Development of Muslim Context Aware Android Application

Context-Aware Computing

By

Nadira Syazwani Mohd Shafie

Dissertation submitted in partial fulfillment of

the requirement for the

Bachelor of Technology (Hons)

(Information & Communication Technology)

May 2011

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Perak Darul Ridzuan

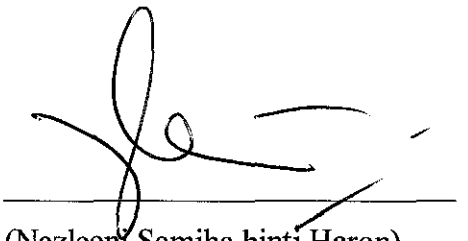
CERTIFICATION OF APPROVAL

Development of Muslim Context Aware Android Application

Context-Aware Computing

By
Nadira Syazwani Mohd Shafie
A project dissertation submitted to the
Information Communication Technology Programme
Universiti Teknologi PETRONAS
in partial fulfillment of the requirement for the
BACHELOR OF TECHNOLOGY (Hons)
(INFORMATION COMMUNICATION TECHNOLOGY)

Approved by



(Nazleeni Samiha binti Haron)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

May 2011

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.

NADIRA SYAZWANI MOHD SHAFIE

Abstract

This project concentrates on context-aware computing approach for utilize the characteristics of mobile computing such as communication, mobility and portability. By improving the computer's access to context, user can increase the richness of communication in human computer interaction and make it possible to produce more useful computational services. The increasing number of smart-phones user in Malaysia has given the opportunity to mobile phone application programmer to be more creative in developing useful yet interactive applications to meet the user satisfaction and requirement. Islamic mobile phone applications have also been developed by Muslim scholars in order to mobilize Islamic practices.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background

Over the past ten years, smart-phones have become the most popular and significant device that it has revolutionize the way human go through their daily life via tons of useful features and applications that comes with every smart-phone. Concurrently with this exciting development, mobile computing has introduced new opportunities such as context-aware computing that can support the mobility and portability of such mobile devices e.g. smart-phones. One of the remarkable smart-phone platforms available around is the Android. Android is an open-source software stack for mobile devices that includes an operating system, middleware and key applications. Brands like HTC, Samsung, Motorola, Sony Ericson and CSL have selected Android as the operating system for their devices such as HTC Desire and Motorola Defy just to name a few . By looking at the various types of smart-phones' brand with Android as their OS backing by study from market research group such as Canalys and IDC , it is safe to say that Android has become close rivals to iPhone.

The Android platform was preferred to iPhone mainly because it uses Java as the main programming language and there are several machine learning frameworks available for Java. It also provides access to more operating system functionality while in the same time it does not require any certification or developer registration to develop the software. This in return makes many developers take the opportunity to develop useful Android-based applications.

The growing number of Android applications help with the positive demand from the users has given the opportunity to Muslim programmers to use Android

technology in spreading and sharing Islamic knowledge by working with Muslim scholars. Referring to Android Market, a catalog of applications that can be downloaded and installed to the Android devices, there are a lot of Islamic Applications such as Qibla Compass, iQuran, Islam Adhan Alarm and also Nearest Mosque Apps that helps user to perform prayer.

Collins English Dictionary (2009), defined context as condition or circumstances in which something happen. On the other hand, Stefano et al.(2007), defined context as an information that being used to illustrate the interaction between people or user with system software and also the environment where the interaction occur. While awareness can be define as notification that are notified when something is around you. According to Dey, A.K., & Abowd, G.D., (2000), context awareness can be described as information that can be used to characterize the situation of the entity. An entity can be person, place and object that can be considered relevant to the interaction between a user and application, including user and system themselves. Android application is written in Java Programming language. The android application used Android SDK and tools provided by android in order to make the application functioning with multiple features.

Based on each word definition, Context Aware is a computing system that is able to notify people about the information needed. A Context Aware Android Application means the android application that can notify information to user based on their context. In this research project, the implementation of android features and tools has been explored to make the application context aware. Two types of context aware; time context aware and location context aware are chosen.

1.2 Problem Statement

1.2.1 Identify the problem

Even though there are several Doa and Qiblah direction applications exist in Android, users sometimes forget that they already have such features in their smart-phones mainly due to hectic lifestyle in their daily life. With context aware features applied to the application, user will be notified automatically. In such way, the idea of having these applications as a tool to promote Islamic practices as the routine of daily life has become fruitless. Besides that, the existing applications have some limitation such as the requirement of good internet receptions e.g. Wi-Fi. There are also issues on style of Arabic font that may reduce the user satisfaction in using the applications.

1.2.2 Significant of the project

This project will be focusing on the enhancement of the current existing Doa and Qiblah direction compass applications in Android platform by implementing context-aware computing methods to improve the effectiveness of the applications. As an example, the Muslim Context-Aware Android Application can be programmed with reminder or cues of suitable Doa or Zikir that user can perform at any specific time. Besides that, improvement can be done in order to make the applications context to the changes of location. The system then will prompt the Qiblah direction compass relevant to the local clock sets by the user in the smart-phones. This kind of system is also applicable if the user travels to other countries. Other than that, the addition of context-aware computing in Android apps can improve the limitations and issues arise in the current applications.

1.3 Objectives

The objectives of this project are:

- To design and develop Islamic Android App that has the following context-aware features :
  - Sense the context including the mobile device's environment.
  - Process the suitable service to be required and the information to be displayed.
  - Display the information in a user friendly manner.

1.4 Scope of Study

This research covers on the context-aware computing that will be applied in Doa and Zikir Applications. The utility of an application can be increased greatly by taking into account the specific context in which application is used. Scopes of study of project are:

1) Study on Android Application development.
2) Muslim as the potential user of the application.
3) Implementation of context-aware concept to the system.

CHAPTER 2

LITERATURE REVIEW

2.1 Mobile Computing

Asoke Talukder (2005) define mobile computing as a computing environment over physical mobility. The user of mobile computing environment will be able to access data, information or other logical objects from any device in any network while on the move. Mobile computing system allows a user to perform a task from anywhere using a computing device in the public, corporate and personal information spaces. While on the move, the preferred device will be a mobile device, while back at home or in the office device could be desktop computer. To make the mobile computing environment ubiquitous, it is necessary that the communication bearer is spread over both wired and wireless media. Be it for the mobile workforce, holidaymakers, enterprises, or rural population, the access to information and virtual objects through mobile computing are absolutely necessary for optimal use of resource and increased productivity.

According to Sasu Tarkoma (2009), there are two principle ways to be mobile:

- **Portability**: Intermittent connectivity to the network, stationary while connected. An example is a traveler accessing the Internet from their hotel room.
- **Mobility**: Mobile while connected to the network requires uninterrupted connectivity even when moving. An example is a traveler on a train needing network access.

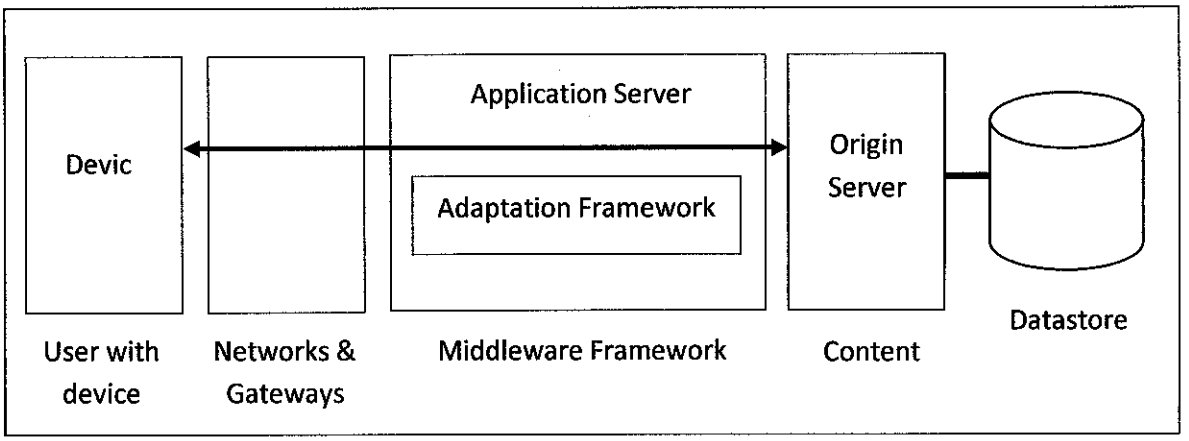


Figure 1:Mobile Computing Functions

2.2 Context

According to Merriam-Webster's Collegiate Dictionary, context is defined as the interrelated conditions in which something exists or occurs. Even in computer science itself, context is used with a number of different meanings. "Context" in the area of context-aware computing refers to any information that can used to enhance an application, especially the interaction with the user.

The simplest definitions of context are given by enumerating all constituents of context. For example, Schilit, Adam and Want (1994) define context by specifying three categories of context:

- **Computing context**: For example, network connectivity, communication bandwidth, nearby resources like printers, displays;
- **User context**: For example, user's profile, location, emotional state, people nearby, current activity;
- **Physical context**: For example, lighting, noise level, traffic conditions, temperature.

2.3 Context-Aware

Schilit and Theimer (1994) refer to context as location, identifies of nearby people and objects, and changes to those objects. In similar definition, Brown *et al.* (1997) define context as location, identities of the people around the user, the time of day, season, temperature, etc. Ryan *et al.* (1998) define context as the user's location, environment, identity and time. In previous work, Dey (1998) enumerates context as the user's emotional state, focus of attention, location and orientation, date and time, and objects and people in the user's environment.

2.4 Context-Aware Application

Many researchers (Schilit, Adams *et al.* 1994; Brown, Bovey *et al.* 1997; Davies, Mitchell *et al.*1998; Dey and Abowd 1997; Ward, Jones *et al.* 1997; Abowd, Dey *et al.* 1998; Kortuem, Segall *et al.* 1998) define context-aware applications to be applications that dynamically change or adapt their behavior based on the context of the application and the user.

2.4.1 Features of context-aware application

According to Max and Iryna (2007), the goal of context-aware applications is to respond to context changes to enhance the computing environment for the user. Similar to the problem of defining the term context, researchers have tried to specify the features characterizing a context-aware application (Dey, 2001). Context-aware features include using context to:

- *Presentation* of information and services to a user;
- Automatic *execution* of a service for a user;
- *Tagging* of context to information to support later retrieval;
- *Adaptation* of application's behaviour and appearance.

2.4.2 Building a mobile context-aware application

Several steps have to be performed in order to make an application context-aware. The design process can be defined as follows (Abowd, Dey, Orr, & Brotherton, 1997):

- **Specification**: What context-aware behavior should be implemented? Which context is required for that purpose?
- **Acquisition**: Which sensors can be used to retrieve this context?
- **Delivery and Reception**: How is the context represented, managed and exchanged?
- **Action**: Which actions should be taken corresponding to the captured context?

For a long time, context aware applications were hard to develop because the devices able to support them were unavailable. However, nowadays, almost every smart phone is equipped with sensors and communication systems which can provide a lot of information about the environment, sufficient to act as input for such applications. Wearable computers present a series of features which make them appropriate for hosting context aware applications (B. Rhodes, 1997):

- **Portable while operational:** A wearable computer is capable of being used while the user is mobile. When a user is mobile, her context is much more dynamic. She is moving through new physical spaces, encountering new objects and people. The services and information she requires will change based on these new entities.
- **Hands-free use**: A wearable computer is intended to be operated with the minimal use of hands, relying on speech input or one-handed chording-keyboards and joysticks. Limiting the use of traditional input mechanisms (and somewhat limiting the use of explicit input) increases the need to obtain implicitly sensed contextual information.

- **Sensors**: To enhance the explicit user input, wearable computer should use sensors to collect information about the user's surrounding environment.
- **Proactive**: A wearable computer should be acting on its user's behalf even when the user is not explicitly using it. This is the essence of context aware computing: the computer analyzes the user's context and makes task relevant information and services available to the user, interrupting the user when appropriate.
- **Always on**: A wearable computer is always on. This is important for context-aware computing because the wearable computer should be continuously monitoring the user's situation or context so that it can adapt and respond appropriately. It is able to provide useful services to the user at any time.

The first context-aware applications were centered on mobility. The Active Badge location system used infrared-based badges and sensors to determine the location of the workers in an indoor location (Want et al., 1992). A receptionist could use this information to route a phone cell to the location of the person being called, rather than forwarding the phone call to an empty office. Similarly, individuals could locate others to arrange impromptu meetings. Schilit, Adams and Want, (1994) also use an infrared-based cellular network to location people and devices, the PARCTAB, and describe different types of applications build with it (Schilit et al., 1994). This includes:

- **Proximate selection**: Nearby objects like printers are emphasized to be easier to select than other similar objects that are further away from the users;
- **Contextual information and commands**: Information presented to a user or commands parameterized and executed for a user depend on the user's context;
- **Automatic contextual reconfiguration**: Software is automatically reconfigured to support a user's context; and
- **Context-triggered actions**: if-then rules are used to specify what actions to take based on a user's context.

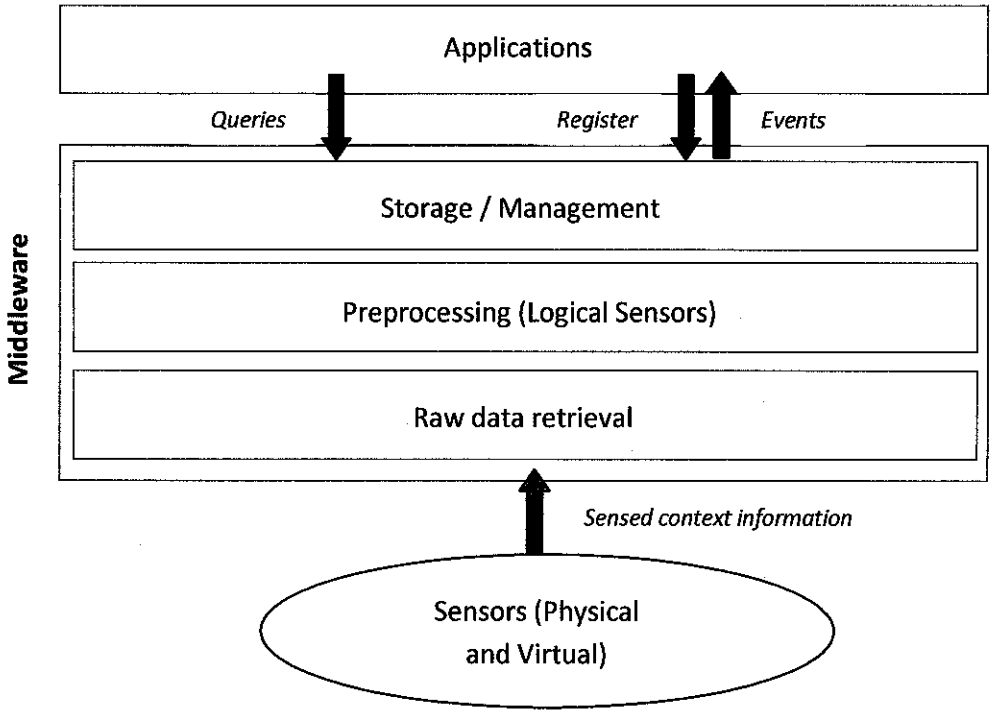


Figure 2: Layers of a middleware for building context-aware applications

2.5 Context-Aware Computing for Android

Alf Inge Wang and Qadeer Khan Ahmad (2010) stated that smartphones are ideal for context-aware applications since they are relatively powerful and contain various sensors. Before decided to go for Android, they have evaluated other smartphone platforms: iPhone, Symbian, RIM, Windows phone and Linux. The two most promising platforms were iPhone and Android because of the popularity, high usability, powerful CPUs and available sensors. The Android platform was preferred to iPhone because it uses Java as the main programming language and it does not require any certification or developer registration to deploy the software to hardware, and the Android SDK is available on multiple platforms.

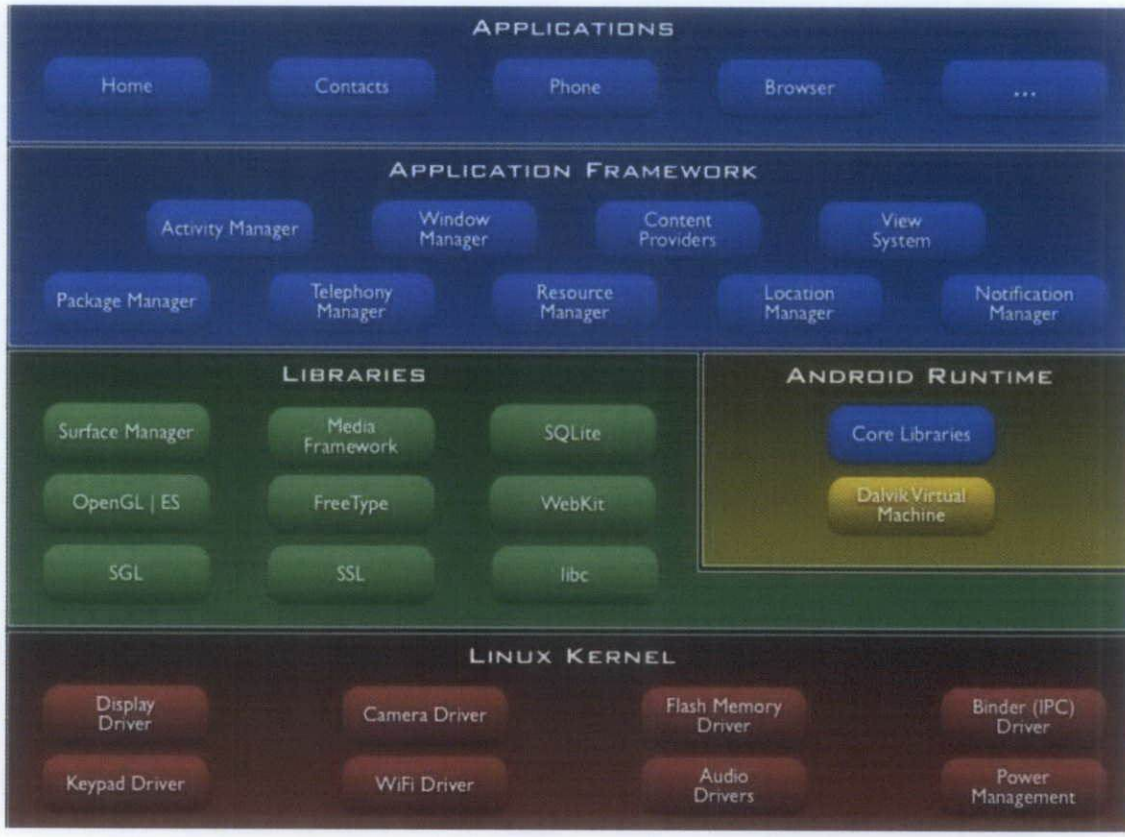


Figure 3: Android Architecture

According to Android Developer Website, the context support in Android application framework consists of two main parts: Raw context data sources and context processing.

2.5.1 Raw context data sources:

The support for raw context data sources contains several packages and classes such as for the camera, Bluetooth scanning of nearby devices, sensor manager for controlling interaction with physical sensors on the Android device, geographical location, time and sound recording. The sensor manager enables Android applications to access a wide range of sensors: accelerometer, light, magnetic field, orientation, pressure, proximity, and temperature.

2.5.2 Context processing:

The context processing support in Android contains functionality for processing raw context data into more useful contextual data and includes face recognition, speech recognition, text-to-speech, location proximity, and a Google Maps API.

Alf I.W (2010) said that a system is context-aware if it uses context to provide relevant information or services to the user, where relevancy depends on the user's task. A context-aware system can improve the user experience, by only showing or doing the relevant things for a given context. A context-aware application needs to learn how the user use his device and in what context. The Android platform has good support for developing context-aware systems and is regarded as one of the best choices for mobile application development. Android uses a middleware infrastructure approach to district context sensing and usage, supports a range of physical components, and provides software components to offer middleware for the physical components and context processing capabilities.

2.5.3 Getting Location Data

- *GPS*

According to Jerome (2008), nowadays, mobile devices are commonly equipped with GPS receivers. Because of the many satellites orbiting the earth, GPS receiver have been used to find the location easily. However, GPS requires a clear sky to work and hence does not always work indoors or where satellites can't penetrate; such as a tunnel through a mountain.

- *Cell Tower Triangulation*

Jerome (2008) also stated that another effective way to locate user position is through cell tower triangulation. When a mobile phone is switched on, it is constantly in contact with base station surrounding it. By knowing the identity of cell towers, it

is possible to translate this information into a physical location through the use of various databases containing the cell towers' identities and their exact geographical locations. The advantage of cell tower triangulation is that it works indoors, without the need to obtain information from satellites. However, it is not as precise as GPS because its accuracy depends on overlapping signal coverage, which varies quite a bit. Cell tower triangulation works best in densely populated areas where the cell towers are closely located.

- *Wi-Fi Triangulation*

Mike Hazas (2006) said a third method of locating the position is to rely on Wi-Fi triangulation. Rather than connect to cell towers, the device connects to a Wi-Fi network and checks the service provider against databases to determine the location serviced by the provider. Of the three methods described, Wi-Fi triangulation is the least accurate.

On the Android, the SDK provides the LocationManager class to help the device determine the user's physical location.

2.5.4 Sensor Manager

The *android.hardware.SensorManager* contains several constants, which represent different aspects of Android's sensor system, including:

Sensor type:

- Orientation
- Accelerometer
- Light
- Magnetic field
- Proximity
- Temperature

The SensorListener interface is central to sensor applications. It includes two required methods:

- The *onSensorChanged(int sensor,float values[])* method is invoked whenever a sensor value has changed. The method is invoked only for sensors being monitored by this application (more on this below). The arguments to the method include an integer that identifies the sensor that changed, along with an array of float values representing the 20 sensor data itself. Some sensors provide only a single data value, while others provide three float values. The orientation and accelerometer sensors each provide three data values.
- The *onAccuracyChanged(int sensor,int accuracy)* method is invoked when the accuracy of a sensor has been changed. The arguments are two integers: One represents the sensor,and the other represents the new accuracy value for that sensor.

To interact with the sensor, an application must register to listen for activity related to one or more sensors. Registering takes place with the *registerListener* method of the *SensorManager* class.

2.6 Related Work

Others researched in context-aware computing was performed by the Ubicomp group in the early 1990's, B. Schilit invented the term context-awareness, and build a system architecture that supported the building of context-aware applications, as part of the highly influential PARCTAB work. In the PARTCTAB work (Want et al., 1995) the provided system present information to users based on proximity to services, turns on the devices or reconfigures them based on the people who are nearby. The system present information or services based on the user location, and automatically execute a service in a particular way depending on the movement or proximity of users to specific rooms or devices.

Distributed Multimedia Research Group from Lancaster University has invented GUIDE, a mobile tourist guide system. When interacting with the system, users carry a portable computing device as they travel through some area such as a museum or city. As users attend to different exhibits or tourist locations, their mobile devices present information relevant to those locations. While early system focused heavily on location, later system took into account of the users' interests in the amount of time they spent at a tourist location or the amount of time they had to tour in choosing what information to show, and what tourist locations to recommend. (Abowd et al., 1997)

In the review of context-aware research on context-aware application, some researched have been done in implementing context-aware to time and location. CybreMinder is a context-aware reminders presents to individuals, triggered by changes in context. An alarm clock uses a simple contextual trigger, time, to set off an alarm, a simple form of reminder. Similarly, location-based services can deliver reminders when users are at a particular location or within some proximity of each other. More sophisticated reminder systems use a combination of different forms of context to trigger reminders. In being more sophisticated, these applications can remind users more appropriately, delivering the right reminder in the right situation. (Dey, A.K., & Abowd, G.D., 2000)

2.7 Muslim Context-Aware Android Application

The current implementation of the project contains three elements: the sensor to sense the context, the process and information to be displayed and the user interface to display the information. Muslim Context-Aware Android Application is a mobile phone application specifically for smart-phones that uses Android Operating System. Similar to CybreMinder, Muslim Context-Aware Application is a reminder system that invents to remind users to practice Doa that is suitable to be practices in certain period of time and locations:

2.7.1 Time context:

The system will alert user whenever the local clock detect the similarity in the time sets for each of the Doa and Zikir. The applications will communicate with the user by prompting specific Doa and Zikir as a reminder to be perform at certain time. Users will then interact with the system either reading the Doa and Zikir prompt or even eject the system prompt. This application can help the target groups which are adult Muslims that use Android OS to practice Doa and Zikir in their daily life.

2.7.2 Location context:

The system will also alert user according to the location detected by user's smartphones via GPS embedded in the system. By using compass, the system will automatically prompted Qiblah direction to the user during the five prayers time. The GPS will detect current location of the user. The system can detect latitude and prompt user Qiblah direction for that particular location.

Android API has classes to allow the access to the device's sensor. The SensorManager is required in order to control the hardware in the device. As the applications used the sensor for the purpose of detecting the current coordinates. Context.SERVICE_SENSOR is required to call the context.getSystemService() method. After a call to context.getSystemService(), types of sensor is chosen to allow

the manager to control that specific sensor. In this application, sensor.TYPE_ORIENTATION is chosen to computes the device's orientation based on the rotation matrix. The rotation matrix is different from the world coordinates system. Besides that, Android API also provides LocationManager class to obtain updates from the device's geographical location. Context.LOCATION_SERVICE is used to call the context.getSystemService() method. In order to determine location using satellites, LocationManager.GPS_PROVIDER is called. LocationListener is then used to notify the LocationManager when the location has changed.

Android API also provides context processing that contains functionality for processing raw context data into more useful contextual data. Two classes in used: calendar class and notification class. The calendar class is use to produce the time field needed to implement the data-time formatting. The system time setting and the current time initialized will be compared. The notification class is used to notify user of the event that happen. This class is happen as the background.

2.8 Tools and Technologies Used

2 Windows 7

3 Eclipse Java IDE Version 3.5 (Galileo)

4 Eclipse JDT plug-in and Web Tools Platform (WTP)

5 Sun Java SE Development Kit (JDK) 6 Update 18

6 Android SDK Version 2.1 (Primary target)

CHAPTER 3

METHODOLOGY

3.1 Software Engineering Process

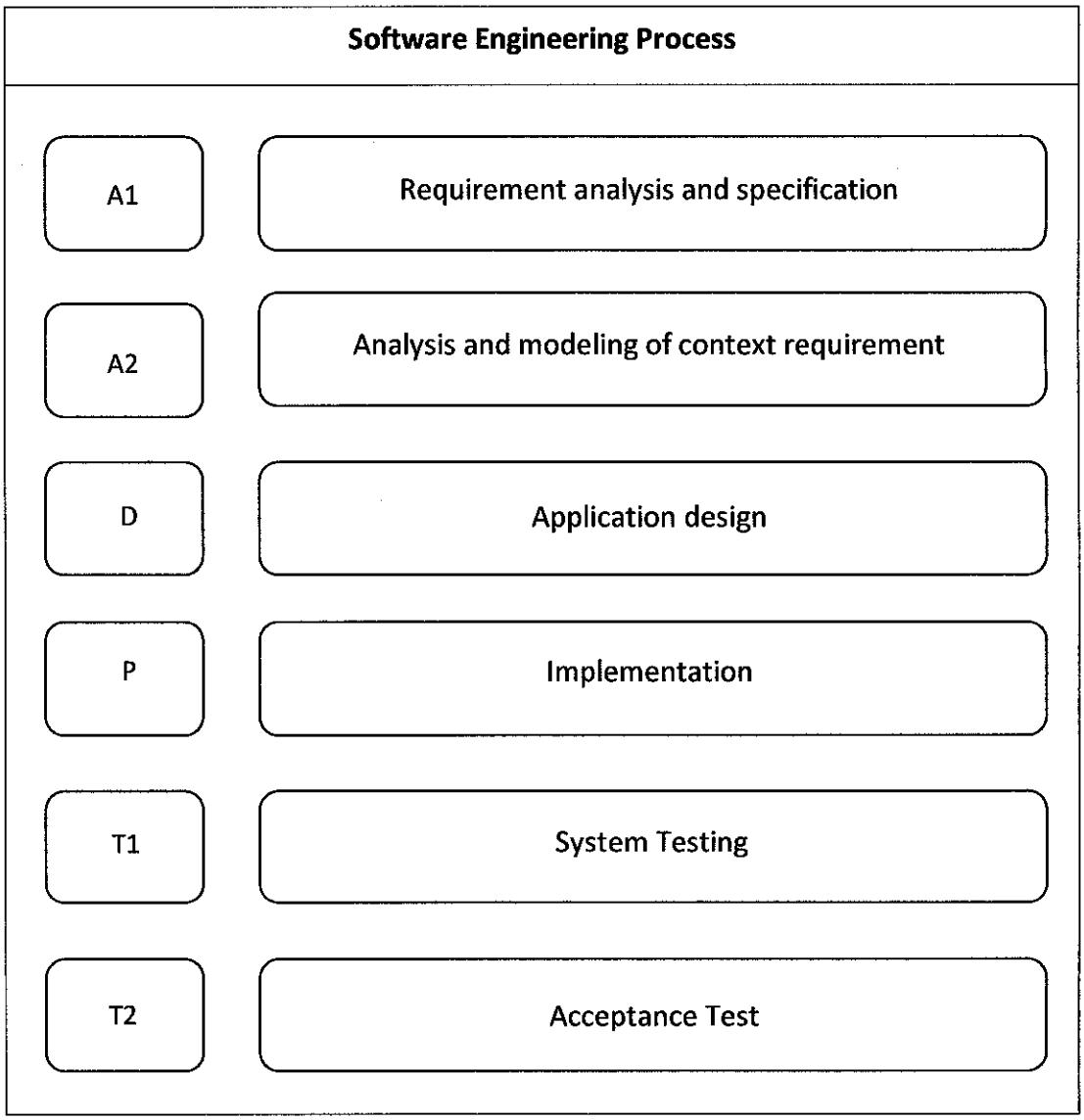


Figure 4: System Software Engineering Process

The software engineering process of the system was adopted from Context Modeling Language (CML) Model. The process is suitable to be implemented for a context aware system. The steps can be partitioned into the following tasks: Analysis (A), Design (D), Implementation (P) and Testing (T).

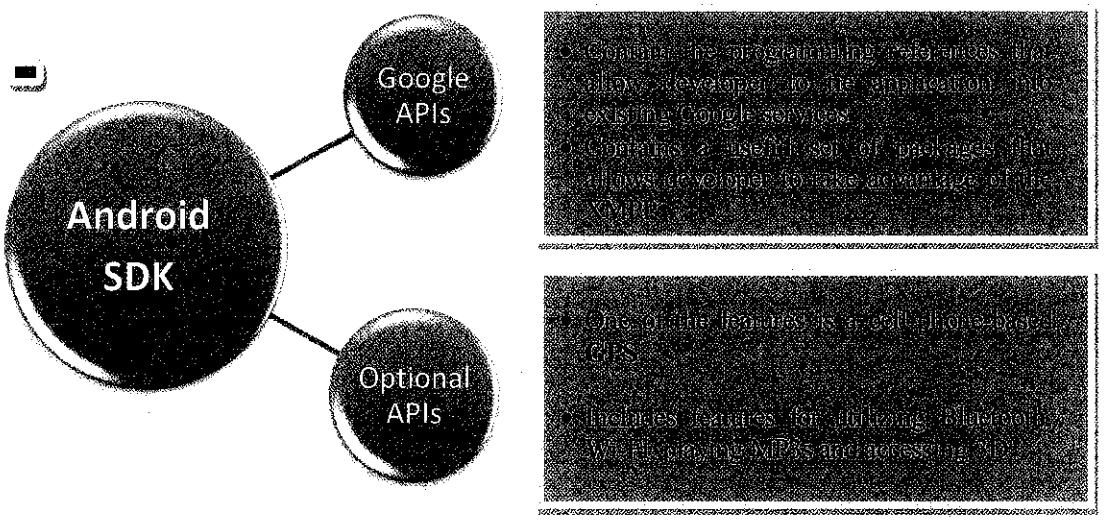
3.1.1 Analysis

From the study and analysis on the related works, system requirement and specification of the system will be defined under partitioned A1. Besides that, A2 will focus on the type of context information that is required in order to implement the concept and functionality identified in A1. There are some issues need to be considered at this stage, include:

- The quality of information in term of timeliness
- Sources for the information that suitable in term of cost and other constraints

Study and Analysis on Android APIs

The API (Application Programming Interface) is the core of Android SDK. An API is a collection of functions, methods, properties, classes, and libraries that is used by application developers to create programs that work on specific platforms. The Android API contains all the specific information that needed to create applications that can work on and interact with an Android-based application. The Android SDK also contains two supplementary sets of APIs which are Google APIs and Optional APIs.



Android Application Life Cycle

Jerome (2008) stated that an application life cycle consists of the steps that the application's processes must follow from execution to termination. Every application, regardless of the language it was written in, has a specific life cycle and Android application are no exception. All android application are run within their own process. Some of the specific methods called during the life cycle of the android activity are:

- onCreate – Called when the activity is first created
- onStart – Called when activity is becoming visible to the user
- Process-specific events (for example: launching activities or accessing a database)
- onRestart – Called after activity has been stopped prior to being started again.
- onPause – Called when system is about to resume previous activity or if the user has navigated away to another portion of the system
- onStop – Called when the activity is no longer visible to the user because another activity has resumed and is now in the foreground of the activity stack.
- onDestroy – Called either because the activity is finished or the system is temporarily destroying the activity to reclaim spac

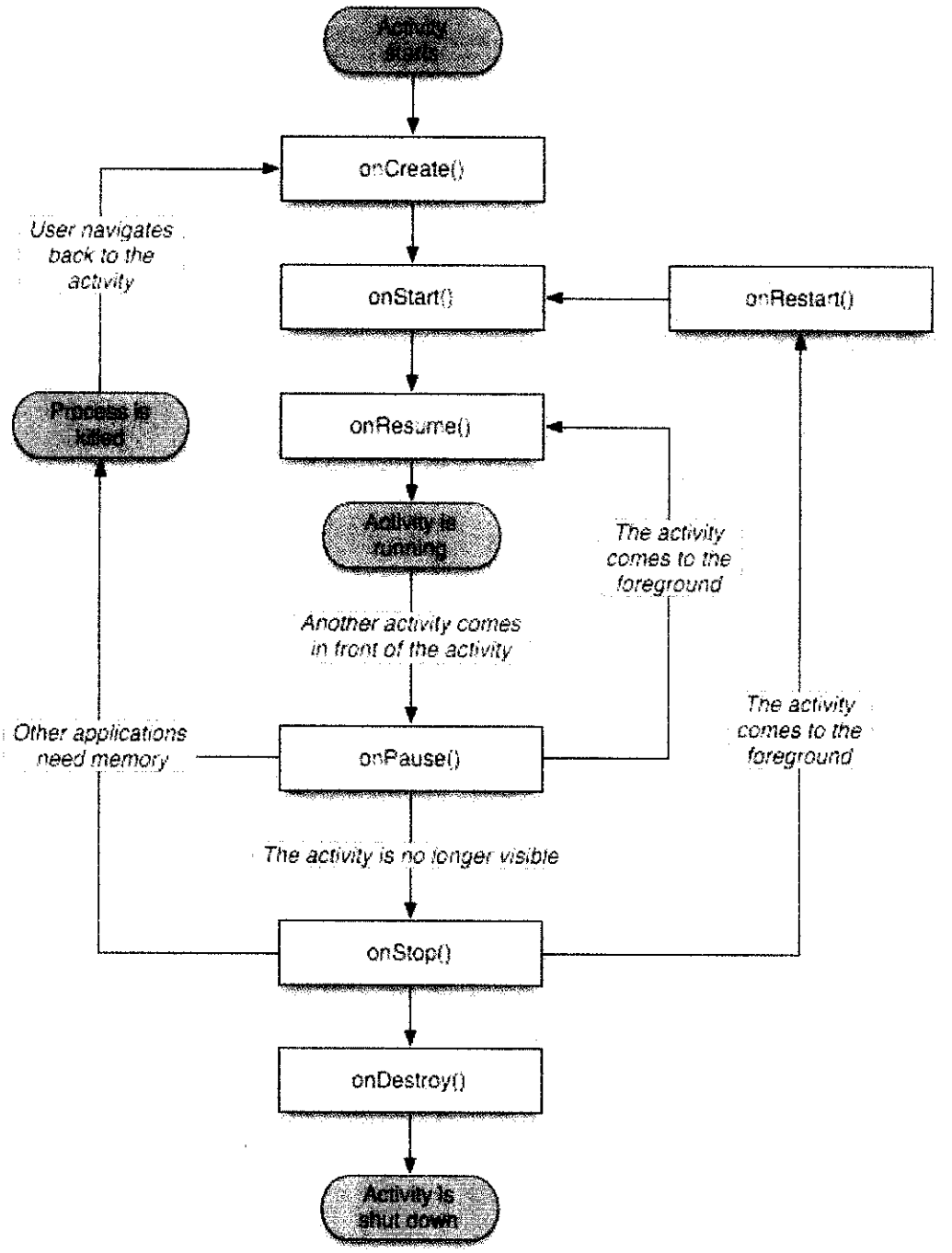


Figure 5: Android Life Cycle

3.1.2 Design

Application design (D) is made based on the requirements and specifications details in the analysis phase. The important of application design is to get the idea and overview on the interaction of the system with the user. The design made will then be implementing in the development phase after the application design is made.

System Design

Time context and location context have been chosen to be implemented in this project. Time context is use to alert or notify users with suitable Doa or Zikir in certain timestamp. While location context is use to alert users on the prayer times when users arrive at current or specific latitude and longitude detected by the GPS. Abowd's dimensions and design approach is use in modeling the context. The model is as follows:

```
Context::==Time_context+Location_context
        Time_context::=Timestamp;
                Timestamp::=AM/PM+Hour+Minute;
        Location_context::=location;
                location::=latitude+longitude;
```

Context-aware Category

Context-Triggered Actions category has been chosen to be implemented in the system to perform the required action autonomously based on presented and detected context. The inferring mechanism is using IF-THEN rules and represented as follows:

```
IF<context1>
        AND<context2>
.....
AND<context(n)>
        THEN<display_notication(i)>
```

For example, consider a scenario which current context is as follows:

```
Time= '6 am'
Location= '4.386389, 100.979722'
Then the rules will be presented as follows:
IF hour = 6
AND ampm = 'am'
THEN display_notifation = "Morning Doa or Zikir"
AND
IF location = '4.386389, 100.979722'
THEN display_notifation= "Qiblah Direction"
```

3.1.3 Implementation

In this phase, system is developed by using the Android System Development Kit (SDK) that is available on multiple platforms. It uses Java as the main programming language and there are several machine learning frameworks available for Java, it provides access to more core OS functionality and it does not require any certification or developer registration to deploy the software to hardware. The system will be developed using Android 2.1 version. According to analysis by Android Developer, there are many devices that have been developed in Android 2.1 version.

Figure 6 provides a history of the relative number of active Android devices running different versions of the Android platform. It also provides a valuable perspective of how many devices your application is compatible with, based on the platform version. Notice that the platform versions are stacked on top of each other with the oldest active version at the top. This format indicates the total percent of active devices that are compatible with a given version of Android. For example, if you develop your application for the version that is at the very top of the chart, then your application is compatible with 100% of active devices (and all future versions), because all Android APIs are forward compatible. Or, if you develop your application for a version lower on the chart, then it is currently compatible with the percentage of devices indicated on the y-axis, where the line for that version meets the y-axis on the right. Each dataset in the timeline is based on the number of Android devices that accessed Android Market within a 14-day period ending on the date indicated on the x-axis.

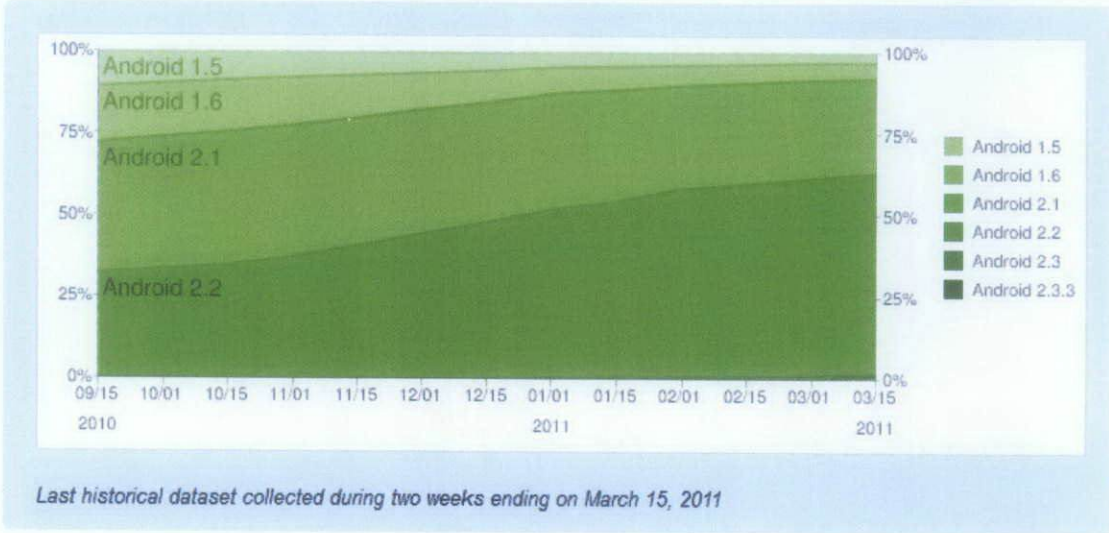


Figure 6: Number of active Android platform

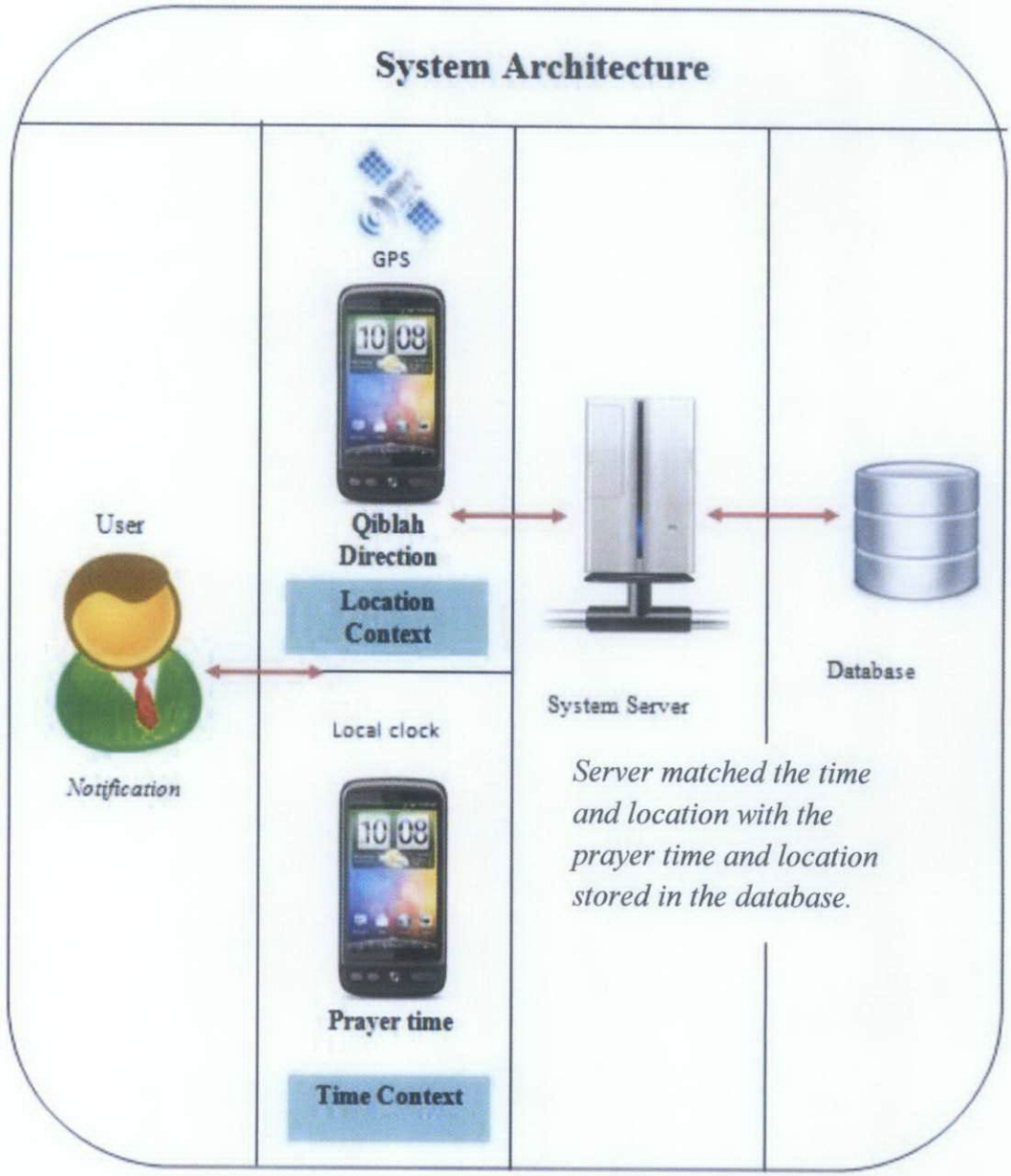


Figure 7: System Architecture

The system architecture is shown in Figure 7. The architecture contains two main components: the client and the server which communicate through network. The client starts by collecting the data that defines the user's context. The data includes the user's location, the current time and date. After collecting the necessary data the client sends the data to the server via the communication network. This network may be a GPS or a Wi-Fi network. At the server side, the context analyzer analyses the data process it and compares it to the data stored in the database. The data stored in the database consists of context element instances. If a context is matched, then a response is sent back to the client containing specific parameters and personalized information. The handler at the client side acts according to the received parameters and accordingly, either displays the received information or take an action such as alerting the user of the imminence of the events. The system is adopting the context-aware features stated before which are to sense the context including the mobile device's environment, process the suitable service to be required and the information to be displayed and display the information in a user friendly manner.

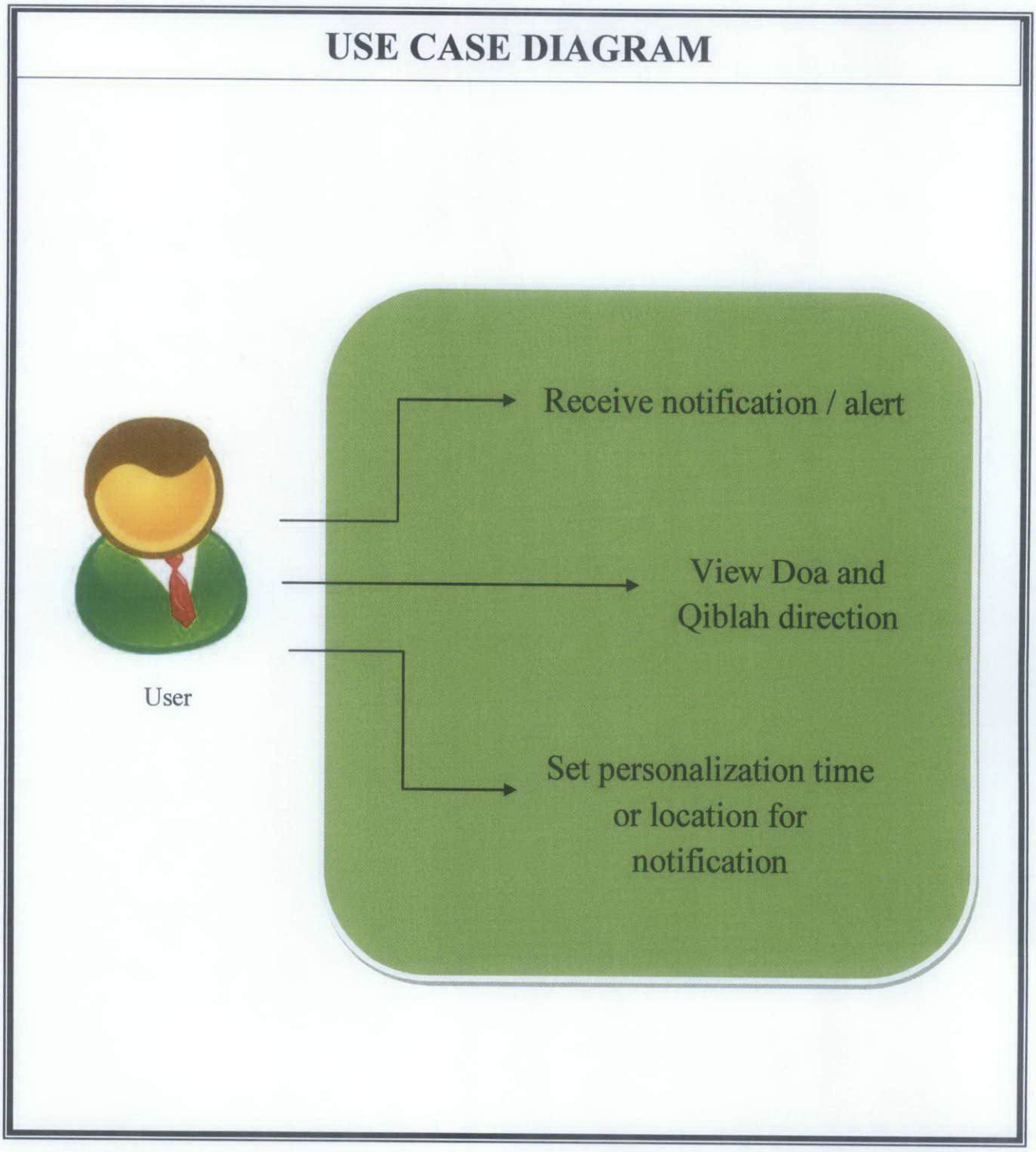


Figure 8: Use case diagra

3.1.4 Testing

White box testing method will be applied during the system testing. While for acceptance test, black box testing is used for guidance. Testing is important as it will ensure that the system is nearest to zero defects and the system also is accepted by users.

Project Milestone

The project milestone begins with the project proposal to plan and to propose the idea of the project. The next phase is proposal defense where the proposed project is presented to get comment, feedback and approval. The next phase is analyzing, researched, development and testing. Testing will be implemented after the system is successfully developed. The grant chart of the project is being attached at the attachment section.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Android SDK Installation and Configuration

In order to start the development process of the application, Android SDK must be downloaded and installed. The SDK contains all the Java code libraries needed to create the application that run specifically on the Android platform.

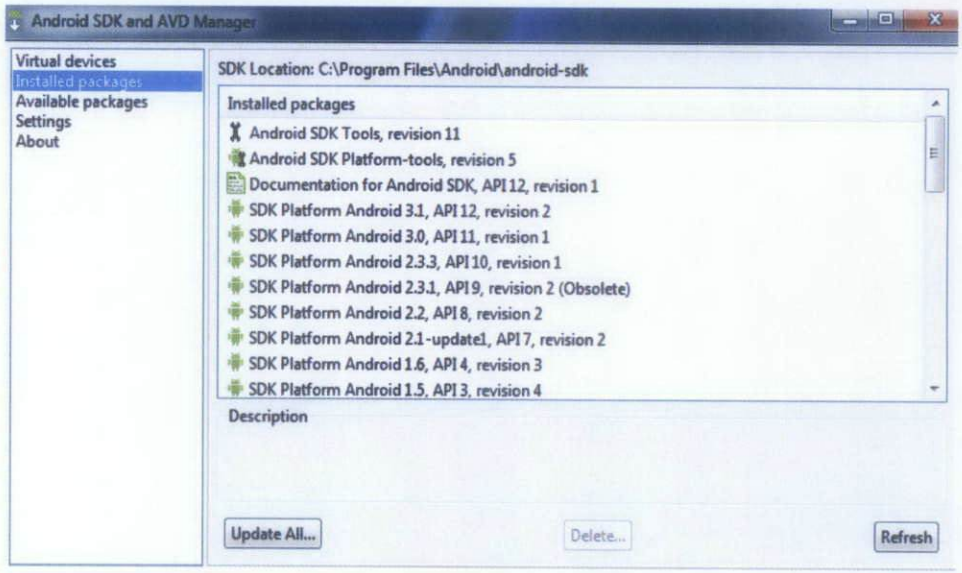


Figure 9: Android SDK Packages

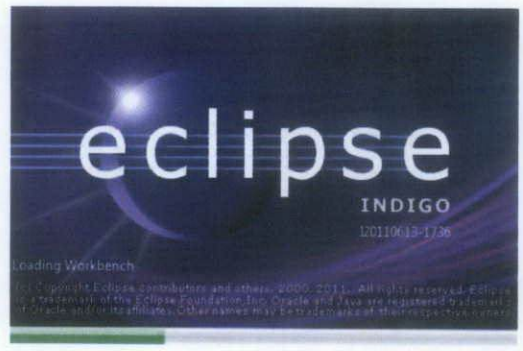


Figure 10: Eclipse Loading

Then, the next step is to install the Eclipse software that is used as the medium of the Java program compilation. The Android plugin for Eclipse has to be downloaded and installed within the Eclipse development environment before it is fully configured and ready to be use for development process.

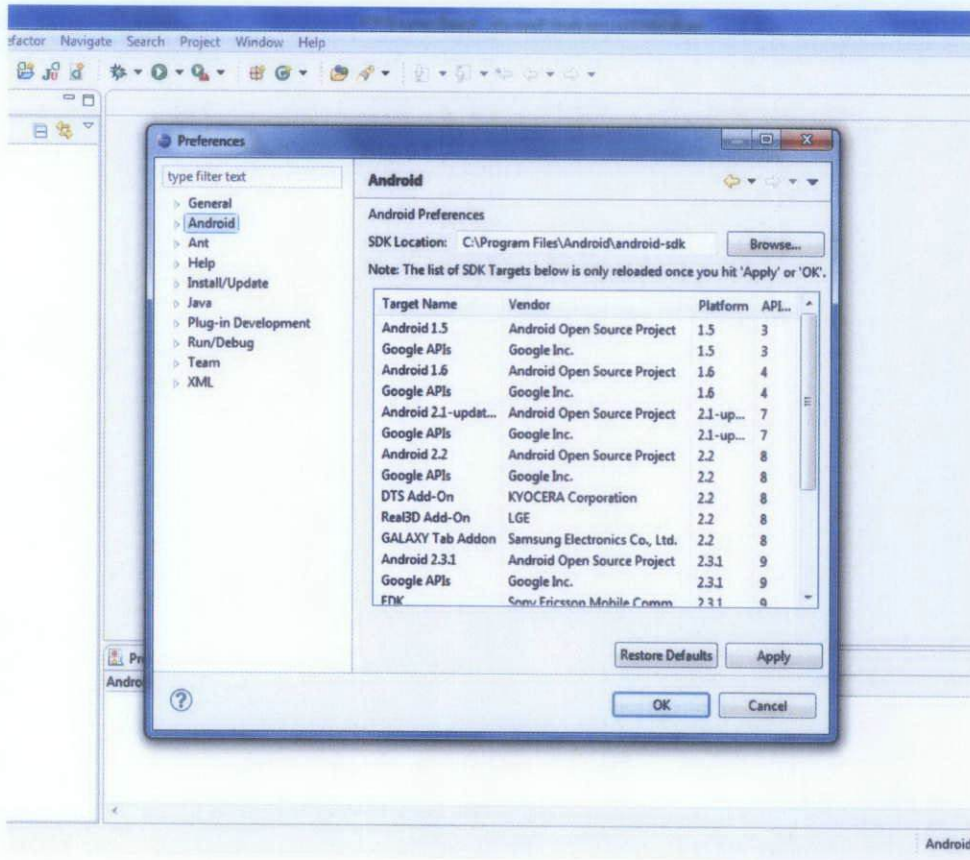


Figure 11: Android Plugin configuration

4.2 System Interface

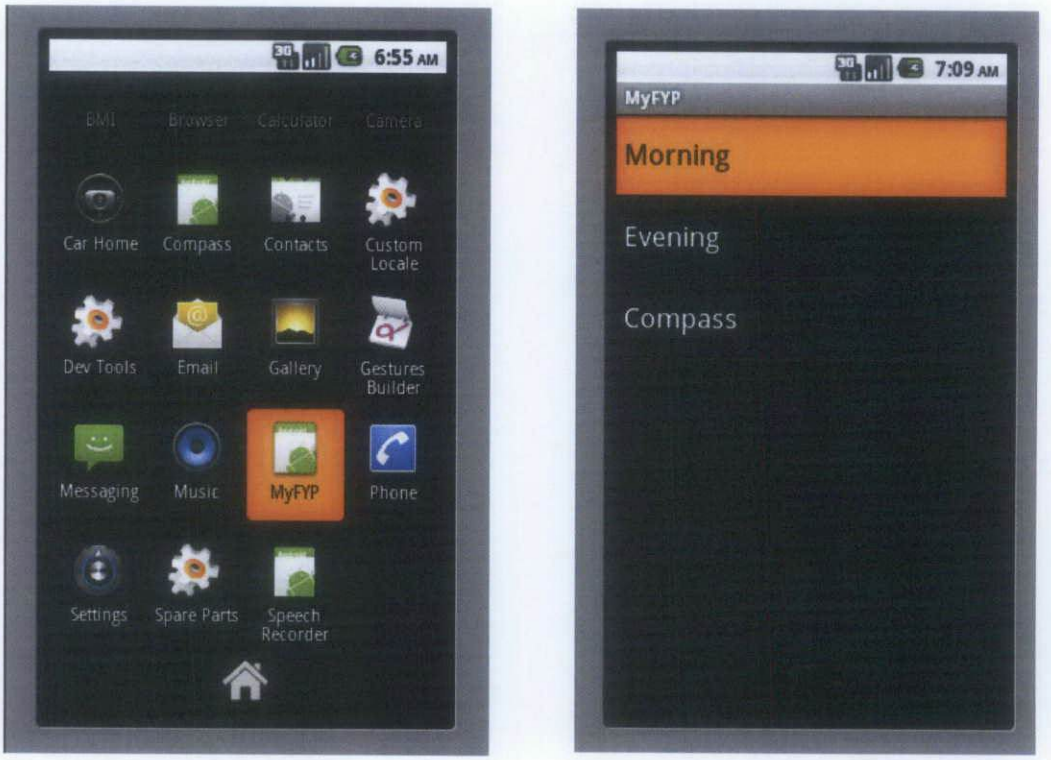


Figure 12: System interface

The system will appear in the application list after installation. User need to click on the icon to open the application. The application will then display the listed option which are Morning for morning doa, Evening for evening doa and Compass for the direction of Qiblah.

Figure 13: System functionality

When the user click on the listed activity, the Morning doa will be appear on the screen. User can slide the screen to view the next doa. User can go back to the previous page by click on the menu button and choose Exit or by clicking on the back button on the Android device.

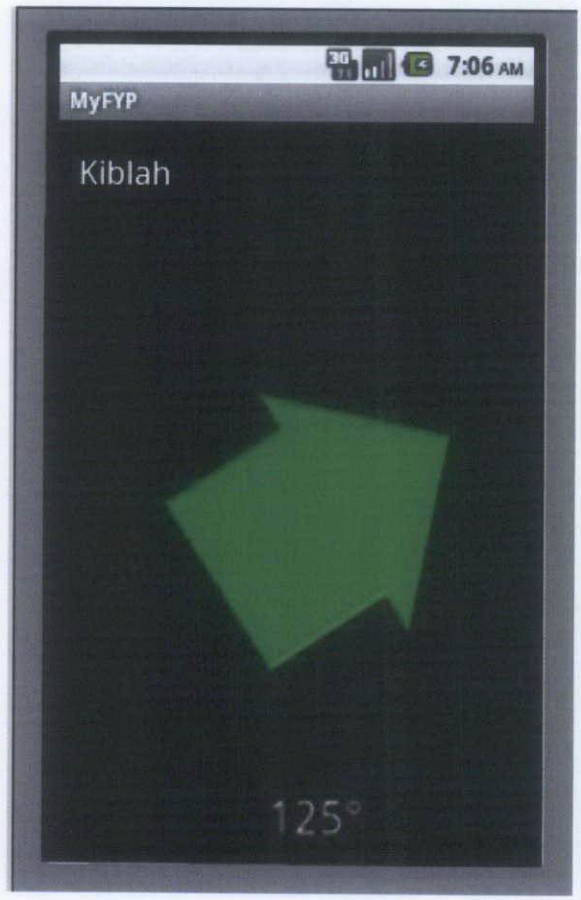


Figure 14: Qiblah Direction

User need to click on the Kiblah from the list to view the Qiblah direction. The Qiblah direction is actually using the magnetic compass from the sensor manager of the Android device. Those are the basic function of the system without implementing the context aware concept yet. To implement the context aware concept, the system will be using GPS to know the current location of user before calculating the Qiblah direction according to the current location.

4.3 System Functionality

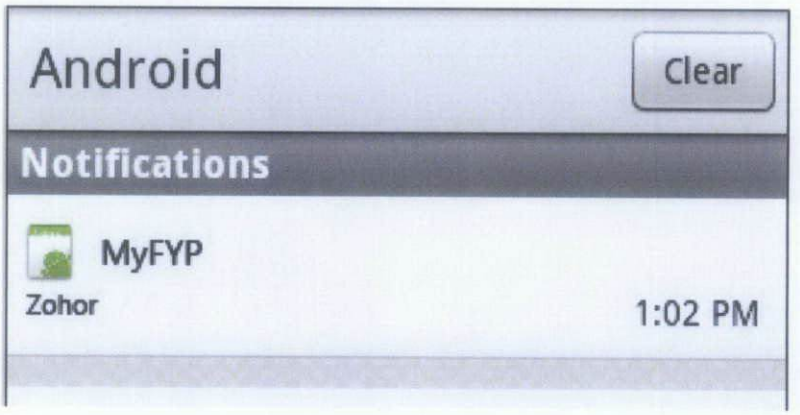


Figure 15: Notification

The main function of the application is the notification system. By using drawable notification in the Android device, user will be notified whenever the local clock is parallel with the time set. User can choose whether they want to view the notification and proceed with the application system or they want to exit the system by click on the clear button. The Android device will be vibrate or notified default tones alert whenever the notification is pop-up. The application will notify the user without producing any annoying or disturbing sounds.

The application will started when the user click on the notification. Directly, the doa or the Qiblah direction directly will appear on the screen. Compare to the basic function of the system that previously explain, the system will need user intention to click and to choose. However by using context aware concept, the system automatically notify the user by using the time and location context aware. The system can minimize user effort and helps the users to do more by doing less.

In order to get the user location, LocationListener and LocationManager have to be added. The system will notify the current location base on the latitude and longitude values.

```
float azimuth = event.values[0];// get azimuth from the orientation sensor
Location currentLoc = new Location("");// get location from GPS or network


//azimuth = azimuth * 360 / (2 * (float) Math.PI);
GeomagneticField geoField = new GeomagneticField(
            Double.valueOf(currentLoc.getLatitude()).floatValue(),
            Double.valueOf(currentLoc.getLongitude()).floatValue(),
            Double.valueOf(currentLoc.getAltitude()).floatValue(),
            System.currentTimeMillis());
azimuth += geoField.getDeclination(); // converts magnetic north into true north
float bearing = currentLoc.bearingTo(qilbah); // (it's already in degrees)
float direction = azimuth - bearing;
```

4.4 Testing

4.4.1 System testing

The objective of performing system testing is to evaluate either the system is perform based on the specific requirements. System testing is using the white box testing that includes analyzing data flow, information flow and coding practices within the system. Codes being tested whether code implementation follows intended design.

TESTING RESULT: FUNCTIONALITY TEST

No	Functionality	Action Perform	Test Result	Pass/Fail
1.	Notification Pop-up	Set the prayer time	Notification successfully pop-up	Pass
		Set the time for doa	Notification successfully pop-up	Pass
2.	View notification	Click on the notification	The notification directly goes to the systems.	Pass
3.	Compass	Set current location	Compass successfully shows Qiblah direction according to the current location set.	Pass
		Get location via GPS	Compass gets current location using GPS and shows Qiblah direction from the current location detected.	Pass

4.	Exit	Click on exit buttion	System will directly stop and close	Pass

Based on system functionality test, proven that the system is successful developed without any major error. The system is functioning as expected. Even though none error is being detected, but the system may contain minor error.

USER ACCEPTANCE TEST

The system will be tested by the end users. Furthermore, user needs to answer a set of questionnaire questions for analyzing system usefulness and ease of use. For system usefulness, a set of questions is to know how useful that system can be to the user. Thirty samples have been evaluated.

1. Using notification, the system can remind me the prayer times.
2. Using notification, the system can show me the direction of Qiblah automatically during the prayer times.
3. The systems provide and remind me suitable doa to be practice every Morning and Evening.
4. The systems interact with the user effectively.
5. The Qiblah direction is accurate.
6. The interface of the system is attractive.
7. Notification system behaves in unexpected ways
8. Overall, the system is useful to all Muslim scholars.

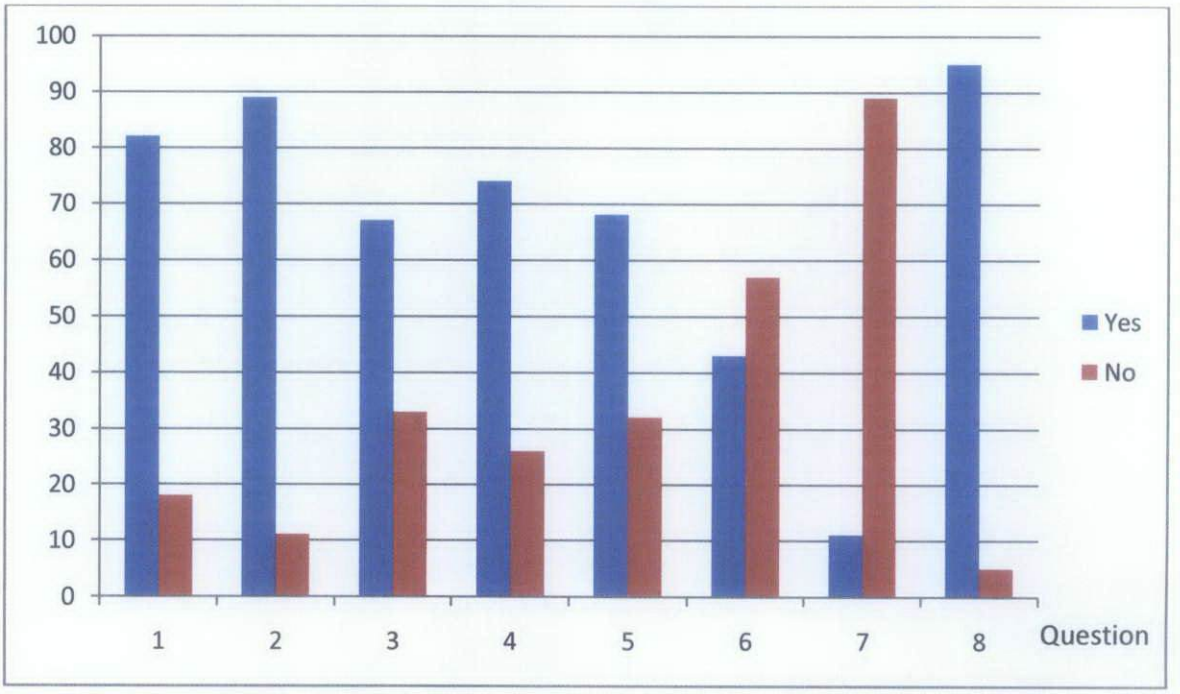


Figure 16: Result of the user acceptance test

Based on the user acceptance test results, most of the user agreed that the system is useful to Muslim scholars. Most of the questions have achieved an average around 60% to 70%, which means the users can perceive the system usefulness when using the system. However, based on the question 6, they are not agreed that the system interface is attractive. To meet the requirement, enhancement can be done to make it more attractive and interesting to catch the eyes of the users.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

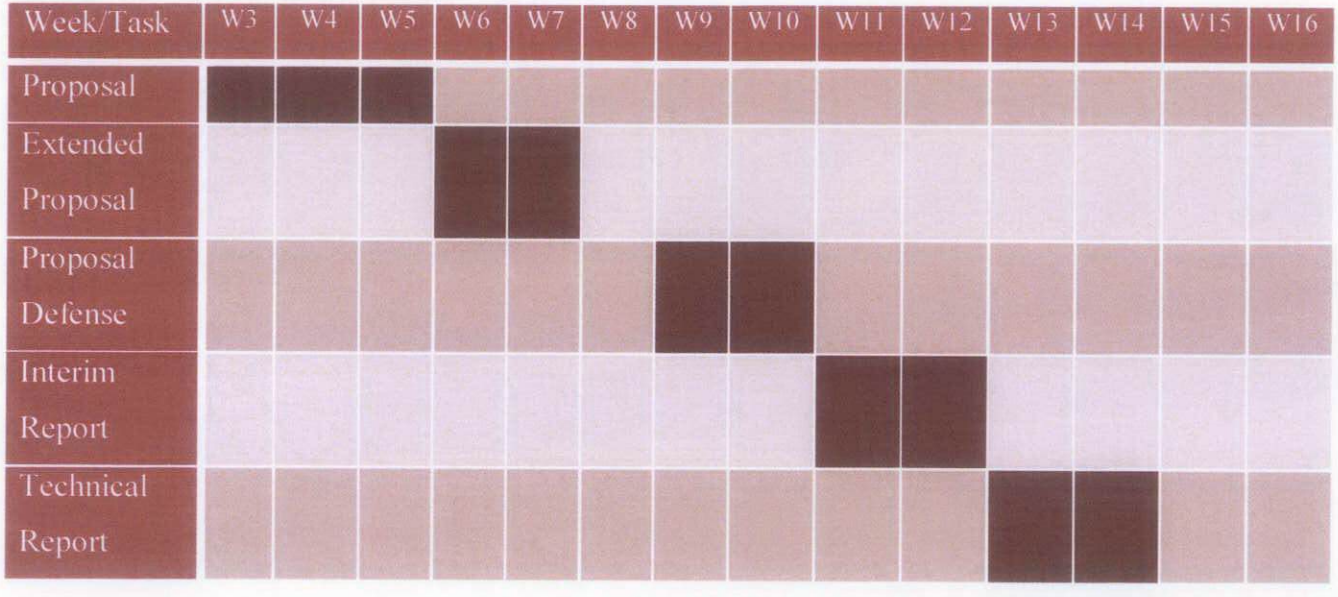
Based on the experience developing the applications, the system study on the user interaction to context aware system and implementation of context aware features: to sense the context including the mobile device's environment, to process the suitable service to be required and the information to be displayed and display the information in a user friendly manner. Android is a very promising platform for context aware systems as it devices support variety of physical sensors. Besides that, Android also provides component and interfaces for raw context data and context processing. Android platform uses XML language for the user interface that is easy to be implemented. The main contribution of this project is the proposal of the context-aware system for Muslim scholar to practice Doa and also to remind user to pray in their daily activity even though in hectic lifestyle. However, further enhancement can be done especially in adding on more features and functionality of context aware. As the system is applying context aware concept, the system features can be added with other context aware method. Updates also can be provided to the user to update new features and enhancement on the application. From the user acceptance test result, the system should also provide more interactive and attractive design and layout to make it more interesting.

REFERENCES

- Abowd, G.D., Atkeson, C.G., Hong, (1997). Cyberguide: A Mobile Context-Aware Tour Guide. 421-433.
- Alf I.W., Qadeer K.A., "CAMF-Context Aware Machine Learning Framework for Android", Norwegian University of Science and Technology. 2010.
- Android Developer, Platform Version, 2011 http://developer.android.com/resources/dashboard/platform-versions.html
- Android Developer, What is An Android, http://developer.android.com/guide/basics/what-is-android.html
- Anind K. Dey & Jonna Hakkila, "Mobile Computing-Concepts, Methodologies, Tools, and Applications",Volume VI, *Context-Awareness and Mobile Devices*-Chapter 8.2
- Asoke K Talukder & Roopa R Yavagal, "Mobile Computing – Technology, Applications and Service Creation", Tata McGraw-Hill Publishing Company Limited, 2005.
- B. Rhodes, *The Wearable Remembrance Agent: A system for augmented memory*, inProceedings of the 1st International Symposium on Wearable Computers, October 1997, pp. 123-128.
- Bill N.S.,Norman A., Roy W. 1994, "Context-Aware Computing Applications", In Proceedings *IEEE Workshop on Mobile Computing Systems and Applications.*
  http://www.canalys.com/pr/2011/r2011013.html
- Intel Corporation, "Context: How It Will Really Change Everthing", 2010.
- Jagoe, Andrew, "Mobile Location Services: The Definition Guide", Pearson Education (Pg 2), 2002.
- James L Crowley, "Perceptual Components for Context-Aware Computing", 2002.

- Jason Small, Asim Smailagic and Daniel P. Siewiorek, "Determining User Location for Context-Aware Computing Through the Use of a Wireless LAN Infrastructure", 2000.
- Kupper, Awel, "Location-based Services: Fundamental and Operation", John Wiley & Sons, Ltd (pg2-3), 2005.
- Mark Burnett, Paul Prekop and Chris Rainsford, "Intimate Location Modeling for Context Aware Computing", 2001.
- Max Muhlhauser & Iryna Gurevych, "Ubiquitous Computing Technology for Real Time Enterprises",2007
- Mike Hazas, John Krumm, Thomas Strang, "Location and Context-Awareness, Second International Workshop, LoCA", 2006.
- Nazir Malik, Umar Mahmud and Younus Javed, "Future Challenges in Context-Aware Computing", 2007
- Palo Alto, Google's Android becomes the world's leading smart phone platform, 2011
- Pascal B., Benjamin H., Beat H., "SSP: Smart Service Provider, A Smart Environment Providing Contextual Services on Android Mobile Devices". *Pervasive and Artificial Intelligence Research Group,* University of Fribourg, Perolles 90, 1700 Fribourg, Switzerland.
- S.P. Hall and E. Anderson, "Operating systems for mobile computing", vol. 25, pp. 64-71, 2009.
- Seyed Hadi Mirisaee and Abdullah Mohd Zin, "A Context-Aware Mobile Organizer for University Students", *Journal of Computer Science* 5(12): 878-904, 2009.
- Tarkoma, Sasu, "Mobile middleware architecture, patterns, and practice", John Wiley & Sons Ltd, 2009
- Stefoni Ceri, Florian Daniel, Maristella Matera, Federico M. Facca, ' Model-driven Development of Context Aware Web Application' *ACM Transaction on Internet Technology (TOIT)*, Vol., 7, No. 2, 2007, pp. 1-32.

FYP 1


Week/Task
W3
W4
W5
W6
W7
W8
W9
W10
W11
W12
W13
W14
W15
W16
Proposal
Extended Proposal
Proposal Defense
Interim Report
Technical Report

FYP 2

PROJECT MILESTONES (FYP2)	DATE	WEEK
Submission of Progress Report	04th July 2011	7
Poster Exibition (Pre-EDX)	03rd August 2011	11
Submission of Dissertation	12th August 2011	12
VIVA – Oral Presentation	19th August 2011	13
Technical Report Submission- Final Dissertation	26th August 2011	14

The FYP project title is Muslim Context Aware Android Application. These questionnaire objectives are for analyzing the project usefulness and ease of use. Please tick the rank for each question.

Thank you for your cooperation.

System Usefulness

Questions	Yes	No
9. Using notification, the system can remind me the prayer times.		
10. Using notification, the system can show me the direction of Qiblah automatically during the prayer times.		
11. The systems provide and remind me suitable doa to be practice every Morning and Evening.		
12. The systems interact with the user effectively.		
13. The Qiblah direction is accurate.		
14. The interface of the system is attractive.		
15. Notification system behaves in unexpected ways		
16. Overall, the system is useful to all Muslim scholars.		