Cancer Care:

Mobile Application For Cancer Care Adaptability

By

Nur E’zzati Ahmad Nazri

16013

Dissertation submitted in partial fulfilment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information Systems)

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CERTIFICATION OF APPROVAL

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Approved by,

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UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

May 2015

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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NUR EZZATI AHMAD NAZRI

ABSTRACT

This project aims to help Cancer patient and their Care Givers to adapt with their new lifestyle after being diagnosed with cancer. Past research has found that majority of cancer patient and their care givers are having a difficult time to cope with cancer which causes them to accumulate stress and depression. Therefore, having to keep track with treatments, dealing with side effects, keep medical record history could be exhausting and essentially time -consuming; where in some cases, the waste of time can lead to a much worse condition of their illness. The goal of this project is to minimize effort and time consumption in keeping track of information and adapting with changes faced when diagnosed with cancer. Cancer Care Mobile Application is essential for anyone who wishes to overcome daily challenges to adapt with Cancer. It helps the user to learn more about cancer such as cancer stages, symptoms, survival rate, step by step to-do-list or check list for cancer patient to plan ahead, financial support, treatments schedule, doctor's appointment and support group channels. Hence, it also may provide notifications or reminders to ease their daily lives to optimize and make use of this latest invention as a platform for Cancer Patient and their care givers to monitor progress. Results of the findings have an overall influence on the mobile application design itself, where future works will aim to further give improvement on the design and development of the mobile application.

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratitude to God the Almighty for His blessing and mercy in completing my final year project.

I would also like to express my sincere appreciation to my supervisor Dr. Mazlina Mehat for her guidance and care throughout my project. She has been a very supportive supervisor during the entire project period. Her advices and guidance has always enlightened my idea in my research work. Beside that her professional comments and patience in reading my report countless time in order to make my thesis perfect are much appreciated.

I would also like to acknowledge to all the Cancer patient and their care givers, who are willing to spend their time and give me a hand throughout my research work without any reluctance. Also, their willingness to provide the information and entertain our demand during conducting the project.

My greatest thankfulness goes to my family and friends who always being understanding and supportive during my undergraduate life.

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CHAPTER 1

INTRODUCTION

1.1. **Background of study.**

Cancer is increasing in incidence and today, it seem that each of us knows at least a friend or a family member that has been affected by cancer. Based on the latest Health Facts 2013 released by Ministry of Health (MoH) Malaysia, cancer is one of the top ten causes of hospitalization and one of the top five causes of death in both MoH and private hospitals. In 2014, cancer has been identified as the world's number one cause of death, over taking the heart disease. Hence, being diagnosed with Cancer can be a tragic and terrifying downfall to a person as well as the people around them.

Coping with cancer has always been one of the biggest challenges faced by cancer patients and their care takers. Keeping up with treatments, managing side effects, financial support and daily life activities is always a struggle. Managing and adapting to cancer can cause stress and depression both cancer patient and their care givers. Therefore, the motivation behind this project is to develop a Mobile Application that can assist Cancer Patient and their Care Givers adapt and manage their day to day activities without and difficulties and stress.

1.2. **Problem statement**

Having preceding knowledge of what to do when you are first diagnosed with cancer, whereabouts of medical experts, treatment schedule and medication can help create a stress free environment to cancer patients and as well as where technology can lead to a less expensive healthcare.

Therefore, the problem statement of this project is as follows:

1. Existing similar mobile applications in the market focuses on specific type of cancer and does not address Cancer issues in Malaysia's context.
2. Existing similar mobile applications in the market are more to a knowledge sharing purpose to educate the public on cancer awareness and early detection instead of assisting patient and their Care givers to adapt with Cancer.

1.3. Objective and scope of study

The main objective of this research is to:

- Develop a user friendly mobile application to help not only cancer patients but also their Care Givers manage the symptoms of cancer or its treatment in order to enhance the quality of their lives.
- Gather reliable information on cancer and integrate them to be available in the mobile applications.
- Develop an alert system to remind patients on their daily medication consumption, doctor's appointment and other important dates prior to treatment.

The scope of project is a boundary for the system. Cancer Care Mobile Application is essential for anyone who wishes to overcome daily challenges to adapt with Cancer. It helps the user to learn more about cancer such as their stages, symptoms, survival rate, step by step to-do-list or check list for cancer patient to plan ahead, financial support, treatments schedule , doctor's appointment and support group channels. Hence, it also may provide notifications or reminders to ease their daily lives. To optimize and make use of this latest invention as a platform for Cancer Patient and their care givers to monitor progress, the targeted users for this mobile application are android user's aged between 18 years old to 60 years old.

1.4. **Project feasibility**

The introduction of Cancer Care Mobile Application into the community will bring the perception of Cancer into another whole new dimension. This mobile application is a key approach to utilize user access and making it more convenient for people to cope with Cancer. Addressing the challenges that Cancer Patient face to will go long a way to improve their quality of living.

-Technical and technological feasibility

Cancer Care is built on android platform. Equipped with fusion table as cloud storage system, it can store data in larger size from any other android application using common server. Android phone or tablet is available in market and affordable. Android application is known for its user friendly features. To develop this mobile application, MIT App Inventor is being used and the programming code can be referred through open sources.

- Time

Cancer Care Mobile Application is estimated to be completed within the timeframe since the time allocated for project development is 28 weeks, of Rapid Application Development (RAD) model was chosen as development methodology consist of several stages; Analysis, Development, Integrating, Testing, Implementation and Documentation. RAD is a concept where the product can be developed faster and of higher quality due to the time constraint.

- Cost

Development of Cancer Care Mobile Application by using RAD methodology will be able to reduce the cost. MIT App Inventor will be used to develop the system. Referring to open source code, the developer can reduce the cost by eliminating consultancy services. To implement and debug this mobile application, author is required to use android smartphone to run the system which is affordable.

CHAPTER 2

LITERATURE REVIEW

2.1. **Cancer in General**

According to the National Cancer Institute (2015), Cancer is the name given to a collection of related diseases. In all types of cancer, some of the body's cells begin to divide without stopping and spread into surrounding tissues.

Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally, human cells grow and divide to form new cells as the body needs them. When cells grow old or become damaged, they die, and new cells take their place.

When cancer develops, however, this orderly process breaks down. As cells become more and more abnormal, old or damaged cells survive when they should die, and new cells form when they are not needed. These extra cells can divide without stopping and may form growths called tumors. Figure 1 shows the difference between normal cells and Cancer cells.

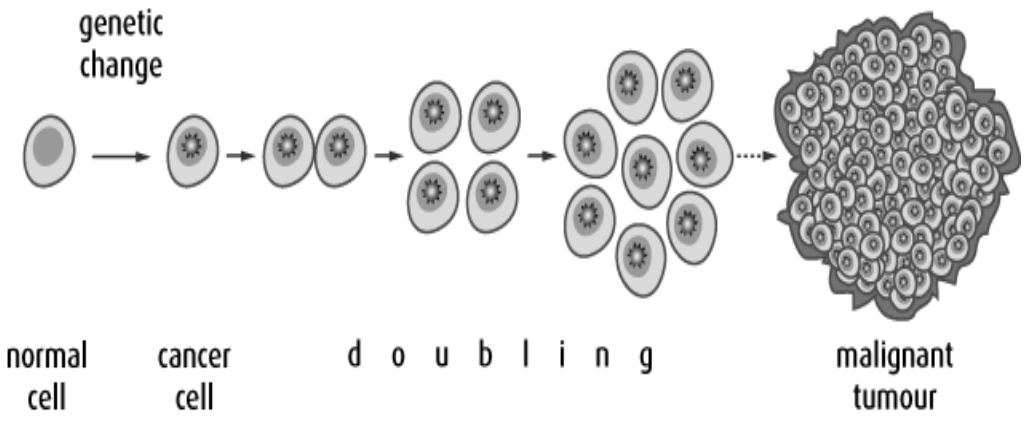


Figure 1 : Cancer Tumor Development

Many cancers form solid tumors, which are masses of tissue except Blood Cancer such as Leukemia, generally do not form solid tumors. Cancerous tumors are malignant, which means they can spread into, or invade, nearby tissues. In addition, as these tumors grow, some cancer cells can break off and travel to distant places in the body through the blood or the lymph system and form new tumors far from the original tumor.

According to unlike malignant tumors, benign tumors do not spread into, or invade, nearby tissues. Benign tumors can sometimes be quite large. However, when removed, they usually don't grow back, whereas malignant tumors sometimes do ("WHO | Cancer," 2015).

2.2. **Cancer Statistic in Malaysia**

Cancers figure are among the leading causes of disease and death worldwide, with approximately 14 million new cases and 8.2 million cancer related deaths in 2012 ("WHO | Cancer," 2015).The number of new cases is expected to rise by about 70% over the next 2 decades. Specifically, by 2025, almost 80% of the increase in the number of all cancer deaths will occur in less developed regions. By 2030, developing countries will bear the brunt of the estimated 21.4 million new cancer cases per year.

According to several research studies in the past, a conclusion of the 5 most common cancer in man diagnosed in 2012 were lung, prostate, colorectal, stomach, and liver cancer. Whereas, among woman were breast, colorectal, lung, cervix, and stomach cancer. More than 60% of world's total new annual cases occur in Africa, Asia and Central and South America. These regions account for 70% of the world's cancer deaths ("WHO | Cancer," 2015).

In Malaysia, the rate of cancer increased from 32,000 new cases in 2008 to about 37,000 in 2012. Mortality due to cancer stood at 20,100 deaths in 2008 and has increased to 21,700 deaths in 2012, according to the International Agency for Research on Cancer (IARC) Globocan of the World Health Organisation (WHO). More than 50% of Malaysian Malay men smoke, more than 30% Malaysians are obese, yet we still do not take screening and prevention seriously.

Figure 2 below generated from the National Cancer Registry (NCR) report in 2007 shows the top five leading cancers among the general population in Malaysia were breast (18.1%), head and neck (13.2%), colorectal (12.3%), trachea, bronchus and lung (10.2%) as well as cervix (4.6%).

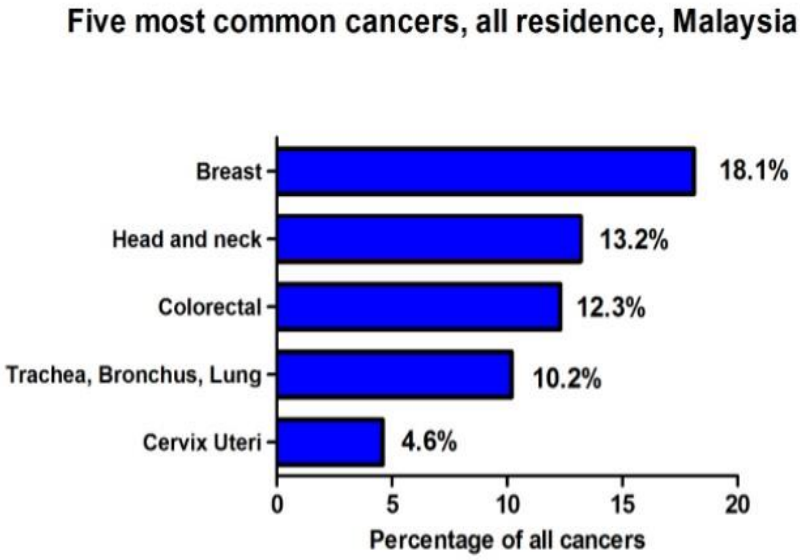


Figure 2 : Leading cancers among the general population in Malaysia

To fight against the global cancer epidemic, World Cancer Day is observed yearly on Feb 4 as a reminder that everyone can take action to dispel the myths about cancer and work together to reduce the burden of the disease (The Star Online, 2014). It aims to save millions of preventable deaths each year by raising awareness and education about cancer, and pressing governments and individuals across the world to take action against the disease.

2.3. **Impact of Cancer**

As any person with cancer knows, a cancer diagnosis affects family members and friends. Sometimes, the complex feelings and lifestyle changes caused by cancer and its treatment become as overwhelming for others in your life as they are for you. Understanding the potential changes in the way you relate to specific family members and friends may help you take steps to foster healthy, mutually supportive relationships during this challenging time.

2.3.1. Physically

Physical impact of cancer can be defined as the signs and symptoms experienced by patient. Signs and symptoms are both signals of injury, illness, disease or anything that is not right in the body.

American Cancer Society (ACS) explain that a sign is a signal that can be seen by someone while symptom is a signal that is felt or noticed by the person who has it, but may not be easily seen by anyone else.

Having one sign or symptom may not be enough to figure out what is causing it. For example, a rash in a child could be a sign of a number of things, such as an insect bites, a skin infection, or a food allergy. But, if the child has the rash along with other signs and symptoms like a high fever, chills, achiness, and a sore throat, then a doctor can get a better picture of the illness. Sometimes, a patient's signs and symptoms still do not give the doctor enough clues to be sure what is causing the illness.

Some of the common physical signs and symptoms of cancer are:

1. **Unexplained weight loss**

When you lose weight for no known reason, it's called an *unexplained weight loss*. An unexplained weight loss of 10 pounds or more may be the first sign of cancer.

2. **Fever**

Fever is very common with cancer, but it more often happens after cancer has spread from where it started. Almost all people with cancer will have fever at some time, especially if the cancer or its treatment affects the immune system. (This can make it harder for the body to fight infection.)

3. **Fatigue**

Fatigue is extreme tiredness that does not get better with rest. It may be an important symptom as cancer grows. But it may happen early in some cancers, like leukemia.

4. **Pain**

Pain may be an early symptom with some. A headache that does not go away or get better with treatment may be a symptom of a brain tumor. Most often, pain due to cancer means it has already spread from where it started ("What Is Cancer? - National Cancer Institute," 2015).

5. **Skin changes**

Along with skin cancers, some other cancers can cause skin changes that can be seen. These signs and symptoms include:

- Darker looking skin (*hyperpigmentation*)
- Yellowish skin and eyes (*jaundice*)
- Reddened skin (*erythema*)
- Itching (*pruritis*)
- Excessive hair grow

2.3.2. Mentally

Some research has proven that positive mental state results in a healthy well-being. Mental stability is also proven to be the key to push one's limit of pain endurance. A positive mind set is what drives a person to act accordingly. Partners and other family members are also the key supports for cancer patients. Most cope well with the caregiving role, but important minorities become highly distressed or develop an affective disorder. Female patient and those with a history of psychiatric illness are more vulnerable, as are those who take a more negative view of the patient's illness and its impact on their lives. Cancer Patient are likely to become more distressed and develop psychiatric morbidity as the illness advances and treatment is palliative. Patients are also more at risk when they lack a support network of their own and when there are relationship difficulties with the patient. The review discusses why, given this evidence, patient fail to take advantage of interventions designed to help them and those who participate derive only limited psychological benefits.

2.3.3. Emotionally

Individuals' interpretation of receiving bad news does not only consider the type of emotion experienced but also the degree to which the emotion is felt. Research on appraisal theory Scherer, Schorr, & Johnstone, (2001), states that when an individual judges the environment to be different with his or her objectives, it will in producing negative emotions. Dillard and Nabi, (2006) argued that their cognitive-functional model (CFM) specifically, will provide an understanding of emotions and their causes of action.

Table 1 below shows several types of emotions and the situation that cause the emotions which is categorized as Molar and the factors that contributes to variables of the situation which is defined as Molecular. For example, fear arises from the perception of danger. These molar assessments are thought to summarize specific conformations of the more frequent molecular assessments, which appear in the third column. We see that fear is

predicated when an individual faces an approaching danger which he or she may have little or no control over it. By having a better understanding about the causes and factors affecting the emotions felt by a person, it would be easier to articulate and control these emotions in order to reach an emotional stability.

Emotions	Assessments	
	Molar	**Molecular**
Surprise	Novelty	Sudden, unfamiliar
Fear	Danger	High probability of serious harm
Anger	Offense	Unwarranted obstruction of goal
Sadness	Loss	Irrevocable failure to meet goal
Happiness	Progress	Acute movement toward goal
Contentment	Satisfaction	Aspirations have been met

Table 1 : Emotion Assesment

Table 1 provides a theoretical framework that can make understandable the range of emotional reactions people might have to cancer-related messages. We could make a similar argument about promoting cancer detection behavior, like mammography screening. During exposure to such a message, a woman might be afraid if she is made to think about being diagnosed with a life-threatening disease, angry at being reminded of something so unpleasant to consider, sad at the thought of losing a breast to cancer, or even hopeful at the thought of taking action to defend her health status. Indeed, in their research on messages designed to motivate mammography screening, Williams-Piehota, Pizarro, Schneider, Mowad, and Salovey (2005) measured not only fear but also hope and reassurance, suggesting that cancer control messages might be appraised such that both positive and negative affective states may be evoked.

2.4. **Coping Style**

Monitoring coping styles are believed to be an individual difference that reflects the degree to which people seek out or avoid information when confronted with threatening situations (Miller, 1987). In a health context, these coping styles are expected to influence people's mental and emotional reactions to health threats that may impact the amount of information desired and the health-related behaviors (Miller, Shoda, & Hurley, 1996).

Several studies suggest that coping style impacts perception of information, which simultaneously influences the extent of emotional state of a person. Based on these research, we can speculate that those with monitoring tendencies will be more emotionally reactive to cancer information generally. Thus, more subtle emotional appeals may be needed to prevent excessive emotional reactivity.

Therefore, based on the literature review, it is found that coping with cancer is not easy towards both cancer patient and their care givers. Hence, by providing the cancer care mobile application device, it would make their lives much more easier.

2.5. **Technology in Healthcare**

2.5.1. Mobile Technology

A change of devices from electronic address books to powerful tools with wireless network connectivity has demonstrated the advancement in mobile technology. Kundu (2000) found out that mobile technology has the capacity of accessing Internet, sending and receiving email/text messages and functioning as information repository and this was related to healthcare industry. In a simpler term, current technology provides access to a wealth of medical information.

Portability, easy to access to data, user friendly, ease of data entry and sharing are the main strengths in handheld technology area of implementation, whether medical or otherwise. Weinstein, Lopez and Joseph (2014), found that mobile application is crucial in a healthy way as it delivers actions to users anytime and anywhere. Mobile applications are able to offer that constant feature as users carry their smart phone everywhere which gives mobile application a positive effect on user trying to keep a healthy lifestyle.

Mobile application allows user to know what they need to achieve and will also track and record the user's performance so that users are to know current progress. Feedback is a positive reinforcement one that can be given by a mobile application.

2.5.2 Android as Leading Mobile Operating System

Android is open source and Google releases the code under the Apache License. This open-source code and permissive licensing allows the software to be freely modified and distributed by device manufacturers, wireless bearer and buff developers. Moreover, Android has a large community of applications developers that extend the usage of devices, written primarily in a customized version of the Java programming language. In October 2012, there were huge a number of apps available for Android, and the approximation number of applications downloaded from Google Play, Android's primary app store, was 25

billion. A developer survey conducted in April–May 2013 found that Android is the most popular platform for developers, used by 71% of the mobile developer population.

Android is software for mobile devices that has operating system, middleware and key applications. The architecture of the Android is like a stack with Application being the top layer and Linux Kernel being the bottom layer of the Android. Core applications of Android include email client, SMS program, calendar, maps, browsers and contacts which are mostly text input based.

Smart phone market will record a growth rate four times faster than the overall mobile phone market, based on the International Data Corporation (IDC) Worldwide Quarterly Mobile Phone Tracker. The growth of smart phone market is catalyzed by the acceptance of consumers and enterprise users in turning their feature phones for smart phones with more advanced features. Below table shows that Android will have the biggest market share in 2015, which indicates that the needs for Android applications and games will increase.

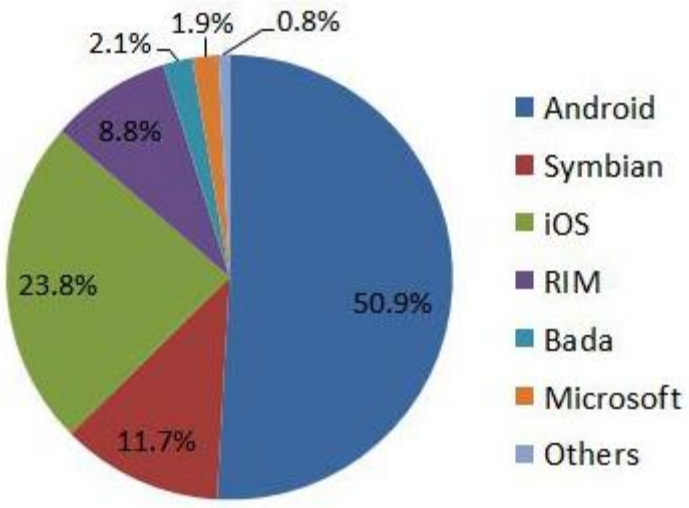


Figure 3: Smartphone Operating Systems: Global Market Share

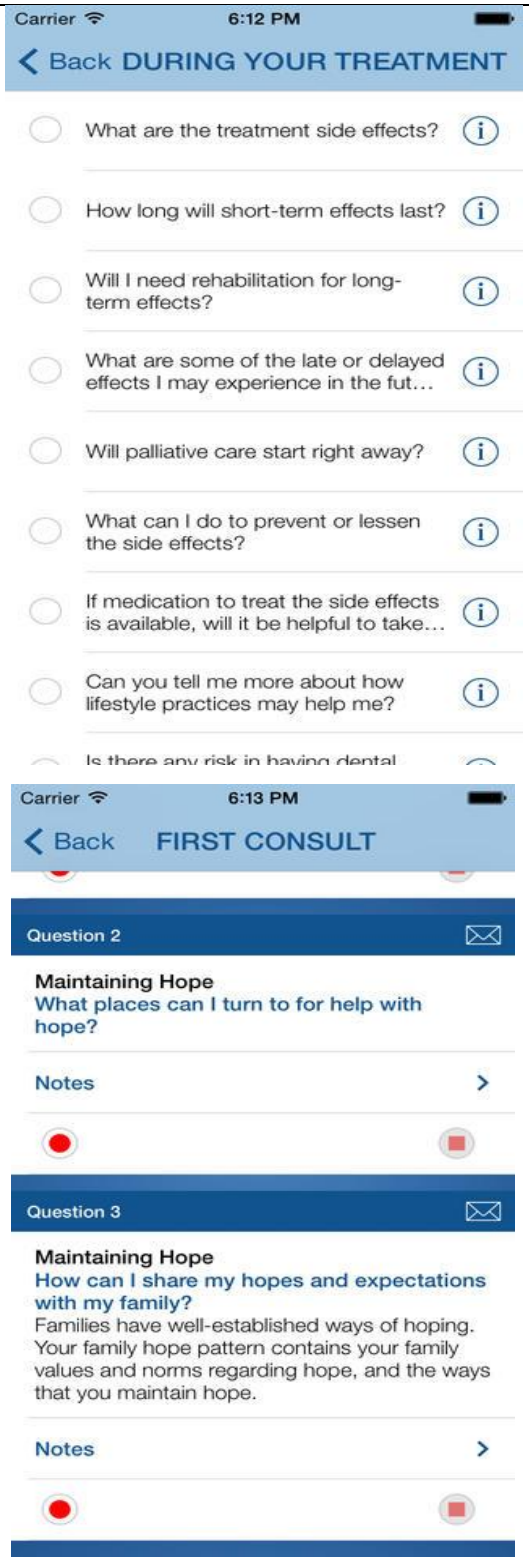
By Barrie Foster| Published April 2, 2012

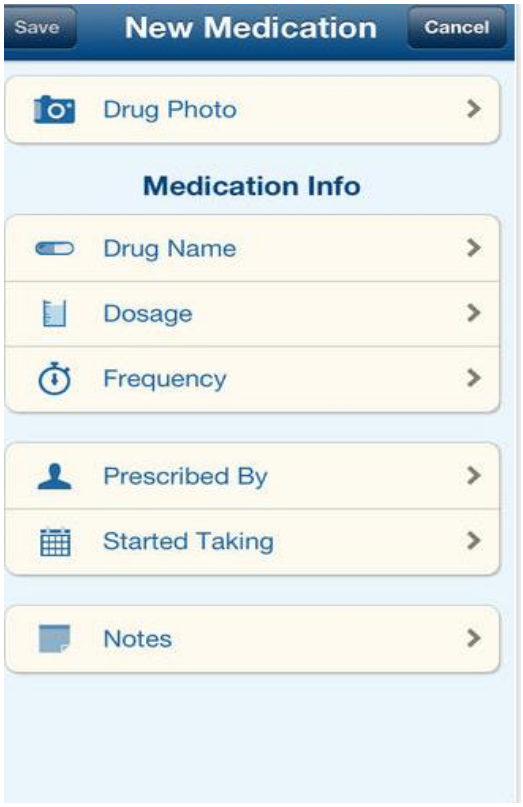
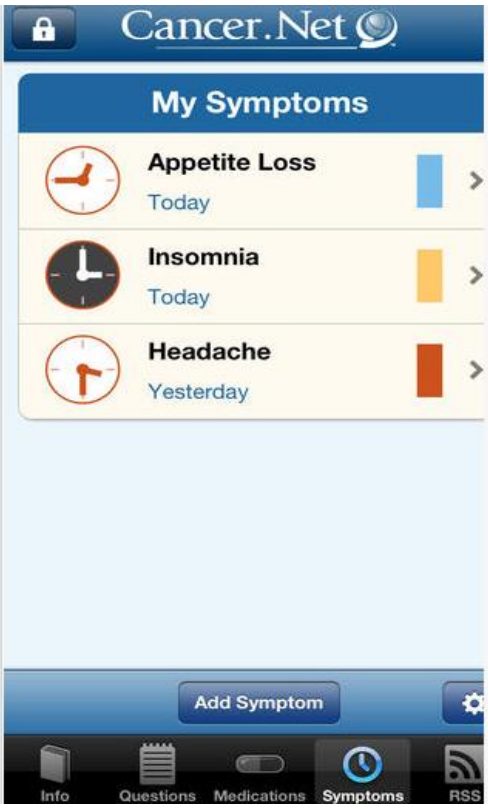
2.6 Demand of mobile applications in Malaysia

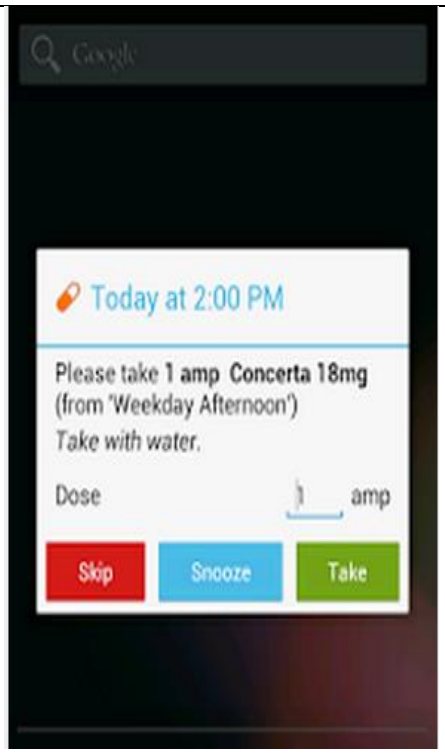
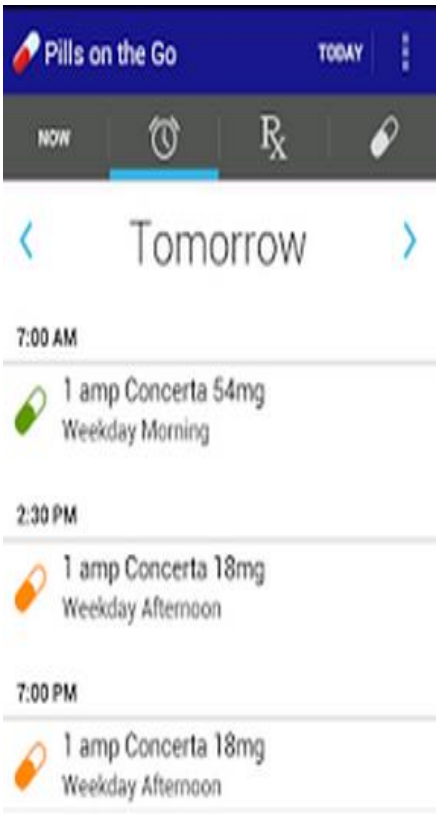
In 2011, a study on consumer behavior towards usage of smartphone in Malaysia was conducted by a team of researcher from School of Computer Sciences and Centre of Excellence from Universiti Sains Malaysia, Pulau Pinang, Malaysia. From the number of respondents that took part in the study, roughly 90% of respondents were of below the age 36 years old. From those statistics, it was discovered that application software is the most popular in regards to mobile contents, generating an amount of interest of 41.8 percent out of a hundred. Furthermore, GPS-based application software established modest attention in utilization amongst the respondents, coming in fifth overall in respondent's preferences of mobile applications (Osman, Sabudin, Osman & Shiang-Yen, 2011).

2.7 Existing Mobile or Web Application Related to Cancer Care

Screenshot	Application Features
 	**1) My Cancer Manager** **By Cancer Support Community** **Features:** • Tracking for common physical and emotional concerns such as fatigue, sleep, sadness, anxiety, pain, hope. • Ability to keep track of how user are doing with other potential life worries such as family, work, money, nutrition and others • Links to valuable articles with helpful hints • Personal journal to record thoughts and questions • Location finder to locate a Cancer Support Community near user or connect user with Cancer Support Community Online

Screenshot	Application Features
	**2) Pocket Cancer Care Guide** **By National Coalition for Cancer Survivorship** **Features:** • Browse hundreds of questions in categories relevant to stages of cancer diagnosis • Build lists of questions to use when talking to doctor or nurse • Link doctor appointments to your lists and automatically add it to calendar • Record and playback doctor's or nurse's answers Explore the extensive glossary to learn more about medical terminology used by doctors.

Screenshot	Application Features
 	**<u>3) Cancer.Net Mobile</u>** **By ASCO** **Features:** • Guides on 120 types of cancer • An interactive tool to keep track of questions to ask healthcare providers and record voice answers • A place to save information about prescribed medications, including photos of labels and bottles (on camera-enabled devices) • A symptom tracker to record the time and severity of symptoms and side effects • A section featuring the latest videos, podcasts, and Cancer.Net Feature Articles • Optional passcode lock

Screenshot	Application Features
 	**4) Pills on the Go** **By App Singularity** **Features :** • Alarms to remind medication intake. • Snooze and auto repeat when use miss a notification. • Visual cue when user needs to get more Medication. • Suspend and enable plans easily for temporary schedules.

2.8 Literature Review Findings

From literature review research, the findings are:

- Cancer patient and their Care Givers is having a difficult time coping with their daily lives after being diagnosed with Cancer.
- Cancer patients and their Care Givers often have a high tendency to fall into depression and stress build up due to their inability to cope with Cancer and its effects.
- With the assistance of technology, it is found that it would be easier for both Cancer Patient to adapt with new daily lives routine.
- Cancer Care Mobile Application features and functionalities will help improve the quality of life for both Cancer patients and their Care Givers by helping them to adapt with Cancer Physically, Mentally and Emotionally.
- Cancer Care Mobile Application will also give a clear overview of what to expect and a step by step process of what to do when one is diagnosed with Cancer.

CHAPTER 3

METHADOLOGY

3.1. Rapid Application Development (RAD)

In developing Cancer Care, the type of methodology to be used is Rapid Application Development (RAD). Since this project needs to be completed within 7 months or 28 weeks, RAD is the most suitable method to develop the application. RAD is a concept where the product can be developed faster and of higher quality.

RAD could help in reducing the development cost of this project as it provides flexibility to completely develop the system within small budget allocation. To satisfy the needs of user in the future or improve the application's features, the developer needs to modify and enhance the application. Therefore, by applying RAD the developer can reduce the complexity of the system at the same time do the changes faster and more efficient.

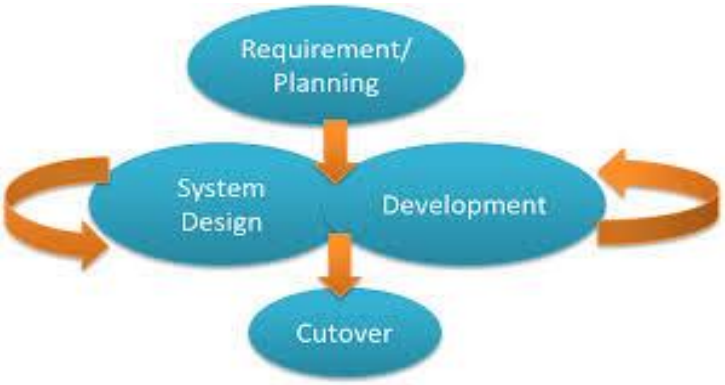


Figure 4 : RAD Model

3.2 Requirement Planning (RP)

The objectives of the RP stage is to establish a general understanding of the problems that will be supported by development of the Cancer Care Mobile Application. Also, to become familiar with existing application in order to compare and improve the functionalities into the Cancer Care mobile Application.

The project starts from the discussion of ideas for the Final Year Project (FYP) with project supervisor. The project initiation begins when the needs or opportunities for the project are identified. The idea of the project was then be written properly for the project proposal.

Quantitative approach has been taken which is helpful and relevant in assessment of the response percentage regarding people's opinion, experiences and behavior .Survey questions technique of this approach has been applied to analyze people's lifestyle, health concerns and awareness towards Cancer.

Important features to be developed is analyzed and discovered the in the application. Process flow of the system is discovered and drawn. Before system designing phase take place, analysis is the crucial part..

The task of Requirement Planning is showed in Figure 5 below:

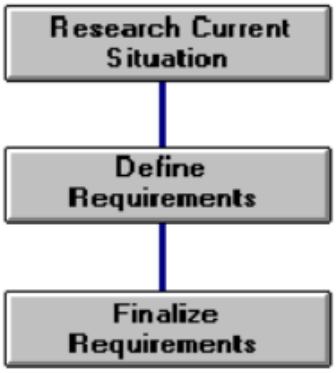


Figure 5 : Requirement Planning

The tasks of this stage are:

(a) Research Current Situation

This task initiates the RP stage for the proposed system by researching the current environment. The information developed in the initial discussions provides a starting point for this investigation. This research is conducted for preparing the requirements definition through the Literature Review. Current Situation is familiarized by investigating current systems, the information available in any existing sources, and by looking at similar systems for the purpose of looking for any reusable structures.

(b) Define Requirements

The outline of the system and scope of the proposed system are developed in this task. The functionality of the system is expressed in terms of the user requirements and the data that the system will support.

(c) Finalize Requirements

In this task, the scope of the proposed system is formally documented. An estimate of duration to implement the system is prepared. The scope must be well defined such that the project is still viable with the cost and duration provided. Approval by supervisors to proceed with the implementation is then obtained.

The method of data collection of this project consists of conducting an interview session with few Cancer Patient and their Care Givers. As explained in the scope of study, this project chooses to focus on the Cancer Patient and Their Care Givers from University Malaya Medical Centre. Meanwhile, data of contact personnel will be gathered and collected to be integrated in a centralized database.

3.3 User Design (UD)

The objectives of the UD stage are to :

- Analyze in detail activities associated with the proposed system
- Develop the system structure
- Develop proposed screen layouts for the most important functions
- Select the appropriate construction approach for the system
- Prepare a work plan defining the steps necessary for transition of the system

The effort required to perform these steps, and a schedule by which these steps can be completed. The UD stage produces a detailed system area model, an outline system design, and an implementation plan. End users will perform the analysis and design activities associated with this stage.

The task of the User Design is shown in Figure 6 below:

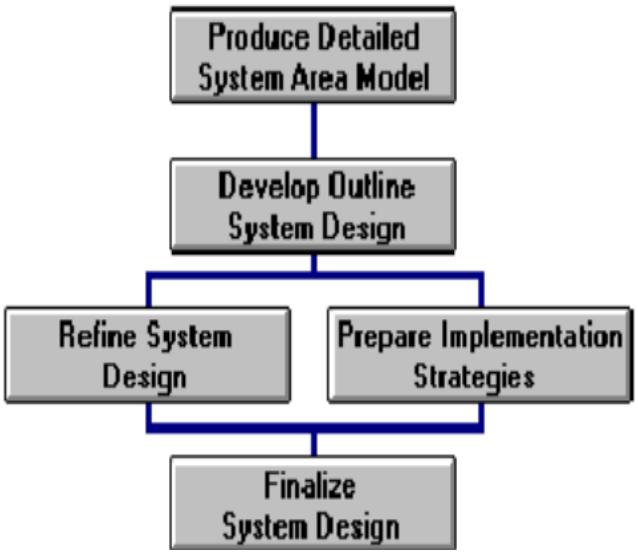


Figure 6 : User Design Phase

3.4 Rapid Construction (RC)

The objectives of the Rapid Construction stage are to:

- Complete the detailed design of the proposed system
- Create and test the software that implements the proposed system
- Design, develop, and test the required conversion software
- Perform the steps necessary to prepare for the conversion of the system.

The design of the proposed system, initially described in the UD stage, is completed in the RC stage, and application software to implement that design is developed and tested. Activities to prepare for the conversion of the system are also performed.

The tasks of the stages are shown in figure 7 below:

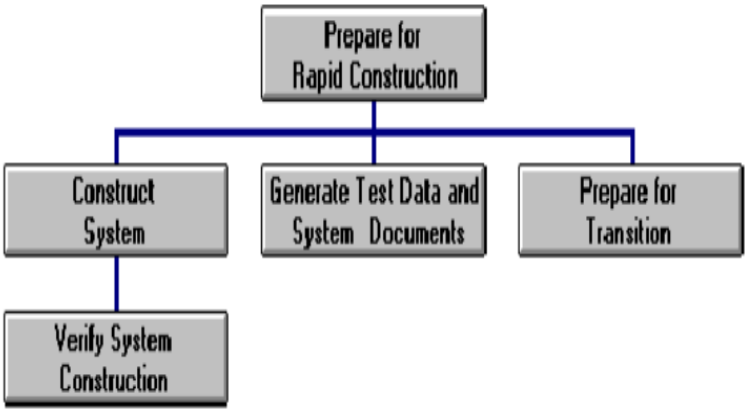


Figure 7 : Rapid Construction Stage

Cutover

The objectives of the Cutover stage are to:

- Install the system in production operation with minimal disruption of normal business activity
- Identify potential future enhancement.

The system developed in the Cutover stage becomes operational. At this time, existing data for the new system is prepared and test by users. User will also provide support to resolve any problems that arise immediately after the application becomes operational.

3.5 Systems Architecture

3.5.1 Use Case Diagram of Cancer Care Mobile Application

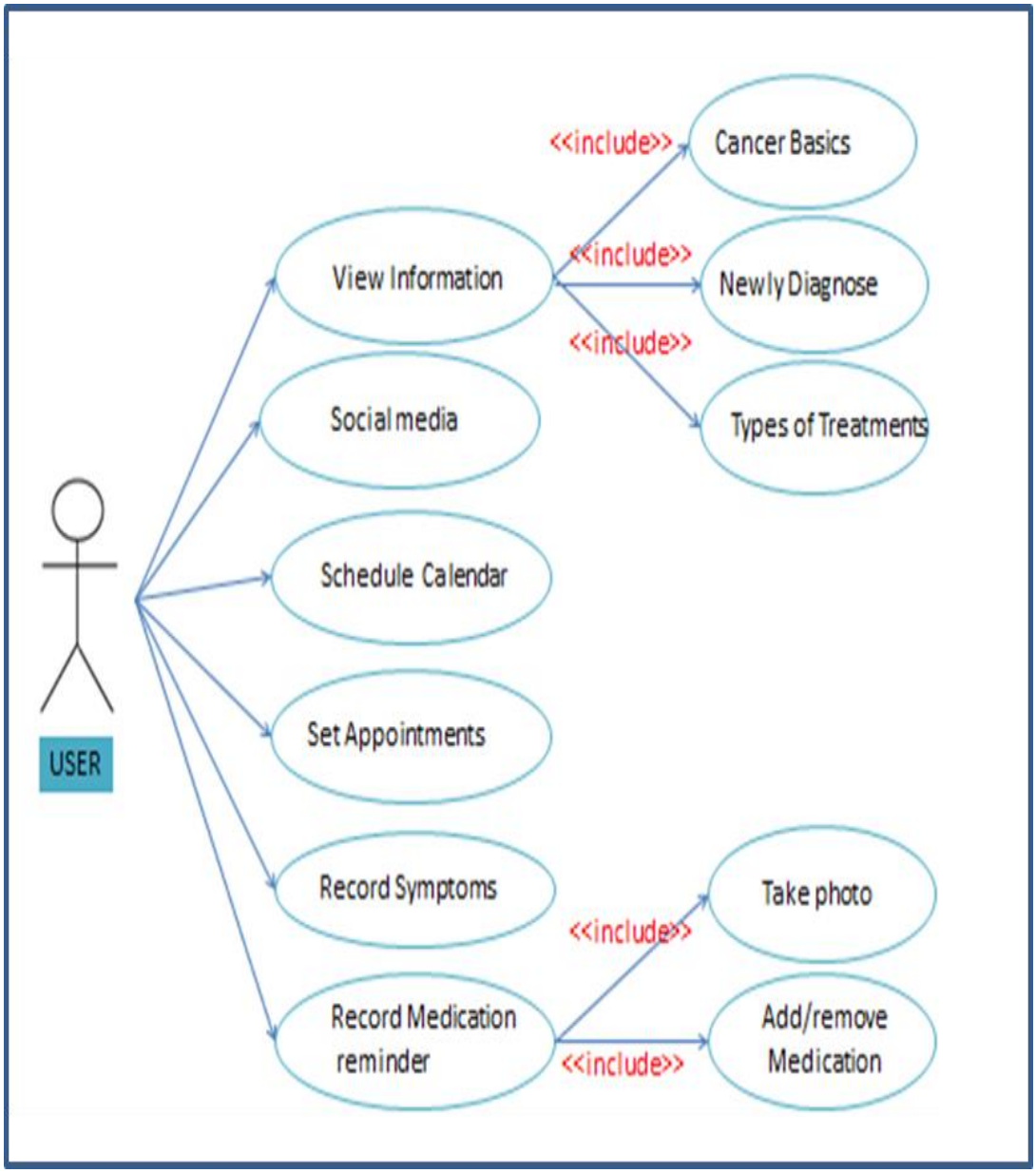


Figure 8 : Use Case Diagram for Cancer Care Mobile Application

3.5.2 Process Flow Diagram

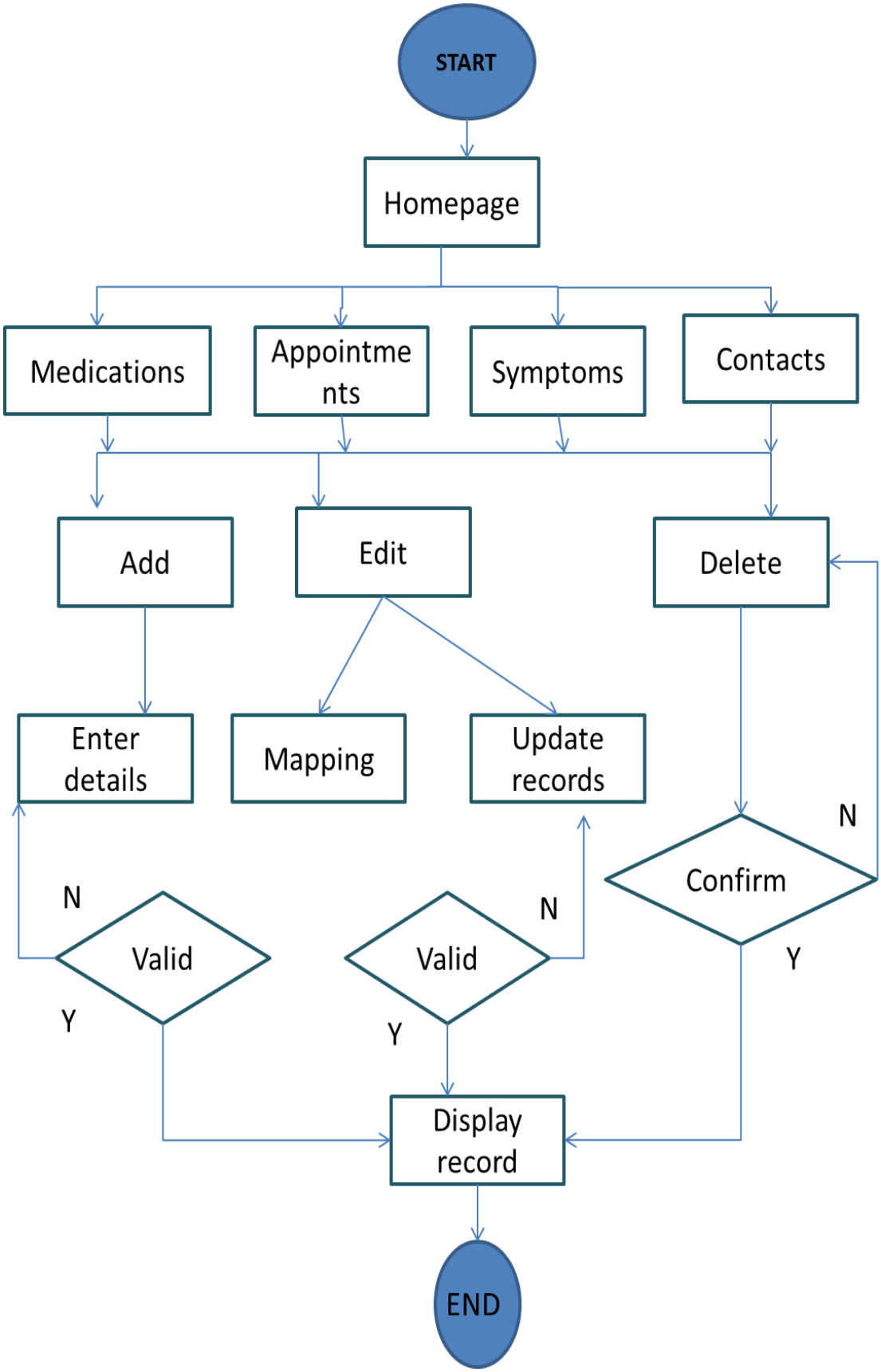


Figure 9 : Process Flow Diagram

3.6 Gantt Chart\Project Timeline

No.	Detail / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	PLANNING														
2	Project Title	■	■												
3	Project proposal submission		●												
4	ANALYSIS														
5	Previous research/study findings			■	■	●									
6	Data collection through survey				■	■	●								
7	Analysis of findings for research						■	■	■	■					
8	Extended proposal submission						●								
9	DESIGN														
10	System diagram design/architecture							■	■	■	■				
11	GUI storyboard/mock-up prototype									■	■	●			
12	Proposal defense											●			
13	Interim report submission													●	

Key Milestones ●

Project Process/Progress ■

Figure 10 : FYP 1 GANTT CHART

No.	Detail / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	IMPLEMENTATION														
1	Build mobile application: Develop GUI, develop app based on storyboard, coding	■	■	■	■	■	■	■	■						
	TESTING														
2	Test workability, refine app, fix coding error etc.								■	■	■	■	■		
3	Technical Paper*											●			
4	Oral presentation*													●	
5	Dissertation*													●	
*Gantt chart timeline and submission dates (FYP2) subject to change															

Key Milestones

Project Process/Progress ■

Figure 11 : FYP 2 GANTT CHART

3.7 Tools Required

To develop this project, there are several tools and requirements needs to be filling to run the system. The most fundamental one is personal computers with Windows platform, 1 GB RAM (minimum), 80 GB hard-disk space, including 115 MB of available space on the hard disk that contains the operating system. Other minimum requirement and tools required also being stated as follows:

Tools	Function
Research for suitable database program	Google Chrome and books
Presentation of the implementation plan and ideas	Microsoft Power Point 2010
Gantts Chart for project planning	Microsoft Exel 2010
Database Development and Interface Design	Fluid UI , iBuildApp
Programming Language	JavaScript, HTML and CSS
Documentation and report writing	Microsoft Word 2010

Table 2 : List of Tools To Conduct Research

Once the development completed it was tested using the Apple or Android Smartphone or tablet as the project was developed using Apple and Android platform.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Interview Findings

Information on the relevancy and the functions of the mobile application was done based on the feedback and suggestion obtained from the Cancer Patient and their Care Givers through an interview session with them.

4.1.1 Cancer Patient

Interview findings from Ms. Nur Nabiha Binti Mohammad, a Stage 1 Lymphoma Cancer Patient from Negeri Sembilan:

- From her observation there is an increasing number of Cancer patients among the young adult with age ranges from 17 to 23 years old. Hence, the relevancy of using technology to assist Cancer Patient is strongly approved.
- After being diagnosed with cancer, Ms, Nabihah stated that the first thing that she and her family did was doing a research about the type of cancer she was diagnosed with online. They also searched for suggested supplements, treatments alternatives and the possible side effects that she will have to face. From her argument, she stated that there are too many resources suggesting different ideas which make it difficult to identify which information is true and reliable.

- Ms Nabihah also shared that one of toughest task for her to adapt with Cancer is keeping track with all the medications prescribed by doctors, supplement intakes, treatment and consultation schedule and monitoring improvements and side effects.
- After explaining the features of the Cancer Care mobile application, she gave a positive feedback by stating the mobile app would help her and her family in so many aspects. For example, she would not miss taking her medicine as one of the application's features is a medication intake reminder system that would alert her by sending notifications.

4.1.2 Care Giver:

Interview findings from Mrs Nora Binti Abu Bakar, mother to Ms. Nur Nabiha Bin Mohammad:

- According to Mrs Nora the mobile application would be very convenient for her to monitor her Daughter's progress easily.
- This is because she has a lot of other responsibilities to fulfill such as being a wife, a mother to her four daughters and a tailor.

  Currently, Mrs Nora keep track of her daughter's progress by writing down in a piece of paper and compile it with Nabihah's medical file. When she need to refer to something, Nabihah's medication prescriptions for example, she has to manually find the written prescription in the file in order to obtain the information which is timely and inefficient.

4.2 Graphical User Interface

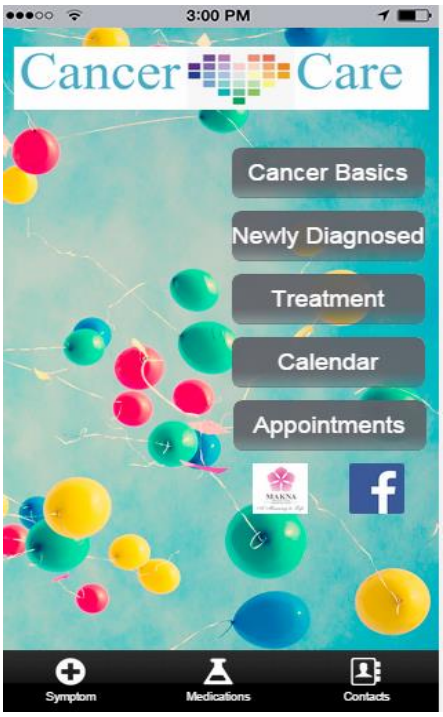


Figure 12 : Prototype Homepage Interface

Figure 12 displays the prototype homepage, a list of the functions and categories of information available according to the project scope as follows:

1. Cancer basics
2. Newly Diagnosed
3. Treatment
4. Calendar
5. Appointments
6. Social Media : MAKNA Malaysia Twitter
   : National Cancer Society Malaysia Facebook
7. Symptoms
8. Medication
9. Contacts

1. Cancer basics

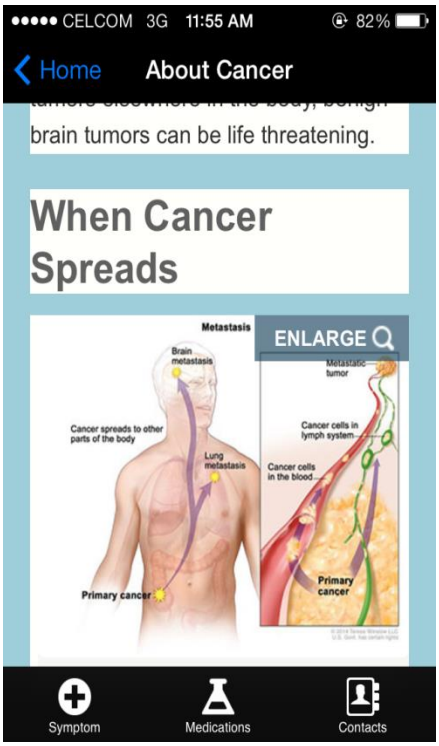


Figure 13 : Prototype About Cancer Interface

Figure 13 displays the About Cancer Page. This page mainly focuses on providing users with basic information about Cancer. It contains information on what is Cancer made of, How does the Cancer Spreads, Image of Cancer tissues, etc,. The objective of this page is to help Cancer Patient and their Care Givers to understand more about Cancer once they have been diagnosed.

2. Newly Diagnosed

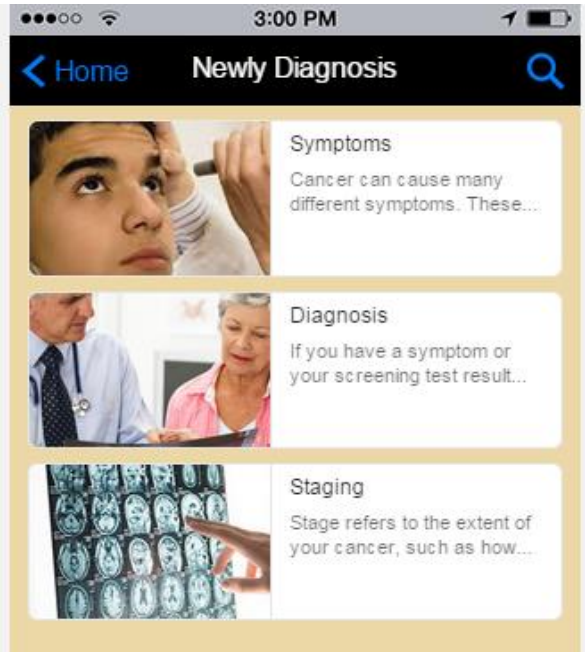


Figure 14 : Newly Diagnosis Page Interface

Figure 14 shows the Newly Diagnosis page. This page contains three different categories which are the symptoms, Diagnosis and Staging information. The Symptoms category is to help users understand and anticipate more on what they are experiencing after being diagnosed with Cancer or after undergoing treatments. For example, the causes of vomiting, hair loss and pain, how to reduce the symptoms and some helpful remedies.

The diagnosis category in the other hand helps users understand the terms and explanation by doctors. For Example information and example of the frequently asked questions, Lab Tests, Imaging Procedures, Biopsy and standard procedures.

The staging category will help users understand which stage their staging systems and what does the stages means. This can help users articulate how much their cancer has spread and how serious their condition is. By knowing this, users can plan ahead on what to do to prepare themselves for any circumstances.

3. Treatment

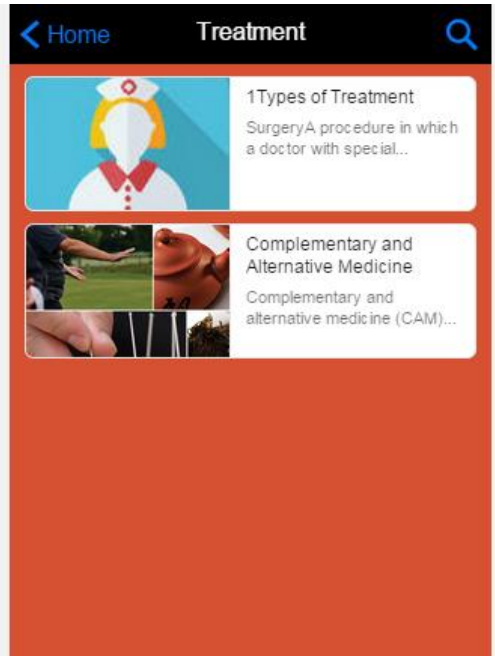


Figure 15 : Treatments interface

Figure 15 shows the Treatment page. This page contains two different categories which are the Types of Treatment and Complementary and Alternative Medicine. Types of Treatment contains information of what treatments that are usually offered to Cancer patient, the side effects and the best treatment based on stages. The complementary and alternative medicine contains information on traditional medication options and also supplementary medication that can help reduce or ease the pain of the cancer patient. Some of the example of complementary and alternative medicine that are available in Cancer Care are Acupuncture treatment, types of traditional Herbs than reduce the cancer effect, types of Vitamins and also a list of supplements that are commonly used by other Cancer patients that are proven to be effective.

4. Calendar

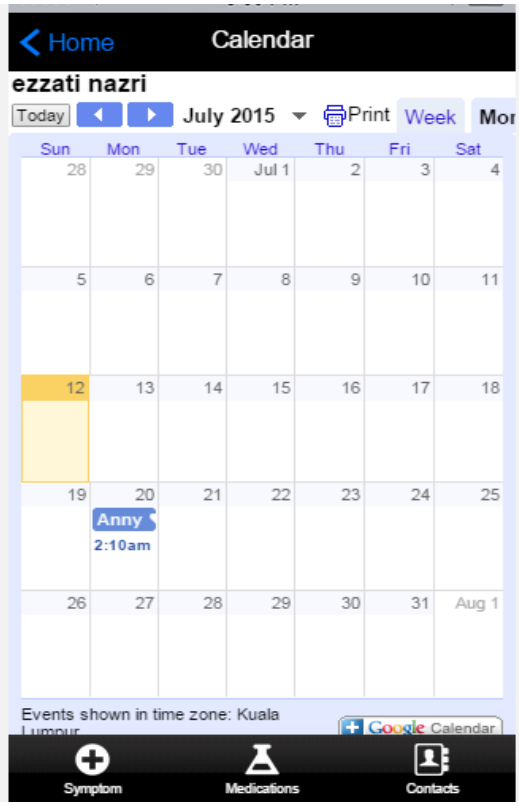


Figure 16 : In App Google Calendar

The calendar function in the Cancer Care Mobile Application is sync from Google Calendar. Therefore, users schedule can be easily managed. User will not get confused on the dates such as chemo sessions, doctors appointment or miss out any important dates.

5. Appointments

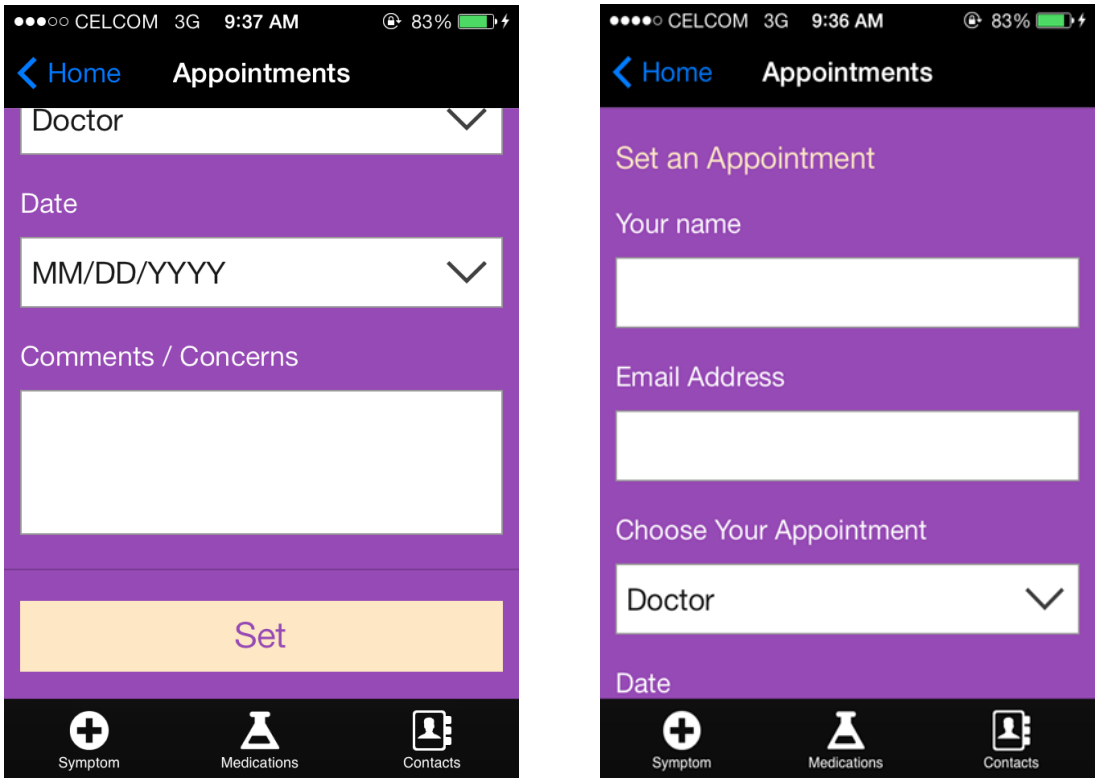


Figure 17 : Display of the Online Appointment Form.

The Appointments function allows user to schedule their appointments according to the type of appointments they choose by emailing the doctors, nurses or the person in charge for the follow up treatment, therapy session or appointments registration. Users can simply key-in their name, email address, choose appointments, choose their preferred time and date and it would automatically be sent to their person in charge.

6. Social Media : MAKNA Malaysia Twitter

: National Cancer Society Malaysia Facebook

Figure 18 : MAKNA Malaysia Twitter Account

The objective of incorporating MAKNA's twitter account and National Cancer Society Malaysia Facebook account is to help users stay updated with current news regarding Cancer in Malaysia. This page can also act as an interactive medium where users can communicate and get feedback from the Cancer community who has experience with dealing with Cancer. With this function, the users, which are Cancer Patient and their Care Givers can share their problems and concerns or even motivate and support other cancer patient and their care givers to be positive in overcoming Cancer.

7. Symptoms

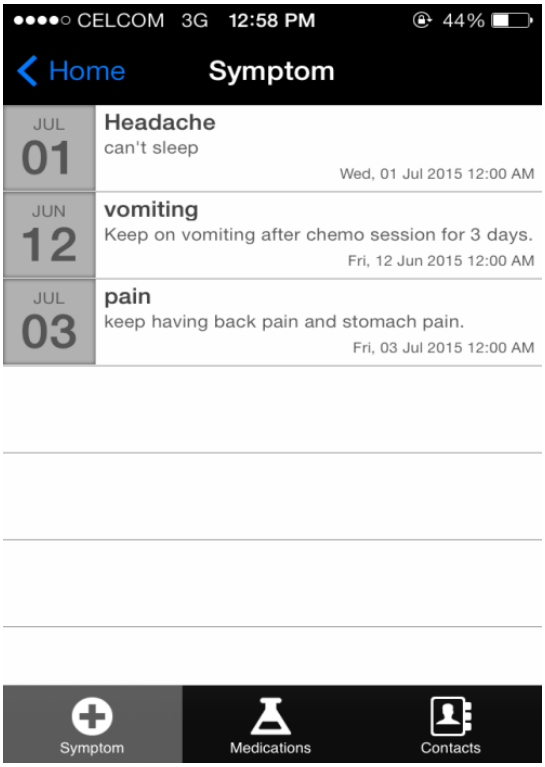


Figure 19 : Cancer Patient's Symptom Diary

Figure 19 shows the interface of the Symptom page. The objective of this page is to assist Cancer Patient and their Care Givers to monitor symptoms. By having this function, these users can keep track of what they have experience and the severity of their symptoms. This function can also help users update their doctors easily on the symptoms that may be an indicator to treatments or medication side effects.

8. Medication

Figure 20 : Medication Reminder Interface

Figure 20 above displays the Medication page. The Medication page enables users to keep track of all the medication prescribed to the Cancer Patient. The function includes an alert system to remind Cancer Patient on their medication intake such as what medicine to take, what time and the amount that should be consumed. Users can also add new medication or remove any medication that they have stop taking. This function can also acts as a mobile medication history that users can access easily as the medication history of what has been prescribed to the Cancer Patient Previously. The Medication Reminder system can prevent users from getting confused on which medicine to consume as the system can take photo of the medicine and stored in the database of Cancer Care. The photo will be displayed when the medication reminder notification pops up.

9. Contacts

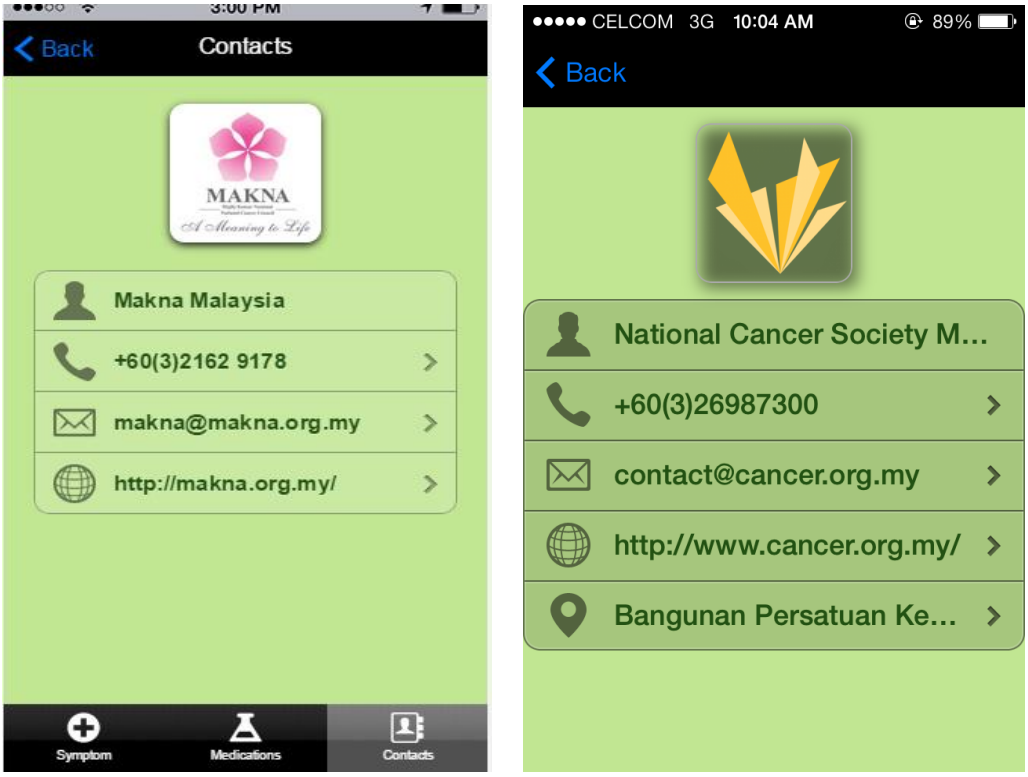


Figure 21 : Contact Number

The list of contact provides user with the list of important contact number related to the cancer society or their personal emergency contact number. User can simply add the contact details by clicking the “Add New” button.

4.3 Testing

Testing and debugging are totally 2 different things. The primary objective of testing is to find errors in an application, whether it satisfies the requirements and or performing other than expected. This might involve initial and actual output expected. In contrast, the objective of debugging is to identify the type and location of the "found" errors and subsequently remove it by a re-definition, re-design or re-code, depending on the level of testing through which the errors were found.

For Cancer Care Mobile Application, Unit Test, Integration Test, and Acceptance Test had been conducted. Unit Test is a process of testing the individual components in an application. It is done only by the programmers without involving testers, in order to ensure that the unit does not contradict with the system or application's internal specifications. Different units being tested in isolation simultaneously and it is performed during the development phase. By reviewing the code, database, requirements and design, the debugging tasks much easier as it only involves a single unit and when an error is found, the error should be located within that particular unit.

Besides, the incompatibility of the interfaces between the application's components can be tested via Integration Test. This test involves design and architecture of the application to ensure the interfaces and linkages between different functions of the application work properly.

Acceptance Test is done primarily by the end users to demonstrate the application is totally complete, meets the users' requirements and ready to be released.

4.3.1 User Testing Result

User testing was conducted with 30 respondents; consisting of Cancer Patient and Their Givers at University Malaya Medical Center (UMMC). After the testing, feedback towards the project is evaluated. User testing was divided into three categories; prototype interface, prototype usability and the interest of the overall project. The results are as follows :

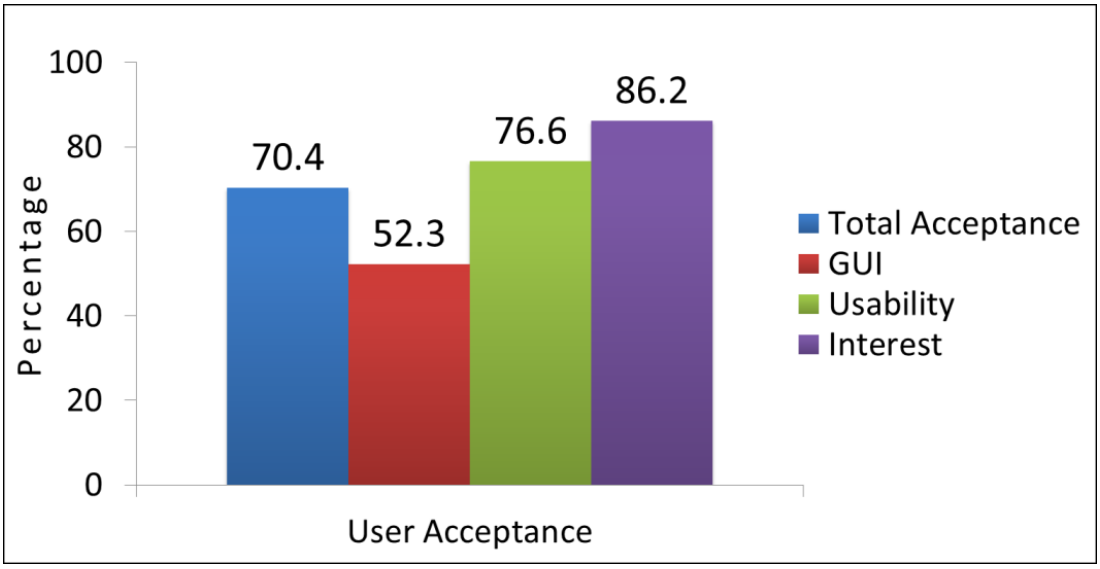


Figure 22 : Overview for the user acceptance test result.

From the result above, it can be clearly seen that 70.4% of respondents gave a positive result towards Cancer Care Mobile Application prototype. A breakdown of the 70.4% shows only 52.3% of the respondents gave positive reviews regarding the prototype interface. This may be due to the fact that the prototype is not fully developed; therefore the interface is not fully completed in terms of visual and aesthetic value. 76.6% of respondents showed positive response in terms of the mobile application's usability; where respondents found it quick and simple to navigate between pages, and work out the basic functions, all through to the end. Last but not least, 86.6% of respondents showed major interest in the prototype itself, with many claiming the intention and objective of the application interesting and worth taking a further look at.

Satisfaction Level

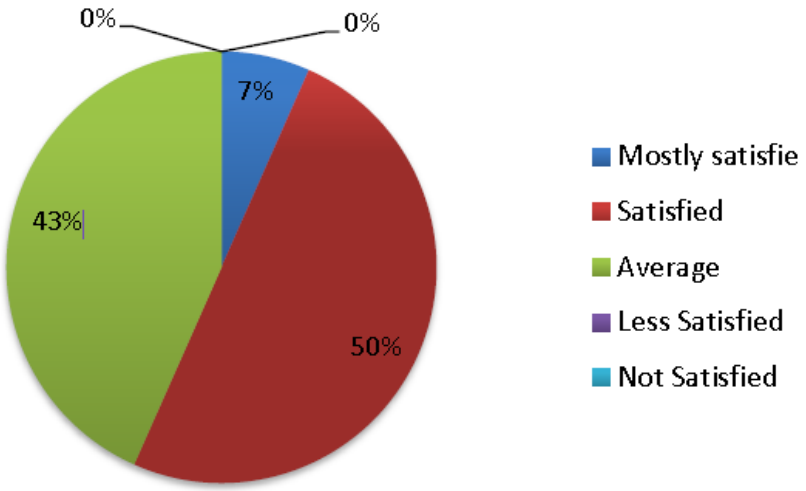


Figure 23 : Pie Chart of users satisfaction level.

From the result above, the average respondents satisfaction level from their experience with the prototype was satisfied; which came in at 50%. This meant that half of the number of respondents who answered tested the prototype reacted positively. 43% of the respondents were at average level of satisfaction, with a mere 7% having feeling very satisfied from the prototype.

The results from this survey may be due to a couple of reasons. The user prototype was fully functional, but it was not 100% complete in terms of data availability. This may be a possible cause in why few respondents felt mostly satisfied with the mobile application. Feedback shows that respondents were interested in the idea, but recommendations included that the prototype to take account of more features and include more upgrades to increase user satisfaction.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Relevancy to the Objectives

As a conclusion, the mobile application has been designed based in accordance to the result findings from respondents. As mentioned previously in Chapter 1, the objectives were to develop a user friendly mobile application to help not only cancer patients but also their Care Givers manage the symptoms of cancer or its treatment in order to enhance the quality of their lives.. This project aims try to solve the problem of where the introduction of Cancer Care Mobile Application into the community will bring the perception of Cancer into another whole new dimension. This mobile application is a key approach to utilize user access and making it more convenient for people to cope with Cancer.

Addressing the Challenges that Cancer Patient face to will go long a way to improve their quality of life. This mobile application will also aim to give patients the opportunity to focus on other things that makes them happy instead of worrying and stressing on coping with cancer. It was found that the profiles of medical experts could be integrated into a database for the purpose of designing similar types of mobile applications in healthcare.

5.2 Suggested Future Works for Continuation

Initial result from user testing of the mobile application prototype shows positive response in terms of its usability. The scope of this project primarily focuses on Cancer Patient and Care Givers only, where future works can include a bigger scope in terms of the number of hospitals involved and the area covered. Besides that, taking account of Malaysians level of literacy towards the English Language, the Cancer Care Mobile Application can be developed in other languages that are commonly used such as Bahasa Melayu, Hindi, Mandrin and Cantonese. Furthermore, the mobile application may be developed on a different platform to give the application further room for improvement, and fix the limitedness of features and functions currently found on App Inventor for Android.

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APPENDICES

CANCER CARE MOBILE APPLICATION : USER TESTING FEEDBACK FORM

The objective of this feedback form is to record the feedback from respondents in order to improve the function and effectiveness of this mobile application.

Please rate 1- 4 for the questions below.	Strongly Agree	Agree	Disagree	Strongly Disagree
INTERFACE				
This application has user-friendly Graphical User Interface (GUI).	4	3	2	1
The layout of the mobile application is neat and structured.	4	3	2	1
USABILITY				
It is easy to understand how this application works.	4	3	2	1
It is easy to navigate through the application pages.	4	3	2	1
My overall experience with this mobile application is positive.	4	3	2	1
INTEREST				
You are interested to use this application?	4	3	2	1
I will recommend this application to be used by friends and family.	4	3	2	1
OVERALL USER SATISFACTION				
Please rate your level of satisfaction towards Cancer Care Mobile Application	5	4	3	2	1