

# Chapter 23

## Development of Mobile Applications for Monitoring and Managing Hajj and Umrah Pilgrimage



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**Abstract** Performing Hajj or Umrah is an Islamic pilgrimage ritual and the fifth essential pillar of Islam. Preparation to perform Hajj or Umrah is very vital before and in the middle of traveling to Mecca including learning all the rituals, obligatory, and rules [1]. The existing mobile applications in the market that are related to Hajj or Umrah are less interactive, too simple, have limitations and do not offer smart features to assist the user, and do not meet the target users' demand. Hence, the proposed project, Umrah and Hajj application are used to provide pilgrims and “*mutawwif*” with guidance and information about the Hajj or Umrah pilgrimage. The “*mutawwif*” can utilize the features to manage his group while pilgrims can learn and see all the mandatory and obligatory rituals to be performed at various locations. The other features are the global positioning system (GPS) tracking system and the Lilypad Tawaf counter that can help the pilgrims to track the number of completed rounds when the Tawaf is complete. The development of this mobile application used the Android Studio software and JAVA programming language and is exclusively for the Android platform only. Moreover, the Android platform for the mobile application is cost-effective and the open-source idea is very popular nowadays for all generations [2]. This application also can help the pilgrims of Android device users to learn, understand, and perform the Hajj and Umrah ritual perfectly. The methodology used in this application is the ADDIE method that contains 5 phases, namely analysis, design, development, implementation, and testing.

**Keywords** Mobile applications · Global positioning system · Lilypad Tawaf counter · Tracking system · Mapping system

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## 23.1 Introduction

In today's era of globalization, mobile applications referred to an application software designed to run on a mobile device, such as a smartphone or laptop. A mobile application is known as an app, web app, online app, or smartphone app. The number of pilgrims that traveled to Mecca from around the world keeps increasing every year. In the year 2018, the quota for Malaysian pilgrims was 30,200 [3] from 2.4 million pilgrims visiting Mecca [4]. The pilgrims do not have to memorize all the prayers for all the rituals, and they can refer to the reference books or "*mutawwif*" throughout performing the duty.

This application aims to create an android platform to build an application for the mobile application. So, besides asking people or referring to the books in a very crowded place, the pilgrims can utilize their mobile devices to review and refresh the upcoming rituals. There are two main features in this application, which are the global positioning system (GPS) tracking system and a pedometer that can help the pilgrims to track the number of completed rounds when the Tawaf is completed. Besides, there is interactive information provided for the user's reference before or during performing the ritual. By having an application that can be accessed from mobile devices, the preparation for the pilgrims and performing it will be effective and enjoyable.

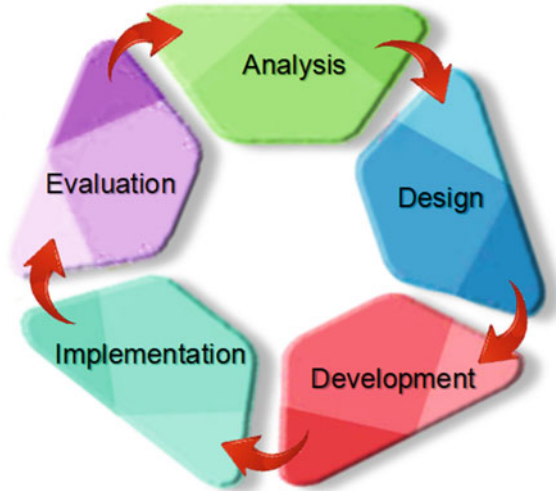
## 23.2 Methodology

This section will discuss the methodology used to develop the application. The ADDIE methodology contains 5 phases such as analysis, design, development, implementation, and evaluation as shown in Fig. 23.1. More information about each phase of this model, hardware, and software will be explained in this chapter.

### 23.2.1 Analysis Phase

At this stage, it involves several determining processes and identifying problems in the process of developing the mobile Umrah and Hajj application. Once the problem is identified, an analytical process will be undertaken to find out what factors that cause the problem. This process involves various aspects including analysis of Umrah or Hajj pilgrims, learning environment, and identify the aims of creating this application. The requirements to complete the project are collected from various sources which include the online sources, document and report analysis, or other similar applications from previous Android application developers.

**Fig. 23.1** 5 phases of the ADDIE model



### 23.2.2 Design Phase

During this phase, identify the design of the system and develop a storyboard based on the functionalities that will be built. The data or requirement obtained during the analysis phase is transformed into the design. The storyboard is designed using the Photopea software to show the look and feel of the application that will be developed [5]. Figure 23.2 shows the design of the home page of Umrah and Hajj mobile application.

### 23.2.3 Development Phase

Building a real Umrah and Hajj mobile application was done by using the Android Studio software by the program with JAVA language with all the elements of multimedia selected based on the requirements of this application. The output in the design phase will be input to the development phase and each development will be tested to ensure that it is consistent and effective. Figure 23.3 shows the development of the Islamic video page. VideoView has been implemented on this page to display or load a video file from various sources. Besides, VideoView allows the user to play, pause, rewind, fast-forward, or back to specific paces in the video. Moreover, listview is a vertically scrollable list below the VideoView that displays the title of the video. When the user clicks the video title in the listview, the selected video will play at VideoView. This allows the apps to minimize the content on one page and make it simple and interactive to use.

Fig. 23.2 Home page

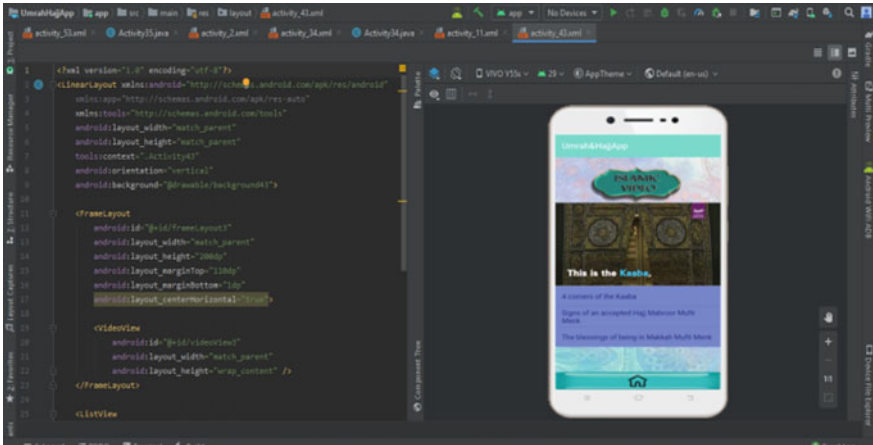
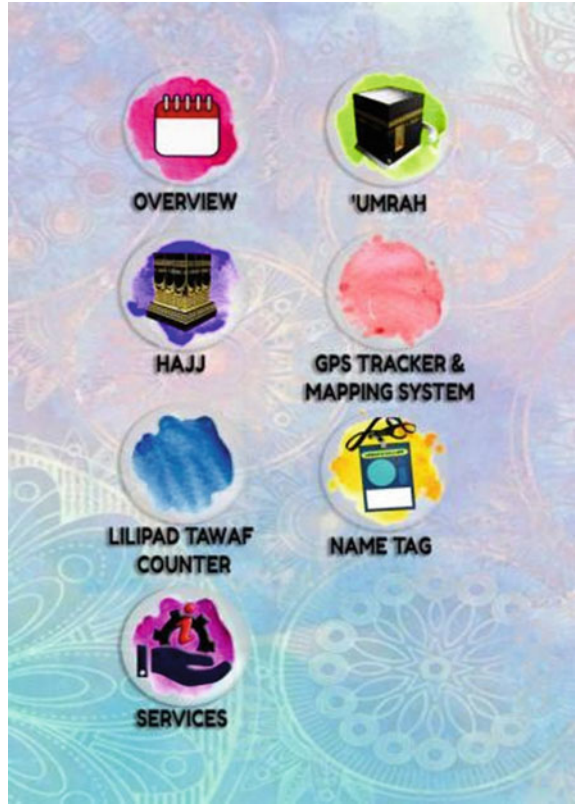


Fig. 23.3 Development of Islamic video page

**Fig. 23.4** Implementation of Tawaf page



### 23.2.4 Implementation Phase

There are two parts in this phase which are the test implementation phase and the final implementation phase. The implementation phase is a testing phase using the Nox emulator. Besides, the final implementation phase will be tested by the supervisor. This phase is important to detect the weaknesses and unobserved errors during the authoring process. The implementation phase aims to demonstrate that the mobile application meets its requirements. Figure 23.4 shows the implementation of the Tawaf page using the Nox emulator. This is important to test the audio and video play smoothly and consistent with on-time frame playback [6].

### 23.2.5 Evaluation

This phase aims to detect the effectiveness and efficiency of the instruction for the Umrah and Hajj mobile application. This assessment involves the process of

obtaining feedback from users on the content, image, audio, video, animation, and interfaces contained in the application.

### 23.3 Results and Discussion

This chapter discusses the results by program the Java programming language in the Android Studio software. The result of the application is installed in the smartphone and the application is tested in the real environment using the target device which is the Android device. The device used is a VIVO Y55s smartphone with a 5.2-inch screen size and resolution of  $720 \times 1280$  pixels.

Figure 23.5 shows the opening page and Fig. 23.6 shows the main page of Umrah and Hajj mobile application. The user can see the objective of this project on the overview page. There is also information about Umrah and Hajj pilgrimage with an interactive device like video and sound for their guidance. Besides, the two main features are GPS tracker and Lilypad Tawaf counter that can help the pilgrims to track the number of completed rounds when the Tawaf is completed. The nametag page contains a pilgrim's information like name, operating company name, country, and emergency number. This information is stored in the Google Firebase Storage

Fig. 23.5 Opening page



Fig. 23.6 Main page



[7]. Lastly, the services page contains information about the medical center, visiting Madinah, post office, Islamic video, Friday prayer, mustajab place, and Al-Quran.

Figure 23.7 shows the Tawaf of the Umrah page. On this page, the user can see the video by clicking the play button. The video can be started and stopped at a specific time. The user can hear the audio by clicking the sound icon. The audio plays the Arabic language and the English language. This interactive device can help the user recite the intention and Talbiyah accurately. Lastly, the home button is connected to the Umrah and Hajj mobile application main page.

Figure 23.8 shows the GPS tracker and mapping system to track missing pilgrims and this is a system that can track the position or location of the object at the specific place that had been decided on the earth space.

Figure 23.9 shows the Lilypad Tawaf counter that helps the pilgrims to track the number of completed rounds when the Tawaf is complete by using a wearable Arduino or known as Lilypad Arduino. The pilgrims should “ON” the Bluetooth connection at the wearable Lilypad Arduino and connect with the Umrah and Hajj mobile application by clicking the scan Bluetooth button. Then, when the pilgrims click the selected Bluetooth it will link to Fig. 23.10 Lilypad Tawaf counter information page that can notify pilgrims on the Tawaf cycle counting by showing the steps and distance.

Fig. 23.7 Tawaf page

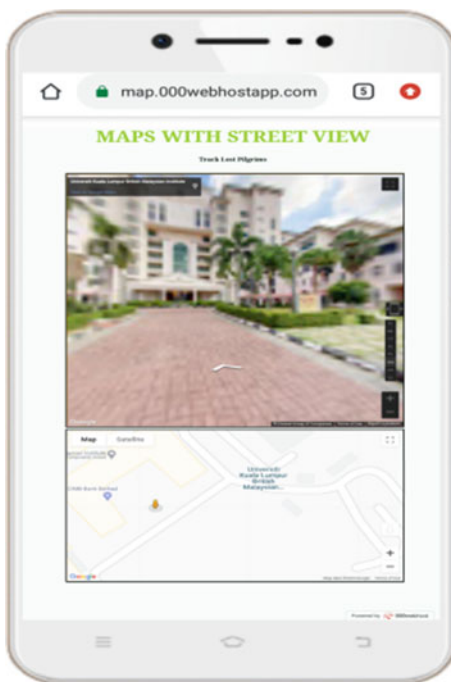


### 23.4 Conclusion

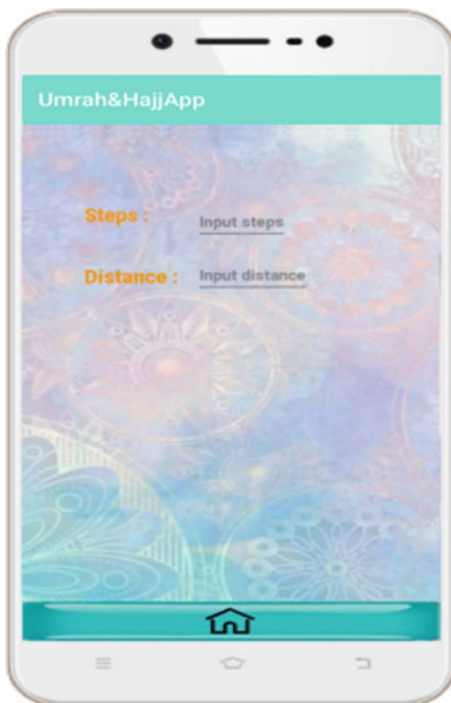
The objective of developing the Umrah and Hajj mobile application is achieved by developing and implementing a basic platform of a mobile application using Android Studio for Muslims on pilgrimage. This project was also successful to integrate the GPS tracking system and Lilypad Tawaf counter. The recommendations for this mobile application are to add more information and features like prayer times, tasbih, hadith, and others. Besides, Umrah and Hajj mobile application should link the emergency contact number in the nametag page to a clickable link that opens a dial dialog in the smartphone in case of an emergency. In the future, an enhancement of this application can be developed to make it compatible with iOS or Apple phones.



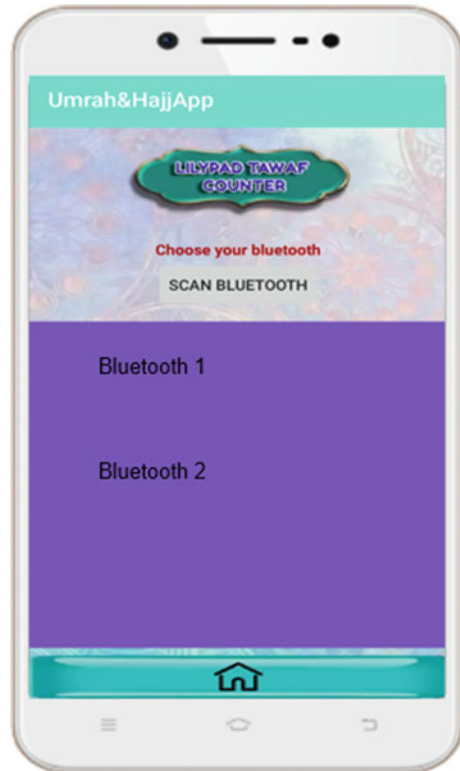
**Fig. 23.8** GPS tracker and mapping system page



**Fig. 23.9** Lilypad Tawaf counter page



**Fig. 23.10** Lilypad Tawaf counter information page



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