correct and reliable source of information about the minor diseases with the specific suitable medicine.

Chapter 2: Research and Literature

2.1 Pharmacy and Pharmacy Industry

According to Kayne (2005), the definition of pharmacy is a place where the medication drugs used for treating disease are distributed or sold. The scope of drug store practice incorporates more customary parts, for example, aggravating and dispersing medicines, and it additionally incorporates more current administrations identified with medicinal services, including restorative administrations, evaluating prescriptions for security and adequacy, and giving medication data. Pharmacist, along these lines, are the specialists on medication treatment and are the essential wellbeing experts who streamline utilization of prescription for the profit of the patients.

The pharmaceutical industry creates, delivers, and markets medications or pharmaceuticals authorized for utilization as medications. Pharmaceutical organizations are permitted to arrangement in nonexclusive or brand meds and restorative gadgets. They are liable to a mixed bag of laws and regulations with respect to the licensing, testing and guaranteeing security and adequacy and showcasing of medications.

2.2 Utilization of Information Communication Technology in Pharmacy

Generally, innovation of information communication technology in pharmacy increase the efficiency and effectiveness of the business processes and activities. Pharmacist depend vigorously on innovation to help them do assignments that are regularly perplexing. According to Goundrey-Smith (2014), ICT can empower the capacity of organized patient records, encourage the electronic recommending, administering and organization of prescriptions, computerize the treatment of meds in the store network and give apparatuses to check the adequacy and wellbeing of solutions being used. ICT can along these lines enhance understanding wellbeing, empower experts to give great care and help patients take advantage of their drugs.

The utilization of smartphone is far reaching in the public eye. A few pharmacy are utilizing content cautions to remind patients that rehash remedies are prepared or to offer administrations, yet refined applications have been produced for sickness checking, for example, recording of peak flow readings in asthma, monitoring of blood glucose levels, medication adherence support and health education (Gaundrey-Smith, 2014). These mobile apps will have a greater influence on pharmacy practice in future

2.3 Advantages Utilization of Information Communication Technology in Pharmacy

Utilization of information communication technology in pharmacy industry lead to one major benefit which is improvement in customer services. ICT in pharmacy industry enable the pharmacy experts and community to increase their personal touch and relationship with their customers and patient (Oscar, 2013).

Oscar (2013) stated that, generally, the benefits that the patient and user gained are:
1. Access to information: ICT enhance the patient security and enable the user accessibility of information regarding medicine details and restriction.
2. Increased convenience: ICT enable the user to retrieve the information needed freely without the time constraints and expends accommodation towards patients.
3. A better mix of products and services: User and patient acknowledge pharmacy that utilize their information to examine inclination, the length of utilization of data to offer more craved items or focused on rebates.
4. Self-service options: A few customers esteem the choice of checkout toward oneself lines, on the off chance that they can pick whether to utilize them.

According to Oscar (2013), mobile application related to pharmacy enable fast access to pharmacy information to the users. Smartphone innovation capacities give arrangement individuals simple access to vital therapeutic and pharmacy benefit–related data, including: Drug prices of nearby pharmacies and expected out-of-pocket costs with generic and therapeutic alternatives, Health-related symptom checkers and Self-diagnosis tools with symptom and disease lookup features.

2.4 Problem Associated with Pharmacy Management System

For the past ten years, many researches and project were conducted regarding the Pharmacy Management System that solely aim for usage in the Hospital and Pharmacy. But there are not much research on application or software that aim for home and personal usage for manage medicine and drugs for daily usage.

Number and type of medicine needed for a particular disease is a problem to a user as they do not know the correct and suitable medicine to consume. The problem arise when there are many type of disease, many type of medicine, number of family member with difference health history and there are no mechanisms to manage all the expects stated. According to Firdaus (2008) "selecting the suitable medicine for the type of illness is usually take time". Time taken needed when selecting the suitable medicine is crucial as in some extend the medicine need to be taken instantly as in term of emergency and as a daily usage of medicine when family member face an illness or minor disease.

Inventory managements and control is crucial towards the successful of the application and system regarding to the pharmacy management system. But inventory for the application for individual and home usage are little difference from the inventory for the pharmacy management system. Home usage inventory focus on how the application manage the information request by the user and how the database manage all the information of the medicine and drugs related to particular disease and minor illness. Sadeep & Sooklal, (2012) indicated that Stock Control is vital for drug stores since stock is a noteworthy speculation made towards the achievement of the firm, consequently sufficient administration is crucial in guaranteeing security of the association's single biggest resource. It is vital as it enhances work process and upgrades consumer loyalty which is eventually the limit of the business.

The problem arises when there are no notification system that will notify the status of the inventory and expired status of the medicine. The notification functionality needed to notify the user and to make sure the user and the pharmacy will react and responds regarding the current status with fastest time. According to Fairuz & Razali (2005), there are still in least amount of framework that ready to give a ready message or update for the lapsed date for every medication in the stock. With the drug store framework, we had admittance to constant and precise data.

Other than that, there are lacks of the analysis mechanisms for the current pharmacy management system. Due to the reason, many research have been done to develop and embedded analysis tool in the current management system to make sure the user of the system will able to analyze and monitors the data and information recorded in the system for the current and future use of the pharmacy. There are no analyses are done for the frequency type of medicine usually buy by the customer or patient at that area. This is also important to determine the medicines that are demanded more from the customers so that pharmacist can be prepared to order more for that type of medicine.

All health care delivery programs require a robust and reliable drug supply system. Stock-outs can have negative effects on patient care, especially in the case of complex, chronic diseases like HIV and TB when poor outcomes, such as drug resistance and death, can often result.

2.5 Existing Pharmacy Management System

Based on further reading and research, the solution that the researcher proposes for the problem statement stated is to develop pharmacy management system. The system basically aims to simplify the process of managing the current pharmacy business process and increase the efficiency and effectiveness of the current business process (Lee, 2004). The system automates the current traditional and manual approach on the current business process on managing the inventory and transaction. The system will record all the transaction and activities regarding information and details of the medicine that owned by the pharmacy and kept all the information in a structural form in a database. According to Altuwaijri (2008), administration framework helps move data immediately around the association, lessening turnaround time for drug conveyance, requesting and courses of action lab work, planning and finishing other errand.

Other than that, the other solution that have been introduced for this segment is the inventory management system that aim to manage all the medicine own by the pharmacy in one inventory. The system will provide reports on status of the medicine own such as current numbers, expired date and type and categories of the medicine (Levison & Fraser, 2008). The system itself provide notification functionality that will notify the user of the system if the inventory is in critical status for example the inventory are decrease in number of medicine or the majority of the medicine will expired in short of time. The inventory management aims to increase the efficiency and time taken in response to the current and real time demand of the customers of the pharmacy management system. The increase in efficiency in response for the current demand and trends from the customers increases the dynamic of the current pharmacy and will increase the profitability and revenue of the organization. Altuwaijri (2008) stated that "advancement of the electronic health technology (e-health) field, whose applications have become necessity for hospital to archives certain objectives such as enhancing the quality of healthcare, and reducing the time and cost for healthcare delivery".

There are also developments of the integration mechanisms of the current pharmacy management system with the other management system use in the hospital to decrease the time needed in the process of patient to get their medicine after the treatment at the hospital and increase efficiency of the work process (Khelifi et al. 2013). The integration process will directly connect the system on the hospitals to the nearby pharmacy and hospital pharmacy so that the doctors will directly send the medicine list to the pharmacy the details of prescription of the patient so that the pharmacy can prepare early before the patient arrive and the patient will have little waiting time for their medicine.

2.6 Critics on Existing Pharmacy Management System

Lack of customizations in application and system is also one of the problems faced by the user. Fairuz & Razali (2005) found that "The process was slow, tedious, and often inaccurate, mostly because the system couldn't keep up with the hospital's dynamic inventory flows". The dynamic and customization factors have an impact on the usage of an application and system by the user.

There are many type of pharmacy management system that have been offered to the current pharmacy, there they are lacks of application that simplify the user experience regarding the pharmacy functionality that the user can easily get without need to go to the physical pharmacy. There are needs much application that enable the user can access or get enough information without need to go and get the information at the pharmacy. It will help the future user a fast respond time in time of emergencies and simplify the work rate of the pharmacist as the user already know what type of medicine and drugs that suitable for the current disease and condition.

Mobile application trends and usage, the existing pharmacy management system does not have extended functionality so that the user can operate the system with their mobile device such as smartphone and tablet. The smartphone application and device are raising trends that drive the current user to fully depend on their smartphone for the daily activities and needed. The advance pharmacy management system needs to utilize and exploit the current trends of mobile application to make sure the user fully benefit from the system used.

2.7 Android

Android is mobile operating system (OS) based on the Linux kernel and currently developed and owned by Google. According to Shu, Du, and Chen (2009), Android stage is another era of brilliant cellular telephone stage dispatched by Google. Android user interface primarily based on direct manipulation that design to interact for touchscreen mobile devices such as smartphone. As states by Blasing, Batyuk, Schmidt, Camtepe, & Albayrak (2010) Android is one of the fresher working frameworks focusing on cell phones. While being in light of a Linux bit, Android has remarkable properties and particular limits because of its versatile nature. Android uses touch inputs that loosely correspond to real-world actions like swiping, tapping, pinching and reverse pinching to manipulate on-screen objects and a virtual keyboard. Android operating system has and support many features and functionality so that the developer is allow to create and develop application based on the existing features. Based on Matos & Grasser (2010), Android OS incorporates a substantial arrangement of peculiarities for supporting versatile applications. At the heart of Android there is the Application Framework empowering reuse and substitution of segments. Android has its own particular virtual machine in view of Linux but improved for cell phones.

The reason why Android is selected compared other mobile operating system is the nature of android that support many features and functionality that developers are allow manipulating it for an application. According to Grant (2012), the main features and functionality that developers can manipulate in process of developing an application for androids are Storage, Network, Multimedia, Location Services and Phone Services. The main component of android that also the developers need to consider and able to manipulate and modify are functions of Activity, Intent Receiver, Service, Content Provider, and etc. (Shu et al., 2009). The other reason is the nature of open source of the Android make the development of an application is easier without restriction of the owner of the source code. Although android is owned by Google based on (Shu et al., 2009), Google are allow the developers to customize, manipulate and use the source code of the android to develop and application for free and with no restriction. The developers have

permission to implement modification on the system level, interface level and system process of the operating system (Blasing et al., 2010).

Common programming language uses in development process of android application also a main reason why many application developers chose Android as their application platform. Grant (2012) stated that Java programming language is essential in developing an android application as Java is one of the popular and commonly used programming language and highly used in Linux based framework software and application. Stated by Matos & Grasser (2010), usually developers write the application programming code in Java and commonly used some of tools in development process which are device emulators, tools for debugging, memory and performing profiling, and a plugin for the Eclipse IDE. Eclipse is commonly used in android application as the software main programming language is Java and usually the developers can get the software easily and free. Android user market is huge and worldwide that make the android application development is profitable and high prospect (Rasthofer, Arzt, & Bodden, 2014). The manufacturers worldwide commonly will preferred for Android more than other operating system such as Ubuntu, IOS, Windows or IOS as android have high number of user and fans.
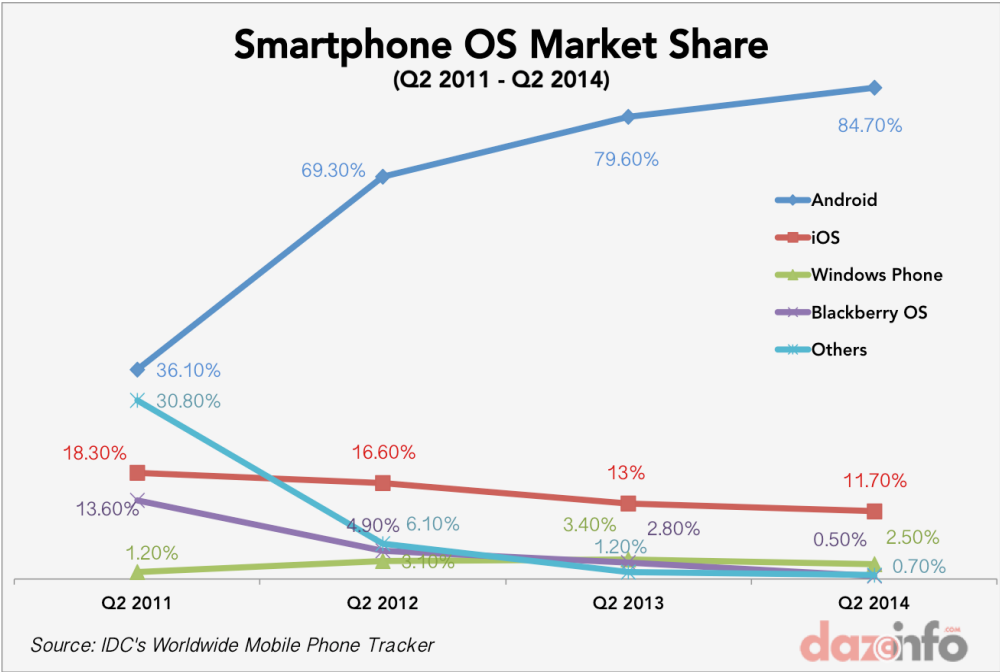
Figure 1: Android Market Share on 2014

Source from: http://dazeinfo.com/2014/08/14/smartphone-shipments-q2-2014-301-million-units-72-400-price/
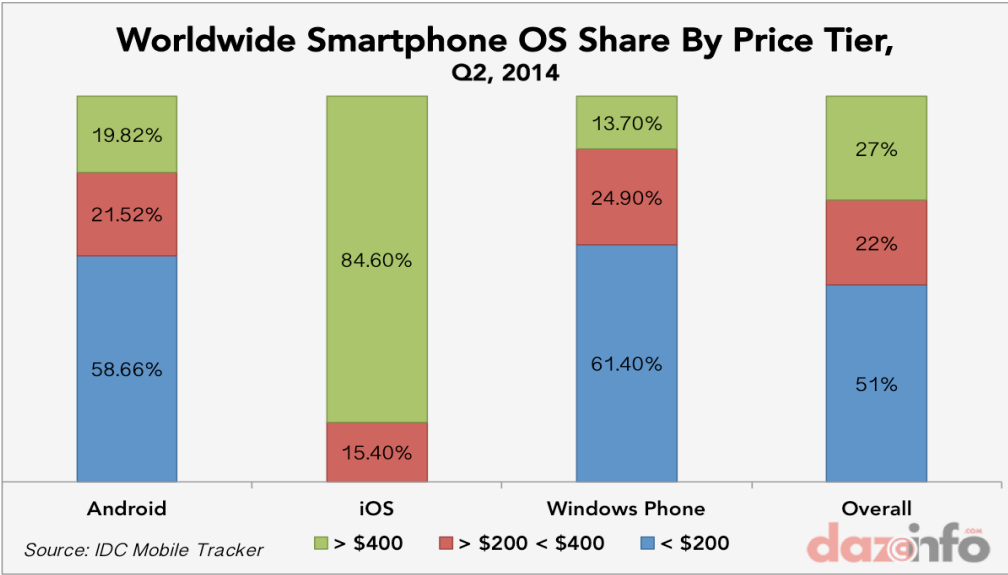

Figure 2: Smartphone Operating System Share by Price

Source: http://dazeinfo.com/2014/08/14/smartphone-shipments-q2-2014-301-million-units-72-400-price/

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2.8 Customization on Mobile application and System

Some of existing system and application todays are more emphasis on delivering their core functionality that may neglect the user experience itself. Customization is the ability of the end user to personalize their experience when using a mobile application or a system. Customization is important as some activities may require specialized services or personalized interface layout and function (Hung & Pasquale, 2004). According to Hung & Pasquale (2004), lack customization ability for a mobile application or a system may degrade the quality of services that will increase in frequency as the number of user increase in time with different needs and type of device. Generally, customization is referred to the personalization of display and look-and-feel of mobile application experience. Based on Dersen & Martensson (2009) research, customization is beyond the look-and-feel of an application but also on the user programming experience and the actual functionality of the mobile application.

The fundamental center was on how the stream and communication between end client and framework ought to be composed, with a specific end goal to make the methodology of customization as easy as could reasonably be expected (Dersén & Mårtensson, 2009). The end users have the ability and are allowed to personalize, choose and manage the mobile application to maximize the usage and capability of the mobile application itself. Customization not only will make a mobile application user friendly, but in the same time customization will increase the productivity and simplify the process and functionality of mobile application when delivering the services. In customization principle, the customization process itself must allow the effortless process and procedure to make sure the functionality of customization that have been provide by the developer are fully utilize and easy to use by the end user.

Customization process for a mobile application should be simple and easy. It is to make sure the user utilize the actual and core functionality of a mobile application and note to focus on how to customize the display layout and functionality customization. According to Adina, Intorsureanu, & Mihalca (2007), mobile application customization should be easy and simple for the administrator and end user. For example the configuration of screen display and user configuration function and data should be intuitive and not

requiring high level of information and technology knowledge and based on common knowledge on operating a mobile application.

The main objective of customization is always to empower customers experience when operating a mobile application (Erdogmus, 2007). Customization ability in mobile application will let end user to design and separate the unneeded functionality of information and focus on needed and important information when operating a mobile application. In other word, customization will help end user to operating the less complex functionality and information then the current information and functionality of the mobile application. The developer must utilize the right portable application appropriated framework to give an high level of customization and setup for application concerned by the administration of customer services (Quéma, Bellissard, & Laumay, 2002).

Chapter 3: Research and Methodology

3.1 Development Methodology

For this project, I have chosen Rapid Application Development (RAD) as the research methodology. The reason why this methodology is selected is due to the rapid prototyping nature where development of the application could be done in the early stage and user's requirement and expectation could be address fully at the development phase. Products development is faster and the quality of the product is higher is the main advantage when utilize RAD concept.

The other reason why Rapid Application Development is selected is time constraints. The time allocated for the execution of the project is only 8 month and the period is not enough for Android Application development if the other methodology is selected. Application development speed can be enhanced and quick result could be produce when RAD methodology is used. RAD methodology can increase the speed of development as developers can quickly deliver parts or functionality of the application to the users is one of the advantages of this methodology. Quality of the product is also increased because of the involvement of user in the stages of development of the application.

There are four main phases in RAD model:
- Analysis and Quick Design Phase
- Prototype Cycle
- Testing
- Deployment/ Implementation
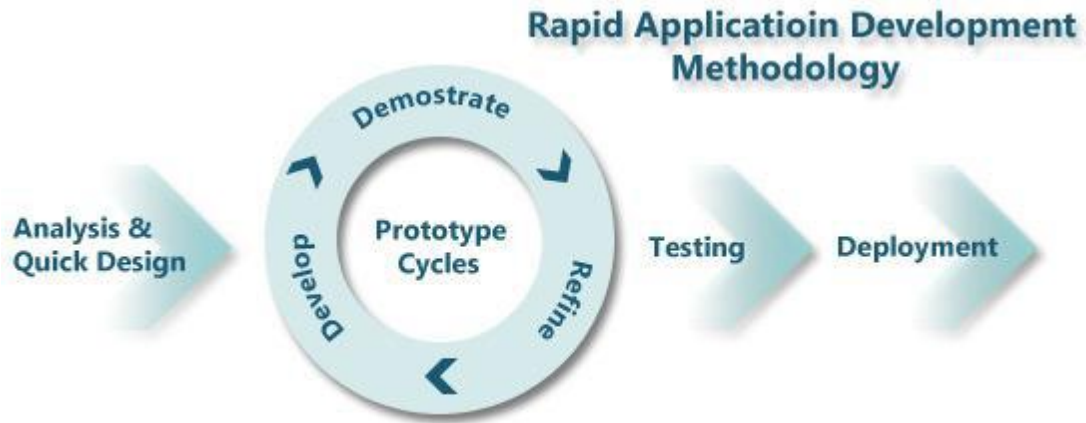
Figure 3: Rapid Application Development Methodology

Source: RamSoft Consulting. Retrieved February 8, 2015 from

http://www.ramsoft.com.au/methodology.php

3.2 Rapid Application Development (RAD) methodology

The analysis, design and implementation phase will be performed in concurrent flow process. After the initial prototype is complete, it will be delivered to the end user for inspection and comments. Based from responds and feedback from the user, process of re-analyzation , re-design and development need to be executed before the development of the second prototype. All the process is then repeated and all these phase are performed concurrently until the application is complete and delivered to all the user requirements and expectation. End user will be provided with the system quickly to enable them to interact with the application and they will get involved in the development of the application development process.

Below are the detailed processes of each phase:

1. Analysis and Quick Design Phase

    The developer carried out a research related to the mobile application development. The major deliverable for this phase is the literature review which point out all the research aspect and element related to the topics. This phase enable developers to approach end user or knowledge experts in order to collect and record all the end user requirements and knowledge expert expertise. The process of collecting and recording all the valuable information is by conducting interview session with the end user and knowledge experts.

    An interview have been conducted with a pharmacist that act as knowledge expert of pharmacist domain knowledge and with the potential end user. The purpose of the interview session conducted is to collect and record all the requirement needed and all the information that must be included in the MyHomePharmacy application. All the information and requirements collected are recorded as functional and nonfunctional requirement for this particular mobile application. For prototyping process, all the requirements and information are translated as Unified Modelling Language (UML) for better understanding and interpretation. The functional and nonfunctional requirement need to be included in prototype of the MyHomePharmacy application to investigate and evaluate the application functionality, to detect the error produce and to improve them. The functional and nonfunctional requirements will undergoes the process of validation to make sure the requirement documented satisfy with what are requested and expected by the potential user and the knowledge expert.

Functional Requirement:

1. The application shall provide user to create their own account for the application

2. The application shall be able to check the username and password inserted are correct

3. The application should provide the end user the ability to select mode type either 'Family Mode' or 'Self Mode'.

4. The application should provide the end user the ability to insert their family member details in 'Family Mode'.

5. The application should provide the end user the ability to select the type minor disease and injuries listed

6. The application should provide the end user the ability to select the correct symptoms listed.

7. The application should provide the end user the ability to display the medicine details and restriction.

8. The application should provide the end user the ability to display the disease selected related advice and tips.

9. The application should provide the user the ability to set the notification and alarm on the time of medication consumption.

Nonfunctional Requirement:

1. The application shall provide user authentication.

2. The application shall available 95% of the time.

3. The application provide simple and structured user interface to the end user.

4. The application should able to support 100 concurrent user.

5. The application should update the medicine database once a week to reflect the latest type and details of medicine.

6. The application should be able to run on Android 2.3 and above version.

Design phase is the stage which determines how the mobile application will functions and works in the future. The developer needs to prepare the mobile application framework and the deliverables of this phase are Activity diagrams, Use Case diagrams, Application interfaces and others.

10. Prototype Cycle

The prototype cycle phase is the most crucial phase in RAD methodology and development of this mobile application development. This phase is the initial development of the prototype to have a tangible view of the design. The complete prototype is delivered and demonstrated to the supervisors and the potential end users for valuation, user feedbacks and improvement ideas for the products. The prototyping process will be cycled and all the improvement are recorded until a complete prototype is created which meets all the end user requirement.

11. Testing

The purpose of testing phase is to validate and verify the end product of the mobile application. Usability test and user acceptance test are executed with the end users to determine whether the mobile application is fulfilling all the established requirements and functionality. This phase also aims to detect any errors or problem that occurs during the operation of mobile application.

12. Implementation

Implementation phase is the final stage in the development of this mobile application. The phase includes and involves the actual construction and installation of the mobile application. It is a process of transition from the development status of the project towards production status. Application is in the steady-state production and is able to be installed at the end user devices. This phase also includes the maintenance of the application and any further updates of the mobile application in the future.

As RAD development methodology selected for the execution of this project, all the prototype created and developed are presented to the end user and the knowledge experts for their comments and feedback. The mobile application will incrementally complete and improved based on the user recommendation and suggestion.

When the mobile application is completed and successfully built, User acceptance testing was performed. The testing gave the developers the confidence that the mobile application produced meets the entire requirement needed. The user acceptance testing result and a summary of the assessments are needed at the end of the process for documentation, validation and verification of the mobile application.

3.3 Application Architecture
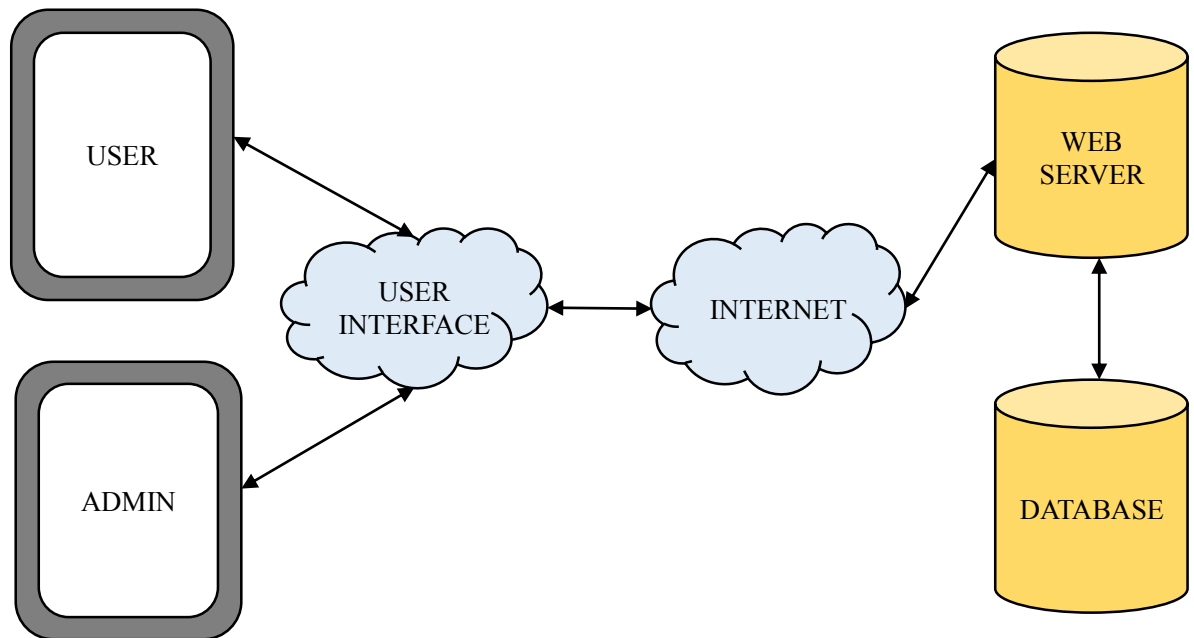
Figure 4: MyHomePharmacy Mobile Application Architecture

The application will have two major user which are ordinary user and admin user. The end user will interact with the user interface of the application to operate all the functionality of the mobile application. The mobile application need to be connected to the internet in order to operate. The application use a web server to host the application as it does not have their own dedicated application server. The web server will host the application and retrieve all the data and information from the database created. Internet connection needed to be established as the application need the internet connection to load all the information such as the user family details, medicine details and advices from the database server. MIT App Inventor web server will serve as host to the application and the database created conjunction with the MIT App Inventor functionality of Database will serve as the application database.

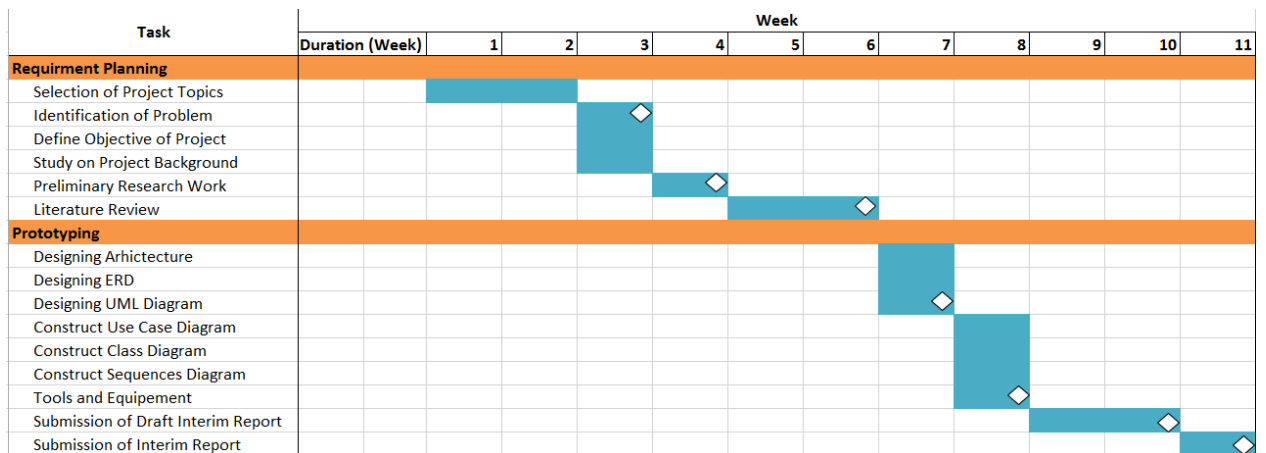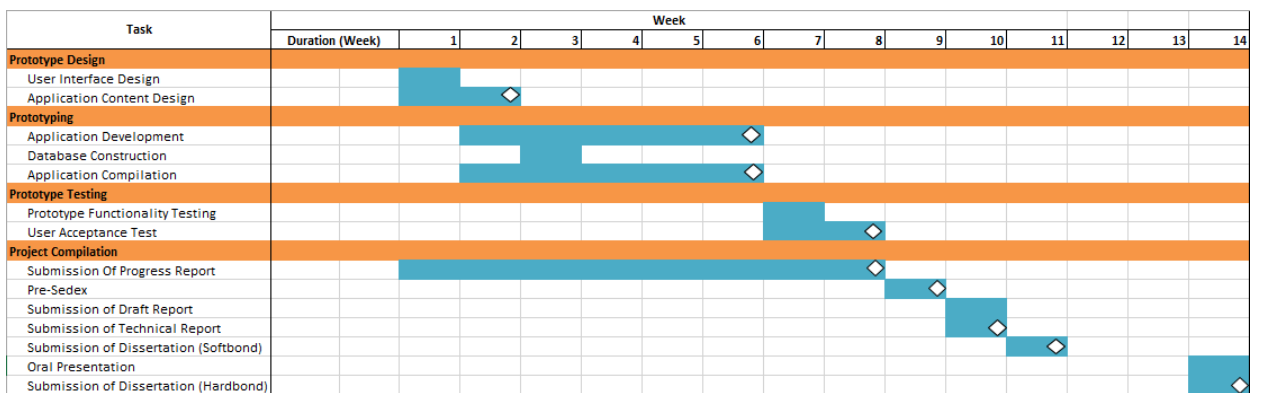## 3.4 Gantt Chart and Key Milestones

Gantt chart:

Task	Duration (Week)	1	2	3	4	5	6	7	8	9	10	11
Requirment Planning												
Selection of Project Topics		▇	▇									
Identification of Problem				◇								
Define Objective of Project				▇								
Study on Project Background				▇								
Preliminary Research Work					◇							
Literature Review					▇	◇						
Prototyping												
Designing Arhictecture								▇				
Designing ERD								▇				
Designing UML Diagram								◇				
Construct Use Case Diagram									▇			
Construct Class Diagram									▇			
Construct Sequences Diagram									▇			
Tools and Equipement									◇			
Submission of Draft Interim Report											◇	
Submission of Interim Report												◇

Figure 5: Gantt chart FYP 1

Task	Duration (Week)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Prototype Design															
User Interface Design		▇													
Application Content Design			◇												
Prototyping															
Application Development			▇	▇	▇	▇	◇								
Database Construction					▇	▇									
Application Compilation			▇	▇	▇	▇	◇								
Prototype Testing															
Prototype Functionality Testing							▇								
User Acceptance Test								▇	◇						
Project Compilation															
Submission Of Progress Report		▇	▇	▇	▇	▇	▇	▇	◇						
Pre-Sedex									▇	◇					
Submission of Draft Report											▇				
Submission of Technical Report											▇	◇			
Submission of Dissertation (Softbond)												◇			
Oral Presentation															
Submission of Dissertation (Hardbond)														▇	◇

Figure 6: Gantt chart FYP 2

Key Milestones:

Table 1: Project Milestones FYP 1

Key Milestones	Week
Identification of Problem	Week 3
Preliminary Research Work	Week 4
Literature Review	Week 4-6
Designing UML Diagram	Week 7
Tools and Equipment	Week 8
Submission of Draft Interim Report	Week 10
Submit Interim Report	Week 11

Table 2: Key Milestone FYP2

Key Milestones	Week
Application Content Design	Week 2
Application Development	Week 2-7
Prototyping Testing	Week 7-8
Pre-Sedex	Week 9
Submission of Technical Report	Week 10
Submission of Dissertation	Week 11
Viva (Oral Presentation)	Week 14

3.5 Tools and Software involved

a) **Android enabled devices**

HTC One M8 and ASUS Zenphone 5 mobile phone was used for the testing of the developed mobile application.

b) **Visual Paradigm**

This is used to create and develop the Unified Modelling Language (UML) to document the end user and pharmacist requirement.

c) **Adobe PhoneGap Platform**

PhoneGap is a mobile development framework. It enables software programmers to build applications for mobile devices using JavaScript, HTML5, and CSS3, instead of relying on platform-specific APIs like those in iOS, Windows Phone, or Android. It enables wrapping up of HTML, CSS and Javascript code depending upon the platform of the device. It extends the features of HTML and Javascript to work with the device. The resulting applications are hybrid, meaning that they are neither truly native mobile application (because all layout rendering is done via web views instead of the platform's native UI framework) nor purely web-based (because they are not just web apps, but are packaged as apps for distribution and have access to native device APIs).

d) **Adobe Dreamweaver**

Adobe Dreamweaver is a web design and development application that provides a visual WYSIWYG editor (colloquially referred to as the Design view) and a code editor with standard features such as syntax highlighting, code completion, and code collapsing as well as more sophisticated features such as real-time syntax checking and code introspection for generating code hints to assist the user in writing code.

Chapter 4: Result and Discussion

4.1 Important Reasoning Element in Medication Suggestion

Based from the interview session with pharmacist, there are three reasoning element that need to consider for medication and drug selection and suggestion. The important reasoning elements which are:

1. Type of Minor Illness and Disease
    MyHomePharmacy only list 3 minor illness which are Fever, Flu and Cough. The reason why the 3 minor illness selected is the high frequency of this illness infect to patient of the pharmacy. The other reason is, the wide range of the medication for each of the illness that provide more recommendation for the patient and user.

2. Medication and Drugs Category
    Every minor illness medicine and drugs have their own category. The category is depends on the user preferences and the illness condition.
    -   Fever   : Powerful Effect, Normal Effect
    -   Flu   : Drowsy, Non-Drowsy, Drowsy/Non-Drowsy
    -   Cough : Phlegm Cough, Dry Cough

3. Type of Medication and Drugs
    Type of medicine and drugs also depends on the user preferences. If the user prefer to consume tablet than syrup form of medicine, they will select tablet type of medicine and drugs. There are three common type medicine form which are Tablet, Syrup, and Suppository.

4.2 Unified Modelling Language (UML) Diagram
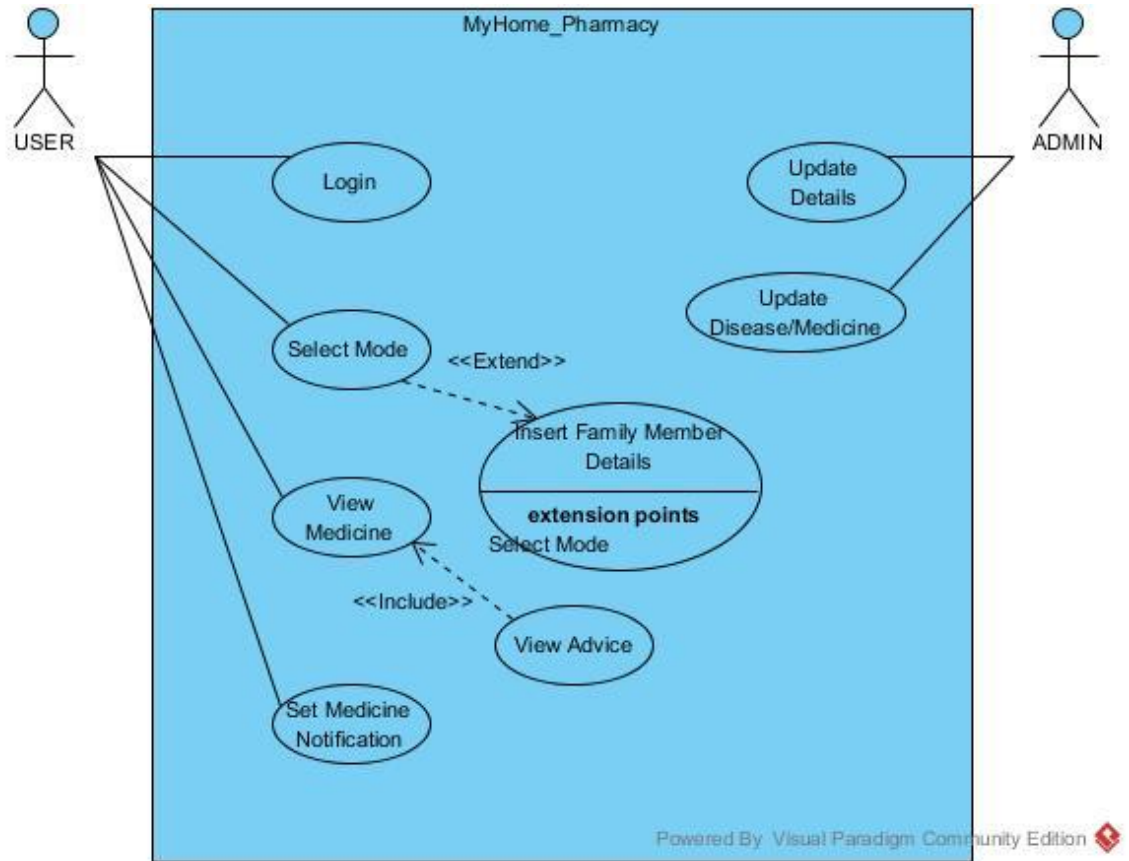
4.1.1 Use Case Diagram

Figure 7: MyHomePharmacy Mobile Application Use Case Diagram

There are two actors included in the use case diagram which are User and Admin actors. The user associated with Login and Set Medicine Notification use case. Other than that, the user also associated with Select Mode use case that have extended functionality of Insert Family Member Details use case. The user also associated with the View Medicine use case which includes functionality of View Advice use case. The admin will only associated with the Update Details use case and Update Disease and Medicine use case as the role of admin is to manage the information gather and needed by the application.
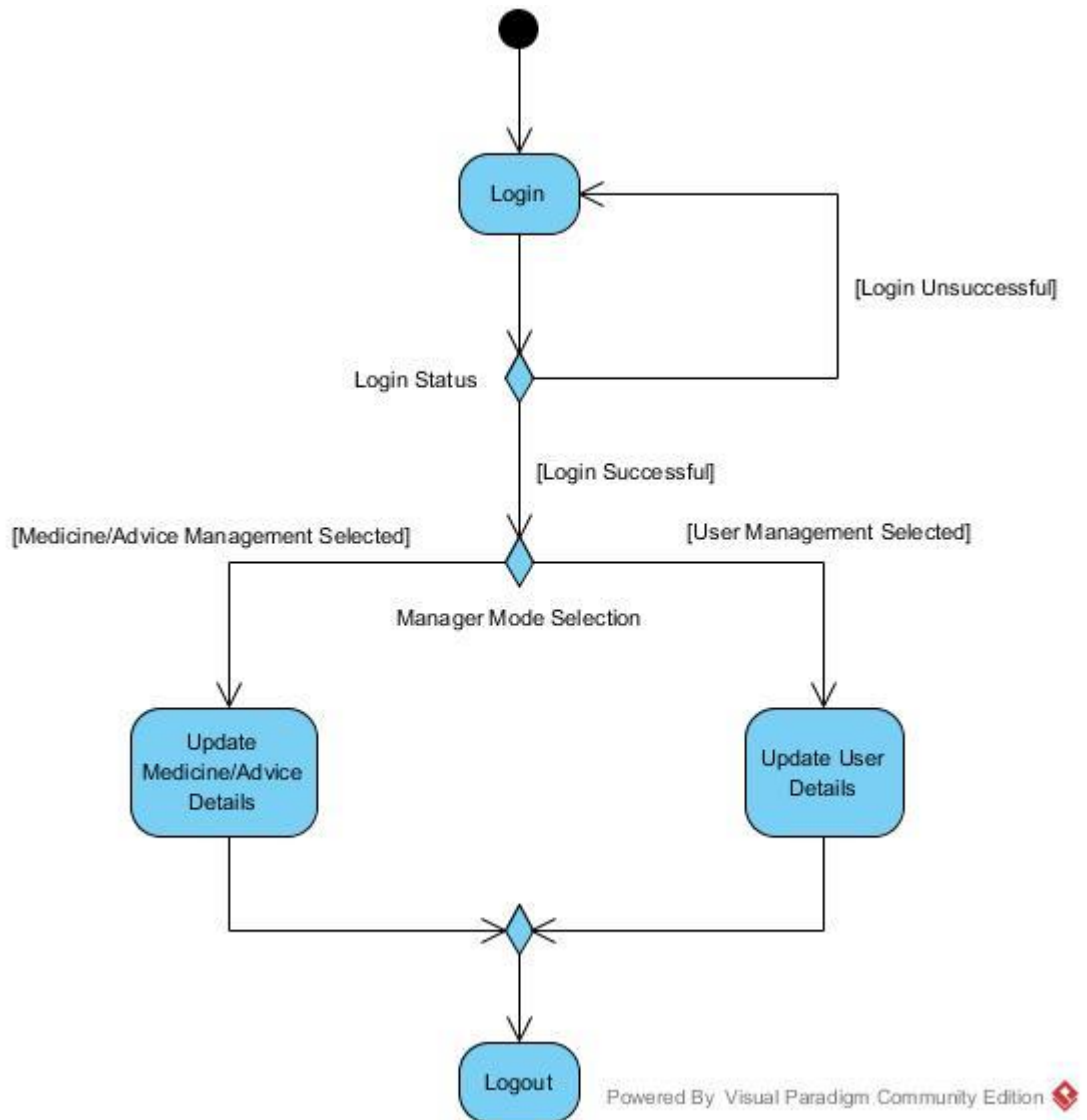
Figure 8: MyHomePharmacy Mobile Application Activity Diagram (Admin)

Activity diagram is a graphical representation of workflows activities and actions with support for choice, iteration and concurrency. Activity diagram above shows the application activity that be experienced by the Admin. Admin user need to be login successfully in order to use the application. Then the admin need to select between User Management Mode and Medicine/Advice Management Mode. The User Management Mode will allow admin to update user details and Medicine/Advice Management Mode will enable the admin to update medicine and advice details.
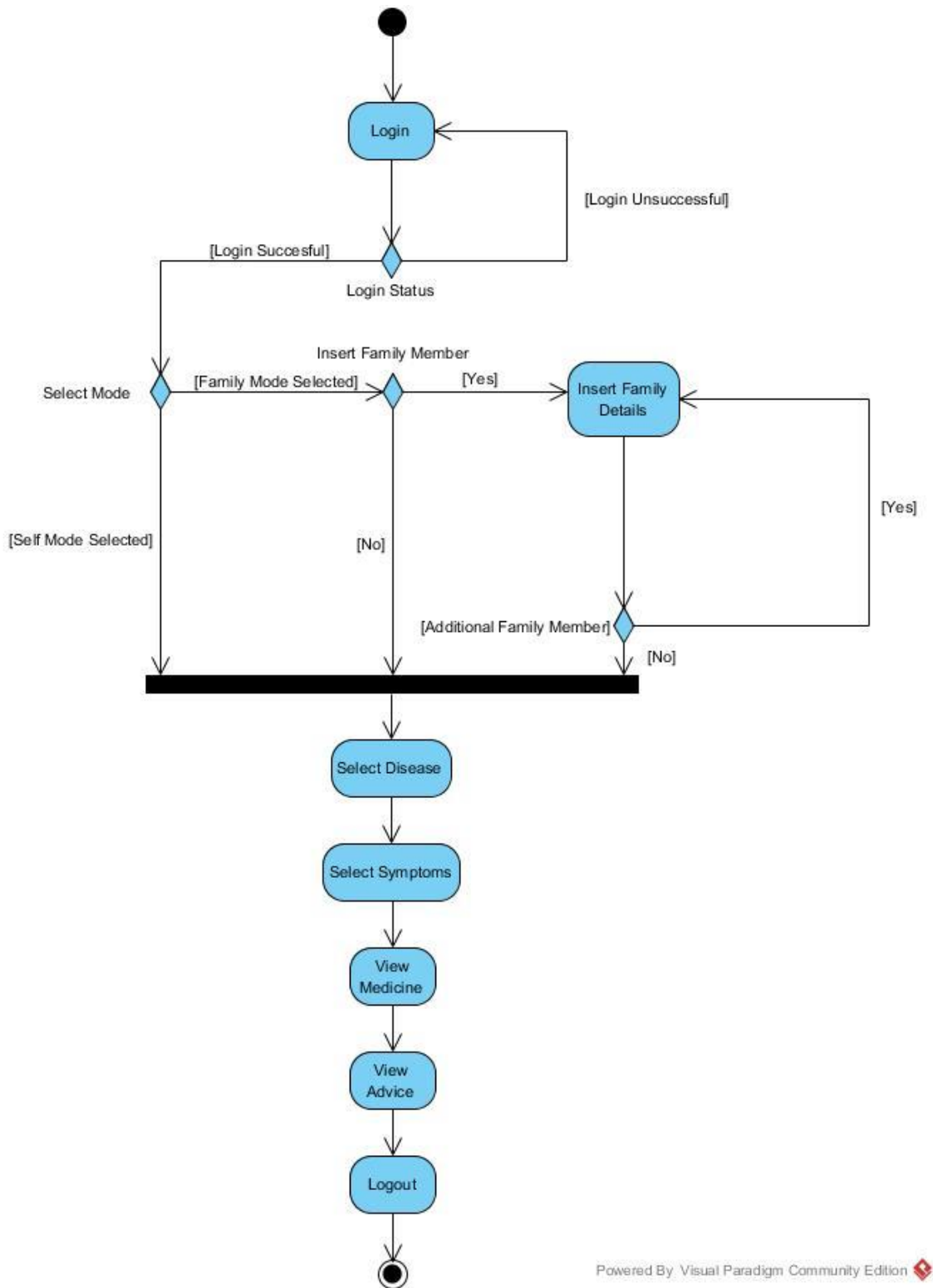
Figure 9: MyHomePharmacy Mobile Application Activity Diagram (User)

Activity diagram above illustrate the activity that will be experienced by the user. The user will need to login successfully in order to operate the mobile application. Then the user need to select mode of the user between Self mode and Family mode. If the Family mode is selected, the application will allow the user to insert the family details, then the application will enable the user to insert the additional family member details if there are more than one family member. If the user have finished update and insert the family details, the application will allow the user to select the disease. The Self mode user will go directly to the select disease interface and then go to the Select Symptoms interface. The result of the Medicine details, restriction and Advice interface will display to the end user after all the selection complete. After all operation performed, the user will able to logout from the application to end the session using of application.
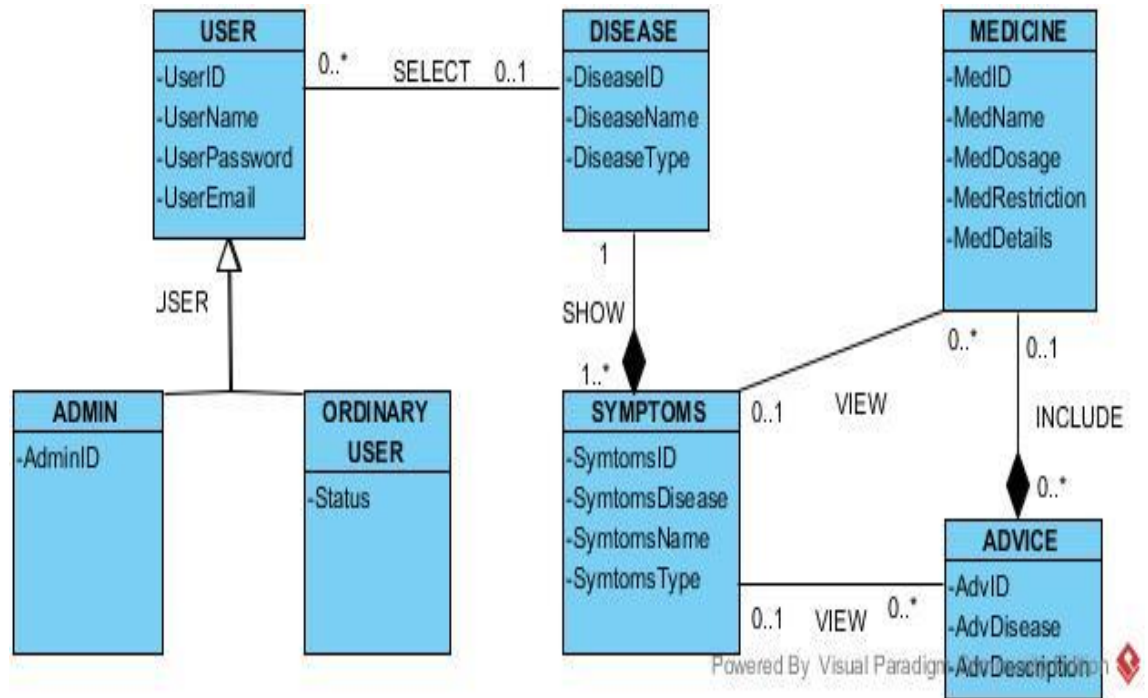
4.1.2 Class Diagram

Figure 10: MyHomePharmacy Mobile Application Class Diagram

There are total 7 table that needed to be created in the database for this prototype of mobile application. The table of user have the generalization relationship with the Admin and Ordinary User table as the application will have two type of user which are ordinary user and admin. The User table will have relationship with the Disease table as to enable the user to select the disease. The disease table will have relationship with Symptoms table as the user need to select the symptoms related to the disease that they select earlier. The Symptoms table will have two direct relation with the Medicine table and Advice table so show and display the Medicine details and Advice related to the disease with the selected symptoms by the user.

4.3 MyHomePharmacy

Preliminary prototype was developed to analyze and test the functional requirements that have been identified in requirement analysis process. The preliminary prototype is built by using MIT App Inventor web software.

The prototype is initial model of the application, the purpose of the prototype is to design, develop and test the functional requirement of the particular application to identify the error and improvement about the application involve. Picture below shows screenshots captured of prototype developed by using Adobe PhoneGap. This prototype was tested by HTC ONE M8 model android device with Android 5.0.1 (Lollipop) operating system and ASUS ZenPhone 5 android device with Android 4.4.4 (KitKat) operating system.
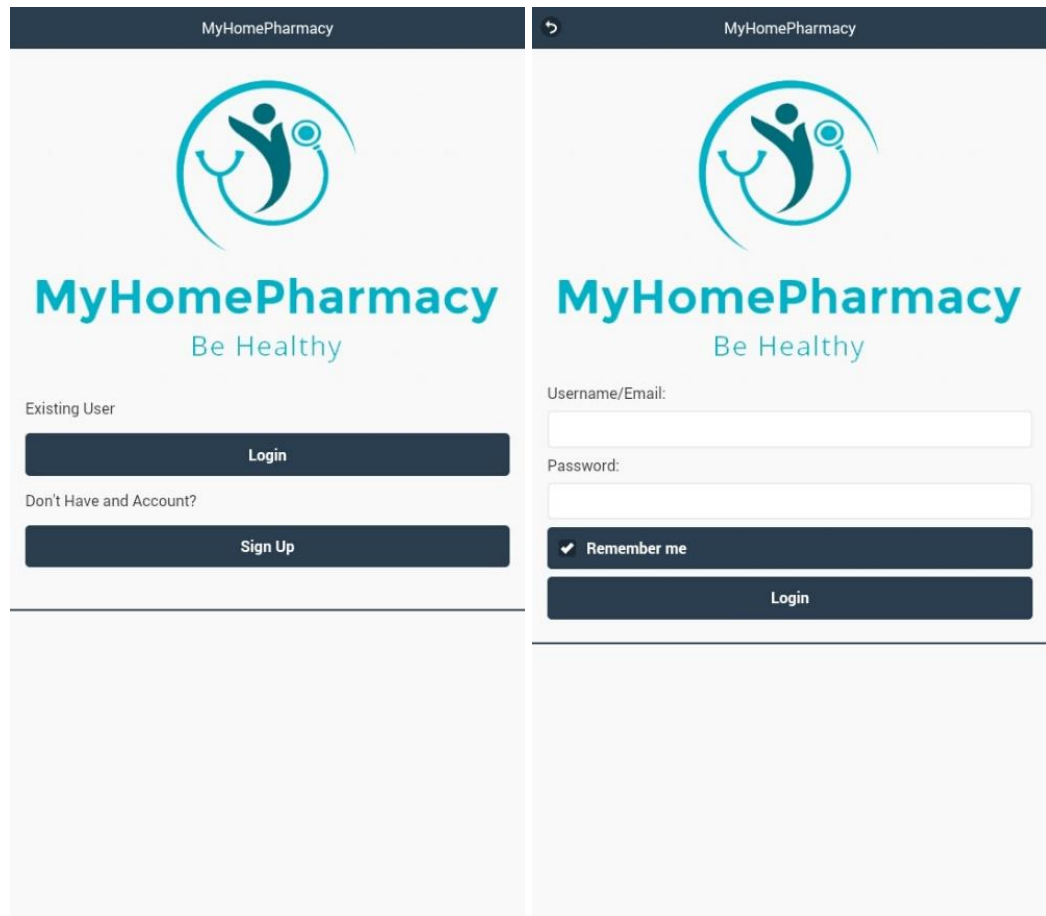
4.3.1 User Interface

Figure 11: User Login Interface

The figure 11 show the User Login interface design for the prototype. Login interface allow user to insert their username and password.
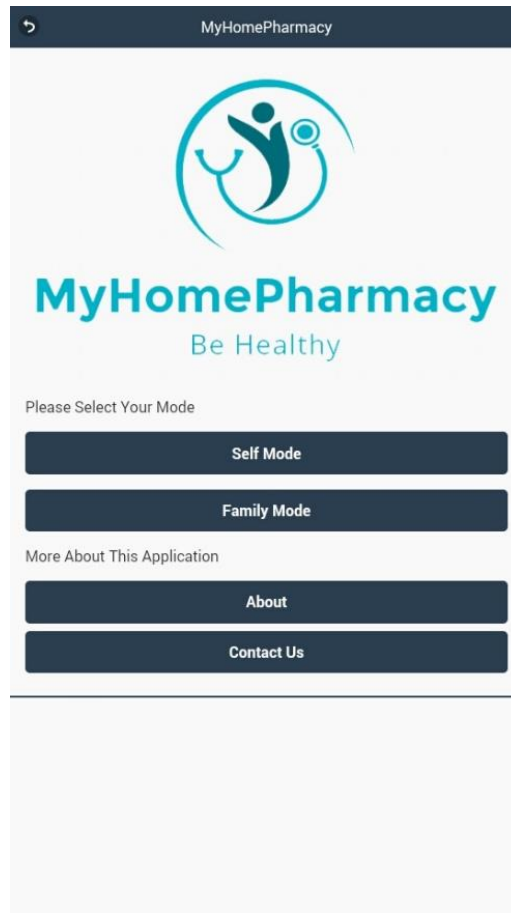
Figure 12: Home Page Interface

Figure 12 demonstrate that User can proceed to Mode Selection interface after successfully login. Mode Selection interface have two type of choice offered which are presented by Self Mode button and Family button to the end user which represents Self-Mode and Family-Mode.
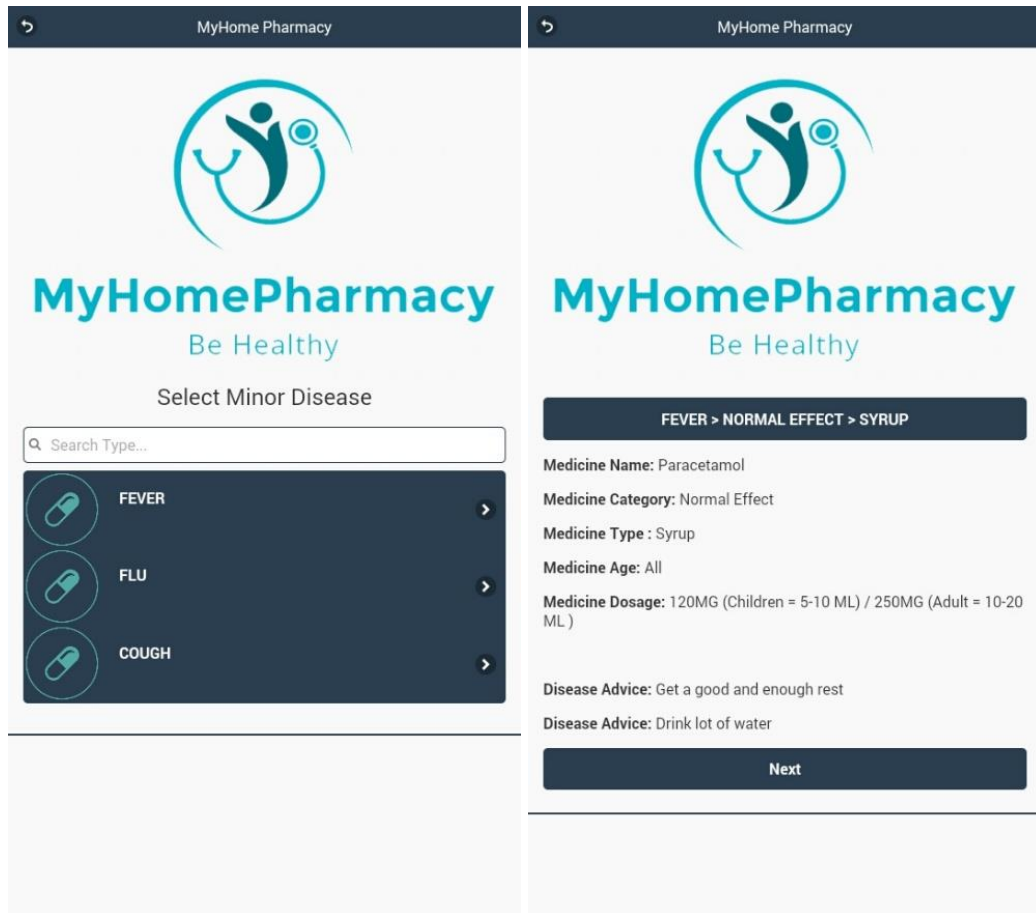
Figure 13: Disease Selection and Medication Details Displays Interface

Figure 13 explain the Disease Selection interface of the prototype. The user can select the range of Disease prepared by the prototype such as Fever, Flu and Cough. The user can click on Select Button to finalize their disease selection. The figure above also expressed the Medicine Details Display interface that permit the end user to view the details of the medicine for the selected disease and symptoms. Firstly, the end user need to select the type of medicine for medicine type such as Syrup, Tablet and Supposhory (Flu) to view the associated medicine.

Figure 14: Family Mode Selection Interface

Figure 14 explain the Family Mode Selection Interface. This interface will display two button which are "Insert Family Details" and "Display Family Details".

Figure 15: Add Family Details Interface

The figure 15 show Add Family Details Interface, this interface can be accessed if the user select the Family-Mode in the Mode Selection interface. This interface enable user to insert the details of their family member which are Name, Age, and Relationship. The user can end the session by click on the Save Family Details Button.

Figure 16: Family Details Display Interface

The figure 16 above demonstrate the Family Details Display Interface that permit
the end user to view the family details for the particular individual user.
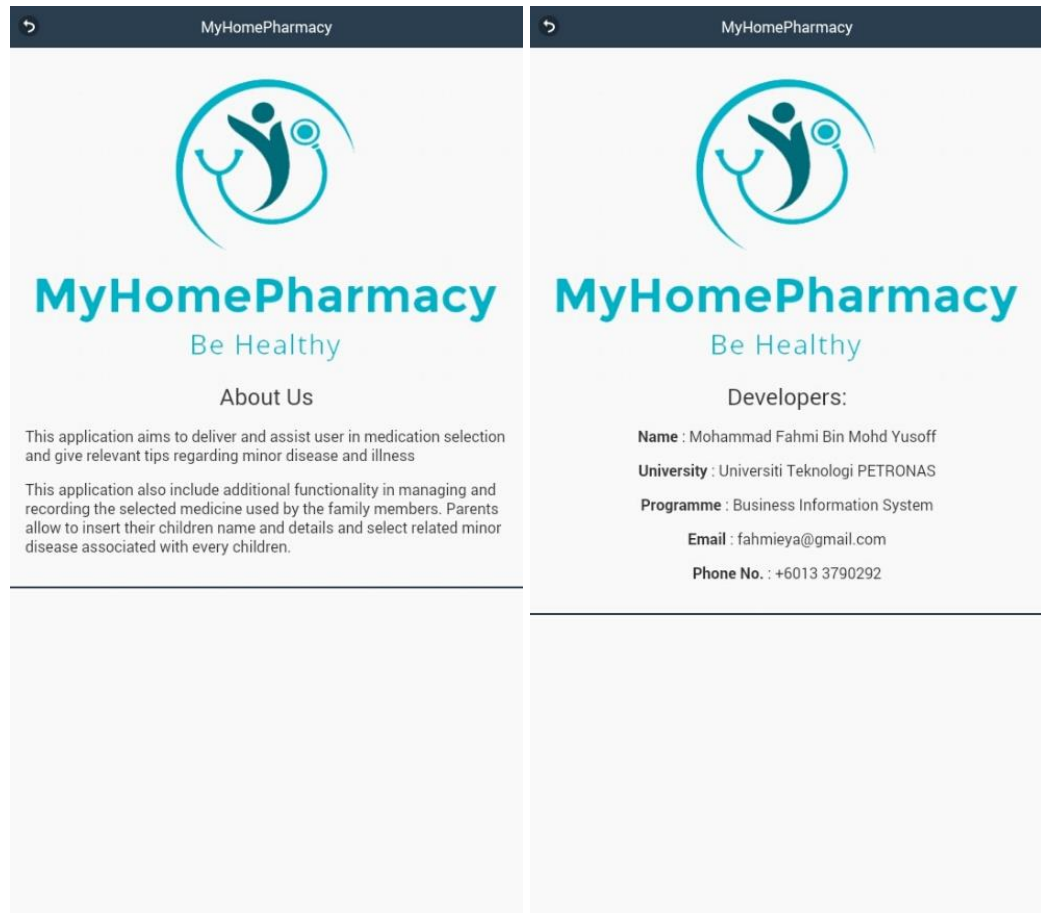
Figure 17: About Us and Contact Us Interface

The figure 17 show "About Us" page that display all the information related to the application and "Contact Us" page that display all information that user can use to contact the developer.

4.4 Testing

4.4.1 Functionality Testing

The purpose of the functionality testing is to check the fulfillment of functionalities based on the requirement. Table 3 shows the functional testing of the MyHomePharmacy: Mobile Android Application. The functionality test cover all four major functionality of MyHomePharmacy application. 10 user which are 5 students and 5 parents are selected in this testing session. All the user are required to filled in the questioners as shown below:

Functions	Expected Outcome	Testing Frequency	Testing Result		Remark
			Success	Failure	
"Login" button	Navigate to Login page	10	10		
"Sign Up" button	Navigate to Register page	10	10		
"MyHomePharmacy" register page	This page will contain username textbox, password textbox and a "Register" button	10	10		
Alert (login) – When username already exists in the database	Alert will pop up	10	10		
Alert (password) – When password entered by user is wrong	Alert will pop up	10	10		
"Register" button	Register user in the application	10	10		
"MyHomePharmacy" login page	This page will contain username textbox, password textbox and a "Login" button	10	10		
Alert (login) – When username already exists in the database	Alert will pop up	10	8	2	
Alert (password) – When password entered by user is wrong	Alert will pop up	10	10		
"Remember Me" button	Save user current session	10	10		
"Login" button	Navigate to	10	8	2	

40

	application homepage				
"Self-mode" button	Display 3 types of minor disease (fever, flu, cough)	10	10		
"Select Minor Disease" dropdown menu (for fever)	Display 2 types of category for fever disease (Powerful Effect, Normal Effect)	10	10		
"Select Minor Disease" dropdown menu (flu)	Display 3 types of category for flu disease (Drowsy, Non-Drowsy, Drowsy/Non-Drowsy)	10	10		
"Select Minor Disease" dropdown menu (cough)	Display 2 types of category for cough disease (Phlegm Cough, Dry Cough)	10	10		
"Select Category" dropdown menu (fever)	Display 3 types of medication (Tablet, Syrup, Suppository)	10	10		
"Select Category" dropdown menu (flu)	Display 2 types of medication (Tablet, Syrup)	10	10		
"Select Category" dropdown menu (cough)	Display 2 types of medication (Tablet, Syrup)	10	10		
Medication recommendation page	This page will display medication/drug that match with specific type of minor disease. It also display the category, medication type, Age Group and Dosage. This page also display advices and tips associates with the medication selected.	10	8	2	
"Next" button	Display the next medication suggestion on the same domain	10	10		
"Family-Mode" button	Display 2 option which are (Insert Family Details, Display Family Details)	10	10		
"Insert Family	Display 3 disease	10	10		

| Details" button	selection (Fever, Flu, Cough)				
"Fever" button	Display a specific form for fever disease	10	10		
"Flu" button	Display a specific form for flu disease	10	10		
"Cough" button	Display a specific form for cough disease	10	10		
"Save Family Details"	Alert will pop up to notify the save operation success	10	6	4	
"Display Family Details" Button	Display all the data that insert by the user in a table	10	10		
"Display Medicine" button	Display medication suggestion page	10	10		
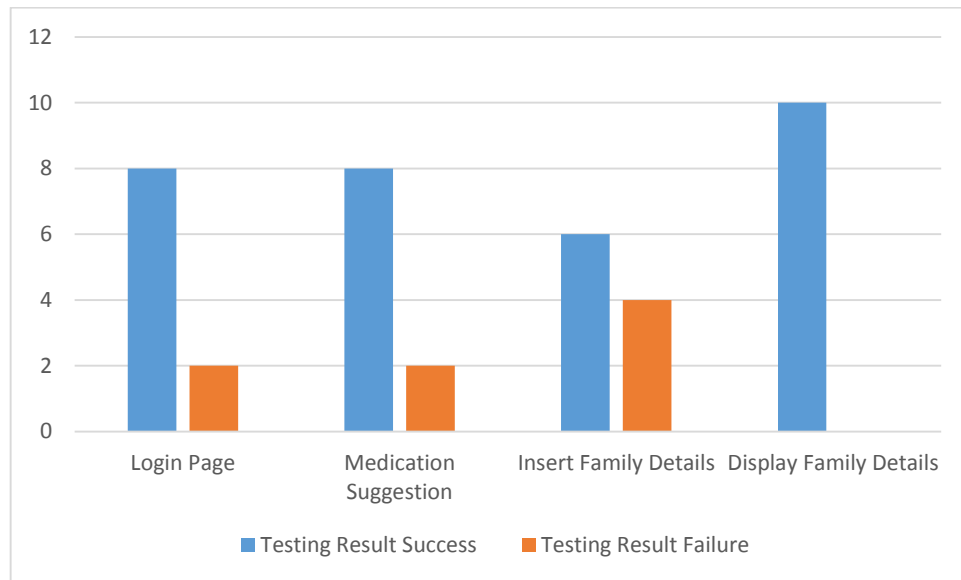
Figure 18: Application Functionality Test Result

Figure 18 above indicate the result from the application functionality test. The test are focused on four major section which are "Login", "Medication Suggestion", "Insert Family Details" and "Display Family Details". There are some failure during testing session due to the database error and unstable internet connectivity. The most successful functionality are "Display Family Details" as recorded 100% success rate. The least successful functionality are "Insert Family Details" as only recorded 60% success rate.

4.4.2 User Acceptance Testing (UAT)

User Acceptance Test is a test that is conducted in order to determine the efficiency of the application. This testing is conducts on the students and parents after the development of this application is complete. The criteria that will be tested in the user acceptance test are understandability, learnability, attractiveness, and performance effectiveness. The details of each criterion as per below:

- Understandability – the interfaces and the purposes of this application must be easy to understand
- User-Friendliness – this application should have attractive screen layouts, pictures, contents and colour.
- Performance effectiveness – this application is able to help the students with medication suggestion and able to help parent manage their child medication inventory.

For understandability, the students must find that this application is easy to use and also the functions of the buttons, instructions, and other interfaces in the application are understandable. Then, for User-Friendliness, the students must find that this application is consists of attractive layouts, pictures, contents and colour which can ease the user usability. Lastly for performance effectiveness, the students and parents must find that this application is able to help the students with medication suggestion and able to help parent manage their child medication inventory.

5 students and, parents have been choose to perform the user acceptance testing. All the user are provide with the instruction and question to test the system according to students point of view and parents point of view and being provided with the smartphone with MyHomePharmacy installed. After the testing, most of the users are required to fill in the questionnaire as shown in the **Appendix 1.**
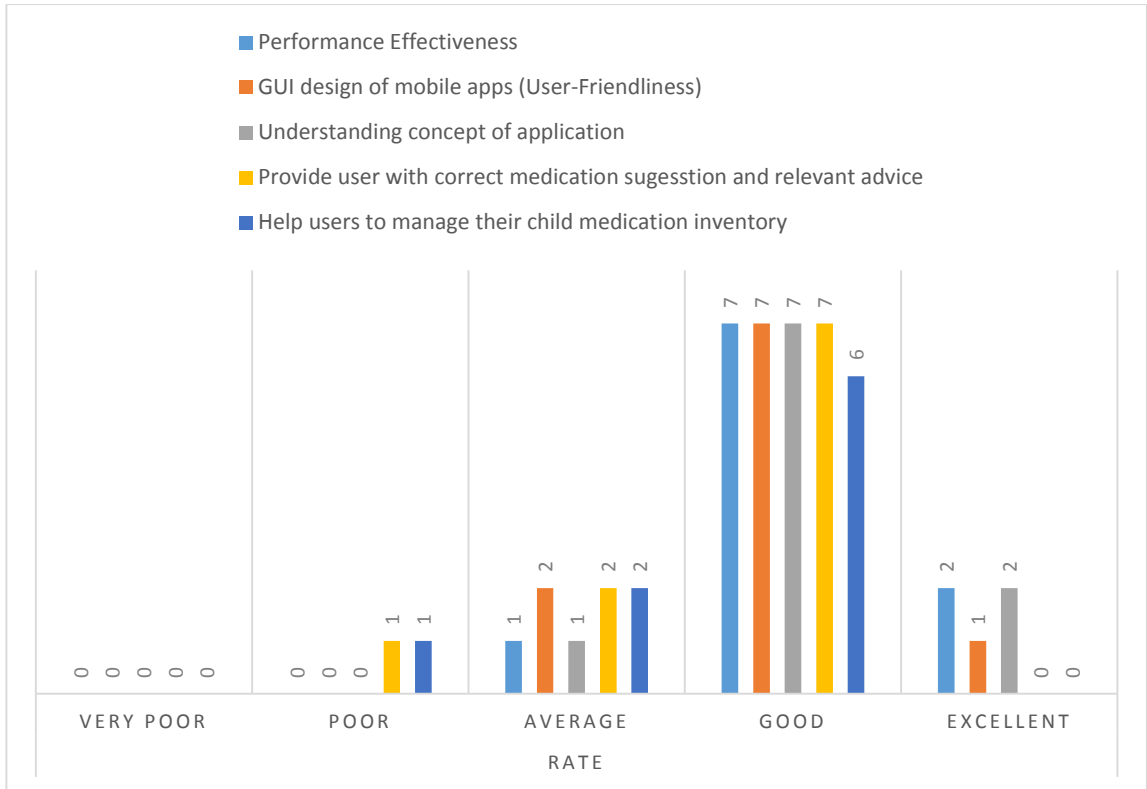
Figure 19: User Acceptance Test Result

Figure 19 above present the user acceptance test result. The test are concentrate on 5 major element which are "Performance Effectiveness", "User-Friendliness", "Understanding concept of application", "Medication Suggestion" and "Medication Inventory". The highest rating recorded is "Good" and the lower rating is "Poor". There are no "Very Poor" rating recorded indicated that the application is useful and highly accepted by the user. Least "Excellent" rating recorded show that the application need some improvement and modification to meet user expectation and usefulness.

Chapter 5: Conclusion and Recommendation

5.1 Conclusion

MyHomePharmacy: Mobile Android Application is intended to help end user which are individual especially students and parents in selection process of correct and suitable medicine that can be consumed and to provide the right advice and tips for a particular minor disease. To provide the correct medicine and drugs recommendation, important reasoning elements for each minor illness need to be identify. Each minor illness have their own reasoning elements such as Flu, has two categories of medicine which are Powerful Effect and Normal Effect.

Unified Modelling Language (UML) diagram also serve as one of the outcome of the research that contain three major diagram which are Use Case Diagram, Activity Diagram and Class Diagram. UML diagram help developer to design and develop MyHomePharmacy application successfully. The complete MyHomePharmacy application is successfully developed and User Acceptance Test, Application Functionality Test are conducted

This application also helps parents in managing and storing the medicine type and details associated with their family member by enabling the user to customize the number of family members and details that can be added in the application. It is proved that the reliable resource of information regarding the correct and suitable medicine can help the user with selecting the medicine exercise the right advice and tip for fast recovery process. Other than that, it is evidenced that customization features help the parents in knowing the groups of medicine details that related to a particular family members. By developing the application on android operating system platform, it will make this application easy to be accessed by the user as the majority of the operating system for mobile device is Android. Overall, this application is simple to use and it also required minimal effort for users especially individual (students) and parents.

5.2 Recommendation

The improvement in features can be added to MyHomePharmacy application in the future in order to make it more reliable and effective to supply the medicine details and advices. The improvement, recommendation and new features can be added in future are as follows:

1. Admin functionality can manage all information and application contents
2. Pharmacy Location Recommendation
3. Wide range of Minor disease that can be selected

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Appendices

1. User Acceptance Test Form

User Acceptance Test Form

Title   : Mobile Android Application: MyHomePharmacy
Developer   : Mohammad Fahmi Bin Mohd Yusoff
Student ID : 15897
Programme   : Business Information System

1. Gender   :_____

2. Age   :_____

3. Occupation   :_____

4. Marital Status :_____

In the scale of 1-5, Please tick the best option for the following questions (5=Excellent, 4=Very Good, 3=Good, 2=Poor, 1=Very Poor)

No	Topic	Very Poor	Poor	Average	Good	Excellent
1	How do you rate functionality of the application in terms of performance?					
2	How do you rate user interface design of this application?					
3	How do you rate the application in terms of user-friendliness?					
4	How do you rate operational performance of this application?					
5	How do you rate android performance for this application?					
6	I understand the concept of this application					
7	I think the application can ease students and parents.					
8	I found the functions and plugins used in the application are consistent.					
9	I understand the information provided by this application.					
10	I would rather use this application than personally refers to nearby doctors or pharmacists.					

Please write your comments (if any):

_____
_____
_____