

**MOBILE DUA AND ZIKR FOR HAJJ
(MDZ4H)**

AHMED SHEIKH ABDULLAH AL-AIDAROOS

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By
Ahmed Sheikh Abdullah Al-Aidaroos

**DEAN OF AWANG HAD SALLEH GRADUATE SCHOOL
UNIVERSITI UTARA MALAYSIA**

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ABSTRACT

In the last decade, the number of mobile phone users has increased dramatically. Nowadays, mobile phone has become part of people's life. Today's mobile phones provide not just voice call and messaging services, but plethora of other services. This research is about the utilization of mobile phone for dua and zikr for Hajj. The main aim of this research is to develop a mobile Dua and Zikr in order to help Hajj pilgrims to recite them while performing all the required rituals. At the moment, this research focuses on developing the application on Android platform. In developing the application, all the required Dua and Zikr have to be gathered, compiled and verified before the prototype could be developed using J2ME. The prototype consists of the text and audio files of the recited Dua and Zikr in Arabic as well as the translation in Malay. Finally the prototype has been evaluated by users and experts using two sets of questionnaires. It is hoped that the developed prototype would be able to help the pilgrims to easily and conveniently recite the Dua and Zikr towards achieving Hajj Mabrur.

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Table of Contents

PERMISSION TO USE	I
ABSTRACT	II
ACKNOWLEDGEMENT	III
LIST OF TABLES	VII
LIST OF FIGURES	VIII
CHAPTER ONE: INTRODUCTION	1
1.0 Introduction	1
1.1 Problem Statements	3
1.2 Research Questions.....	4
1.3 Research Objectives.....	5
1.4 Research Scope.....	5
1.5 Significance of Research.....	6
1.6 The Structure of Report.....	7
CHAPTER TWO: LITERATURE REVIEW	9
2.0 Introduction	9
2.1 Hajj and Hajj's Supplication	10
2.1.1 Related Work of Hajj Education (Interactive Software for Teaching of Hajj) ..	11
2.2 Electronic Book (e-book).....	13
2.2.1 Audio Book	14
2.3 Mobile Devices.....	15
2.3.1 Mobile Phone	16
2.3.2 Smartphone	17
2.4 Mobile technologies.....	19
2.5 Mobile Applications	20
2.5.1 Types of Mobile Applications.....	21
2.6 Open Source Operating System.....	23
2.7 Android Platform.....	24
2.8 Eclipse IDE	26
2.9 Mobile UI	27
2.10 Mark-up Language.....	29
2.10.1 The problem with HTML.....	29
2.11 XML.....	30

2.11.1	Tools for Writing XML	31
2.12	Mobile Sound	32
2.13	Java 2 Platform Micro Edition (J2ME).....	32
2.13.1	Architecture of J2ME.....	33
2.13.2	J2ME configurations.....	34
2.14	Summary	37
CHAPTER THREE: RESEARCH METHODOLOGY.....		38
3.1	General Research Design Methodology (GRDM)	38
3.1.1	Awareness of The Problems.....	39
3.1.2	Suggestions	40
3.1.3	Development	42
3.1.4	Evaluation	43
3.1.5	Conclusion.....	45
3.2	Summary	45
CHAPTER FOUR: SYSTEM ANALYSIS AND DESIGN		47
4.0	Introduction	47
4.1	System Requirements.....	47
4.1.1	The MDZ4H Functional requirements	48
4.1.2	The MDZ4H Non- Functional requirements.....	48
4.2	System Design	49
4.2.1	The Use Case Diagram of MDZ4H:.....	49
4.2.2	The Sequence Diagram of MDZ4H.....	51
4.2.2.1	Starting of MDZ4H sequence diagram	51
4.2.3	The Flow Control (Flowchart) of MDZ4H	59
4.3	System Development	61
4.3.1	Developing Initial Prototype	61
4.3.2	Using Prototype	62
4.3.3	Revising and Enhancing Prototype.....	63
4.4	System Screenshots and Description:	63
4.4.1	Logo Screen:	63
4.4.2	Main Menu	64
4.4.3	Information Screen Without Sound File	64
4.4.4	One Page Screen With One Sound File Only	65

4.4.5	One Page Screen With Multi Sound Files	66
4.5	Summary	67
CHAPTER FIVE: SYSTEM TESTING AND EVALUATION		68
5.0	Introduction	68
5.1	The Evaluation Techniques	68
5.1.1	The Contents Validation	68
5.1.2	The User Interface Satisfaction (Expert Evaluation)	69
5.1.3	The Usefulness and Usability of the System (User Evaluation)	69
5.2	Evaluation questionnaire	70
5.3	Analysis of Data	70
5.4	Expert Evaluation (User Interface Satisfaction)	70
5.5	User Evaluation	72
5.5.1	Sample Distribution	72
5.5.2	System Usability	74
5.5.3	Comparing groups of users	76
5.6	Summary	77
CHAPTER SIX: DISCUSSION, CONCLUSION AND FUTURE WORKS.....		78
6.0	Introduction	78
6.1	Discussion	78
6.2	The Application's Limitations	81
6.3	Future Works	81
6.4	Conclusion	82
REFERENCES:		83
APPENDIX A.....		90
APPENDIX B.....		92

LIST OF TABLES

Table 3.1: Five-Point Likert scale format.....	44
Table 5.1: Descriptive Statistics for All Items in User Interface Satisfaction questionnaire	71
Table 5.2: The Demographic Data summary of the sample	73
Table 5. 3: General Outcome of Data	75
Table 5.4: Descriptive Statistics for All Items.....	75
Table 5.5: Novice users VS. Expert users	77

LIST OF FIGURES

Figure 2.1: The Flowchart of Hajj Simulation Program	12
Figure 2.2: Screenshots of Web-Based Hajj Simulation Software.....	13
Figure 2.3: Examples of E-books.....	14
Figure 2.4: Examples of Mobile Devices.	16
Figure 2.5: Some Examples of 1G and 2G Mobile Phones.	17
Figure 2.6: Examples of Smart Phones.	18
Figure 2.7: Smartphone platform market share in US	19
Figure 2.8: US Smartphone Market Share un Jan 2012	25
Figure 2.9: Android system architecture. The Android software stack contains Java applications on top of a Linux kernel.	26
Figure 2.10 : Structure of J2ME system.....	34
Figure 2.11: Common J2ME profiles and configurations.	35
Figure 2.12: The Connected Limited Device Configuration (CLDC)	36
Figure 2.13: The Connected Device Configuration (CDC).	37
Figure 3.1: The General Methodology for design research	39
Figure 3.2: The Flowchart of Hajj Simulation Program.	41
Figure 3.3: Prototyping Approach.	43
Figure 4.1: Use Case Diagram of Mobile Dua and Zikr for Hajj (MDZ4H)	50
Figure 4.2: Sequence Diagram of the Starting of Mobile Dua and Zikr fro Hajj	52
Figure 4.3: Sequence Diagram of the Information Screen (Screen without sound file) in MDZ4H	53

Figure 4.4: Sequence Diagram of the One Page Dua Screen with One Sound file in MDZ4H	54
Figure 4.5: Sequence Diagram of Exception E0 (While Sound file is playing) in MDZ4H	55
Figure 4.6: Sequence Diagram of the One Page with Multi Sound files Dua Screen in MDZ4H	56
Figure 4.7: Sequence Diagram of Exception E1 (Another Sound file is Playing now) in MDZ4H	57
Figure 4.8: Sequence Diagram of the Multi Pages with Multi Sound files Dua Screen in MDZ4H	58
Figure 4.9: Sequence Diagram of Exception E2 (Reach the first page) in MDZ4H	59
Figure 4.10: Sequence Diagram of Exception E3 (Reach the last page) in MDZ4H ...	59
Figure 4.11: The Flowchart of MDZ4H	60
Figure 4.12: The Logo Screen of MDZ4H	63
Figure 4.13: The Main Menu of MDZ4H.....	64
Figure 4.14: Information Screen in MDZ4H	65
Figure 4.15: One Page Dua with One Sound File in MDZ4H	66
Figure 4.16: One Page Dua with Multi Sound Files in MDZ4H.....	67

CHAPTER ONE

INTRODUCTION

1.0 Introduction

Hajj (pilgrimage) is the fifth pillar of Islam that must be carried out at least once in a lifetime by every able bodied Muslim. It is the largest annual convention of faith in the world that requires travelling to Makkah. Hajj is performed based on predetermined dates, times, and places. It is a demonstration of the solidarity of the Muslims and their submission to Allah. Hajj is an important event in every Muslims' life, which offers religious, educational, scientific, social, economical, political and other benefits that are rewarded by Allah to Muslims (Khan, 2007). Two to three millions out of 1.5 billion Muslims around the world performed Hajj annually.

The term Hajj literally means to resolve for visiting a sacred place. However, technically it means to visit a sacred place for performing certain acts of worship (Ibadah). In Islam the term Hajj implies to visit the Kaabah for the sake of performing a particular kind of Ibadah that Allah (SWT) has made an obligation for those Muslims who fulfill certain conditions stipulated by him (Obaid, 2008). The cubical edifice that is known as Kaabah is situated in Makkah at the site of a house that Ibrahim (May Allah grant him peace) had built by the command of Allah (SWT)

to worship Him. Allah (SWT) revealed in the Qur'an in the following verse about his sacred House:

"The first house ever set up for mankind was indeed at Bakkah a blessed place, and guidance aala all the worlds, wherein an- clear signs, the place where Ibrahim stood, and whosoever enters it, finds peace..." .(Al-i-'Imran 3:96, 97) (Abdul-Raof, 2001).

Ibn Kathir (2003) wrote in his Tafsir that it is the first house that was built in the blessed place of Makkah for performing the Manasik of Ibadah to Allah (SWT), for doing Tawaf around it, for establishing Solat and for staying in I'tikaf in it. Allah (SWT) revealed in the Qur 'an:

"And Hajj to the Home (the Kaabah) is a Duty that mankind owes to Allah, for those who can afford the Sabil (means), and whoever disbelieves (denies Hajj). Then Allah is not in need of the worlds (of mankind and jinn and all that exists)". (Al-i-'Imran 3: 97) (Abdul-Raof, 2001).

Hajj involves several rituals which among others include Ihram, Tawaf, Saie, staying in Mina, staying in Muzdalifah, Wuquf, and stonning of the Jamarat and etc. All these rituals are accompanied with duas that have to be recited by the pilgrims. Since there are so many duas, it is impossible for the pilgrim to memorize all of them. Thus, several methods have been introduced to help the pilgrims to recite the duas while performing the rituals of Hajj. Among others include book, booklet, pamphlet, and etc. These are the most popular methods that have been widely used. Electronic gadgets have also been developed to cater for this, for example Hajj Player. It is a mobile device like MP3 Player containing only audio of Dua and Zikr for Hajj (Alibaba, n. d.).

Today, mobile technology maintained a wide range of our daily activities. It is rare to get a person who does not have a cell phone. In addition, the mobile devices are regarded as very flexible devices because they are easy to handle and to be used everywhere by the users. Cell phones have become useful device. Mobile phone applications which provide better knowledge and taking full advantage of improving capabilities are still limited and that includes application related to Dua and Zikr for Hajj.

1.1 Problem Statements

Every year about two to three million Muslims from all over the world come to Makkah to perform the Hajj or Umrah (Himdi & Sandhu, 1997). Islamic communities in countries such as Malaysia and Indonesia conduct a month of training on ways to perform the hajj rituals. Pilgrims need to know and memorize the important prayers (Dua and Zikr) throughout the pilgrimage that need to be recited in every rituals of the Hajj such as in Tawaf (Anad, 2009). Normally, the Dua and Zikr are available in the form of books, booklets, leaflets, and even pages. Some of them are also available on the Internet. Some of the Dua and Zikr are grouped together as a book while some are separated based on the rituals to be performed. Even though these approaches have been the most popular and widely used approaches, there are some limitations to them. Among the limitations include difficulty to find pages of the required Dua and Zikr especially while performing ritual such as Tawaf which involve large crowd. Some of the pilgrims are not able to read Arabic thus they are not able to recite the Dua and Zikr properly. When performing Tawaf and Saie, difficulty arises when identifying the exact number of rounds. On the top of that, most of the approach did not provide detail

step-by-step recitation of the Dua and Zikr for example while performing the Tawaf and Saie.

Electronic gadgets have been developed to cater for reciting Dua and Zikr for Hajj. An example includes Hajj Player where it supports audio only (Alibaba, n. d.). It is actually an MP3 player that plays the audio of the Dua and Zikr. The user is still required to refer to a booklet for the Arabic and translation texts of the Dua and Zikr. By using this player, the pilgrim has to carry the player as well as the booklet. This does not really help the pilgrim especially while in a large crowd. Anyway, Hajj player is made in Korea, thus the validity of the content is also doubtful. Thus, mobile phone has been considered as a viable alternative for developing the Dua and Zikr for Hajj application.

1.2 Research Questions

The research questions are:

- i. What are the requirements of the Mobile Dua and Zikr for Hajj (MDZ4H) application?
- ii. What are the contents of MDZ4H application?
- iii. How to ensure that the contents of MDZ4H are valid?
- iv. Is the proposed MDZ4H usable?

1.3 Research Objectives

This research aims to develop the Mobile Dua and Zikr for Hajj application. In order to realize this goal, the research objectives are as follows:

- i. To identify the requirements of MDZ4H application.
- ii. To evaluate MDZ4H among experts in terms of contents validity.
- iii. To develop a prototype MDZ4H.
- iv. To evaluate MDZ4H among users in terms of usability.

1.4 Research Scope

The study focused on designing and developing an Android based mobile application to help pilgrims to read and listen to the Dua and Zikr for Hajj. The contents of the application include the Arabic texts and the translation in Malay. The Dua and Zikr cover all the rituals beginning with the preparation before Musafir until visit (Ziarah) to Madinah. In developing the prototype, the Java 2 Platform Micro Edition (j2me) under Android platform was applied. User evaluation was conducted to determine users' perception on the usability aspect of the MDZ4H application. The instrument was adapted from Davis (1989) and Lewis (1995). The instrument covers three dimensions: Usefulness, Ease of Use and Outcome/Future Use.

The purpose of the evaluation is to obtain feedback from experts on how to improve the prototype and also from user on the usability of the prototype. The evaluation consists of two phases which include:

- i. Expert Evaluation:
 - Contents Validation.
 - User Interface Evaluation.
- ii. User Evaluation: At least 30 users were divided by age group as follows:
 - 15 users (who have been to Makkah to perform Hajj or Umrah).
 - 15 users (who have not been to Makkah to perform Hajj or Umrah).

1.5 Significance of Research

Generally, this work contributes to the design and development of mobile based application. Specifically it will be beneficial and useful for the Hajj pilgrims and all Muslims in this world. Hereby, the following significant achievements can be fulfilled.

- i. To overcome the current limitations of conventional approaches (books, booklets, leaflets and electronic gadgets) for Dua and Zikr required during the Hajj.
- ii. To enhance the utilization of the mobile phone.
- iii. To increase the number of mobile application specifically for Hajj.

- iv. To reduce the problems of memorizing, searching, reading, and understanding of Dua and Zikr required during the Hajj.
- v. To offer assistance to pilgrims who are not able to read Arabic texts.
- vi. To promote the Android based platform for mobile application.

1.6 The Structure of Report

The rest of this study is organized as follows:

Chapter Two:

A brief explanation will be given in this chapter about Hajj and its ritual supplications and how those supplications can be recited properly. In addition some of the previous studies and related works in this area will be reviewed like the concept of E-Books, Audio Books, mobile devices, and mobile phones. Then the mobile technologies and mobile applications will be discussed briefly. After that the principles of Open Source Operating System and Google Operating System (Android Platform) for Smartphone will be introduced. Finally the technologies and the development tools which were used to develop the proposed prototype will be elucidated.

Chapter Three:

In this chapter the research methodology that is used in order to answer the research questions and achieve research objectives will be introduced and discussed.

Chapter Four:

This chapter discusses the design and implementation of MDZ4H. The discussion will include the system requirements, the application's implementation architecture, the system flow chart and the user interface design.

Chapter Five:

This chapter aims to test and evaluate the developed prototype MDZ4H in terms of usability and usefulness. The most important fundamental method in usability evaluation is the usability test, because the system will be subject to a real test by real users.

Chapter Six:

This chapter discusses the problems and limitation of the proposed application, the recommended future work and the study finding and results conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter some of the previous studies and related works in this area will be reviewed. A brief explanation will be given about Hajj and its ritual supplications and how those supplications can be recited properly. After that the concept of Electronic Books (E-Book) will be discussed especially on the Audio Book. Since the proposed prototype of this study is the Mobile Doa and Zikr For Hajj (MDZ4H), a special application which is similar to e-book with enhanced audio of the Arabic text recitation. This application works on mobile phone (Smartphone) with Android operating system. Therefore the concepts of mobile devices and mobile phones especially Smartphone will be explicated. Then the mobile technologies and mobile applications will be discussed briefly. After that the principles of Open Source Operating System and Google Operating System (Android Platform) for Smartphone will be introduced. Finally the technologies and the development tools which were used to develop the proposed prototype will be elucidated.

2.1 Hajj and Hajj's Supplication

Hajj is one of the five fundamentals Ibadah of Islam, also known as “Five Pillars of Islam” (Hameed, 2010). Ibadah is defined as an act, behaviour or practice of a Muslim performed with the sole intention of pleasing Allah (SWT) and gaining His favour. Therefore, Hajj, being an Ibadah, is also performed to seek the pleasure and favour of Allah (SWT) and that is the ultimate objective of performing Hajj. In fact, the principle of obeying Allah’s commands (that is, doing willingly what He likes you to do and refraining from all what He forbids) for the sake of pleasing Him, is imperative for every Muslim, in every activity of his life, whether obligatory or mundane. In order to achieve His pleasure, Hajj should be performed in the way His most truthful and trustworthy Messenger (May Allah bless him and grant him peace) has described and demonstrated in his own Hajj. Only then do we deserve to beg Him (SWT) for the acceptance of our Hajj (Obaid, 2008).

However, we have to bear in our mind; we are performing Hajj solely to please Allah (SWT). So, in order to focus our mind totally on Allah (SWT), to whom we are addressing through our supplications, it is preferable to memorize the supplications and understand well what we are asking Him for; or else, all our focus will be diverted to the words of supplication and their pronunciation, and you will end up in utter confusion and dissatisfaction. In case it is difficult for us to memorize all the supplications and to understand their meanings, even with the help of their translation into Malay or any other language, we, can, supplicate in our own language for our satisfaction, thus, we will feel ourselves closer to Allah (SWT), having no veil of an alien language between you and Him. He knows the secrets of our heart. He needs no particular language to understand what you ask Him for

(Obaid, 2008) But it is better; we supplicate in Arabic language in order to follows Allah's Messenger our Prophet Mohammed (May Allah bless him and grant him peace) and doing what exactly he did. Therefore, a lot of studies were done and a lot of books and gadgets were developed in order to facilities all the difficulties with memorization and recitation of all the supplications of hajj.

Since this study is conducted in Malaysia, Malay language has been used. In addition, Indonesia having the largest population of Muslims in the world (Fathnan, Wibowo, Hidayat, Marenda, & Ferdiana, 2010). Since Indonesians can also understand the Malay language, the target users of the MDZ4H application will be those who are able to read and understand this language. Thus, the language has been used as the interface and the translation of the Arabic supplication. This will make the proposed application MDZ4H useful for the majority of Muslims especially those who can speak or understand one of these languages or both of them as well as Muslims who can follow the audio recitation of the Arabic supplications.

2.1.1 Related Work of Hajj Education (Interactive Software for Teaching of Hajj)

A group of researchers from the Electrical Engineering and Information Technology Department, Faculty of Engineering, Gadjah Mada University in Indonesia have developed an information technology product in the form of interactive application to enhance the Hajj performance's usefulness, by delivering a new media in the education of hajj for pilgrims. Figure 2.1 shows the flowchart of the Hajj Simulation Program. The study indicates that although benefits can be gained from this work for example the effectiveness of hajj education will be improved as well as the pilgrims will have enough knowledge about the formal performance of

Hajj. On the other hand the management system of Hajj organizing process will be increased. Also it will reduce the cost of organizing Hajj therefore the surplus cost will be used to support other training activities (Fathnan et al., 2010). The system has been published in the internet and it is accessible by all pilgrims. Figure 2.2 shows some Screenshots of Web-Based Hajj Simulation Software developed through this study.

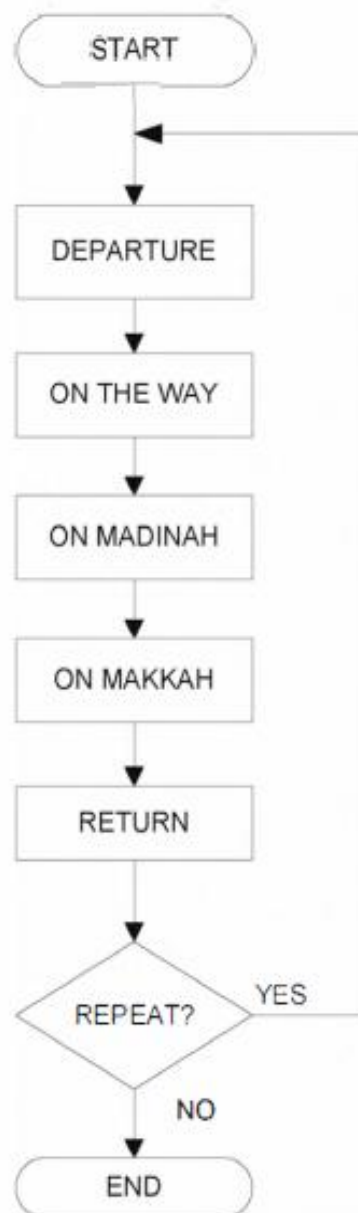


Figure 2.1: The Flowchart of Hajj Simulation Program (Source: Fathnan et al., 2010)



Figure 2.2: Screenshots of Web-Based Hajj Simulation Software (Source: Fathnan et al., 2010).

2.2 Electronic Book (e-book)

E-book is a digital form of an already published printed book, consisting of images, texts, or both. It can be read on computers, mobiles and other electronic devices (Gregory, 2004). E-books are widely used documents that are designed to be displayed on a computer screen (Desrosiers, 1996). It is defined as a “book” in the sense that it addresses a significant portion of a subject area and consists of chapters with an associated table of contents and an index (Desrosiers, 1996). The English Oxford Dictionary defines e-book as an electronic version of a printed book (Y. Chen, 2010). Large number of user manuals and books are made available in digital form in CD-ROMS or over the World Wide Web (Internet) (Ozsoyoglu, Balkir,

Cormode, & Ozsoyoglu, 2000). E-books are usually read on dedicated e-book readers. Personal computers and some mobile phones can also be used to read e-books or audio books which are an Mp3 file recording of a text book used for blinds (Taylor, 2004). Figure 2.3 shows some examples of E-books.



Figure 2.3: Examples of E-books

2.2.1 Audio Book

Audio book is a recording of reading the text of published book or magazine. It is not necessary that the audio book is match an exact printed book or magazine. This kind of books has been used in schools as well as in public libraries since 1930's. They

help the illiterate people and unskilled readers to understand the contents of the books which have been converted to audio books. The reader can simply listen to the audio recording and follow the text in the book (Byrom, 1998). Only audio books in unprotected and audible format like MP3 can be played in iPod, iPhone as well as Android Smartphone (STONE, 2008). Therefore the concept of audio book will be used to enhance the proposed application to help pilgrims who cannot read Arabic text to recite the required Duas and Zikrs in Hajj rituals.

2.3 Mobile Devices

Mobile devices are easy handled devices, such as mobile phones, laptop computers and other devices that require special operating systems. Figure 2.4 shows some examples of mobile devices. Mobile devices also include Personal Digital Assistants (PDAs) with or without networking capabilities and cell phones which may not have the ability to access the web (Elliott & Phillips, 2003). Or it is a simple term used to refer to different set of devices that allow people to get data and from anywhere they are. This includes cell phones and other devices (Bucki, 2011). It is seen as a handheld, handheld computer or machine, and is a small computing machine. Mobile devices basically come with a touch display screen and sometimes with keyboard (Viswanathan, n. d.). There are different variety of mobile devices, the popular among them, mobile phones, smartphones, PDAs, pagers and Personal Navigation Devices (Koushanfar, Prabhu, Potkonjak, & Rabaey, 2000). PDAs and smartphones are among most useful mobile devices which provide all the conveniences of a personal computer and with a very small form factor. EDAs or Enterprise Digital Assistants are best for business users. However, not all mobile

devices are suitable for this study. For example the big size mobile devices are difficult to carry by hand while performing the Hajj rituals. The device should be powerful, popular and small size like mobile phones (Schall et al., 2008). The most popular technological devices in the world are mobile phones and they are essential in our live (Saran, Cagiltay, & Seferoglu, 2008).



Figure 2.4: Examples of Mobile Devices.

2.3.1 Mobile Phone

According to Webopedia (n.d.), mobile phone is an electronic mode of communication, often known as cell phone or cellular phone. Mobile phones connect to a wireless network to communicate through radio wave or satellite transmissions. Figure 2.5 shows some examples of the first and second generation of mobile phones. Many of the mobile phones provide voice free communications, Short Message Service (SMS), Multimedia Message Service (MMS), and some mobile phones can provide Internet services such as Web browsing and e-mail. However, not all mobile phones are powerful, they also have some limitations for example the

space (Saran, et al., 2008). In this study, a lot of space is required to store the audio files of Duas as well as images. Thus, this study was applied on smartphone to avoid the space problems.



Figure 2.5: Some Examples of 1G and 2G Mobile Phones.

2.3.2 Smartphone

According to Aram, Troiano, and Pasero (2012), a new device called Smartphone was brought by the combination of cell phone features and the features of Personal Digital Assistant (PDA). A Smartphone is a mobile phone with powerful capabilities built on a mobile computing and spotlight platform (Android, iOS, Symbian, Windows Phone 7, etc.) with higher connectivity and computing ability (Nusca, 2009). It can carry desktop synchronisation tools, email client, GPS functionality, Web browser, as well as the normal functions such as contacts, diary, voice recorder and notepad (Charlesworth, 2009). The Smartphone's computing capabilities and features allow it to deal with more than data services and personal communication (X. Chen, 2011). Figure 2.6 shows some examples of Smart phones. Smartphone can be used in different enterprise applications.



Figure 2.6: Examples of Smart Phones.

Today, Smartphone's are the capable devices that can be used in many various sectors such as business, social networks, education, healthcare, environmental monitoring, transport, and safety, depending on it's operating system (Aram, et al., 2012). According to Mogg (2012), the results released by comScore (a global leader in measuring the digital world and the preferred source of digital marketing intelligence) about the US mobile market through a study ending January 2012 conducted for three months period shows that from 100 million Smart phone users in US there are 48.6% of them are using Android platform manufactured by Google which makes it in the first place in the US market and iOS manufactured by Apple, in the second place with 29.5% while the other platforms tacks 21.1% only from the US market (RIM 15.2%, Microsoft 4.4% and Symbian 1.5%). Figure 2.7 shows the Smartphone platform market share in US at the beginning of 2012. Hence in this study the researcher has developed the proposed prototype on the Google Android Smart phone platform by using Java and XML. Since the proposed prototype has been developed by using Java programming language, it can work on any platform

supporting Java Virtual Machines (JVM) (Chase & Foreword By-Liberty, 2001).

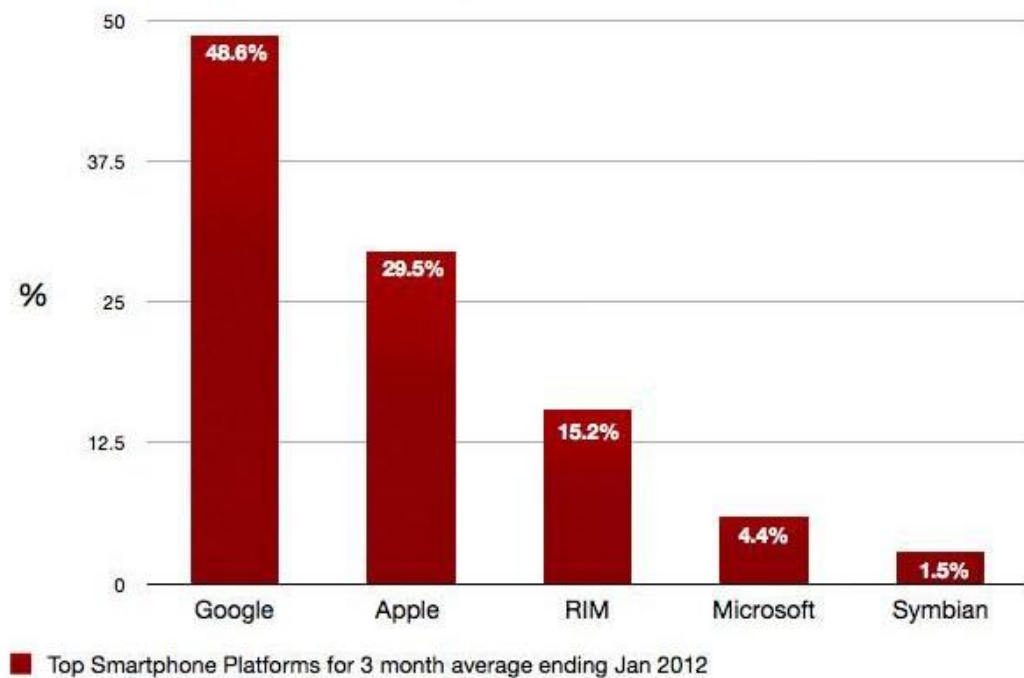


Figure 2.7: Smartphone platform market share in US (Source: Mogg, 2012).

2.4 Mobile technologies

According to Tiainen, Wigelius, and Lonnqvist (2009), mobile technology entered the main stream in 2002 when the global number of mobile networks exceeded the number of fixed lines. In January 2007, the number of mobiles doubled the number of fixed lines in the world and ended up at 2.6 billion. Eighty percent of the people in the world live under or near by a mobile signal. Almost every second person on this planet has a mobile device. In developed world, mobile technology continues to exist among other ICTs, but in developing countries, mobile may be the only technology people can access and afford.

According to Teng and Helps (2010), mobile technologies such as smart phones are enabling a new generation of users and business applications. From web, email to remote access and Customer Relationship Management (CRM), there is no end to what could be accomplished with the mobile devices. The mobile technology tools are one of the common tools that are utilized in this work. Mobile technology is the applications that are developed to assist personal mobile phone, personal digital or enterprise digital where they can be pre-installed cell phone from the firm or downloaded by the user from the applications website (Tahnoon Al Ali, Berri, & Zemerly, 2008). These applications are developed by using many programming languages like HTML, JavaScript, J2ME and etc. Each of these languages has an environment which provides the necessary tools to permit user to write his code. Java and XML will be used to develop the proposed prototype of this study.

2.5 Mobile Applications

Mobile applications are developed for small handheld devices, such as cell phones, smart phones, PDAs and so on. Mobile applications are able to move themselves between hosts on the network (Scott, Beresford, & Mycroft, 2003). It has additional characteristics than wireless and stationary applications (Cha, Kurz, & Du, 2009). Mobile apps can come preloaded on the handheld device and they can be downloaded by users from the Internet. Mobile apps can be found on both cell phones and smart phones. The most popular Smartphone platforms that support mobile apps are Windows Mobile, Android, Symbian, Java ME, iOS and Palm.

These days with massive usage of technology, the mobile devices are used in the fields of agriculture, medical (Carlsson, Hyvonen, Repo, & Walden, 2005), as well as business and education (Alahuhta, Helaakoski, & Smirnov, 2005). Mobile phones have become widely used technology and for many people a daily companion (Jung & Lee, 2003). According to Fogg (2002) , the main function is to enable communication and information access anywhere and anytime. According to Ichikawa, Chipchase, & Grignani (2005) the mobile phones are an interesting platform for the user to see many parts of the world. Mobile phones are used commonly in daily life to communicate, coordinate and to access information. These functions make many people carry a phone with them at most of the time. Depending on market situation of parallel, mobile application software is developed for each mobile platform such as the Wireless Internet Platform for Interoperability (Choi, Yang, & Jeong, 2009).

2.5.1 Types of Mobile Applications

Mobile applications can be divided into many types, among all of them, context-aware the applications' complexity developed for mobile devices is more than its equivalent copy that developed for non-mobile devices, because the migration of the software objects or components from node to another within a non-homogeneous software and heterogeneous networking environment. The environment in mobile applications can be extremely dynamic, changing from time to time as users and equipments roam through networks resulting in CPUs becoming loaded and unloaded and network hot spots or overcrowding points are being in a invariable state of flux (Ryan & Rossi, 2005).

There are different types of mobile applications. These types are divided into too many categories like MMS/SMS client music players and browsers. These categories can be one of the following types (Tahnoon Al Ali, et al., 2008):

- Multimedia: Like audio players, video players, and photos views
- Utilities: Like call manager, Task manager, Address book and profile.
- Communication: Like mobile internet, e-mail web, browsers and clients
- Productivity: Like calendar, diary, note pad, and calculators.
- Games: Like card/casino such as blackjack, poker, actions and sport.
- Travel: Like translators, GPS map, weather and city guides.

Moreover, Microsoft Corporation categorises mobile applications into two, file-based for web (example: e-mail clients, mobile internet) and web browsers or non file-based for non web application (example: multimedia, games, travel, and productivity) (Hill, 2011).

The development of mobile applications uses Integrated Development Environments (IDEs) such as Eclipse, Visual Studio, NetBeans, JBuilder, etc. The development task is very complex (Samuel & Joseph, 2008). In the present age, mobile applications were developed in line with each specific developing environment that are provided by platform vendors, and also executed only on each vendor's platform. Each of the industry needs an open standard for the integration of these application models found in the device middleware; providing the application shared components (Cha, et al., 2009). Eclipse will be used as IDE to develop the

proposed prototype of this study and Android 2.2 platform as the development environment.

2.6 Open Source Operating System

In general an Open Source Operating System term can be referred to an Operating System in which the source code in terms of availability is free of charge to be used or modified by the general public. Usually the open source developed by collaborative effort, in this case the developers share the changes by each other and improve the code together as a community (Perens, 1999). The Open Source software allows the community of technological to response to the proprietary software which is owned by the corporation. The Open Source Initiative (OSI) issues a standard certification which indicates that a certain software source code can be used by general public for free or not (Initiative, 2007). The motivation of the Open Source OS is the large number of programmers in the community who are not worried about the financial benefits and the proprietary rights and produce useful, powerful and bug-free OS which can be used by general public. The idea of releasing the source code is to have a double check and review to indicate the insufficiency and incapability then provide the solution in the lowest cost and in efficient way. The process of reading, improving and bugs eliminating advanced faster in the open source software. (Tilson, Sørensen, & Lyytinen, 2012).

The free source plus the features in the Open source OS attract many programmers around the world. The open source approach becomes the dominant fashion applied in building embedded systems. Open source OS and tools have been

used in developing embedded systems process as a framework (Tan, Zheng, Liu, Lin, & Yu, 2006).

The meaning of Open Source Software is not only the ability to access the source code. There are many criteria to be fulfilled and complied to become an open source software. For example the redistribution process should be free of charge as well as the source code should be provided and included in the software with a compiled form and without any deliberately obfuscated. One of the important criteria is the modification license and derived work. The modification process must be allowed by the licence under the same terms like the original software license. The license should be distributed and should be not specific to a single product as well as not restrict to software. There should be no personal discrimination or groups, Fields of Endeavour favouritism (Berg, 2005).

2.7 Android Platform

Android is a Linux-based platform developed by using Java programming language and manufactured by Google in 2007 (Agarwal & Bilokhatniuk, 2012). It is an Open Source mobile device (Smartphone) OS. It is an operating system plus middleware, user interface and application software (Wu, Luo, & Luo, 2010). The platform is malleable to support diverse connectivity technologies for example CDMA, Wi-Fi, UMTS, EV-DO and Bluetooth. In addition Android platform support a wide range of audios, images and videos plus a lot of others futures which make it a suitable platform for the proposed prototype of this study (Doukas, Pliakas, & Maglogiannis, 2010). Android applications are developed using Java and can be

ported rather easily to the new platform. Other features of Android include an accelerated 3D graphics engine (based on hardware support), database support powered by SQLite and an integrated web browser (DiMarzio, 2008). Moreover Android platform takes the first place in the Smartphone's market (S. W. Chen, Yang, & Liu, 2011). According to a latest statistics study (see Figure 2.8) in January 2012 of comScore shows that in US market, the Android takes 48.6% from the total Smartphone Subscribers (Mogg, 2012).

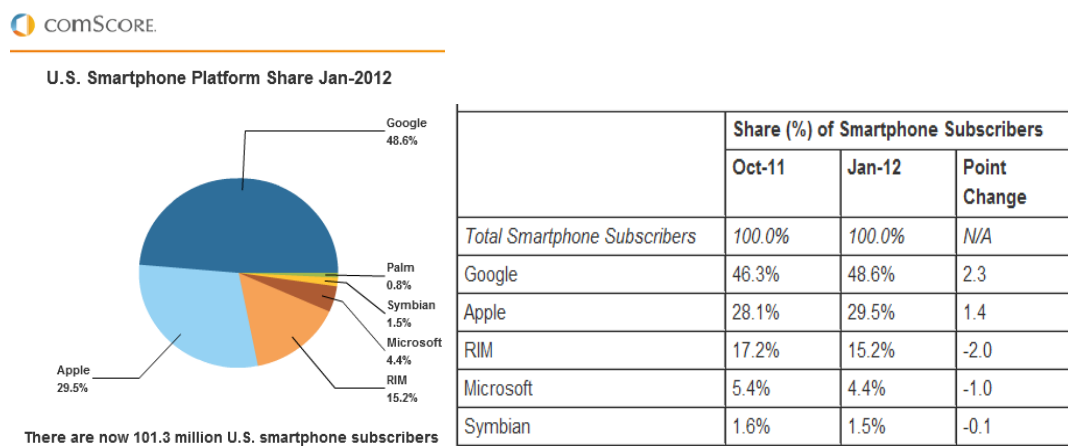


Figure 2.8: US Smartphone Market Share un Jan 2012 (Source: Mogg, 2012)

One of the most exciting and compelling features of Android is that of its architecture where third-party applications are executed with the same system priority as those that are bundled with the core system (Tilson, et al., 2012) (Refer to Figure 2.9). This is a major shift from most systems, which gives embedded system apps a greater execution priority than the thread priority available to apps treated by third-party developers (Moon et al., 2011). Also, each application is executed within its own thread using a very lightweight virtual machine (Butler, 2011).

Nowadays mark-up language like HTML and XML becomes more than a web programming tool for laptops and PC's only. It is used as a tool to develop mobile

device applications such as smart phones (Android, iPhone, ect) and tablet (Brandon, 2012). To start programming at least one of the Integrated Development Environments (IDEs) is needed. Therefore to develop an Android application, Eclipse is the recommended IDE with Java and XML (Agarwal & Bilokhatniuk, 2012).

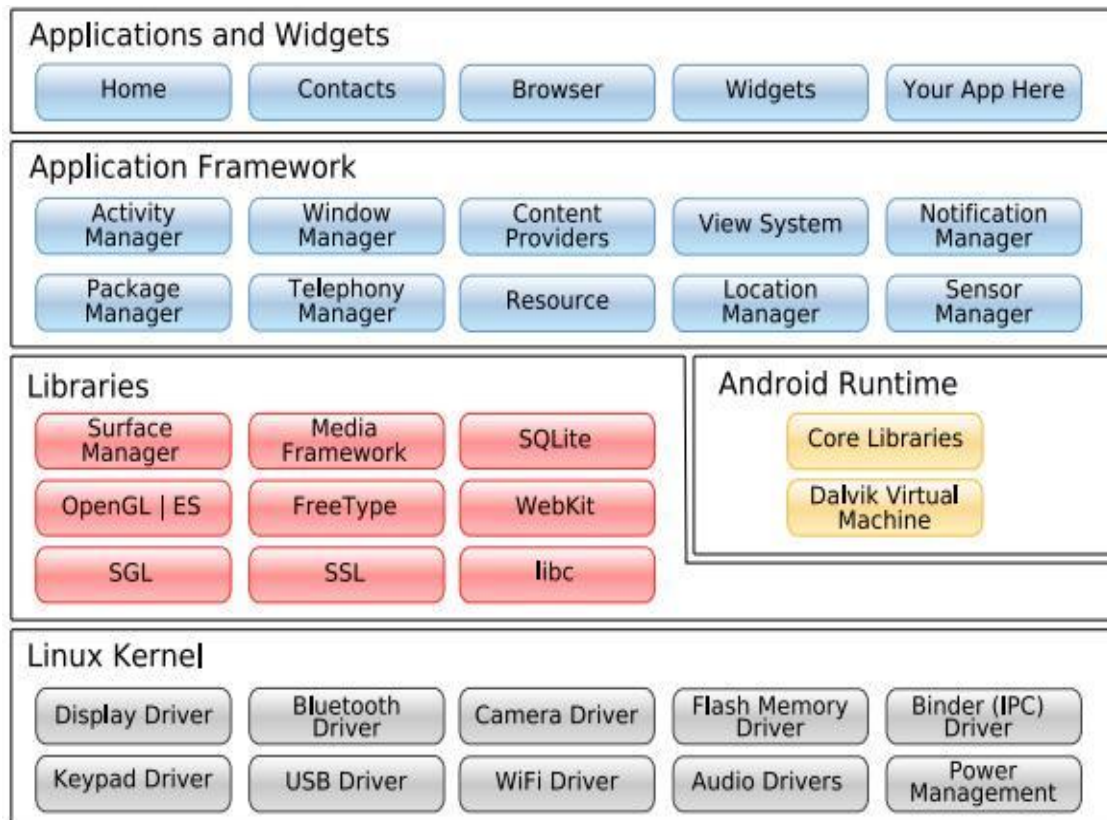


Figure 2.9: Android system architecture. The Android software stack contains Java applications on top of a Linux kernel (Source: DiMarzio, 2008; Wu, et al., 2010).

2.8 Eclipse IDE

Java was released by Sun Microsystems in 1995. Since that date many approaches sought to come out with an integrated development environment that can make programming in Java easier (Geer, 2005). Additional functionalities can be given to a project developed by using Eclipse and it can be characterized by

Eclipse's "nature" concept (Caire, Porta, Quarantotto, & Sacchi, 2008). Debugger is extremely important in modern IDEs (Alsallakh, Bodesinsky, Miksch, & Nasser, 2012). In Eclipse debugger the execution's superfluous suspension can be avoided by two features. By adding a condition to the breakpoints or by setting the breakpoint hit count (Gruber, Alsallakh, Bodesinsky, & Miksch, 2012). Eclipse provides many ways of visualizing dynamic information such as memory state or the objects number that created by a method which allow the developers to assess quickly the method runtime complexity (Röthlisberger et al., 2011).

There are many reasons that make Eclipse for Android applications as the recommended IDE (Hartness, 2012). It is powerful, easy to use and the fully featured free java IDEs. In addition the Open Handset Alliance has provided a free Android plug-in for Eclipse which allows developers to create Android projects and compile their projects as well as debugging and run them by using Android Emulator. In addition Eclipse's Android plug-in provide a very strong help to save the development time and minimize the learning curve (Duego, 2006). Finally it is available for Linux and Mac OS as well as many operating systems which mean that Android applications can be developed on any computer (DiMarzio, 2008).

2.9 Mobile UI

Developing an application with urbane, elegant, and stylish user interface is a very complicated process and takes a lot of time. Many studies have shown that around 80 percent of the total application's code depends on the user interface (UI) (Hussain et al., 2008) however, around 50 percent of the total implementation period

is consumed in the user interface designing and implementation. Therefore, user interface is highly important in the development process of the software application. A lot of researches has been done in software technology area to find the better solutions that can help the system developers to fabricate UI (Hussain, et al., 2008). Generally, the user interface developing process consists of the following steps:

- By using text, illustrations, graphic, and the representation of the relevant multimedia the requirement specification of the user interface can be created by the user interface designers.
- Based on the defined specification of the user interface the developers will implement it.
- The UI that created by developers will be verified by the designers of UI to check it is meet the requirement specification or not.
- The UI will be re-implemented and modified until it is meet the requirement specification completely. This process will take a lot of time and it will iterated many times between the designers of the user interface and user interface developer in order to come out with a urbane, elegant, and stylish user interface that meet the UI requirement specification completely.

Currently mark-up languages like HTML5, XHTML and XML are used not only for the traditional PC's and laptop's web application, it is also used to develop mobile devices application for smart phones like iphone and Android (Brandon, 2012). In this study, XML was used to design the user interface in Eclipse.

2.10 Mark-up Language

Mark-up language is a systematic way of describing certain context attributes through some standardized codes; these codes are modified by certain values to give specific description of the character and shape that the special context should take; it is just a guide on how a particular content should look. It defines some numbers in the ASCII code which indicate some specific non-printed conditions without any mark-up (Zhang, Liu, & Abraham, 2012)..

It is a way of describing content for instance, to help indicate how you want it to look. You might have specific tags, in this case indicated by < and >, that mean certain things. If you want bold, you might use . For italic, you might use <i>. But the important thing is that the reader understands what those tags should mean (Castro, 2001).

This is how HTML came to rule. It wasn't just a mark-up language. It was a mark-up language that had been through a process of standardization through public discussion and recommending body, the W3C; it was an agreed upon mark-up language. Because of that, every browser knew that meant bold, <i> meant italic, and <h1> meant it was a very important header, so you should make it prominent somehow.

2.10.1 The problem with HTML

HTML's success is due to its simplicity, ease of use, and tolerance. HTML is easy-going, it does not care about upper- and lowercase letters, it's flexible about quotation marks, and it does not worry excessively about closing tags (Brandon,

2012). It's tolerance makes it accessible to everyone. But HTML's simplicity limits its power (Castro, 2001). Since HTML's tags are mostly formatting oriented, it is not possible to reuse the content in different context because there is no information is given about the web page's contents. Since HTML is not obsessive about case and punctuation, browsers have to work twice as hard to display HTML content properly (Spencer, 1999). Since HTML is limited with respect to formatting and dynamic content, numerous extensions have been tacked on, usually in a hurry, in order to add power. Unfortunately, these extensions usually only work in some browsers, and thus the pages that use them are limited to visitors who use those particular browsers.

2.11 XML

XML is a subset of the Standard Generalized Mark-up Language (SGML) designed to provide most of power of SGML without as much complexity (N. Chase, 2001). SGML is a meta-language that was designed as a way of defining mark-up for documents of all types. Mark-up is the addition of 'tags' to data, the tags having some significance for the processing of the data by an application. An XML document comprises a combination of mark-up and character data (Spencer, 1999). The mark-up contains the meaning, such as "this is the designer of the dinghy" and is held in tags and other XML elements, while the character data is the content, such as the name of the designer (Zhang, et al., 2012).

The passage tries to explain the function of SGML and its relationship with both XML and HTML (N. Chase, 2001); SGML is a mete-language use to top certain additions to data with the XML and HTML being its subset and its implementation

respectively. It however describe relationship with Chemical mark-up language (CML) and Mathematical Mark-up language (MML) which both are example of XML. Lastly the passage tries to show the shortcoming of XML structure (Zhang, et al., 2012).

XML though look similar to HTML in terms of tagging and mark-up language in terms of assigning attributes and values is more comprehensive than the two in both respects. HTML is all about language for web pages. XML is used for other pages. While HTML does not just find data but its power lies in the fact that tag identifies other data (Sarasa-Cabezuelo, Temprado-Battad, Sierra, & Valmayor, 2009).

2.11.1 Tools for Writing XML

XML like HTML can be written with any text editor or word processor, including the very basic TeachText or SimpleText on the Macintosh and Notepad or Wordpad for Windows. There are some specialized text editors that can test your XML as you write it. Be sure and save all your XML documents with the (.xml) extension (Spencer, 1999). And finally, there are several mainstream programs that have filters that can convert other kinds of documents (from layout programs, spreadsheets, databases, and others) into XML (Sarasa-Cabezuelo, et al., 2009).

XML is a grammatical system for constructing custom mark-up languages. For example, you might want to use XML to create a language for describing genealogical, mathematical, chemical, or business data (hwan Park, Song, Jung, & Jeon, 2007). Since every custom language created with XML depends on XML's underlying grammar, which is where we will begin. There are basics rules for writing

documents in XML should be known, and thus, in any custom language created with XML (S. Chen & Wang, 2003).

2.12 Mobile Sound

One of the most important concepts in this study is sound. Sound in some way, represents our way of being, our character and even our mood in some moments. For this reason, it is important for us to carry with our favourite sound or music and be able to listen to it anywhere, anyway and in any moment (Boix Sancho, 2011). Audacity will be used to record the sound files of MDZ4H. A group of volunteers developed and distributed Audacity as open source software with a free of charge license under the GNU General Public License (GPL). This software allowed the users to record, convert, mix, splice and edit audios it is also allowed to change the speed and pitch of recording.

2.13 Java 2 Platform Micro Edition (J2ME)

Java 2 Platform, Micro Edition (J2ME) is the other revolution in Java's short background. When Java was developed in 1995, it seemed like the future of computing was in applets, minor programs that could be downloaded and run on demand. A slow Internet and a restrictive all-or-nothing sandbox security model accounted for the initial slow adoption of applets. Java, is a platform, actually took off with the advent of servlets, Java programs that run on a server. Java further developed into the server side of things, eventually picking up the moniker of Java 2

Platform, Enterprise Edition (J2EE). This was the first revolution, the blitz of server-side Java. And the second revolution is the explosion of small-device Java, and it's happening now. The market for small devices is highly growing rapidly, and Java is important for two reasons. First, developers can write code and have it run on dozens of small devices, without change. Second, Java has important safety features for downloadable code.

J2ME is an integral part of the Java 2, together with Java SE, Java EE they make up the main three versions of Java technology, and also work out by JCP (Java Community Process) (Ren & Yu, 2011). J2ME is a highly optimized Java running environment, mainly aim at consumer electronics devices, such as mobile phones, digital set-tops, and car navigation system and so on. J2ME technology was officially launched in Java One Developer Conference in 1999; it transplanted platform-independent character of the Java language into small electronic equipment, allowing the wireless mobile equipment to share between applications (Knudsen & Li, 2005).

2.13.1 Architecture of J2ME

Compared with J2SE and J2EE, the operating environment and target of J2ME are more diversified, but each of this kind is actually with a resource constraints and also more strict. In order to achieve standardization and compatibility and at the same time try to meet different demand, structure of J2ME is divided into Configuration Profile and Optional Packages (See in Figure 2.10). Their combination trade-offs formed specific operation environment. Configuration is mainly classified according to longitudinal equipment including storage and processing capability, which defines the virtual machine characteristics and basic class library (Ren & Yu,

2011). Standardized configuration includes Connected Limited Device Configuration CLDC and Connected Device Configuration CDC.

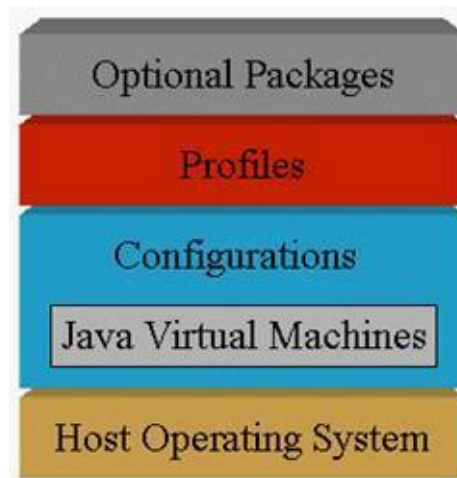


Figure 2.10 : Structure of J2ME system (Source: Ren & Yu, 2011).

Established based on Configuration, Profile together with Configuration formed a complete operating condition. Profile is mainly classified into market segment according to specific field; it mainly includes libraries of specific use and the API (Zhang, 2009). The standardized Profile on CLDC has Mobile Information Device Profile MIDP and Information Module Profile IMP, and the standardized Profile on CDC has Foundation Profile FP Personal Basis Profile PBP Personal Profile PP. Optional package which is independent from the front two provided additional, modular and more diversified functions. Currently standardized optional package includes database access, multimedia, Bluetooth etc (Ren & Yu, 2011).

2.13.2 J2ME configurations

The configuration of J2ME platform has been divided and categorized in two types, the first type is appropriate to the small mobile equipments with low

capabilities and the second one is compatible with mobile equipments that have a high capabilities like set top boxes and smart-phones (JunWu & JunLing, 2010) (See Figure 2.11).

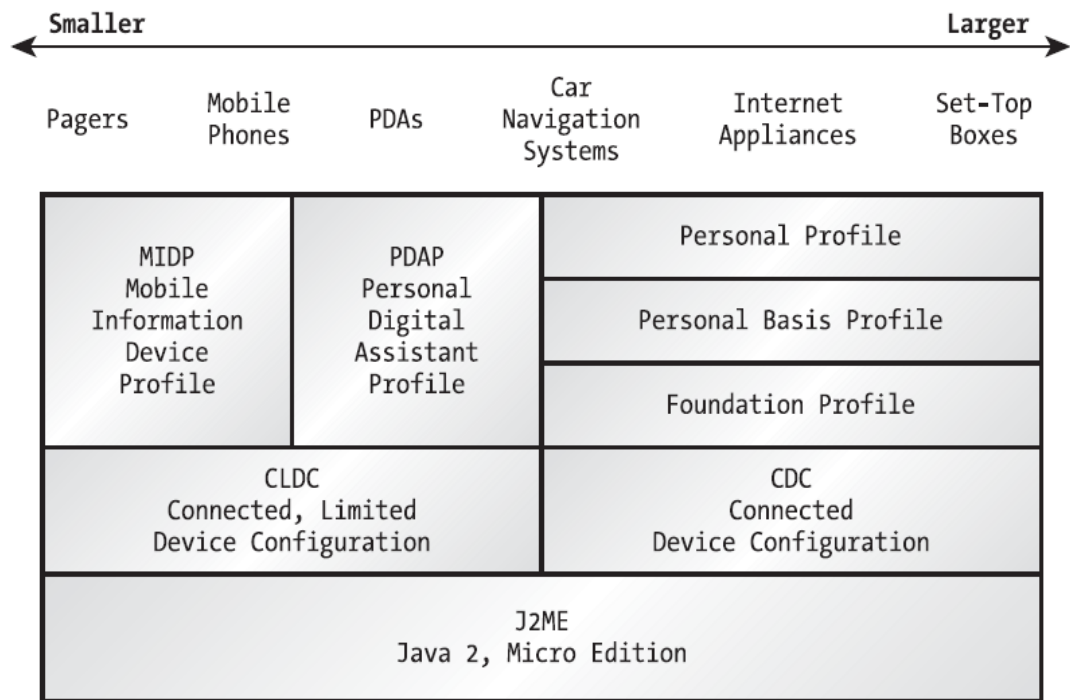


Figure 2.11: Common J2ME profiles and configurations (Source: Hemachandra, n. d.).

The configuration dealing with the limited resource equipments like cell phones is named the Connected Limited Device Configuration (CLDC). It is intentionally created to fit the desire of running a Java platform on devices with the small size memory constraints, processing power limitation and the constraints of the graphical capabilities. For a CLDC and MIDP environment, which is typically what most of the mobile devices today are implemented with, a MIDlet is then created. A MIDlet is the software developed by a Java ME application developer, such as a business application, a game or other mobile features. These MIDlets can be created once and

executed on any available equipment meeting the specifications of Java ME technology (Gu, Mukundan, & Billinghamurst, 2008) (See Figure 2.12).

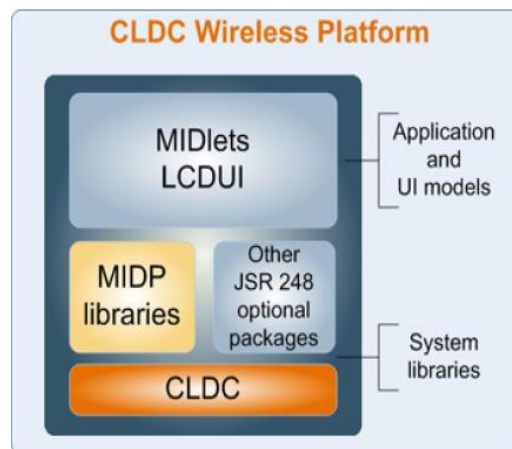


Figure 2.12: The Connected Limited Device Configuration (Source: JunWu & JunLing, 2010).

The compatible configuration with mobile equipments that have high capabilities with network connectivity like high-end set-top boxes, smart-phones, and personal digital assistants, is named the Connected Device Profile (CDC) (see Figure 2.13).

By taking in consideration the benefits of this type of configuration that can be bring to the different groups in the value-chain the following can be believed:

- By using the mobile based network application the companies will expand its business to reach workers, partners and customers.
- Users will benefit from the security and compatibility of Java technology.
- The productivity of the Java programming language, safety, and the rich APIs in the Java platform will bring a lot of benefits to the applications' programmers

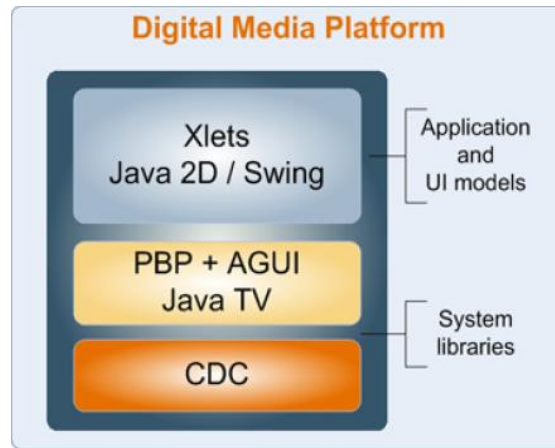


Figure 2.13: The Connected Device Configuration (Source: JunWu & JunLing, 2010).

2.14 Summary

This chapter provides some related works in the area of study. It explains briefly about Hajj and its ritual supplications. It then elaborates on the concept of Electronic Books, mobile devices and mobile phones especially Smartphone. It also covers mobile technologies, mobile applications, the principles of Open Source Operating System and Google Operating System. Finally it describes the technologies and the development tools that were used to develop the proposed prototype of this study.

CHAPTER THREE

RESEARCH METHODOLOGY

Research methodology is very important to come out with good and useful study and prototype (Ardakan & Mohajeri, 2009). Research methodology is a set of techniques, methods and instruments used by researchers to conduct their study. For example the techniques and instruments that are used to collect and process data. It is not just a set of steps to perform a study or to develop an application (Mohrman, 2007). There are many methodologies available to guide researchers to develop different kind of applications. This chapter discusses on the research methodology that is the General Research Design Methodology (GRDM) by Vaishnavi and Kuechler which will be adapted in this study.

3.1 General Research Design Methodology (GRDM)

This research primarily focuses on the development of a mobile application to facilitate the recitation of Hajj's Dua and Zikr among the pilgrims. The Hajj's Dua and Zikr application was developed in Arabic accompanied with Malay translation. This application can be installed on any Smartphone platform which support Java especially Android. In addition, the goal of Design Science Research (DSR) for information

system (IS) is providing a useful artefact. Furthermore the proposed application solves a problem which has engineering and technical roots (Gericke, 2009). Therefore the suitable methodology for this kind of research is the General Research Design Methodology by Vaishnavi and Kuechler (2008) (Hevner & Chatterjee, 2010). The methodology has five basic parts which include; Suggestion, Awareness of Problem, Development, Evaluation and Conclusion as shown in Figure 3.1. The following sections provide further explanations on each of the parts.

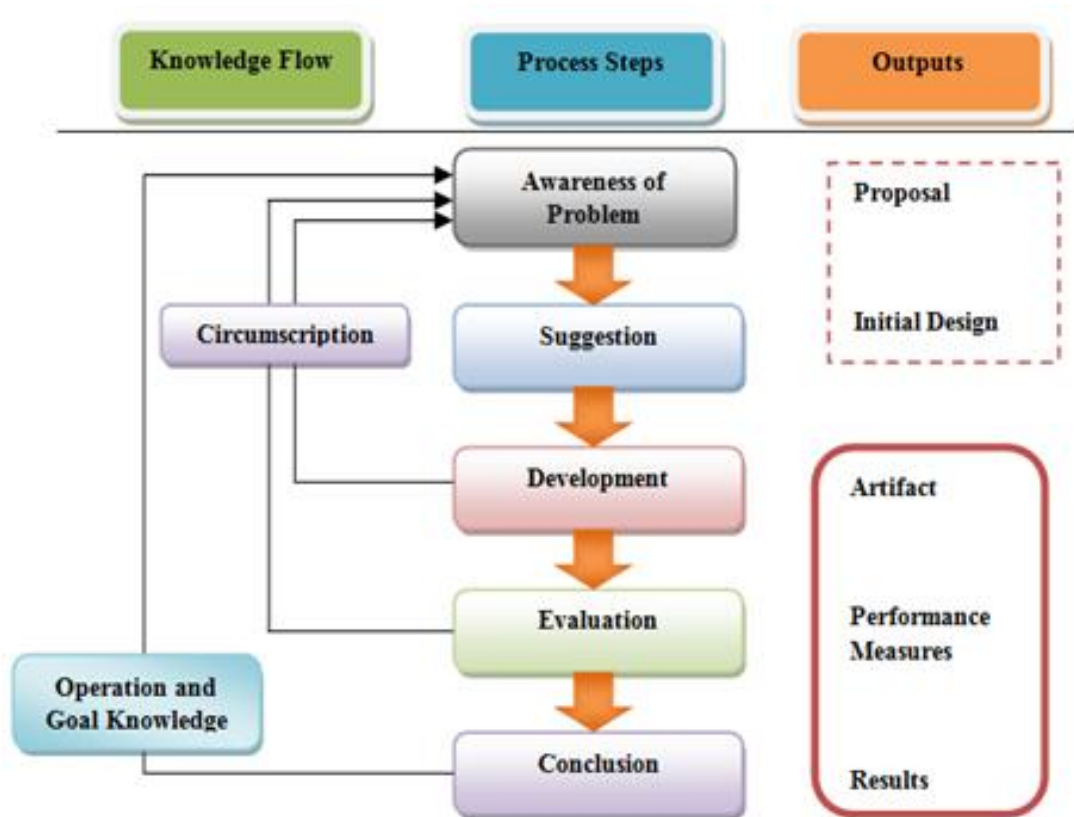


Figure 3.1: The General Methodology for design research (Source: Vaishnavi & Kuechler, 2008)

3.1.1 Awareness of The Problems

The awareness of problems refers to finding the latest development in the same fields or relevant industries (Shiratuddin., 2009). It needs to understand the mobile

technology fields and Android application development techniques by reviewing the latest and relevant research outcome. It also needs to find out the current problems in the conventional approaches which are currently used (books, booklets and gadgets) in order to make a proper research objectives and scope.

By using direct interview plus literature survey, the required information can be gathered. (Hoffer, George, & Valacich, 2011). In this study, the researcher used the literature survey technique to collect the required Duas and Zikr for Hajj as well as Umrah and Ziarah (visiting Medina) including going to Hajj and returning home. The researcher has to refer to books, booklets and other resources to collect those Dua's and Zikr. After that the collected Dua's are categorized to four types (Going to Hajj "Departure + On The Way", In Medina, In Makah and Returning Home) based on the flowchart as illustrated in Figure 3.2 (Fathnan, et al., 2010) and arranged according to a specific sequence of events and rituals. Those Dua's and Zikr were sent to the experts to check and validate. Then the validated Dua's and Zikr are translated from Arabic to Malay, and later the translation was also validated. Finally, some instructions and explanations were added including the times and places where Dua's are acceptable. Direct interviews were also used to identify the problems of the current and existing approaches of reciting of Dua and Zikr.

3.1.2 Suggestions

In this part, the researcher will come out with the design of the proposed prototype. The design of the prototype was done using the Unified Modeling Language (UML) diagram model. The UML diagram is a standard system model tool. With the UML assistance, the system model and architecture can be easily

tested in the artefact availability (Booch et al., 2007). Because the system model or architecture must be executed by using the definition of the component in the system to make sure that the system can be built based on this artefact.

Rational Rose 2000 Enterprise Edition has been used as a tool to draw the required diagrams like Use Case Diagram, Sequence Diagram. Rational Rose 2000 helps designers to create novel products faster and easier than the competition with the lowest cost and risk. By using Rational Rose 2000 the designers will know how they design, develop and deliver both software itself and software embedded hardware.

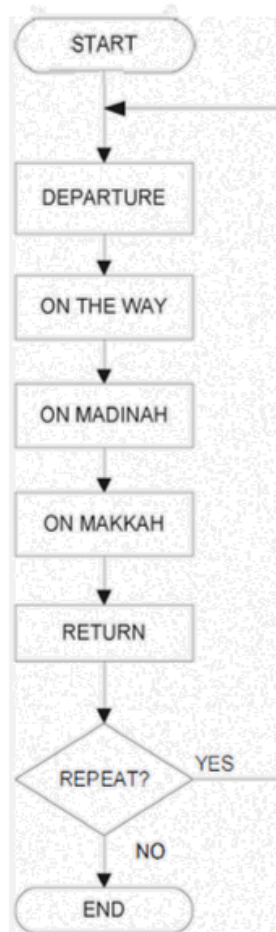


Figure 3.2: The Flowchart of Hajj Simulation Program (Source: Fathnan et al., 2010).

3.1.3 Development

In this part, the tentative design is used and archived according to the previous step. The tentative design is explained into the programming language to build the prototype MDZ4H (Mobile Dua and Zikr for Hajj). This kind of prototype is a representation of the product, that was able to display what the product should be doing, but it is not compulsory to produce like an exact copy of the final product. Since the proposed prototype was developed by using Java to work in Android Smartphone, JDK7.0 was installed as well as Android SDK 2.2 platform and Android emulator (virtual device to run the developed Android application). Eclipse integrated development environment (eclipse Indigo IDE) enhanced with Android development tools as a Plug-in was used as a tool to develop the proposed prototype in which Java programming language is used to write the logical code while XML is used to design the interface of the proposed MDZ4H prototype. Photoshop 7 (Image Processing Program) was used to create and adapt the required images, photos and icons. While Audacity 2.0 (A Free Digital Audio Editor) was used to record and edit the required audios.

The prototyping approach was used as a development methodology. There are three steps of prototyping approach adapted from Prototyping Process (Laudon & Laudon, 2009). Figure 3.3 shows the steps of Prototyping Approach. First of all the users would be provided with initial artefact which would give them ideas on how to use the prototype and also to get feedbacks in enhancing the current prototype before the final delivery.

The main function of MDZ4H is the recitation of Dua's and Zikr. The user can click on the speaker icon to play the sound file of the selected Dua till the end of the sound file. The user can pause the sound file any time after pressing the mute icon which will be displayed after playing the file sound and he can continue the paused Dua by pressing the speaker icon again. If the user exit from the current page while the sound file is playing, the sound file will immediately stop.

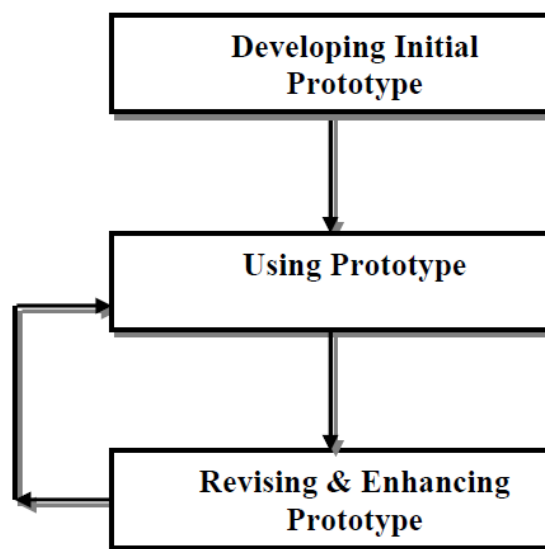


Figure 3.3: Prototyping Approach (Source: Laudon & Laudon, 2009).

3.1.4 Evaluation

In this part, some evaluations on the artefact from the development aspect will be conducted in order to get feedback from expert and users in order to know whether the prototype satisfies the user's demands and expectations. The evaluation consists of the two aspects.

Expert Evaluation

The expert evaluation was executed by scholars of Hajj to check the validity and reliability of the contents before it is used and included in the prototype. The evaluation process comprised of Arabic text and its Malay translation as well as the way of reciting the Arabic text. Besides that expert evaluation was also executed by some lecturers who specialize in the design of user interfaces when it has been developed.

User Evaluation

In this process, the tentative prototype was installed in 30 Smartphones of 30 users. 15 of those users have been to Makkah to perform Hajj or Umrah and 15 other users have not been to Makkah to perform Hajj or Umrah. User evaluation process was conducted using a set of questionnaires among the 30 users. The questionnaires basically involve measurements such as Ease of Use, Usefulness, and Intention to Use. The questionnaires were adapted from (Davis, 1989) and (Lewis, 1995). A 5-point Likert scale anchored by "Strongly Disagree" (1) and Strongly Agree (5) was used as shown in Table 1.

Table 3.1: Five-Point Likert scale format

	Strongly	Disagree	Neutral	Agree	Strongly
Score	1	2	3	4	5
Category	Disagree		Neutral	Agree	

3.1.5 Conclusion

In this step, some of the research's results are written with some descriptions on the overall research process. The outcome of the research process and the further prospective can be concluded here.

3.2 Summary

This chapter explains the research methodology that has been adapted in this study. This research methodology called The General Research Design Methodology (GRDM) was developed by Vaishnavi and Kuechler. It consists of five parts to answer the research questions and achieve the research objectives as follows:

The first part is awareness of the problems or information gathering in which all the required information will be gathered by using information gathering techniques. In this work, interviews and literature survey were used to identify the problems and solutions.

The second part is suggestion in which the prototype functional and non-functional requirements were analysed. As a result of this part, the researcher come out with the design of the proposed prototype. Rational Rose 2000 Enterprise Edition has been used as a tool to draw the required UML diagrams like Use Case Diagram, Sequence Diagram and so on.

The third part is development where the prototyping approach will be used. The prototyping approach consists of three steps as follows:

- Developing Initial Prototype:** The first version of the prototype will be produced.
- Using Prototype:** The produced prototype will be used to identify its ability and adequacy.
- Revising & Enhancing Prototype:** All the inabilities in the previous version will be revised and enhanced.

The fourth part is evaluation which consists of expert evaluation where the contents are validated and the user interfaces are checked and user evaluation where the prototype will be evaluated by users in terms of Ease of Use, Usefulness, and Intention to Use.

Finally the fifth part is conclusion where the research results and findings will be concluded.

CHAPTER FOUR

SYSTEM ANALYSIS AND DESIGN

4.0 Introduction

This chapter discusses on the design and implementation of MDZ4H. At the beginning of this chapter, the system requirements will be introduced which have been gathered through the awareness of the problems phase and the suggestion phase of the research methodology. Then it will explain the application's implementation architecture, directly followed by the system flow chart. Finally the user interface will be designed according to the first and second stages of the research methodology.

4.1 System Requirements

According to IEEE (1998), the system's requirements are defined as what the user's need from the systems, containing the capability, attribute, characteristic and features of the system. Based on the outputs from the pervious phase, the requirements of Mobile Dua and Zikr for Hajj can be grouped as follows:

4.1.1 The MDZ4H Functional requirements

The main functional requirements of Mobile Dua and Zikr for Hajj are as follows:

1. The pilgrims will be provided with all the required Dua and Zikr for Hajj, Umrah and Ziyarah (visiting Medina).
2. Step by step instructions of the ways of reciting those Dua's and Zikr should be provided by MDZ4H.
3. It is allowed for the pilgrims to read and recite Dua's and Zikr by following the sound files in Arabic language.
4. The Malay language (*Bahasa Melayu*) translation of the Arabic Dua's and Zikr should be provided to allowed pilgrims to understand the meaning of those Dua's and Zikr.
5. Additional information would be provided like the places and time of the acceptable Dua (Doa Mustajab).

4.1.2 The MDZ4H Non- Functional requirements

In order to come out with a good and useful application, a set of non-functional requirements have to be considered which include:

- **Usability:**

1. MDZ4H should be easy to use.

2. MDZ4H should provide pilgrims with useful, precise and clear information while they are performing their rituals.

3. MDZ4H should have a user-friendly interface.

4. The Arabic text should be clear by using popular font same as the font of Holy Qura'n (AlQalam Quran Majeed font) supported by diacritics.

5. The sounds should be clear and slow enough to make the recitation process easy and well understood.

- **Reliability:**

1. MDZ4H should be avuncular from errors.

- **Completeness:**

1. MDZ4H should be compatible with others Hajj systems.

4.2 System Design

4.2.1 The Use Case Diagram of MDZ4H:

The Use Case diagram shows the scenario of interactions between the system and the users of the system. It explains what tasks that can be done by the system, not how the system do it. The Use Case refer to the task that can be performed by the system while the Actor refer to the pilgrims in this system but it can be anything who can initiate any task in the system (Fowler & Scott, 2000). Figure 4.1 illustrates the MDZ4H Use Case Diagram.

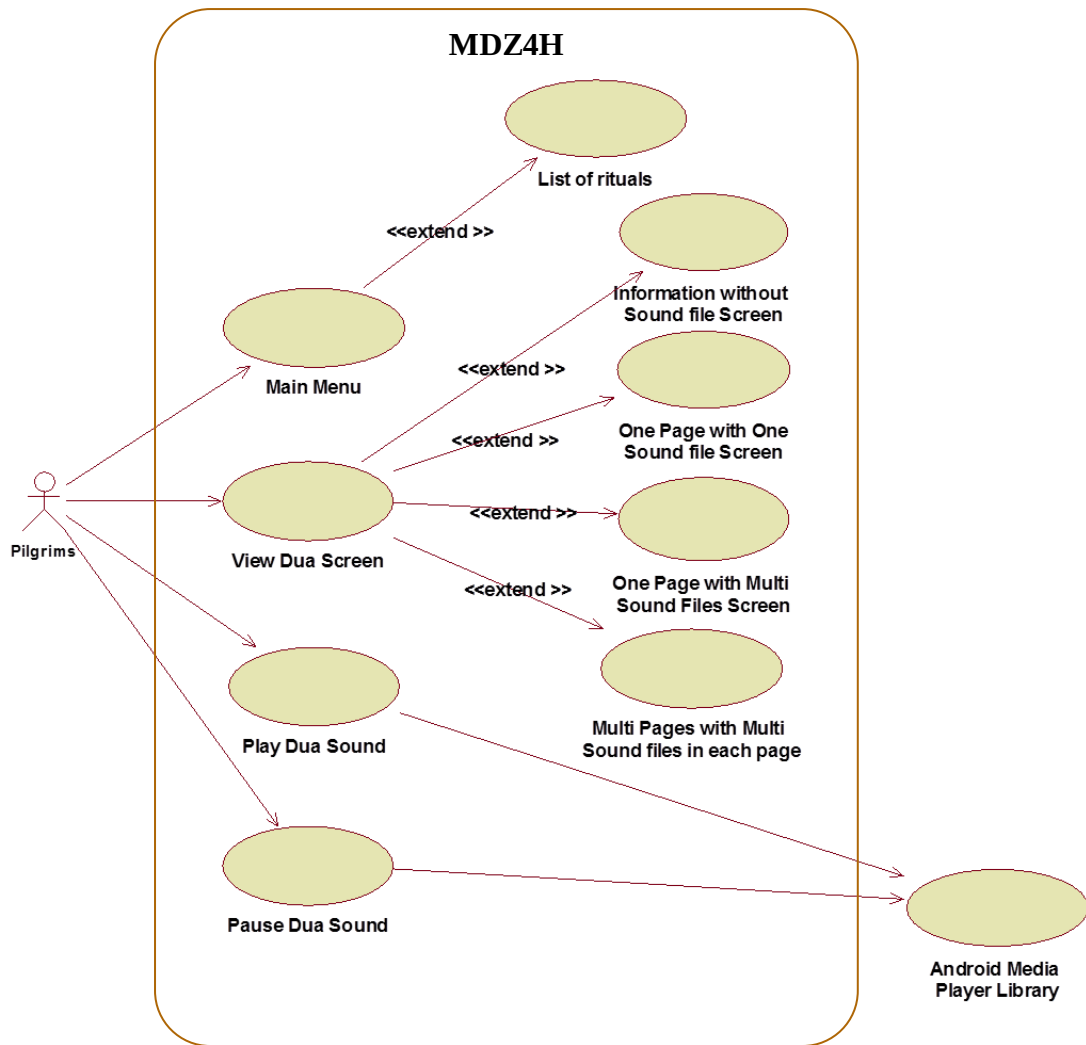


Figure 4.1: Use Case Diagram of Mobile Dua and Zikr for Hajj (MDZ4H)

As it has been shown in the Figure 4.1 above, there is only one Actor in the system (Pilgrim) who can initiate all the tasks in the system. Pilgrim can start the system by clicking the system icon to access the main menu which can be extended to contain the list of rituals. The pilgrim can then choose the ritual from the list to initiate the chosen Dua page which extended to four categories or screens (information only, one page Dua with one sound, one page Dua with multi sound, and multi pages Dua with multi sounds). These entire screens have its own sequence and should be performed in specific way. Pilgrim can play as well as pause the sound files and this requires a sound media player. Since Android is open source operating

system, the media player library is available to be used by calling it only without the need to develop our own media player to deal with those sound files.

4.2.2 The Sequence Diagram of MDZ4H

The diagram emphasizes the interaction between the system objects. It shows the time order of the system messages between the objects (Dennis, Wixom, & Roth, 2008). The analyst can illustrate all the possible scenarios in the system in one sequence diagram. But the majority of them prefer to separate each scenario in a single sequence diagram to make it clear and easy to understand (Glover, Sarma, & Overbye, 2011).

4.2.2.1 Starting of MDZ4H sequence diagram

This sequence diagram illustrates the starting of MDZ4H scenario or in other words the interaction between the system objects when the system has been started by the pilgrim. As shown in Figure 4.2, the Actor initiates the system by clicking the system icon. The system interface will send a request to load the Logo screen which needs to call the Android media player library to play the Preview sound file. After the required library loaded the interface, it shows the Logo screen and plays the Preview sound file to the pilgrim. This logo screen will be displayed to the pilgrim for 13 seconds only while the preview sound is playing then automatically the main menu and the rituals list will be shown to the pilgrim. The control of the system will be given to the pilgrim again, so that he/she can go deeply through the system by using one of the four possible sequences which will be explained after this directly or he can exit from the system by clicking the exit icon. If pilgrim clicks the exit button,

the system interface will show him a message to be confirmed. If the pilgrim responds by clicking No, nothing will be display. However, if respond by clicking yes, the system will prepare itself to destroy all it is activities by sending a destroy request and abandoned the main menu activity.

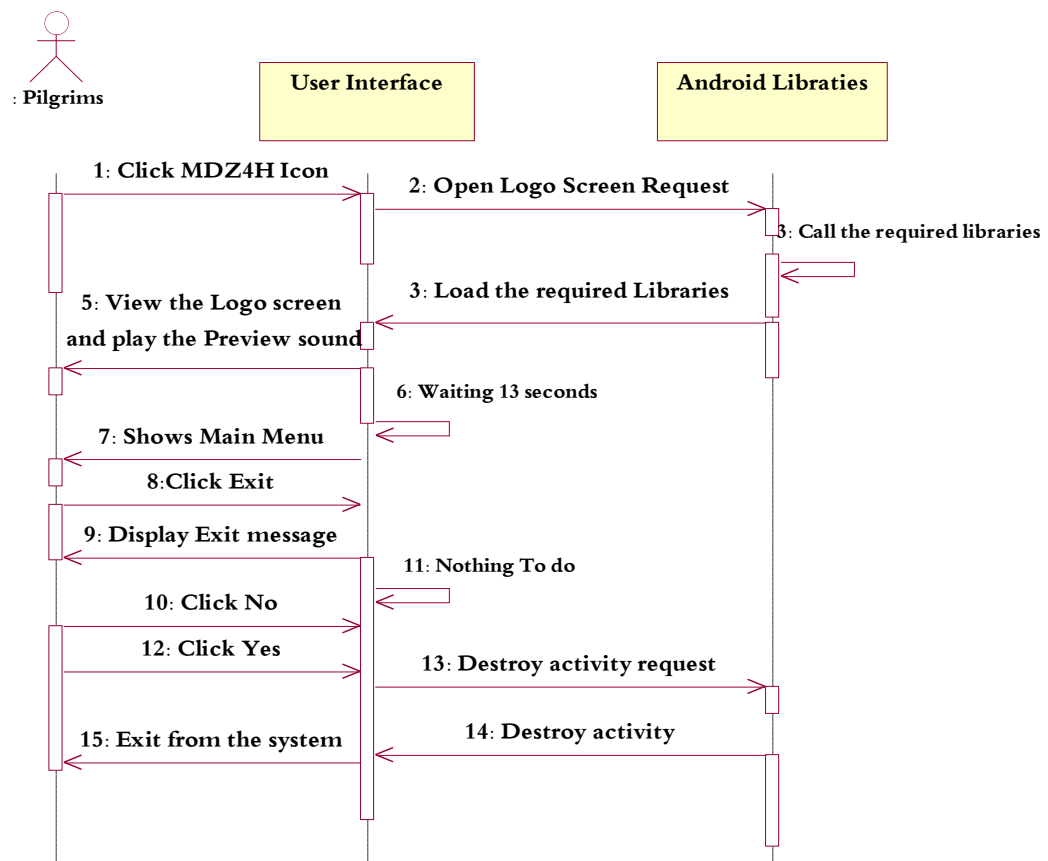


Figure 4.2: Sequence Diagram of the Starting of Mobile Dua and Zikr fro Hajj

4.2.2.2 Sequence Diagram of the Information Screen (Screen without sound file)

After the system is started, the pilgrim can choose any ritual from the list which he intends to follow from the four main sequences. The first diagram explains the sequence diagram of the information screen which does not contain any sound file. The pilgrim initiates the interaction by selecting from the main menu, then the mobile interface will send the request to the Android libraries to load the required

libraries so that it will open the required screen and view this screen to the pilgrim. The control of the system will be given to the pilgrim again and move to the next screen of the next ritual or back to the main menu as well as back to the previous screen of the previous ritual (see Figure 4.3).

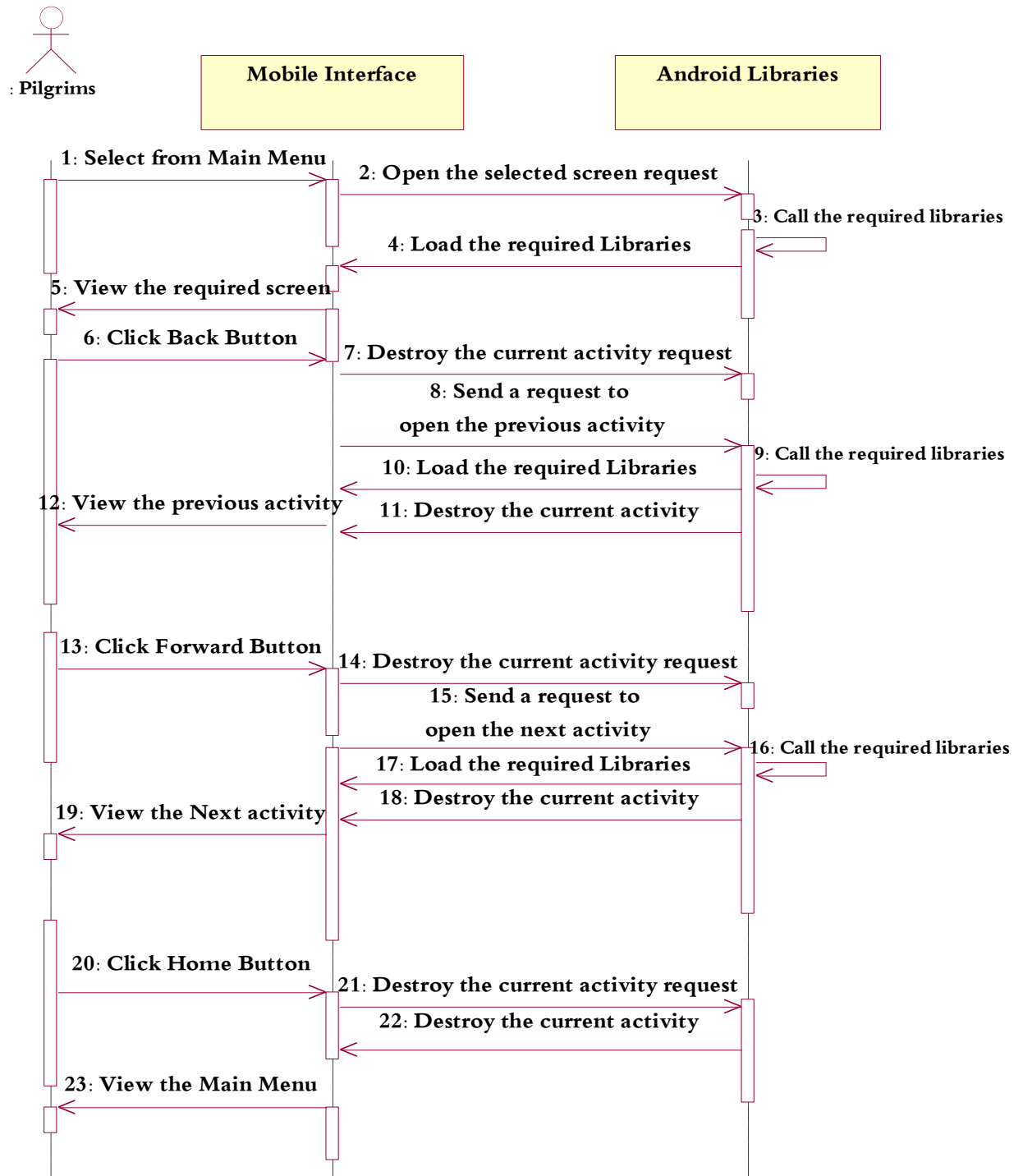


Figure 4.3: Sequence Diagram of the Information Screen (Screen without sound file) in MDZ4H

4.2.2.3 Sequence Diagram of the One Page Dua Screen with One Sound file:

The second diagram explains the sequence one page Dua with one sound file which is the same as the first diagram (see Figure 4.4). The only difference in this diagram is the alternative sequence (E0) which can be taken if the pilgrim clicks one of the buttons (back, home, forward) while the sound file is playing.

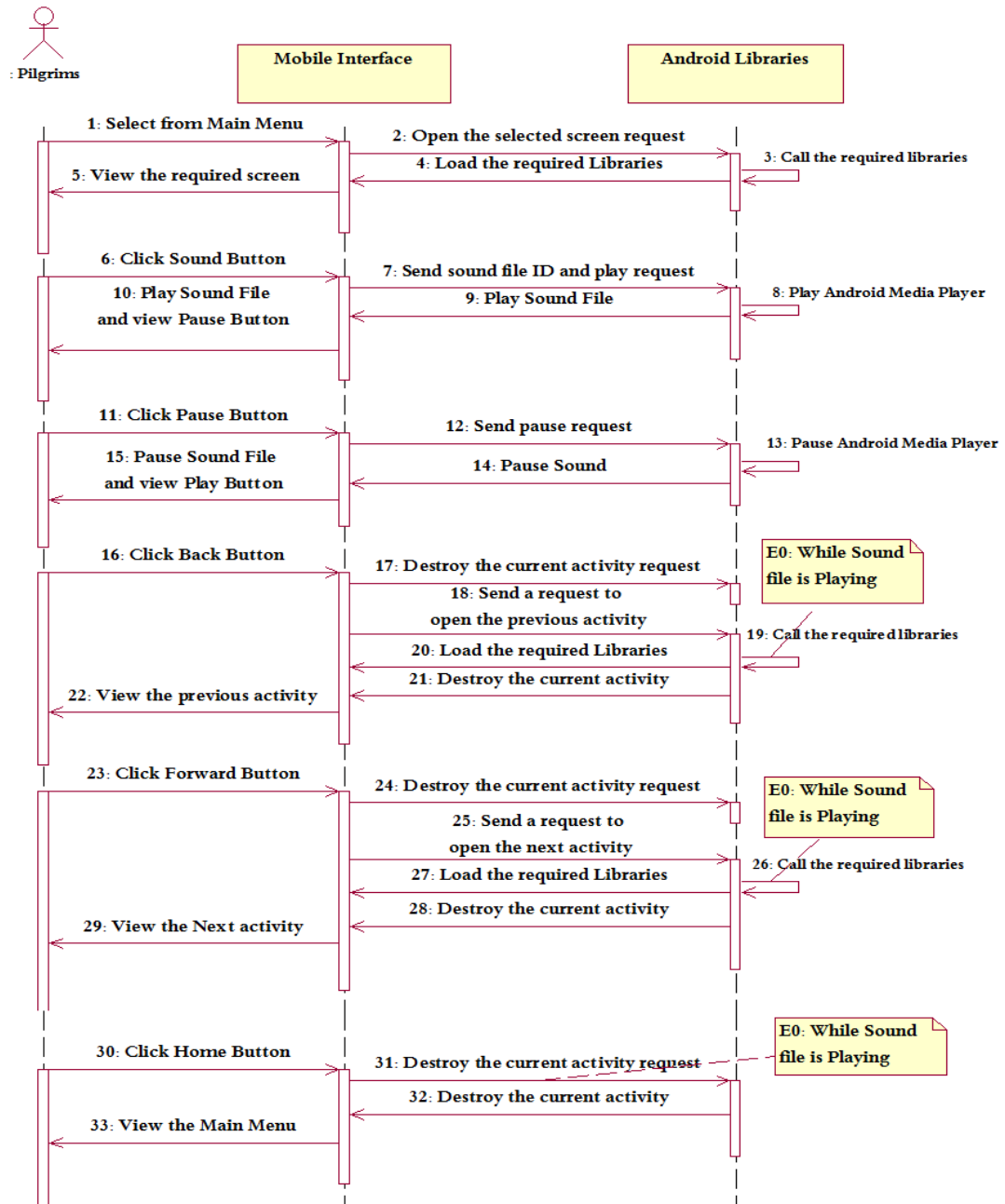


Figure 4.4: Sequence Diagram of the One Page Dua Screen with One Sound file in

The pilgrim can play the sound file by clicking the sound button; the mobile interface will send the sound file name to the Android media player which will be called from Android libraries. Then the pilgrim can hear the sound and the button icon will be changed to Pause icon. When the sound file is playing, the pilgrim can pause the sound by clicking pause button. Then the pause request will be sent to the Android libraries to call the media player library and pause the playing sound file as well as changing the button icon to play icon.

4.2.2.4 Sequence Diagram of Exception (E0: While Sound file is playing)

This alternative scenario is followed when pilgrim clicks one of those buttons (Home, Back, and Forward) while the sound file is playing. The sound file should be stopped first before the current activity has been destroyed, because if it has not been stopped it will continue playing in the background until it is finished (see Figure 4.5).

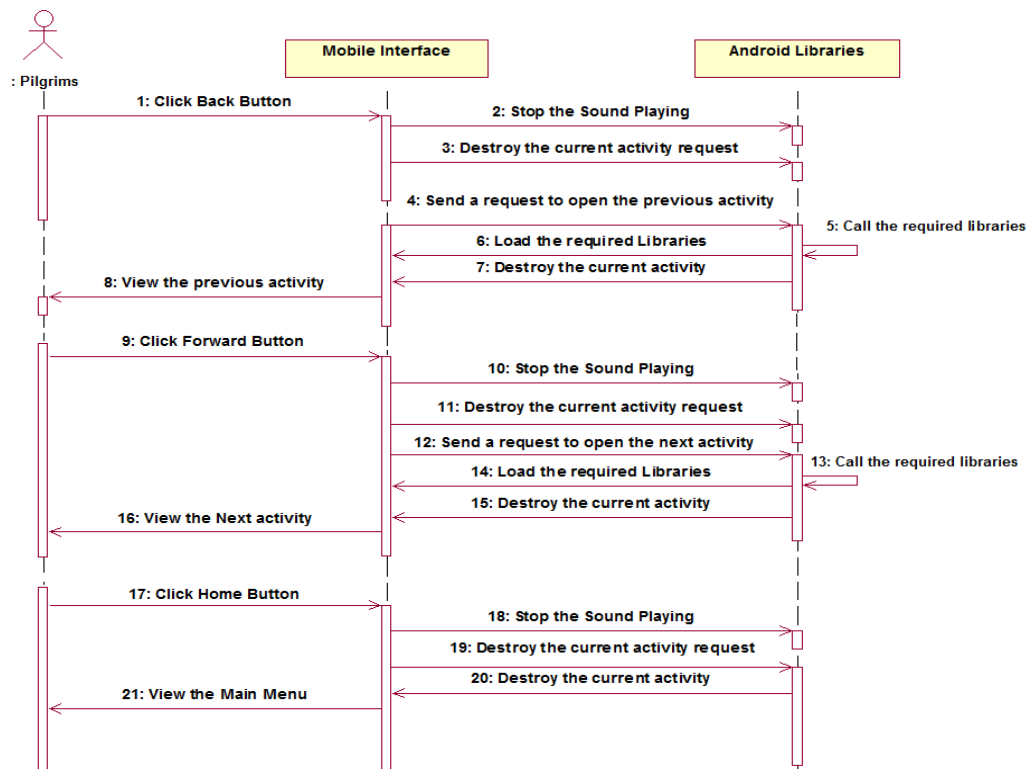


Figure 4.5: Sequence Diagram of Exception E0 (While Sound file is playing) in MDZ4H

4.2.2.5 Sequence Diagram of the One Page Dua Screen with Multi Sound files

This diagram explains the sequence one page Dua with multi sound file which is also the same as the pervious diagram (see Figure 4.6). The only difference in this diagram is the alternative sequence (E1) which can be taken if the pilgrim wants to play a sound file while another sound file is currently playing.

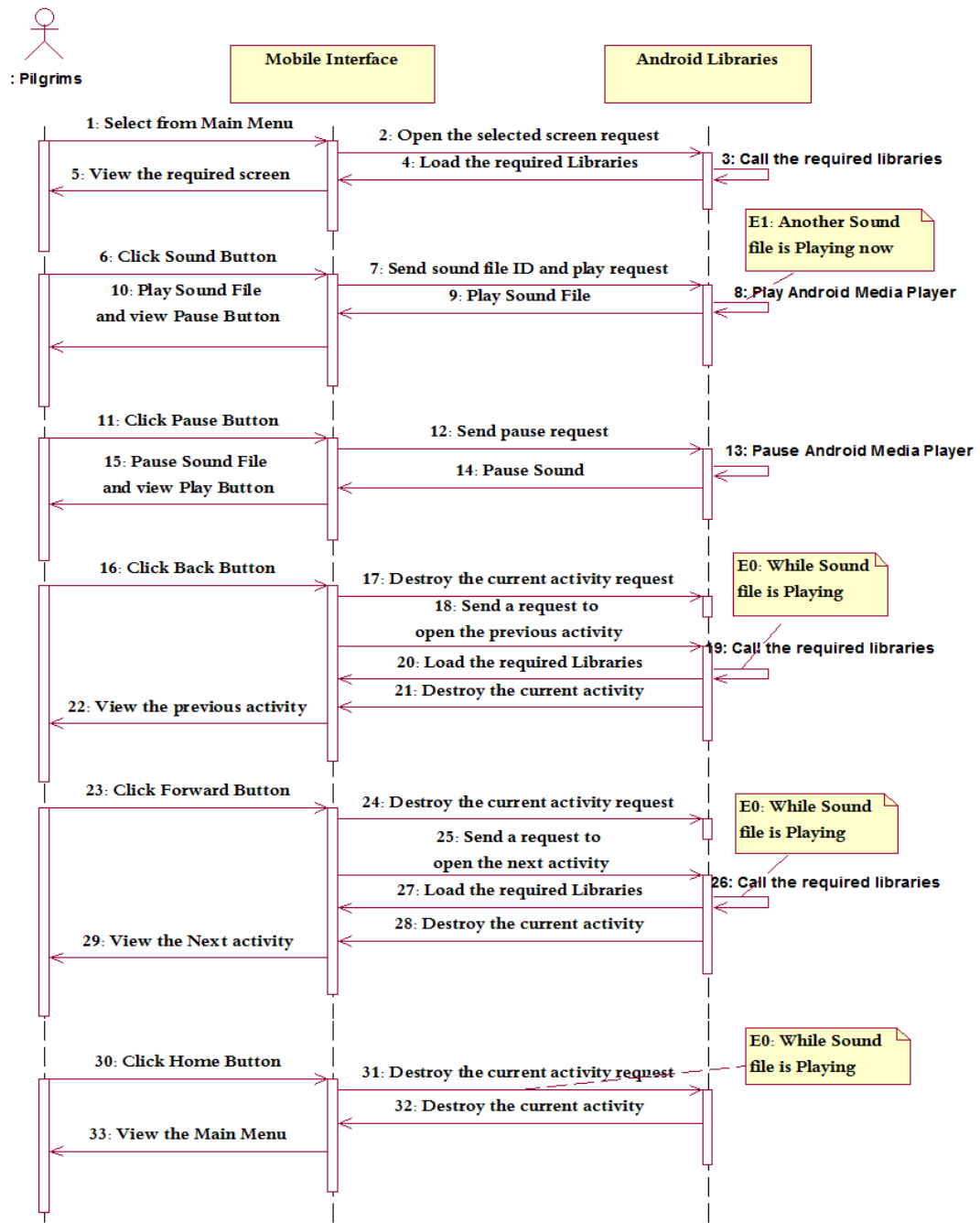


Figure 4.6: Sequence Diagram of the One Page with Multi Sound files Dua Screen in MDZ4H

4.2.2.6 Sequence Diagram of Exception E1 (Another Sound file is Playing now)

This alternative scenario is followed when pilgrim want to play a sound file while another sound file is playing. The first sound file should be stopped first before the second sound file is started to avoid overlapping voices (see Figure 4.7).

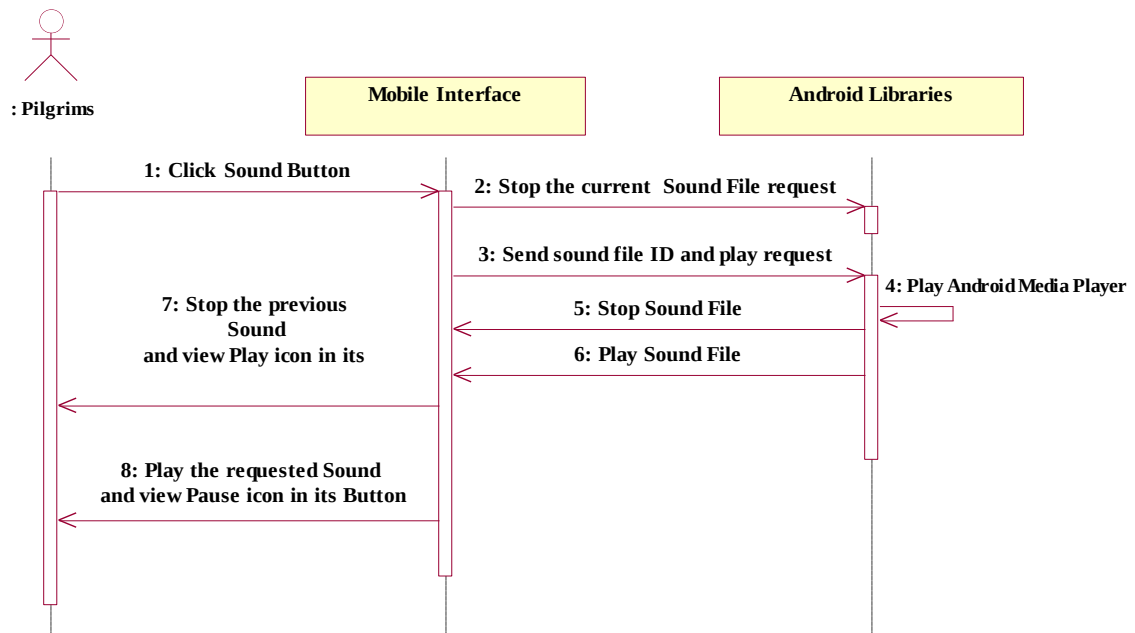


Figure 4.7: Sequence Diagram of Exception E1 (Another Sound file is Playing now) in MDZ4H

4.2.2.7 Sequence Diagram of the Multi Pages Dua Screen with Multi Sound files:

In general, Multi pages Dua screen with multi sound files is the same like one page Dua screen with multi sound files except the function on Back and Forward buttons (see Figure 4.8). Those buttons allow the pilgrim to go and back through the Dua pages of the same ritual, but there are two exceptions, E2 and E3 which leads to an alternative sequence if the pilgrim reach the first page and he clicked the Back button. In this case, the system will tack the alternative sequence E2 (see Figure 4.9) which will show him the screen of the previous ritual's Dua. However, if the pilgrim reaches the last page of the series and he clicked the Forward button, the system will

tacks the alternative sequence E3 (see Figure 4.10) which will show him the screen of the next ritual's Dua.

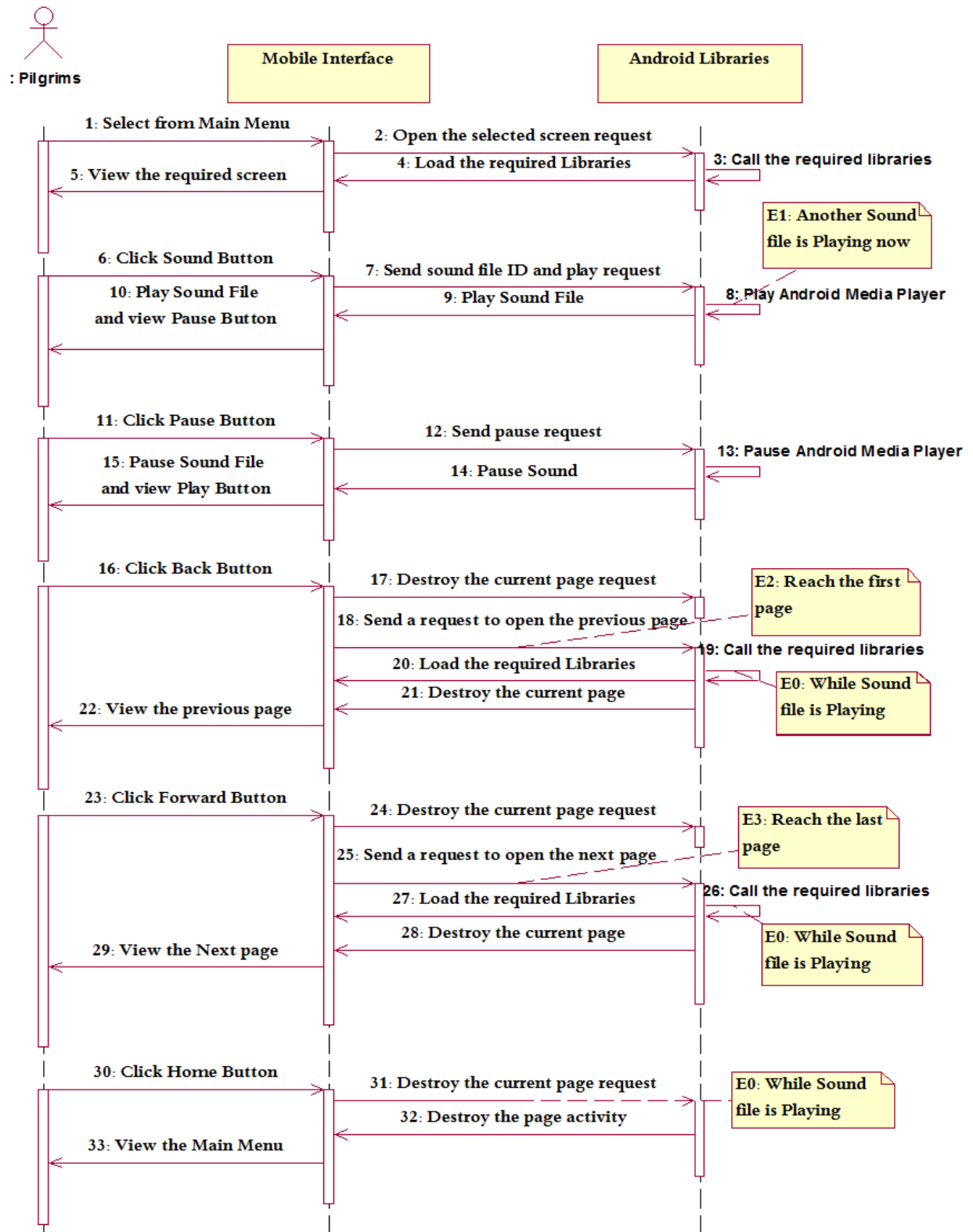


Figure 4.8: Sequence Diagram of the Multi Pages with Multi Sound files Dua Screen in MDZ4H

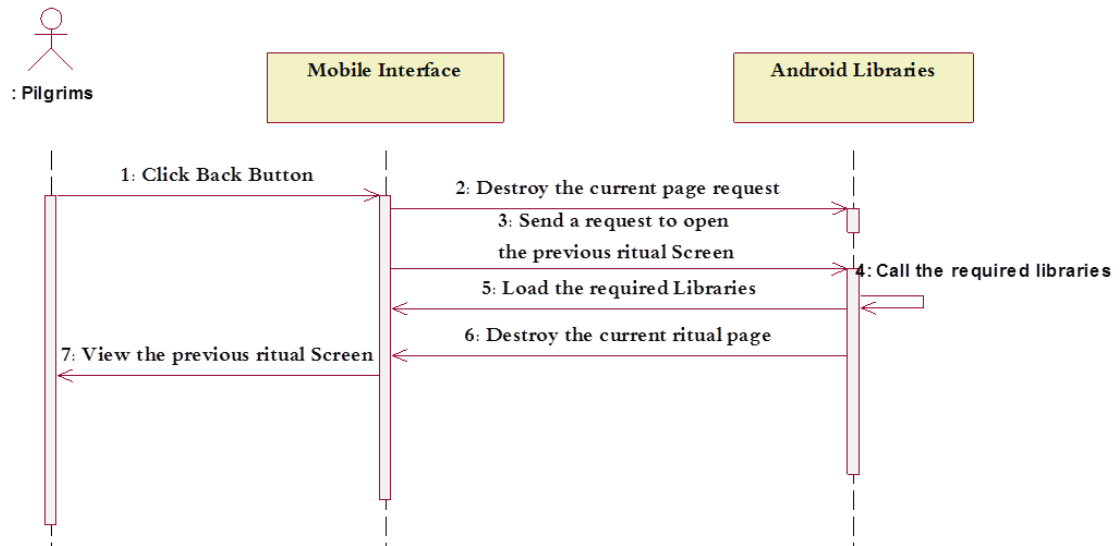


Figure 4.9: Sequence Diagram of Exception E2 (Reach the first page) in MDZ4H

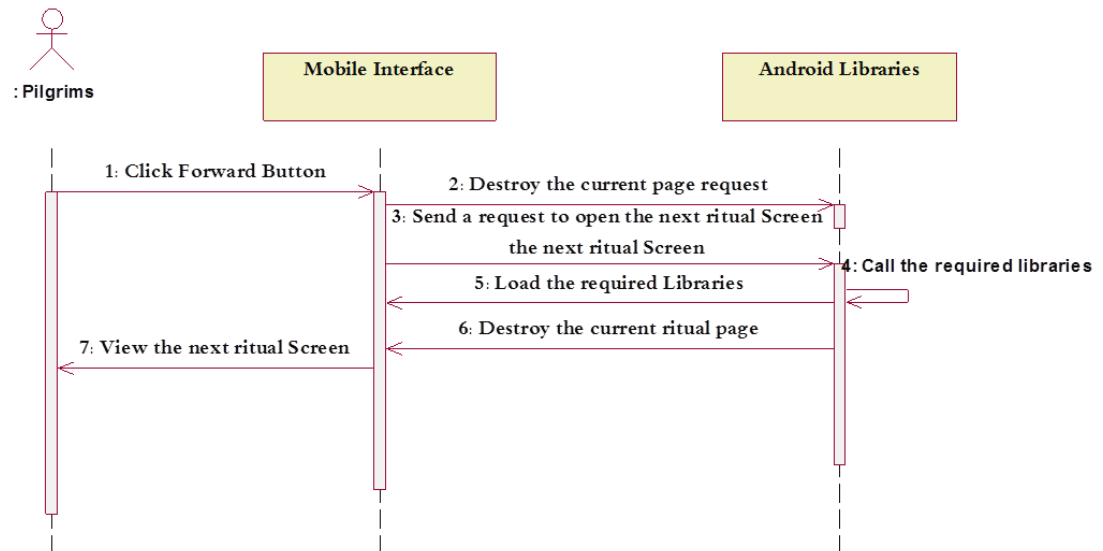


Figure 4.10: Sequence Diagram of Exception E3 (Reach the last page) in MDZ4H

4.2.3 The Flow Control (Flowchart) of MDZ4H

Flow control diagram is used to make the system structure easy to understand. It is like a map of the system which shows the flow of various screens of the system. In MDZ4H all the Dua screens can be accessible from the main menu except the multi pages Dua, where the first page can only be accessible through the main menu (see Figure 4.11).

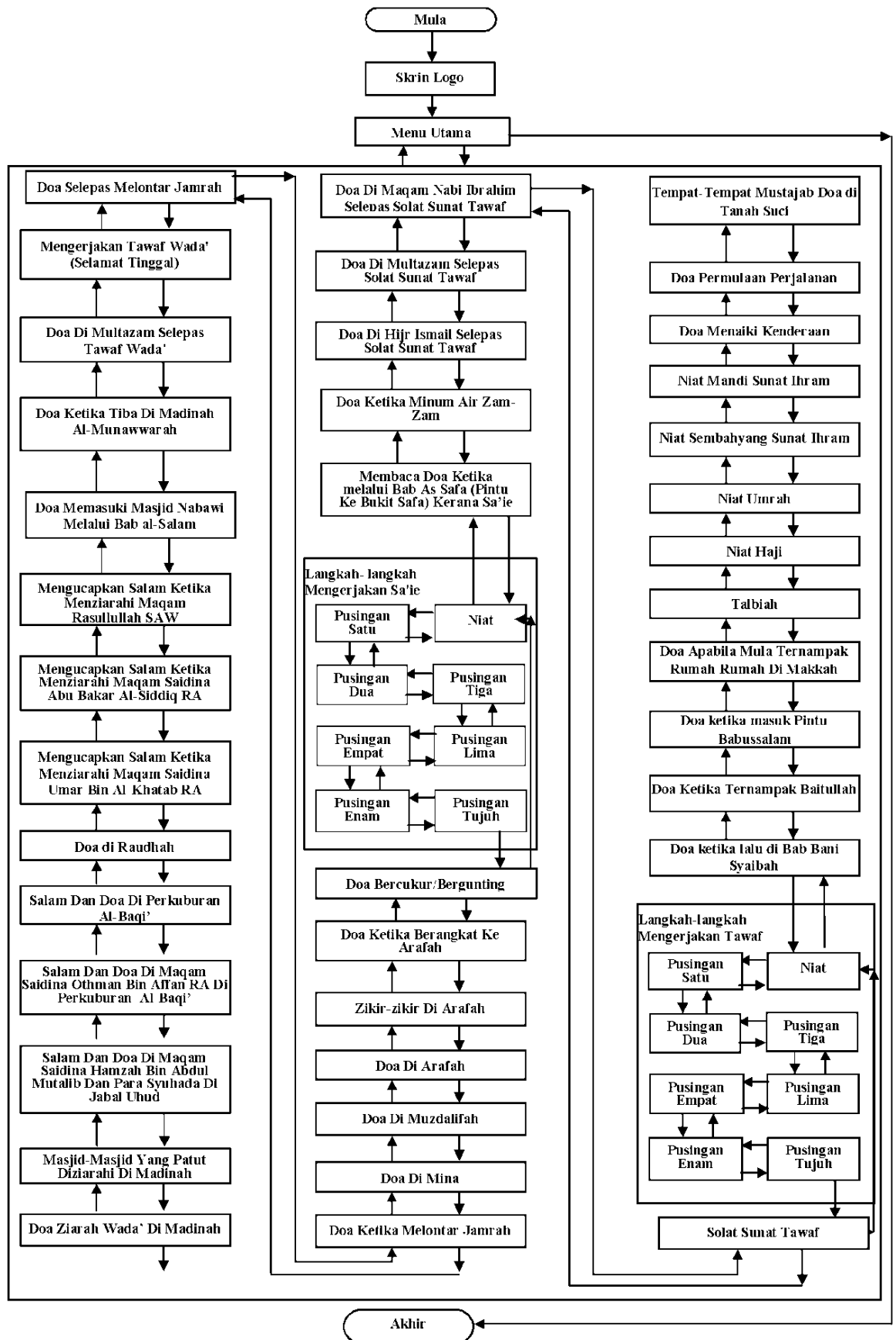


Figure 4.11: The Flowchart of MDZ4H

4.3 System Development

Prototyping Approach was used to develop the proposed prototype of this study. The prototyping approach involves three steps which include developing initial prototype, using prototype, and revising and enhancing prototype. Each step of the prototyping approach involves sub steps or rules and results. The first step results pass to the next step and so on. The second and third steps can be repeated till reaching a satisfied prototype.

4.3.1 Developing Initial Prototype

This step involves some sub steps which are:

4.3.1.1 Information Gathering:

The required information like the prototype contents which delivered by the supervisor are checked and ready to be used in the prototype.

4.3.1.2 Contents Preparation:

In this step, several kind of preparations are done as follows:

A. Image Preparations:

Here the required Duas are converted from the text form to Image form, since some mobiles phones do not support Arabic language. By using PRTSC button the primary version of images have been captured. Then those images have been processed by using Photoshop 7 to divide the big images to small one which are suitable with the mobile screen size and combining the different part of the long images.

B. Sound Files Preparations:

In this step all the required Duas and Zikr have been recorded by using Audacity 2.0 which allow saving the sound files in different extensions. The MP3 extension has been chosen because it is supported by many types of mobile phones.

C. Icons Preparations:

The required Icons like the system icon and buttons icons have been prepared in this step. By using Photoshop 7, those icons are prepared and save in PNG extension.

4.3.1.3 Prototype Programming

XML2.0 and Java are used as the programming languages to develop the proposed prototype of this study. Java has been used to develop the logical body of the application while the system interface is designed by using XML2.0 and the integrated development environment (IDE) used was Eclipse. After that the application was tested by using the Android Emulator to insure that the code works properly without any errors. Finally the APK file is created to pass it to the next step.

4.3.2 Using Prototype

The APK file which was produced in the previous step has been installed in Android mobile phone (Samsung Galaxy ACE) and iSO mobile phone (iPhone 4S) that have 3.7 inch screen size for testing. During the system testing some notes have been taken to improve and enhance the next version of the prototype like the font size and the image size and so on.

4.3.3 Revising and Enhancing Prototype

In this step the notes that have been taken in the previous step have been considered and applied in the second version of the prototype. After that the APK file was created again to install and test it again until the prototype is fully satisfied.

4.4 System Screenshots and Description:

4.4.1 Logo Screen:

This is the first screen in the application. It shows the system name and logo with a sound background. This screen displayed for several seconds only then automatically disappears to show the main menu of the application (see Figure 4.12).

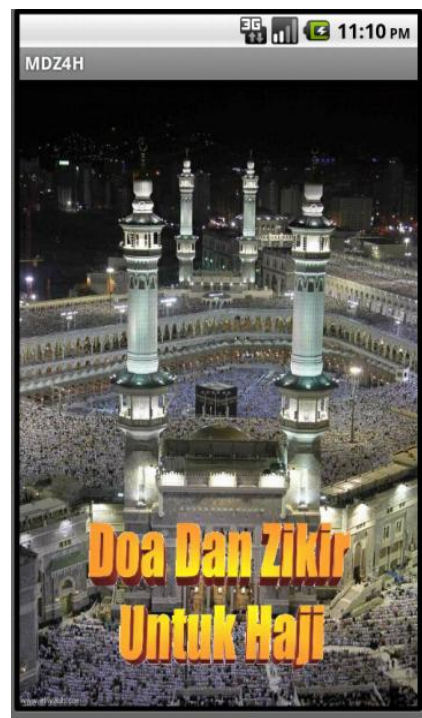


Figure 4.12: The Logo Screen of MDZ4H

4.4.2 Main Menu

The second screen in the system is the main menu which is the most important screen. It allows the user to navigate the system by clicking on the required ritual to be displayed. From the main menu, only the user can exit from the system. If he clicks the Exit button the system will display a message to confirm the exit request (see Figure 4.13).



Figure 4.13: The Main Menu of MDZ4H

4.4.3 Information Screen Without Sound File

This kind of screen contains extra information which may be needed by the pilgrims or instruction. This can help the pilgrims like what are the times and places of the acceptable supplications. There are three buttons at the bottom of each screen which allow the pilgrim to navigate the system and go through the system screens. The pilgrim can proceed to the next screen by clicking the forward button or he/she can

return back to the previous screen by clicking the back button. The pilgrim also can go to the main menu by clicking the home button (see Figure 4.14).



Figure 4.14: Information Screen in MDZ4H

4.4.4 One Page Screen With One Sound File Only

This type of screens contains an Arabic Dua and its translation to Malay language plus the recitation sound file. The pilgrim can play the sound and pause it any time and continue playing it again by clicking the speaker icon on the top of the screen. The pilgrim can also use the buttons (back, home, and forward). If the pilgrim clicks one of those buttons while the sound file is playing, the file sound will stop and proceed to the function related to that button to avoid overlapping voices (see Figure 4.15).



Figure 4.15: One Page Dua with One Sound File in MDZ4H

4.4.5 One Page Screen With Multi Sound Files

This kind of screens contains more than one sound file. The pilgrim is allowed to play one sound file only at a time. If he clicked the speaker icon of the playing Dua, the sound will be stopped. But if he/she clicked another speaker icon of another Dua while the sound is playing, the previous sound file will stop and then the selected Dua sound file will be played, (see Figure 4.16).

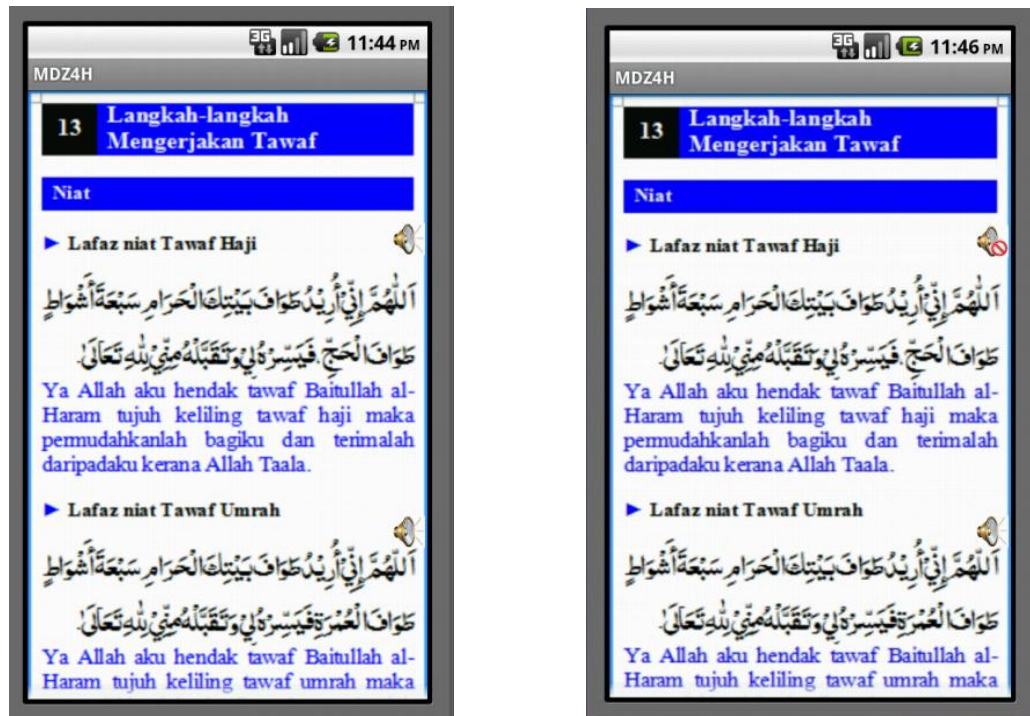


Figure 4.16: One Page Dua with Multi Sound Files in MDZ4H

4.5 Summary

The important screen in MDZ4H is the main menu which allows the users to navigate the system. As it has been shown in the system design and architecture, the pilgrim can reach to any screen in the system from the main menu except the screens that consist of multi pages where the pilgrim can reach the first page only and the other pages can be accessible by using the navigation buttons at the bottom of each screen. The prototyping approach was used to develop the proposed prototype in which the second and third steps were repeated around three times to fully satisfy with the prototype. Finally, some screenshots were displayed and described to show the deferent functions of the screens contents.

CHAPTER FIVE

SYSTEM TESTING AND EVALUATION

5.0 Introduction

This chapter aims to test and evaluate the developed prototype MDZ4H in terms of usability and usefulness. The most important fundamental method in usability evaluation is the usability test, because the system will be subjected to a real test by real users. The questions that are encoded representing the test moderator which will be given to the users who will use the system's functions (Nielsen, 2006).

5.1 The Evaluation Techniques

After the Mobile Dua and Zikr for Hajj (MDZ4H) has been developed, it has to go through the next step which is the evaluation stage. The purpose of this stage is to measure the usefulness level and the system usability. Three types of evaluation have been done and are as the follows:

5.1.1 The Contents Validation

The expert evaluation was conducted by scholars of Hajj to check the validity and reliability of the contents before they are used in the prototype. The evaluation

process will include the Arabic text and the Malay translation as well as the way of reciting the Arabic text.

The contents have been validated by Ustaz Mohamad Khadafi Hj Rofei. He is a lecturer at the UUM College of Arts and Sciences, Islamic Studies department and he is one of the qualified Hajj trainers for the Lembaga Tabung Haji of Malaysia.

5.1.2 The User Interface Satisfaction (Expert Evaluation)

The tentative MDZ4H has been delivered to some of UUM Malaysian IT or multimedia lecturers who have already performed Hajj and Umrah. Initially those lecturers were asked to use the MDZ4H, then they were asked to answer the questionnaires of the user interface satisfaction. The questionnaires basically involve measurements such as system capabilities, learning, screen, terminology and system information, and overall reaction to the software. The questionnaire was adapted from (Chin, Diehl, & Norman, 1988). The questionnaires are shown in Appendix A.

5.1.3 The Usefulness and Usability of the System (User Evaluation)

The tentative prototype has been installed in 30 Smartphone of 30 users. 15 of those users have been to Makkah to perform Hajj or Umrah and 15 other have not been to Makkah to perform Hajj or Umrah. User evaluation process will be conducted using questionnaires among the 30 users (Burgess, 2001; Nielsen, 2006). The questionnaires basically involve measurements such as *ease of use*, *usefulness*, and *outcome / future use*. The questionnaires were adapted from (Davis, 1989) and (Lewis, 1995). The questionnaires are shown in Appendix B.

5.2 Evaluation questionnaire

Many standard questionnaires are available to be adapted to come out with different questionnaires to evaluate the different aspects of this study. The user interface satisfaction was adapted from (Chin, et al., 1988) standard questionnaire. Furthermore, for the user evaluation, the standard questionnaires were adapted from (Davis, 1989) and (Lewis, 1995). These questionnaires consist of two sections. The first section involves questions asking about the demographic data and the classification of the study sample. The second section involves questions asking the participants about their perception relating to the application in terms of the usability dimensions (Usefulness, Ease of Use, and Outcome and Future Use).

5.3 Analysis of Data

SPSS version 18 has been used to analysis the data which has been collected through the questionnaires. In terms of expert evaluation, the Descriptive Statistics technique has been used to analyses the data while the T-test and Descriptive Statistics techniques have been used to analyse the data collected through the user evaluation questionnaires. The results of the data analysis are discussed in the next section.

5.4 Expert Evaluation (User Interface Satisfaction)

Descriptive Statistics technique has been used to analyse the data collected in this type of evaluation. The sample for this evaluation involved only 6 respondents. The criteria for choosing the respondents include; must be Malaysian or Indonesian, PhD holder in multimedia or IT and should have been to Makkah to perform Hajj or Umrah.

Table 5.1 shows the results of the Descriptive Statistics analysis of the collected data. If the item score is below 3, it indicates that the respondents satisfaction is very low and if the score is between 3 and 4, it indicates that the respondents are not sure but the if the score is above 4, it shows a high satisfaction of the respondents, whereas NA means that the respondent believes that the item is not applicable. The results show that the lowest value of mean was 4.3333 which is above 4. The results indicate that the user interfaces of the proposed application have received high satisfaction among the expert evaluators.

Table 5.1: Descriptive Statistics for All Items in User Interface Satisfaction questionnaire

No.	Item	N	Minimum	Maximum	Mean	Std. Deviation
OVERALL REACTION TO THE SOFTWARE						
Q1		6	4.00	6.00	5.3333	.81650
Q2		6	4.00	6.00	5.5000	.83666
Q3		6	5.00	6.00	5.3333	.51640
Q4		6	4.00	6.00	5.0000	.63246
Q5		6	3.00	5.00	4.3333	.81650
Q6		6	4.00	5.00	4.6667	.51640
SCREEN						
Q7	Reading characters on the screen	6	4.00	6.00	5.3333	.81650
Q8	Organization of information	6	4.00	6.00	5.1667	.75277
Q9	Sequence of screens	6	4.00	6.00	4.8333	.75277
TERMINOLOGY AND SYSTEM INFORMATION						
Q10	Use of terms throughout system	6	4.00	6.00	5.3333	.81650
Q11	Position of messages on screen	6	4.00	6.00	5.1667	.75277
LEARNING						
Q12	Learning to operate the system	6	5.00	6.00	5.6667	.51640
Q13	Exploring new features by trial and error	6	5.00	6.00	5.5000	.54772
Q14	Remembering names and use of commands	6	5.00	6.00	5.5000	.54772
Q15	Performing tasks is straightforward	6	5.00	6.00	5.5000	.54772
SYSTEM CAPABILITIES						
Q16	System speed	6	4.00	6.00	5.1667	.98319
Q17	System reliability	6	4.00	6.00	5.5000	.83666

Q18	System tends to be	5*	4.00	6.00	5.0000	.70711
Q19	Designed for all levels of users	6	4.00	6.00	4.6667	.81650

(*) one of the responders believes that this item is not applicable.

The results showed that the overall reactions towards the use of MDZ4H are that MDZ4H is wonderful, easy, satisfying, adequate, stimulating, and flexible. Furthermore, in term of reading characters on the screen, organization of information and screens' sequence, the results indicate that the application screens are very clear. In addition the results illustrate that the terminology and system information of the application is consistent. It is also shows that the software learning is easy in terms of learning to operate the system, exploring new features by trial and error, and remembering names and use of commands, also application is always straightforward in terms of performing tasks. In terms of system capabilities the results shows that the system speed is fast enough, the system reliability is reliable, the system tends to be quiet, and the system is designed for all levels of users.

5.5 User Evaluation

5.5.1 Sample Distribution

The results of data analysis indicate that in terms of gender of respondents 53.3% were males while 46.7% were females. On the other hand, in terms of respondents' education level, the results shows that 13.3% were undergraduate's holders (3.3% Diploma holders and 10.0% Bachelor Degree holders) while 86.6% were postgraduate's holders (43.3% Master holders and 43.3% Ph.D. holders). The respondents in this study have been categorized in to two, novice users who have not been to Makah to perform Hajj or Umrah, and expert users who have been to Makah

to perform Hajj or Umrah. The results shows that 50% of respondents were novice users (who have been not to Makah to perform Hajj or Umrah) while 50% of respondents were expert users (who have been to Makah to perform Hajj or Umrah).

In terms of the ability of Arabic text reading or in other words the ability of reading Qur'an (reading Arabic text does not mean understanding the meaning of the text) the results displays that 86.7% of respondents were able to read Arabic text while 13.3% were not able to read Arabic text at all. In addition, the results indicated that in term of the ability to read Arabic text among the respondents, 16.7% are excellent readers and 63.3% are good readers, and only 6.7% are bad readers plus 13.3% cannot read Arabic text at all. Table 5.2 shows the Demographic Data summary of the sample.

Table 5.2: The Demographic Data summary of the sample

Variable	Demographic Data	Frequency	Percentage %
Gender	Male	16	53.3
	Female	14	46.7
Age	Below 25 Years	2	6.7
	26 – 40 Years	20	66.7
	41 – 55 Years	8	26.7
	Over 55 Years	0	0
Education Level	Diploma	1	3.3
	Bachelor Degree	2	10.0
	Master	13	43.3
	Ph. D	13	43.3
Experience in Mobile Applications	Below 1 Year	0	0
	1 – 2 Years	4	13.3
	2 – 3 Years	5	16.7
	Over 3 Years	21	70

Variable	Demographic Data		Frequency		Percentage %	
Perform Hajj or Umrah	Yes	1 time	15	10	50	33.3
		2 times		2		6.7
		3 times		2		6.7
		Over 3 times		1		3.3
	No		15		50	
Ability of Arabic text reading	Yes	Excellent	26	5	86.7	16.7
		Good		19		63.3
		Bad		2		6.7
	No		4		13.3	

5.5.2 System Usability

There are three dimensions in the questionnaire to be measured which are Usefulness, Easy to use, and Outcome or Future use. The data collected from respondents' are analysed through descriptive statistics over all the questionnaire's dimensions. The mean values of all those dimensions show (see Table 5.3) a high satisfaction, since it is 4 and above which means that the proposed application is useful and easy to use. In addition the means values of each variable or item shows that the system has great usability if the score of all items is 4 or above. On the other hand if the score of all items is below 3, it indicates that the system has low usability. Table 5.4 shows the descriptive statistics for all items. While the minimum value of mean over all the items is equal to 4.3000 as shown in Table 5.4, the system has good usability. The users of MDZ4H show a high satisfaction in terms of usefulness and usability as well as the outcome/future use of the application.

Table 5. 3: General Outcome of Data

Dimensions	Mean
Usefulness	4.4000
Ease of use	4.4467
Outcome / Future use	4.4833

In general MDZ4H is useful and easy to use. It is has received high satisfaction among the users. It fulfils both the functional and non functional requirements of the users.

Table 5.4: Descriptive Statistics for All Items

Item	Mean	Std. Deviation
Perceived Usefulness		
1. Using MDZ4H would enable me to accomplish the reciting of doa and zikr for Hajj more quickly.	4.4333	.56832
2. Using MDZ4H would improve my performance in reciting the doa and zikr for Hajj	4.3000	.59596
3. Using MDZ4H would increase my productivity in reciting the doa and zikr for Hajj.	4.4000	.49827
4. Using MDZ4H would enhance my effectiveness in reciting the doa and zikr for Hajj.	4.3333	.54667
5. Using MDZ4H would make it easier to recite the doa and zikr for Hajj	4.5333	.50742
6. I would find MDZ4H useful in every Hajj or Umrah task.	4.5333	.57135
Perceived Ease Of Use		
7. Learning to operate MDZ4H would be easy for me.	4.4333	.56832
8. I would find it easy to get MDZ4H to do what I want it to do.	4.5000	.57235
9. My interaction with MDZ4H would be clear and understandable.	4.4333	.62606
10. I would find MDZ4H to be flexible to interact with.	4.4000	.62146

11. It would be easy for me to become skilful at using the MDZ4H.	4.4667	.68145
12. I would find MDZ4H easy to use.	4.5667	.56832
Outcome / Future Use		
13. I was able to complete the recitation of the doa and zikr for Hajj quickly using MDZ4H.	4.4667	.62881
14. I could effectively complete the recitation of the doa and zikr for Hajj using MDZ4H.	4.4667	.50742
15. I was able to efficiently complete the recitation of the doa and zikr for Hajj using MDZ4H.	4.4667	.57135
16. I believe I could become productive quickly in reciting the doa and zikr for Hajj using MDZ4H.	4.5333	.57135
17. From my current experience with using MDZ4H, I think I would use it regularly.	4.4000	.67466

5.5.3 Comparing groups of users

The users are divided into two groups (expert and novice). The first group is the respondents who have been to Makkah to perform Hajj or Umrah which is named as expert while the second group is those who have not been to Mekkah to perform Hajj or Umrah which is named as novice. The independent samples T-test has been used to perform the comparison between the two groups. The significant value of T-test should be less than 0.05 which means that a significant difference between the two groups (Coakes & Steed, 2009). The results of T-test show that there are a significant difference between the novice users and the expert users for all the usability different dimensions (Usefulness, Ease of Use, and Outcome and Future Use). Since the value of significant in T-test is .000 (see table 5.5).

Table 5.5: Novice users VS. Expert users

Measure	Group	N	Mean	Std. Deviation	T	df	Sig
Usefulness	Novice	15	4.4533	.4373	39.441	14	.000
	Expert	15	4.3467	.4688	35.907	14	.000
Ease of Use	Novice	15	4.5467	.4240	41.527	14	.000
	Expert	15	4.3467	.5476	30.745	14	.000
Outcome / Future Use	Novice	15	4.5500	.3919	44.968	14	.000
	Expert	15	4.4167	.4880	35.056	14	.000

5.6 Summary

After the proposed application has been developed, the application has been delivered to the expert and users to evaluate it. The evaluation results show that the application fulfils the functional and non functional requirements of the application developers and users. The results show that the application interface is fully satisfied. The application also won the desirability of users in terms of Usefulness, Ease of Use, and Outcome and Future Use. Some view of points of experts and users were considered to improve that application after the evaluation process.

CHAPTER SIX

DISCUSSION, CONCLUSION AND FUTURE WORKS

6.0 Introduction

This study is about the utilisation of smart phone for dua and zikr for Hajj. The main goal of this work is to develop a mobile Dua and Zikr application to help the pilgrims to recite them while performing the Hajj or Umrah. In this chapter the finding and results of the whole research will be reviewed briefly. The application consists of the text and audio files of the recited Dua and Zikr in Arabic as well as the translation in Malay. It is hoped that the developed application will be able to help the pilgrims to easily and conveniently recite the Dua and Zikr towards achieving Hajj Mabrur. Therefore the results discussion will be based on the objectives of the research. This chapter will also involve the application limitations and the future works related to this study.

6.1 Discussion

As mentioned in the first chapter, this study made a contribution to the design and development of mobile based application named Mobile Dua and Zikr for Hajj (MDZ4H). The main objective of this study is to design and develop an Android

mobile application which can help pilgrims to recite Dua and Zikr for Hajj. In order to realize the main goal of this study, the research objectives are as follows:

Research objective 1:

To identify the requirements of MDZ4H application; in chapter four the results are discussed.

Research objective 2:

To evaluate MDZ4H among experts in terms of contents validity; in chapter five the results are discussed.

Research objective 3:

To develop a prototype MDZ4H; in chapter four the results are discussed.

Research objective 4:

To evaluate MDZ4H among users in terms of usability; in chapter five the results are discussed.

A lot of work has been done in order to achieve those objectives. The first objective is addressed in Chapter 4. By using direct interview plus the literature survey, the required information related to user requirements were gathered. In addition reviewing the latest relevant research outcome helped in identifying the functional and non functional requirements of the application.

The second objective is related to the contents validity. The prototype contents have been delivered by the supervisor who is one of the experts in this filed. In addition in order to achieve this objective, the contents was then delivered to another

expert to check the validity, reliability, and the sequence of the contents before it is used and included in the application. The validation process includes the Arabic text and the Malay translation as well as the way of reciting the Arabic text.

The third objective is the important one. It is the main objective of this study. In order to achieve that objective the prototyping approach has been used as a development methodology. The prototyping approach involves three steps which include developing initial prototype, using prototype, and revising and enhancing prototype. Developing the initial version of MDZ4H consists of sub steps which are information gathering and programming.

The last objective of this study is MDZ4H usability evaluation. Two types of evaluation have been conducted on MDZ4H. The first one is the User Interface Satisfaction or the Expert Evaluation (in this study expert is a Ph.D lecturer who is Malay, IT specialist or related to IT, and have been to Makkah to performed Hajj or Umrah). In this type of evaluation 6 respondents were invited to use the application and involved to measure the user interface of the application. The results show that the user interfaces of MDZ4H have been received with high satisfaction among the experts.

The second type of evaluation is the usability or user evaluation. The tentative application has been installed in 30 Smartphone of 30 users. 15 of those users have been to Makkah to perform Hajj or Umrah and 15 other users have not been to Makkah to perform Hajj or Umrah. User evaluation process was conducted using a set of questionnaires among 30 users. The questionnaires basically involve measurements such as ease of use, usefulness, and outcome / future use. The results indicate that the users of MDZ4H show a high satisfaction in terms of usefulness and usability as well as the outcome/future use of the application.

6.2 The Application's Limitations

While the experts and users evaluated the application, they also provided some suggestions to be considered in enhancing the application which include;

- The application was developed for a specific type of mobile phones and mobile devices (3.7 inch screen size), it should also cater for other sizes of mobile devices.
- The main menu is too long containing too many Duas.
- Fixed font and image size, no zoom in and zoom out features.
- Search functions for a specific Dua and bookmark feature are not available.
- The function buttons (home, back, and forward) should be accessible at the top of screen as well.
- The feature of highlighting the words spoken during the recitation does not exist.

6.3 Future Works

- The feature of highlighting the words spoken during the recitation will be provided.
- The zoom feature will be provided and ability of minimize and maximize the font size.

- The search and bookmark features will be provided.
- The main menu will be categorized in such a way by grouping the related Duas and Zikr based on the places where the rituals are performed.
- The function buttons will be provided for easy access.
- Multi languages of the application and the Duas translation will be provided.

6.4 Conclusion

Mobile Dua and Zikr for Hajj (MDZ4H) have been developed to help pilgrims to recite the required Dua and Zikr while they are performing Hajj or Umrah rituals. The application was evaluated and the results confirm that it is useful for users and it is capable to help them to make their Dua and Zikr recitation easier regardless of the ability of reading the Arabic. It is hoped that the findings of this study will encourage Hajj agency to incorporate MDZ4H into the existing services and approaches in order to improve and enhance the pilgrims' Hajj or Umrah performance.

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APPENDIX A

QUESTIONNAIRE FOR

USER INTERFACE SATISFACTION

Questionnaire for User Interface Satisfaction Of Mobile Dua and Zikr for Hajj (MDZ4H)

Please rate your satisfaction with the system.

- Try to respond to all the items.
- For items that are not applicable, use: **NA**
- Add a comment about an item in 1-6.

OVERALL REACTION TO THE SOFTWARE		1	2	3	4	5	6		NA
1.	terrible	☐	☐	☐	☐	☐	☐	wonderf	☐
2.	difficult	☐	☐	☐	☐	☐	☐	easy	☐
3.	frustratin	☐	☐	☐	☐	☐	☐	satisfyin	☐
4.	inadequat	☐	☐	☐	☐	☐	☐	adequate	☐
5.	dull	☐	☐	☐	☐	☐	☐	stimulati	☐
6.	rigid	☐	☐	☐	☐	☐	☐	flexible	☐
SCREEN		1	2	3	4	5	6		NA
7. Reading characters on the screen	hard	☐	☐	☐	☐	☐	☐	very	☐
8. Organization of information	confusing	☐	☐	☐	☐	☐	☐	very	☐
9. Sequence of screens	confusing	☐	☐	☐	☐	☐	☐	very	☐
TERMINOLOGY AND SYSTEM INFORMATION									NA
10. Use of terms throughout system	inconsist	☐	☐	☐	☐	☐	☐	consiste	☐
11. Position of messages on screen	inconsist	☐	☐	☐	☐	☐	☐	consiste	☐
LEARNING		1	2	3	4	5	6		NA
12. Learning to operate the system	difficult	☐	☐	☐	☐	☐	☐	easy	☐
13. Exploring new features by trial and error	difficult	☐	☐	☐	☐	☐	☐	easy	☐
14. Remembering names and use of commands	difficult	☐	☐	☐	☐	☐	☐	easy	☐
15. Performing tasks is straightforward	never	☐	☐	☐	☐	☐	☐	always	☐
SYSTEM CAPABILITIES		1	2	3	4	5	6		NA
16. System speed	too slow	☐	☐	☐	☐	☐	☐	fast	☐
17. System reliability	unreliabl	☐	☐	☐	☐	☐	☐	reliable	☐
18. System tends to be	noisy	☐	☐	☐	☐	☐	☐	quiet	☐
19. Designed for all levels of users	never	☐	☐	☐	☐	☐	☐	always	☐

List the most negative aspect(s):	List the most positive aspect(s):
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Thank you very much for your cooperation

APPENDIX B

QUESTIONNAIRE FOR

APPLICATIONS USABILITY

QUESTIONNAIRE

System to be rated:

Mobile Dua and Zikr for Hajj (MDZ4H).

Objective:

Obtain your view on the evaluation of the MDZ4H.

Introduction:

This questionnaire consists of two sections:

- General Information
- Mobile Dua and Zikr for Hajj (MDZ4H) Evaluation.

Please answer **ALL** questions from each segment.

1) General Information

This segment is about your background information. *Please fill up the blanks and mark [✓] where appropriate.*

1. Gender: ☐ Male ☐ Female

2. Age: ☐ 10-25 Years. ☐ 26-40 Years.

☐ 41-55 Years. ☐ Over 55 Years.

3. Education background

☐ Diploma ☐ Degree ☐ Master ☐ Ph.D.

4. Your mobile applications experience _____ months.

5. Have you been to Makkah to perform Hajj or Umrah? ☐ Yes ☐ No.

 If yes how many times _____ .

6. Can you read Arabic? ☐ Yes ☐ No.

 If yes please rate you Arabic reading level ☐ Excellent ☐ Good ☐ Bad.

2) Mobile Dua and Zikr for Hajj Prototype Evaluation

This segment is intended to obtain your view on the Mobile Dua and Zikr for Hajj prototype. Please check or shade the answer to the following questions.

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Perceived Usefulness	1	2	3	4	5
20. Using MDZ4H would enable me to accomplish the reciting of doa and zikr for Hajj more quickly.	☐	☐	☐	☐	☐
21. Using MDZ4H would improve my performance in reciting the doa and zikr for Hajj.	☐	☐	☐	☐	☐
22. Using MDZ4H would increase my productivity in reciting the doa and zikr for Hajj.	☐	☐	☐	☐	☐
23. Using MDZ4H would enhance my effectiveness in reciting the doa and zikr for Hajj.	☐	☐	☐	☐	☐
24. Using MDZ4H would make it easier to recite the doa and zikr for Hajj	☐	☐	☐	☐	☐
25. I would find MDZ4H useful in every Hajj or Umrah task.	☐	☐	☐	☐	☐
Perceived Ease Of Use	1	2	3	4	5
26. Learning to operate MDZ4H would be easy for me.	☐	☐	☐	☐	☐
27. I would find it easy to get MDZ4H to do what I want it to do.	☐	☐	☐	☐	☐
28. My interaction with MDZ4H would be clear and understandable.	☐	☐	☐	☐	☐
29. I would find MDZ4H to be flexible to interact with.	☐	☐	☐	☐	☐
30. It would be easy for me to become skilful at using the MDZ4H.	☐	☐	☐	☐	☐
31. I would find MDZ4H easy to use.	☐	☐	☐	☐	☐
Outcome / Future Use	1	2	3	4	5
32. I was able to complete the recitation of the doa and zikr for Hajj quickly using MDZ4H.	☐	☐	☐	☐	☐
33. I could effectively complete the recitation of the doa and zikr for Hajj using MDZ4H.	☐	☐	☐	☐	☐
34. I was able to efficiently complete the recitation of the doa and zikr for Hajj using MDZ4H.	☐	☐	☐	☐	☐
35. I believe I could become productive quickly in reciting the doa and zikr for Hajj using MDZ4H.	☐	☐	☐	☐	☐
36. From my current experience with using MDZ4H, I think I would use it regularly.	☐	☐	☐	☐	☐