



Mohammednur Mohammed

**THE DEVELOPMENT AND USE OF PATIENT LOCATION  
APPLICATION**

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Mohammednur Mohammed  
Bachelor's thesis  
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Oulu University of Applied Sciences

## **PREFACE**

This work was conducted at Oulu University of Applied Sciences in the year 2013 with the aim of incorporating it into the Ubipill project. This was for the fulfillment of my bachelor's degree according to the requirement of the school. The tutoring teacher played a very fundamental role in ensuring that I was well guided during the entire process of doing this work. In addition, it was necessary to have some external help while carrying out this work especially in areas that were faced with some difficulties. This external help mainly came from the team members that were involved in the Ubipill project.

Let me take this opportunity to thank the supervisor during the process of undertaking my laboratory practical work for the chance to do the practical work in a conducive environment full of friendly and helpful people and for the support needed throughout the whole period of the practical work. I would also like to thank all the students and teachers for the support they offered during the whole period of doing the practical work.

Raahe, November 2013

Mohammednur Mohammed

## TIIVISTELMÄ

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Kirjoittaja: Mohammednur Mohammed

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Ohjaaja: Leo Illko, Juhä Raty

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Tämän opinnäytetyön aiheen keksiminen oli oma ideani. Luennoitsijani antoi kuitenkin minulle idean käyttää nykyistä UbiPill -sovellusta ja selvittää, jos jotain muuta voitaisiin lisätä sovellukseen. Pää tavoitteena on tehdä tutuksi älypuhelimet, jotka käyttävät Android- ja Google Maps -sovellusta. Lisäksi tavoitteenani on mahdollistaa pystyä toteuttamaan tietokoneohjelma, joka voi toimia todellisena, joka käyttää Android -alustaa. Saavuttaakseen tämän, oli tarpeen kehittää Potilaan Sijainti mobiilisovellus järjestelmä. Sovellus on osa Ubipill- hanketta, jonka tarkoituksena on auttaa potilasta ottamaan lääkkeensä ajoissa, etenkin vanhoja potilaita. Lisäksi sovellus toimii apuna hoitajille, jotka voivat seurata potilaitaan säännöllisesti helpommin ja tehokkaammin.

Tutkimuksen toteuttamisessa on mukana useita menetelmiä, materiaaleja ja laitteita kuten tietokone, modeemi ja tulostin keskeisin niistä oli verkkomateriaali, joka auttoi saamaan lisää tietoa UbiPill projektista. Keskeisin niistä oli verkossa, mikä auttoi saamaan lisää tietoa UbiPill -projektista . Nykymaailmassa matkapuhelimet ovat erittäin tärkeitä ja välttämättömiä laitteita, joilla on merkittävä rooli päivittäisessä ihmisen elämässä. Tämä ei ole ainoastaan sen tosiasian vuoksi, että ne ovat erittäin hyödyllisiä laitteita mitä tulee viestintään, vaan siitä syystä, että ne tulevat olemaan enemmän ja enemmän mielenkiintoisia ominaisuuksiensa kehittymisen vuoksi . Ihmiset muuttuvat hyödyntämällä älypuhelimia, koska ne voivat auttaa heitä tekemään monia eri asioita, joihin tavallinen puhelin ei kykene. Ne asiat, joita ihmiset tekevät matkapuhelimilla ovat pelaaminen, suunnan etsiminen ja potilaiden muistuttaminen ottaa lääkkeensä, mikä perustuu kyseiseen tutkimukseen. Matkapuhelinten valmistajat ovat esiasentaneet pelit osaksi matkapuhelimia sekä Google map- sovelluksen, joka auttaa ihmisiä suunnistamaan.

Langattomien älypuhelimien kehittämisestä ja suosioista saakka tietokoneen sovelluksen integrointi mobiilisovellukseksi on ollut kasvussa. Nämä sovellukset on kehitetty toimimaan Android matkapuhelin- alustalla. Tosiasia on, että Android -alusta hallitsee älypuhelin- markkinoilla. Idea sovelluksen takana on, että jotkut potilaat unohtavat ottaa lääkkeensä ajallaan tai jopa hoitaja unohtaa antaa lääkkeitä potilailleen. Sovellus muistuttaa ilmoituksella antaa lääkitys potilaille ja antaa tarkan tiedon potilaiden sijainnista. Tästä huolimatta on edelleen mahdollista tehdä hakemukseen tulevaisuudessa parannuksia erillään potilaan sijainnista. Yksi tällainen parannus on tehdä hakemukseen valmiudet näyttää täsmälleen oikea lääkeannostus.

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Keywords: *Ubipill application, operating system, embedded applications, virtual machine, interface, pill box, Java.*

## ABSTRACT

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Coming up with this topic for the bachelor's thesis was my own idea. However, my lecturer gave me the idea to use the current UbiPill application and find out if anything else could be added to the application. The main aim of this thesis was to enable one to be familiar with smart phones that use Android and Google maps. In addition, it aimed at enabling one to be able to implement a computer application that can run on a real smart phone that uses Android platform. In order to achieve this, it was necessary to develop a Patient Location mobile application system. The application will be part of the UbiPill project and aimed at assisting the patients to take their medication on time especially the elderly patients. In addition, it had to assist nurses to be able to monitor their patients regularly more easily and effectively.

Conducting this study involved a number of methods, materials and devices such as a computer, modem and a printer. The most fundamental one was the online reading materials that assisted in getting to know more about the UbiPill project.

In the current world, mobile phones have become very important and vital devices that play major roles in the day-to-day life of human beings. This not only for the fact that they are very useful devices when it comes to communication but for the reason that they come with more and more interesting features with the advancing technology. People are changing towards making use of smart phones because they are able to assist them in doing many different things that an ordinary phone is not capable of doing. Among the things that people do with mobile phones is gaming, finding directions and remind patients to take their medication, which the basis of this research. Mobile phone manufactures have preinstalled games into the mobile phones and Google map application that assist people in finding the directions of a place.

Since the development of mobile smart phones and its popularity, the integration of a computer application into a mobile application has been on the rise. These applications are developed to run on the Android mobile phone platform. This is for the fact that Android platform dominates the market of smart phones. The idea behind the application is that some patients forget to take their medication on time or even the caretakers forget to give medication to their patients. The application makes use of notifications to remind the nurses to give medication to their patients and gives them the direction to the exact location of their patients. Nevertheless, there are still possible future improvements that can be done on the application apart from the patient location. One such improvement is making the application to have the capabilities to show the exact correct medication dosage for a particular drug. The result of the study is a working application, which makes use of mobile phones to find the location of a patient that has not taken medication

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Keywords: *UbiPill application, operating system, embedded applications, virtual machine, interface, pill box, Java.*

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## 1. INTRODUCTION

In the current modern world, smart phones are no longer considered as a tool that can only be used for communication purposes. With the availability of a variety of applications, smart phones have proven to have capabilities to be used for various functions. Internet surfing, sending of e-mails, taking photos, recording videos, chatting and many more are some of the application areas of mobile smart phones.

However, mobile phone applications are playing the major role in all of these functions of smart phones. Just to mention but a few, smart phones are being used with applications that assist in finding the location of a place and the shortest route and giving a notification and reminders to the users. For these reasons, it will be an understatement to say that smart phone applications are not making it easy for people to carry out some of their activities.

The trends of mobile phones are evolving and changing each day as fast technological changes and more and more mobile phone applications are being developed each day. Earlier, no person could have imagined that one can use mobile phones to receive find direction and shortest distance and receive notifications and reminders to one's medication at the right time. People only used to use compasses and paper maps to find directions and alarms to remind them to take their medication (Frederick & Gail 2003, 200).

The type of applications available for mobile phones greatly depends on the type of mobile phones. However, the current hardware of the mobile phones is getting more and more sophisticated enabling the available applications to be used in almost every smart phone.

In order to use most of the mobile phone applications, including the Patient Location application, it is very important to ensure that the mobile phone has enough storage capacity, it is fast and it can quickly connect to the internet. The most important part to remember when using the Patient location application is the fact that one can be able to operate the application on a smart phone easily. Most of the smart phones make use of a touch screen where the user just taps on the screen in order to perform an action on a smart phone (Zheng, Pei & Lionel 2006, 150).

The main problem of using paper based maps to find direction is that it does not show the user the actual distance and the available shortest routes to a particular location. In the case of using alarms to



remind patients to take their medication, it may be difficult for the nurses to know the exact location of the patient that has not taken their medication. This makes mobile applications popular tools for finding the direction of a location and give notifications to remind the users of a particular activity.

The aim of this project is to enable one to be familiar with the process of Patient Location mobile application that assists both the patients and the nurses that are assigned the duty of taking care of some patients. In addition, it aims to offer the knowledge of Google maps and Android SDK (android software development kit).

## **2. BACKGROUND**

The issue of the patients forgetting to take their medication completely or at the correct prescribed time is normally the worry of most of the doctors and physicians. Patients can forget to take their medication as prescribed which could lead to serious consequences. Consequently, some of the patients end up not treating their illness or even losing their lives because of not taking their medication. This is the case with elderly patients. This is not only been the concern of the doctors but also the relatives and friends of the patients.

For the fear of losing their loved ones because they do not take their medication, some relatives end up hiring a nurse that will be responsible for ensuring that the patient takes the medication. Nurses are also human and may end up forgetting to remind a patient to take their medication. This is especially in the case where a nurse has a large number of patients to take care of or the caretaker is an employee of a health care facility and has the responsibility of ensuring that the patients take their medication. It may be difficult for the nurse to remember which patients are to take their medication, at what time and their exact location.

Having a checklist alone will not be enough for the nurse to be able to manage this activity effectively. The Patient Location application is a smart phone application that will help in solving this problem. The application needs an internet connection in order to perform its roles. It helps nurses to navigate to the exact location of a patient easily. With just a click, they immediately receive a notification on their mobile phones.

The application is to be incorporated into the Ubipill project. Ubipill is a system that controls a medical dose for patients at their home. It targets those people that have problems in remembering to take

their medication at the right time. It is mainly to effectively monitor the activities of a medicine box using a web browser of any device (Harty k.2010, 100).

### **3. THE DEVELOPMENT OF THE APPLICATION**

#### **3.1. The Ubipill project**

Before getting into discussing about the development of the Patient Location application, it will be equally important to have a brief look at the Ubipill application project. The Ubipill application is a mobile phone application that was developed in order to assist to remind the nurses and the elderly people to take medication at the right time. The main aim of the project was to make it possible for the caretakers to be able to monitor their patients' medication schedule on a regular basis.

The application runs a service that runs in the background and occasionally polls the Ubipill server and gives an alert to the caretakers in case of any new notifications. The user interface of the application on the smart phone used displays the real state of a patient's classic days of the week in relation to the Pillbox on the 4\*7 grid on the interface of the application.

The user interface normally display on one week as a time basis. The summary of the medications that the patients missed to take can also be viewed on the display. In addition, the application also enabled the nurses to update the timing of the medication to the main server when necessary. However, the Ubipill mobile application project did not put into consideration of the issue of including an additional application that would assist the nurses to be able to locate the actual location of the patients and also get the directions to a particular locations. Therefore, it necessary to develop the Patient Location application and incorporate it into the Ubipill project in order to make the project more efficient, successful and reliable ((Walker, Jeffery & Sean 2013, 200)).

#### **3.2. Overview**

Through the development of electronic and communication technology in current years, a mobile phone has shown to be the most necessary and important device in the daily life of human beings. The things that people need to carry with them every time they go out have changed from "wallet and keys" to "wallet, keys and mobile phones". The availability of great hardware, 3G and even 4G connections has made it possible for people to be able to do most of the things using their mobile smart phones.

Actually, the functions of smart phones are now being used in medical applications. The pie chart in the figure 1 below shows a comparison of the percentage of time spent on each category of applications among the people that won smart phones. The medical application category comes third after games and social networking.

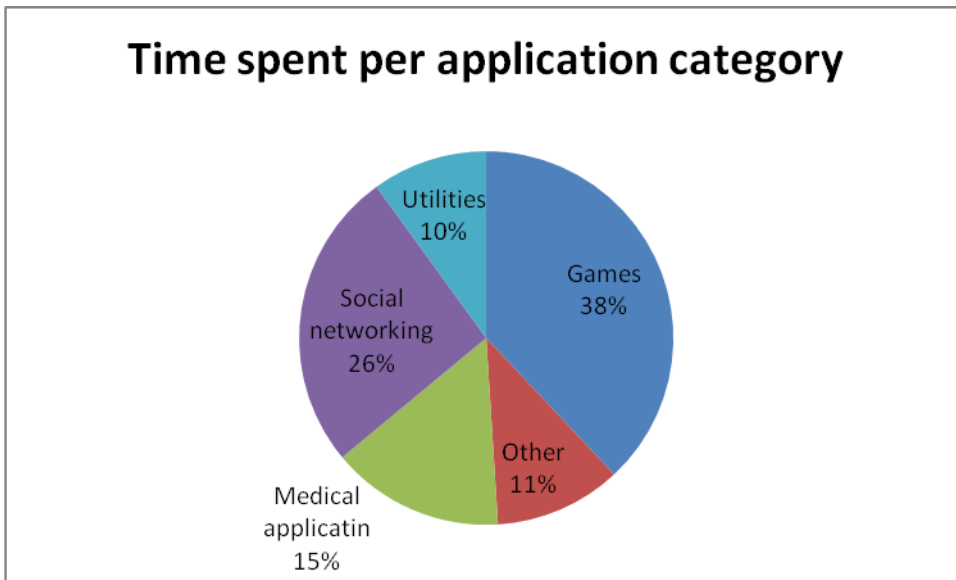


Figure 1. Time spent per application category (retrieved from applications' use.com)

From the above, it can be seen that the use of mobile phone in medical applications is greatly gaining popularity. As compared to the past year when smart phones came into existence, most of the smart phones only used game applications and other applications (Hartmann, Maren, Patrick & Rossler 2008, 108). Nevertheless, with the realization of how helpful smart phones can be in medication, a number of medical applications to be used in smart phones are being developed leading to the popularity in the medical applications that can be used in smart phones.

Just the way computer applications grow with the evolution of computers, the applications used in mobile phones also grow with the evolution of mobile phones technology. Mobile medical applications are being used in a number of health care facilities and are growing rapidly each day.

### 3.3. Embedded mobile phone applications

In the late 90s, the system and hardware of mobile phones had numerous limitations. This made it very difficult for people to be able to develop and install mobile phone applications in a mobile phone device. For this reason, only embedded applications could be run on old mobile phones. During this time, the application that was embedded was mainly the mobile phones' games. There were no mobile

medical applications that were embedded in the mobile phones. The embedded applications are normally preinstalled into the microchips of a mobile phone device.

### **3.4. Java based mobile phone applications**

After the era of mobile phones that were monochrome, there came the mobile phones that had a colored display in the mobile market. Mobile phones with embedded applications became no longer the main player in the mobile phone application. This is because mobile phones started coming with faster processors and numerous memory sizes. This made it possible for people to be able to develop their own mobile applications and install them into the mobile phone despite the fact that there was no actual operating system for the smart phones.

This led to the revolution in the development of mobile phone applications that could be used for medical purposes. Before smart phones gained popularity, the mobile medical applications were Java based. This made many medical application development companies to come into existence and join the mobile application development market. The first mobile medical application was an imaging application that could make it possible for the physicians to observe radiology using their mobile phone devices (Fling 2009, 250).

The introduction of the colored display was of great importance in the medical applications. As time passes, the expectations of the mobile phone users on medical applications continue to rise resulting in the development of more advanced mobile phone medical applications including those applications that make use of an internet connection. This same applies to the Ubipill mobile device that functions using an internet connection. For this reason, it is important to have a brief look at a wireless application protocol.

### **3.5. Wireless mobile application protocol**

This protocol is a very important standard that enables mobile phones to have access to wireless networks. Since the Patient Location application uses requires an Internet connection, it will be important to have a brief look at this protocol. Before WAP came into existence, the providers of mobile services had narrow opportunities of offering interactive services to their customers. With the introduction of WAP, BREW and J2ME, medical applications began getting more evolution because it

was now possible to develop medical applications that will require an internet connection just like the mobile Patient Location application. In addition, instant messaging and notifications came into existence.

### **3.6. Smart phones operating systems**

Before the introduction of Android operating systems, the first popular operating system for smart phones was a Symbian operating system, a product of Nokia. During this time, applications based on Java dominated the smart phone market. Beyond the expectations of the people, Symbian gained popularity and dominated the operating system market for smart phones. Despite the fact that it was not a very good platform to run mobile applications, it gave people the hope that it was possible to embrace mobile phone technology into the field of medicine (Sales 2005, 100).

However, people were still able to develop mobile applications that could be used in medicine using this operating system. With more advancement in the operating system technology, Google introduced an Android operating system that led to the downfall of Symbian.

## **4. GOOGLE ANDROID OPERATING SYSTEM**

### **4.1. A brief history of Android**

Android is a product of the Open Handset Alliance, a collection of organizations that come together in order to come up with better performing mobile devices. Google leads the group that consists of manufactures of handset devices, components, software solutions and mobile operators. Android acts as the center of the open source world. The very first Android device was the G1 device, which was a product of HTC and initiated the T-Mobile. The device became in existence after almost two years of anticipation. During this time, the only available tool for developing software was the improving versions of SDK. Because the release date of G1 became close, Android developers introduced the SDK V1.0, which marked the origin of new Android platforms (Lee 2012, 67).

### **4.2. Android platform**

The Patient Location application uses an Android platform. This platform is preferred because it is rich of capabilities and functions. Its user interface is user friendly and consists of views, windows and widgets that are used for displaying elements like lists and edit boxes. In addition, it contains an embedded internet browser for easy browsing. Android platform boasts a variety of internet connection options like the Bluetooth, wireless data and WiFi.

Since the application requires an internet connection, these capabilities of Android make it the best choice of platform to run the Patient Location application. Another important element of android is its Google map that helps in displaying addresses on an application. For the Patient Location application, this is a very important element because it assists the nurses to locate the locations of the patients using the application. The location capabilities are based on services like accelerometers and GPS, which are also available in the software kit of Android. Google maps capabilities of Android are discussed in detail in the other sections of this thesis.

### **4.3. Android and Apple iOS**

When android came into existence, people had already had a test of smart phones using Symbian. The Patient Location application runs on Android operating system for a number of reasons. First, android has a very easy to use and attractive user interface, which attracts most of the users of smart phones. In addition, the open source nature of android attracted many companies like Samsung, HTC and Sony, which could not produce smart phone products. As a result, provides a variety of smart phone products where people can run the application according to their smart phone product choice.

When Google introduced Android, mobile medical applications entered an exceptional era in technological advances. Using the improved and advanced hardware of the new smart phones, application development companies and individuals were able to come up with applications just like the Ubi pill medical application project.

In addition, Android SDK is available for use by anyone, which makes it the development tool to use in developing the Patient Location application. For this reason, not only professional mobile medical application companies but also individuals and students are able to develop an Android medical application. However, Android meets competition from other operating systems like the Apple iOS.

However, IOS is a full closed OS. Apple became brave enough and opened the initial application for commercial use. This was the App store. This means that the companies that develop applications were not the only ones that could make money from the applications they develop. This is because an application that is fully closed does not allow anyone to download any application without the App store.

The App store is not a free service and this enables the companies that develop mobile phones OS to earn more money from that. This is the reason that makes Android to have the most users but most of

its applications are initially released from the iOS. For example, when one wants to use the Patient Location application, the person will first have to release it on the iOS (Ali 2010, 178).

## **5. DESCRIPTION OF THE DEVELOPMENT OF THE PATIENT LOCATION APPLICATION**

### **5.1. Theoretical foundation**

The Patient Location project was based on Allan Paivio's dual coding theory of 1991 (Leonard 2002, 200). The theory explains that the mind of human beings functions using two discrete mental representation classes, mental images and verbal representation, and that the memory of humans hence consists of two systems that function independently. Paivio (Leonard 2002, 250) also adds that the dual coding theory has its fundamental characteristics in that information can be stored in the long-term memory of humans in a verbal or non-verbal form.

Each system of the human body has different functionalities and the brain is responsible for the storage and remembrance of information. From this theory, it clearly supports that human beings can forget to do something even if they have a good plan of activities. The same way, patients can forget to take their medication completely or at the right time. The same applies to the nurses because they can also forget to give medication to their patients.

This was what inspired the development of the Patient Location application system, which could remind the nurses or patients to take their medication. The application notifies the nurse when the time to give medication to a particular patient is reached and gives the direction of the exact location of a patient. In addition to giving the notification and the direction to the location, the application also reminds the nurses and patients when they are supposed to refill the pill box in accordance with the prescriptions of the doctor.

### **5.2. Acquisition of information**

Before coming to the final decision of developing the Patient Location application, it was necessary to get some information on the current available mobile medical application. The basis of the information acquisition was specifically for the Ubipill alarm application. The reason for basing the information acquired on this particular mobile medical application was the fact that the Patient Location application was to be part of it. It was therefore very important to get enough and adequate information about the application.

In getting this information, two main approaches will be used. These approaches will include carrying out a research on the internet about the Ubipill project. The area of concentration will be who can use the Ubipill project application will be the elderly patients, i.e the nurses and the doctors. They were the key players in conducting the research on the people using the application.

Carrying out the research on the internet will provide some very important information about the Ubipill project. It is from there that it will be possible to find out that the Ubipill alarm application only had the option of calling the patients to remind them to take medication. This approach is very much reliable because most of the elderly people do not have cell phones. In addition, it is possible for them not to hear their cell phones ringing and hence they cannot pick the call unless there is someone else to receive the call.

Because of this, it will be clear that the nurses usually have a rough time in trying to locate the exact location of their patients, whom they are suppose to give medication at the right time. The process of conducting the research on the users of the Ubipill application that was the result of the Ubipill project is discussed in detail in the following section.

### **5.3. The research process**

The objective of conducting a research before the actual development of the application will aim at finding out from the users of the Ubipill project application on what they feel are the strength and weaknesses and what they feel should be included into the application to make it more reliable. It is through conducting the research that will make it possible to realize that the development and incorporation of the Patient Location application into the Ubipill project is a great idea, which will greatly benefit the users of the application and make it more reliable and useful to them.

## **6. RESEARCH METHODOLOGY**

### **6.1. Sample size**

Carrying out the research will take the assumption that it would involve a large population size because it would carry an interview on any person that has ever used the Ubipill application after it was put to implementation. The research will mainly target the doctors, nurses and the elderly people that have used the application. In estimating the size of the research sample, the research will make use of the Z-test that is given by the formula:



$$SS = \frac{Z^2 * p * (1-p)}{C^2}$$

In which

Z = Z value (from the normal distribution)

P = the percentage of picking a choice, expressed as decimal.

c = alpha, expressed as decimal

The research picks every 6<sup>th</sup> person. Assuming a CI of 95%

P=0.1, Z= 1.96, C=0.05

Hence, the size of the sample was 100

## **6.2. Research method**

The collection of the secondary data will be done from the publications and reports on the Ubipill project. In addition, the information about if the Ubipill project will be very satisfactory will be required in order to be able to compare what the users feel if a location finding application was included in the project. Questionnaires will be used in collecting information from the users of the Ubipill application (See appendix 1).

## **6.3. Data collection method**

The research will make use of questionnaires to gather useful information. In order to make the questionnaire more reliable, it would include both the close-ended and the open-ended question. In addition, the questionnaires will have questions that include the measurements of variables, which are also very important. (Brace 2008, 158). In order to limit time spent on interviewing people that have never even used any Ubipill application, a screening question will be part of the questions that will aim at determining if the person has used the application before.

Only the respondents that have used Ubipill mobile application will be eligible to fill in the questionnaire. The variables to be used are to measure what degree the respondents agree to a particular question.

## **6.4. Preparation of the research**

In the preparation of the research, the research tool will be structured in an appropriate way with the correct necessary questions. Having a wrong structure of the questionnaires will mean that the

information collected will not be correct (Willis 2005, 200). In addition, all the necessary tools that will be used in the research will be made available on time before the commencement of the study.

## **7. THE WORK ENVIROMENT**

The work environment in conducting this work was mainly involving the fellow students, the tutoring teacher and the outside help. It may be said that the environment was convenient for the work because there were no major challenges that were met. In addition, all the tools required for the development of the system were acquired without any kind of difficulties. The work is related to the outside world in the way that the nurses and patients will make use of the system.

### **7.1 Development tools**

In the development of the application, the three most important tools, which were necessary, were the Android SDK, Eclipse, Google maps and the database server. Each of these is discussed in detail in the following sections.

### **7.2. Android SDK**

This is the software development kit, which was used in the development of the application. It consists of development tools, an emulator, a debugger, required libraries and sample projects necessary for developing Android applications. The writing of the application using Android SDK uses of Java programming language and runs on Dalvik, which is a virtual machine that is specifically meant for an embedded use and runs on top of the kernel of Linux.

This virtual machine is a kind of operating environment that behaves like it is a separate computer system. The advantage of having the virtual machine in the SDK tool is that it is secure because the virtual machine does not have any contact with the computer being used to develop the application. As a result, there will be very little chances of Java affecting the other applications or programs (Steele & Nelson 2000, 102).

Another advantage is that the virtual machine is system independent. This means that the application will run the same way in any given Java environment, regardless of the software or hardware of a system. However, the fact that the virtual machine's programs are separated from the OS, it may not be possible for them to fully utilize the special features of an operating system. It is good to bear in mind that Dalvik VM is the only interpreter virtual machine that can execute files that are in .dex

formats. This format is optimized for the purpose of efficient storage and memory mapping during the execution.

The source code as an element of Android SDK is a set of instructions in their original manner. Initially, during the programming of the application, the language that is used to write the application's program is the source code. The SDK has a compiler that translates the source code into a language that a computer will understand. Eclipse is another important feature in the development of the application. It provides a run time environment including hints for suggestions of codes and help in context-sensitive cases.

This makes it easy during the coding of an application and saves a lot of time. However, it is still possible to develop the application without Eclipse, but one will have to be very familiar with Android SDK. The Android SDK that was used to develop the application is distributed in Zip files, which are unpacked to the directory on the hard drive of the computer that one is using to develop the application.

Because of the availability of various updates for SDK, it is always recommended that one keeps the application development environment in an organized manner in order to be able to easily switch between the installations of SDK. The SDK zip files that one uses during the development of the application include the documentation.html and docs directory, android.jar, sample directory, USB driver and the tools directory.

The android.jar file contains all the SDK classes that are necessary for building the application. On the other hand, samples directory contains the source codes for various applications. For those that are beginning to develop applications, it is important that they explore this file. The USB driver file is only necessary if one is developing the application on Windows (Meier 2012, 60).

When beginning to create the application, the first thing to do is to launch the new android project wizard. Launching it will bring a window that appears like the one below in figure 2.

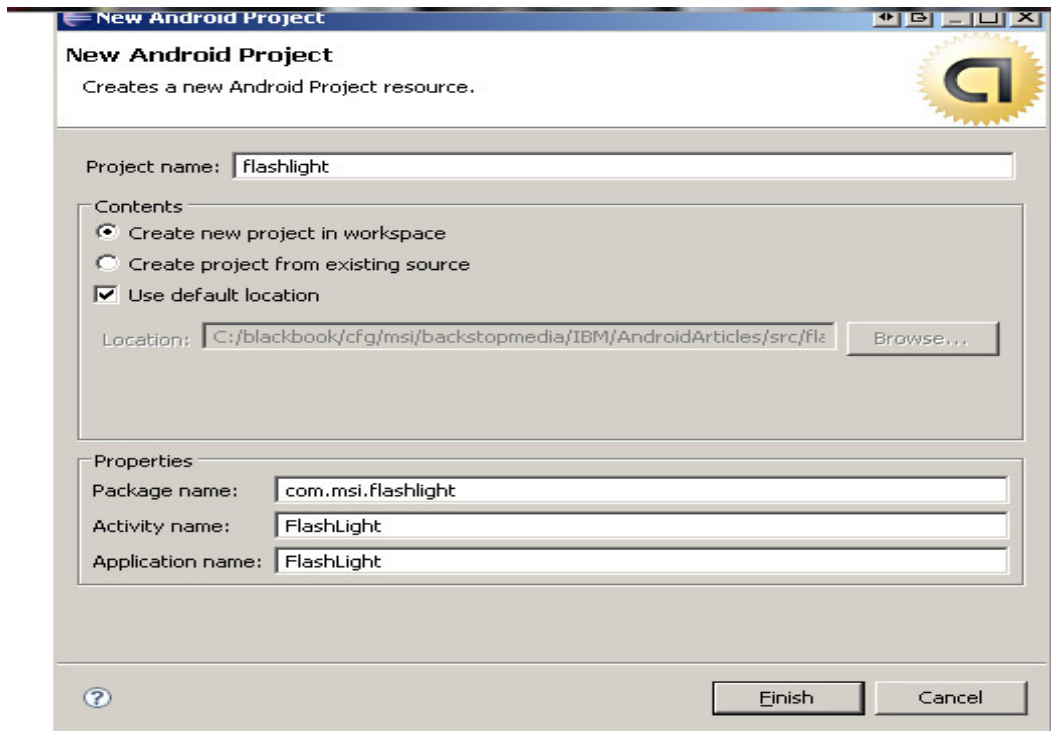


Figure 2: New Android project launch window

After filling in the necessary fields and clicking finish it will be ready for one to start coding the application. One major advantage of using Android SDK is that it is downloadable and comes with a comprehensive debugging tool.

### 7.3. Google map

This is another very important tool for the Patient Location application. The mapping service will enable the users of the Patient Location application to be able to find the location of the patients after receiving a notification. It is a free service and makes use of the internet and this makes it necessary for the application to be used where there is an internet connection. It is a free application and does not require any installation because it comes preinstalled in most of the smart phones.

This makes it possible for the nurses to locate the location of their patients using the application because it shows the direction to the users, including the alternative routes available that can enable one the shortest route possible to a location.

The only thing to do during the development of the application is to incorporate Google maps into the application in order for it to be available in the application when a user wants to locate a particular

location. What actually happens is that, when a user clicks on the location button on the application, it automatically opens Google map with the exact location of the user.

The user then selects a destination and a Google map will display the actual distance of that particular destination and the possible routes alongside with their distances. From this, it is clearly seen that Google map is like the backbone of the Patient Location application because it is the one that make it possible for the caretakers to locate the location of their patients.

#### **7.4. The database server**

There was no much work to be done with the database server of the application. This is for the reason that the Patient Location application is to be part of the Ubipill project. The Ubipill project already has a database server developed and in operation. Hence, the Patient Location application will use the same database server that was developed in the Ubipill project. In addition, on the server a simple PHP interface exists that enables the response to the requests of polling of the server (Lavin 2006, 230).

Moreover, the smart phone that the application will be running also maintains a local database by the name SQLite database. The main purpose of this local database is to store any future schedule and the history that may be required in the future for reference. The SQLite database, it is a library of software, which implements an SQL database engine that requires no configuration. In addition, it is transactional and does not require any server. It is clear from this that in order to use the SQLite database, there will be no need to carry out any form of configuration (Allen & Mike 2010, 106).

However, if necessary, the SQLite database has methods for creating and deleting executing the commands of SQL and performing any other database operations that are common with databases. It is important to note that the database server is a very important element of the application or any other application that requires the storage of some kind of information. This is because it is the database where the patients' address information, dosage schedule, telephone number, any other vital information is stored, and where they are retrieved from when required.

## **8. THE PATIENT LOCATION APPLICATION**

### **8.1. Description**

Just as the name of the application describes, the application is mainly to be used for assisting the nurses in finding the direction of the location of their patient. In addition, it is for reminding the nurses of the time they are supposed to give medication to their patients. For elderly patients, the application is for reminding them that they are supposed to take medication at a given time.

The idea behind the application is that a caretaker has been given the responsibility for taking care of a number of patients. It is the role of the caretaker to ensure that the patients take their medication on time, among other roles. Because the patients may be located in different locations, it may be difficult for a nurse to navigate to a particular destination without the help of a navigation tool.

In addition, the application helps the nurses in monitoring the patients on a regular basis. With the help of the application, since it is installed on a mobile phone, a nurse will find it easy to locate the location of a patient immediately after a notification has been received. The notification that is received is to remind the nurses that the patient is supposed to take their medication at a give particular time. The elderly patients, especially the ones who do not have anyone to take care of them, they will be forced to take their medication all by themselves. It is obvious that the old people usually have the problem of short-term memory.

As a result, they are likely to forget to take their medication completely or at the right time. The application will assist such patients to remember that they are supposed to take their medication at a given time, regardless of their location. As mentioned earlier, this application will be part of the Ubipill project and will run on an Android platform of a smart phone.

## **8.2. The user interface of the application**

The user interface of the application is very simple and user friendly even for the novice users who are using a smart phone application for their first time. Besides, using the application is very simple and straightforward. What the user has to do is to wait for a notification that will appear on the smart phone. When a notification appears, the application will open and be ready for use. Since the Patient Location is part of the UbiPill project, the window that opens is the one shown in figure 3.

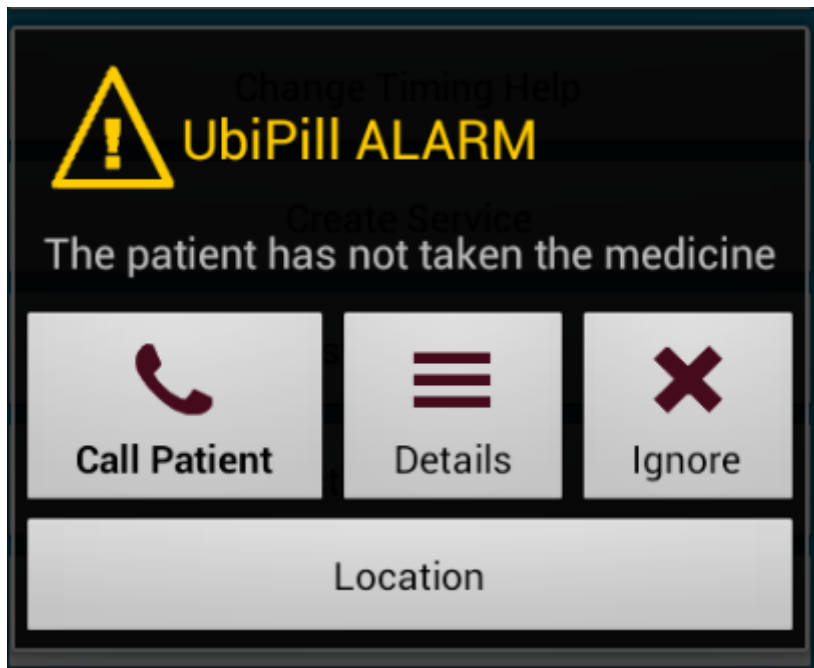


Figure 3: UbiPill Alarm window

In order to be able to use the application, it will be necessary to make some changes and additions to the UbiPill alarm application. The first thing to do is to change the layout of the application's settings. This is done by adding a two-text view and a button that one can use to save the address of the patients. The next thing to do is to do in the application setting. Java is to create a code that will enable the application to save the address that a user will enter in the preferences (Farrell 2012, 68).

After that, the next thing to do is to create a class location.xml and include a web view in the xml. This is to enable the application to be able to display the locations on the screen of the user. The next thing to do is to add a button in cp\_callpatient.xml (a location a) and then add an action listener. In the action listener, create a new intent that starts the activity of finding a location is created. The final thing to do is to create a file findlocation.java and then implement the location listener. This will enable the application to locate a location using the GPS application.

After making these changes, the next thing to do is to go to the applications setting and perform some setting in order to start using the Patient location application. It is from the application's settings where one enters the details of a new patient. These details include the patient's telephone number and the address. After making the changes, what one is supposed to do in order to make them effective is just to click on the update button in the user interface of the application. It is also from the application's

settings where one can be able to change the sound or vibration to use for the notifications and the application will be ready for use.

## **9. MAIN COMPONENTS OF THE APPLICATION**

The Patient Location application, being part of the Ubipill project has six main components that are usually displayed in the application's user interface. These components include the week's overview, missed medication summary, change dose timing, application settings, about and developer testing a. Each of these components is described in detail in the following sections.

### **9.1. The week's overview**

At the end of the week, a nurse may find it necessary to have an overview of the patients' medication. The week's overview component is used to display this information. It will give the full details to the nurse in terms of the number of patients that missed their medication, their location, the number of Pillboxes that were filled among many other information.

In addition, this component will be able to view the summary of the activity involved in the monitoring of the patients in that particular week. This will enable the nurses to be able to analyze the overview presented and use it to create a more flexible, reliable and efficient schedule for monitoring the medication of the patients. From the week's overview, the nurses will also be able to view at a glance the patients that have been missing their medication on frequent occasions. This will enable the nurses to keep a close eye on such patients.

### **9.2. Missed medication summary**

For the nurses to have an elaborate and effective monitoring of their patients' medication, it will be important to make it possible for them to view the summary of the missed medication. The application presents this summary to the user in terms of the total number of missed medication by all the patients and the number of medications that each patient missed in a particular week. Just like the weeks overview, this is important because it enables the nurses to be able to identify the patients that miss their medication on a regular basis.

In addition, the nurses are able to monitor themselves if their efforts to ensure that their patients take medications are of importance. This will be viewed by them in terms of the overall number of the missed medication in a given week. If the number of missed medication in a given week is too high, this will mean that the nurse has not been putting more efforts to ensure that the patients take their



medication. On the other hand, if the overall number of the missed medication is at a minimum, it will indicate that the nurse is putting more efforts to ensure that the patients take their medication.

### **9.3. Change dose timing**

The component makes it possible for the nurses and doctors to change the dosage timing of a patient. This is normally the case where a patient has been given a new medication the time of which is not the same as the time of the previous medication. This is because the time that a patient is supposed to take a certain medication is not always the same for all medications. For this reason, it will be medically wrong to give a medication to a patient at the time that is not recommended by the doctor for taking that particular medication. This will therefore make it necessary to make the changes to the time that a patient is supposed to take a particular medication. Therefore, this component plays a very important part of the application.

### **9.4. Application setting**

This makes it possible for the users of the application to make some changes to the setting of the application. These changes that a user can make to the application include adding the information on a new patient or updating the existing one, changing the notification and alarm sound of the application and putting on or off the vibration mode of the application.

The information about a patient that one can add or update is the patient's phone number and the location address. When a user makes these changes, they automatically become effective in the database server where the patients' information is stored. Remember that a user has to click on the refresh button of the application after making all the necessary changes from the application settings.

### **9.5. About**

This component does not play a major role when one is using the application. It provides the necessary information to those people that are using the application for the first time and those ones that have very little information concerning what the application is all about. It gives brief descriptions to the user about the application and what it can be used for. The copyright, authors and license information are also found in this component.

### **9.6. Developer testing**

This is the most important component of the application. This is because it enables the developers to test the other components of the application before the users can use it. This also enables them to identify the errors or the changes that need to be made to the application. It is through this that the developers are able to test the application's components like the week's overview, missing medication summary, change dose timing, application settings, about, call patient and the help services. When one clicks on a component, it will run as if it was running on an actual smart phone.

## **10. DEFINITION**

### **10.1 The working principle of the Patient Location application**

It should be noted that the Patient Location mobile application works alongside with the Ubipill nurse mobile application, which is a Ubipill project. When the time for a patient to take their medication comes and a patient has forgotten to take their medication, the nurse will receive a notification informing that a patient has forgotten to take their medication at the right time. This notification will appear on the nurse's smart phone just in the same way as a new message notification appears on a smart phone.

In order to view the notification, a nurse will just have to click on the notification. After doing that, the Ubipill alarm window will open with a cautionary message that a patient has not taken their medication. In addition, four other options will be displayed on the Ubipill alarm window besides the notification message. These options are call patient, details, ignore and location and they all appear as click buttons. This means that the nurse has the freedom of deciding to ignore the notification, call that particular patient, view the notification details and locate the exact location of the patient. The Ubipill alarm window that appears is like the one shown in figure 4 below.

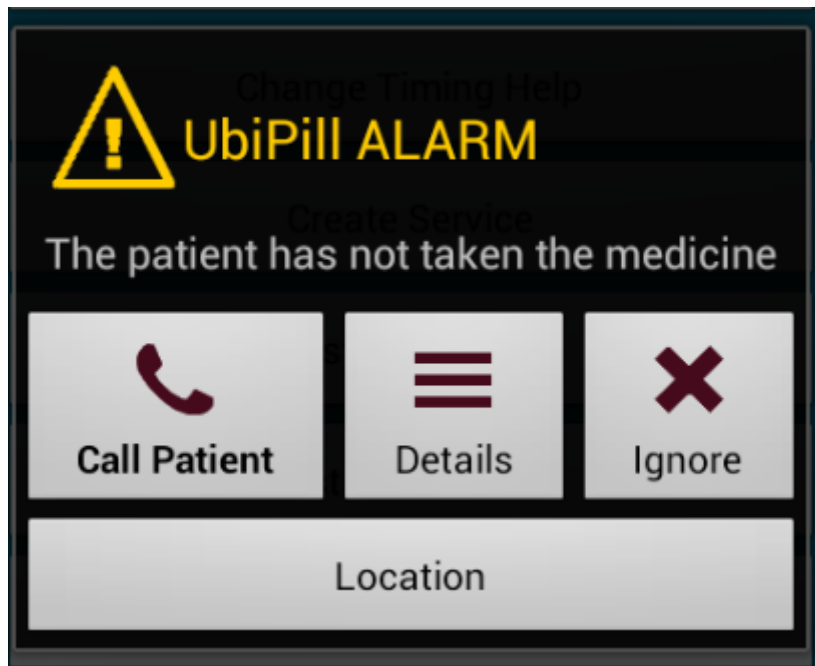


Figure 4: UbiPill alarm notification window

The Location button as seen in the above image is actually the Patient Location application when added to the UbiPill alarm application. When the user clicks on the call patient button, it will automatically redirect to calling that particular patient who has forgotten to take their medication. This means that the patient will receive a call from the nurse. However, calling the patient is not normally the option that most of the nurses take, especially the ones dealing with the elderly patients.

This is because elderly people will rarely pick a call or some of them even do not know how to operate a cell phone for some reasons like maybe they lack eyesight. The caretakers will have to locate the exact location of such patients so that they assist them to take their medication. This is now where the patient Location application comes in handy. It may be very difficult for the nurse to locate the exact location of a patient with even if the exact address is known. However, with the application, it is very easy for the nurses to do this.

What the nurse will have to do is just to click on the Location button in order to begin the process of using the application to locate the location of a patient. Remember to activate the GPS service when using this application. On clicking the Location button, a window will appear where one will be able to view a detailed map. Initially, a map that shows the route through multiple countries will appear like it is shown in figure 5. However, after the application has finished loading all the information about the location of a patient, it will display the exact direction details to a particular patient.

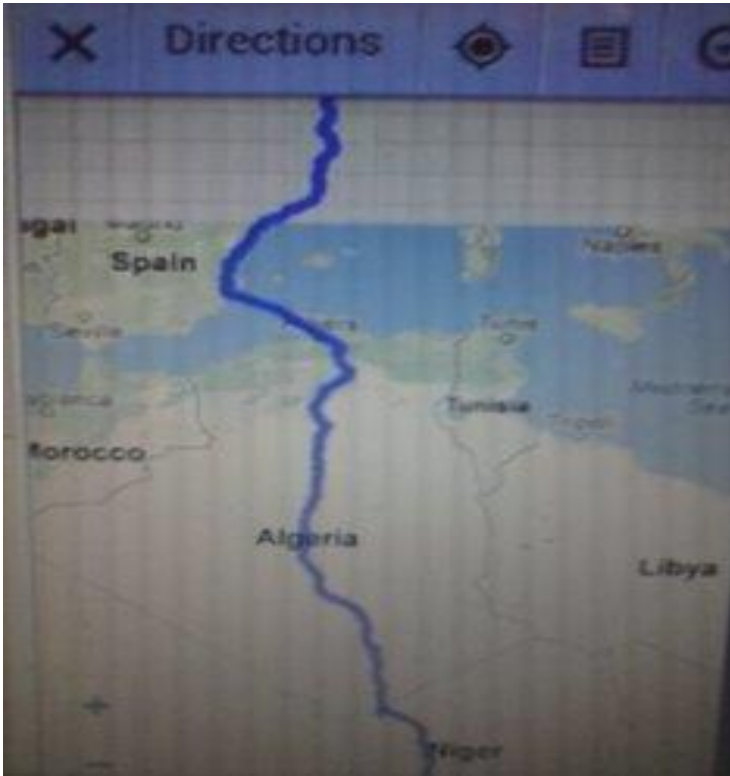


Figure 5: UbiPill route map

The information that will be displayed by the application includes the distance, directions and alternative routes to a particular location.

## 11. TESTING

According to Harty J (2010, 278), in order to ensure that the application functions as expected, testing should be done using two main environments. These environments include a real phone and a simulator environment. The first testing should be done using the simulator.

### 11.1. Testing using a simulator

Testing using a simulator is done using the same one that was used during the development. The figure 6 below shows the interface of the simulator that one uses for testing.

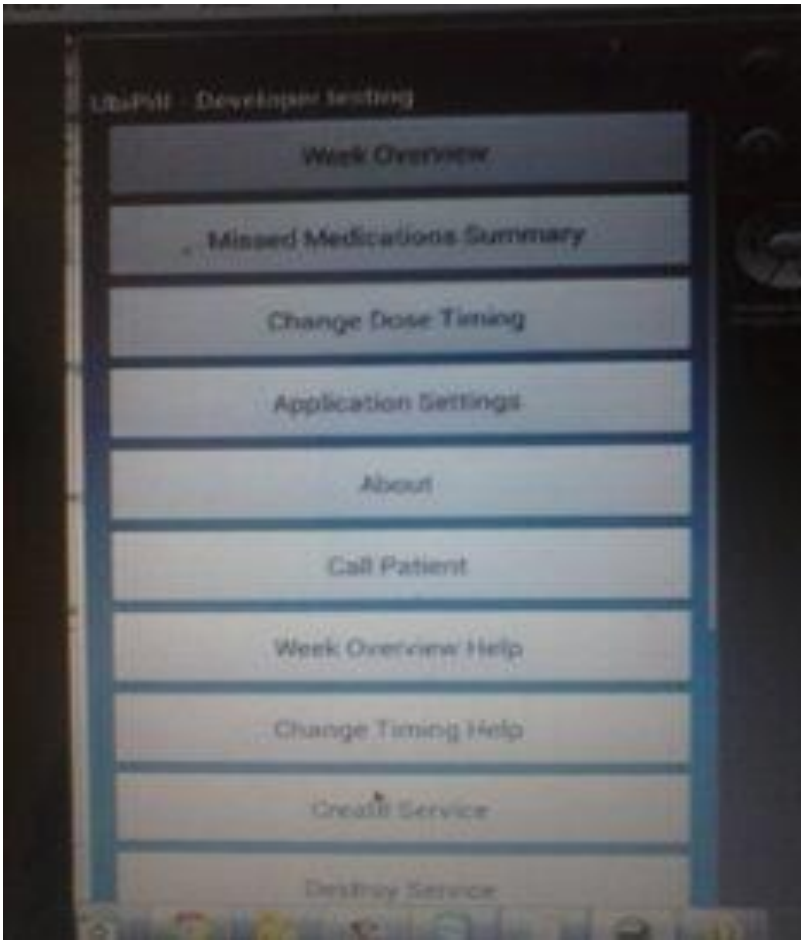


Figure 6: Simulator interface

Testing using the developer testing tool is very simple because the user just has to select what to test and the simulator performs the testing.

### 11.2. Testing using a real phone

Since the main aim of this project is to come up with an application that can run on a smart phone effectively and efficiently, this part of testing it with a real phone is very important (Schwaiger 2010, 200). The table 1 below summarizes the details of the smart phone device that was used for testing the application.

Table 1. The details of the smart phone device used for testing the application

Hardware device	Smart phone device: Samsung galaxy S plus CPU speed: 1.5 GHZ Memory size: 512 MB
-----------------	--

Operating system platform	Android version 2.3
---------------------------	---------------------

What are tested with the real smart phone are the same things that were tested with the simulator. In addition, testing the application with a real phone will ensure that the buttons of the application do what they are supposed to do when one clicks on them. Moreover, it is to ensure that the application is able to link with Google map in order to locate a location and that the information of a patient can be successfully stored, updated and retrieved from the server database using the application effectively.

B'Far ( 2004, 149) explains that the result of both tests should be similar and should reflect that all the parts of the application are working accordingly. This means that a user should not come across any kind of problem when using the Patient Location application. This is in terms of receiving notifications and the user being able to locate the location of a patient.

## **12. CONCLUSION**

The main aim of this thesis was to give a detailed look at what was involved in the development of the Patient Location application for that can be used on anAndroid operating system and how to test it using a real smart phone. As the name suggests, the Patient Location applications should be able to locate the exact location of a patient that has forgotten to take medication. The result of the tests performed proved that the application could successfully run on any smart phone with an Android operating system. Hence, it can be concluded that the aim of the project was achieved.

The process of developing the application or any other mobile phone application can be very challenging for someone that has very little knowledge about Android programming or simply programming using the Android SDK. It is therefore very important that one gets equipped and familiar with an Android programming language before attempting to develop any application (Duffy 2012, 171). In addition, learning to be good in any programming language requires a lot of dedication and practice.

With the application incorporated into the Ubipill project, the users will find using the application very fascinating and useful. They will not be wasting a lot of time trying to inquire about the location of a particular address of a patient. The application will do it all for them. In addition, with the application incorporated in the Ubipill project, the nurses will be able to know where the patients are because of the ability of one to locate a patient's location using the application. Moreover, people will not only use

the application to locate the location of only patients but also the location of places and other people when they find some difficulties in finding directions.

### **13. DISCUSSION**

During this thesis, it was learned that the process of developing a mobile application is a continuous process. When one completes developing an application, there is always no assurance of that being the final product. There will always be additions and subtractions to be done on the application. For example, the Ubipill alarm application will be developed to remind the patients and the caretakers on taking medication at the right time.

Initially, the developers of this application thought they had come up with the final product. However, they never thought that it will be necessary to include an application that will enable the users to find directions to a location. It can be seen that the Patient Location application will be part of the Ubipill project.

This project will be a success because the application will be able to perform its function of giving directions to a particular location. In addition, the completion of the project is expected to be within the anticipated duration and the cost will also be realistic and within the budget estimates. Moreover, from the response from some of the people that have some idea about Ubipill alarm application , it will be possible to realize that the application will enhance the effective use of the Ubipill alarm application and they really appreciate the idea of creating the Patient Location application part of the Ubipill project.

In the process of developing an application, it is always recommended that one checks for any error after each step of development. This is because it is much easier to deal with an error during the early stages of application development than to deal with it when the application is complete and ready to be used. When one has completed developing an application, the process of locating where an error was made can be very tedious, especially for the application that has been developed using numerous code sizes. Checking the errors at the early stages also reduces the task of having to deal with so many errors at the same time when the development of an application is complete.

Some developers would always argue that testing an application using only one environment is enough. However, this statement is not true for the fact that the two environments for testing are equally important. Performing a test using only one environment will make it difficult for one to be able

to be very sure that an application functions properly. In simple terms, the second testing environment, which is testing using the actual device, will normally ascertain the proper functioning of an application when it is put in real use.



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**APPENDICES**

**QUESTIONNAIRE**

**APPENDIX 1**

**Dear Sir/Madam,**

**This is a research to find out if the Ubipill project mobile applications is of great help to its users.**

**Note:** The interviewer should tick the appropriate box below if the respondent is a doctor, nurse or patient. (Tick the appropriate box)

Doctor  nurse  Patient

Q1: Have you ever used the Ubipill project mobile application?

Yes  No

Q2: If Yes, do you agree that the application is very useful and reliable? If no, terminate the research.

*Tick where appropriate.*

<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>

Q3: Will including a Patient location application in the Ubipill project be of much significance?

<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>

Phone number \_\_\_\_\_

**Thank you very much for your time and cooperation.**

**WORK PLAN****APPENDIX 2**

Time	Activity
4 days	Gather required resources (software, material, Secondary data, Questionnaires)
2 days	Distribute survey material to interviewers
1 week	Conduct the interview
1 week	Conduct analysis
Total = 4 weeks and 4 days	

**EXPENSES**

## APPENDIX 3

<b>ITEM</b>			<b>COST (In euros)</b>
Stationery			
<b>OTHER REQUIREMENTS</b>			
Printing costs			
Data collection costs			
Miscellaneous			
<b>Total</b>			