MYMARHALAH: A SMART NAVIGATION MOBILE APPLICATION FOR MUSAFIR IN MALAYSIA USING GIS AND RELATED TECHNOLOGIES

Adnan Ismail[1], Mohamad Faisal Mohamed Yusof[1], Norafiza Saleha Sahlan[1], Samsuddin Omar[1], Siti Nordiana Mohd Rabai[1], Syahidah Fariza Moh Esa[1], Abdul Ghaffar Surip[2], Khairul Anuar Yazid[2], Nur Amie Ismail[2], Ridzuan Awang[2]

[1]Malaysian Space Agency (MYSA),
Ministry of Science, Technology and Innovation (MOSTI),
No.13 Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia,
Email: adnan@mysa.gov.my, faisal@mysa.gov.my, fiza@mysa.gov.my, samsuddin@mysa.gov.my, diana@mysa.gov.my, syahidah@mysa.gov.my

[2]Jabatan Kemajuan Islam Malaysia,
Aras 4, Blok A, Kompleks Islam Putrajaya,
Pusat Pentadbiran Kerajaan Persekutuan, Presint 3, 62100 Putrajaya, Malaysia
Email: abdulghaffar@islam.gov.my, khairulanuar@islam.gov.my, nuramie@islam.gov.my, ridzuan@ns.gov.my

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ABSTRACT: Smartphone penetration in Malaysia has exceeded 88% as share of the population and is projected to continue to increase over the coming years. Rapid technological advances open up opportunities to develop Geographical Information System (GIS) based mobile applications using embedded features inherent in mobile devices as well as application framework components and APIs. The evolution in Global Positioning System (GPS) technology has improved the accessibility and navigation accuracy in mobile applications. Islam has set some specific rukhsah (concession) concepts that can be applied by musafir (muslim travellers) including prayers of jama' and qasar (combine and shorten) if the journey exceeds two (2) marhalah which has been decided as 81km by Malaysian Islamic Authority. Currently there aren't any well-defined application available to assist them in fulfilling their obligation in Malaysia. myMarhalah is a mobile GIS application developed to facilitate musafir with their journey by displaying navigation routes, calculating travelled distances, identifying permissible leniency for prayers, locating nearby mosques, showing prayer times and listing the answers for frequently asked questions on related issues. The application uses open source native cross platform development that supports agile software development life cycle (SDLC) and allows DevOps to develop full native application for iOS and android simultaneously. This saves a lot of time in maintenance and upgrades. Equipped with artificial intelligence and machine learning technologies, myMarhalah provides multiple route options to users and dynamically changes active navigation based on user's decision. Integration with mosque location allows users to navigate to the mosque of their choice in the middle of the journey to perform prayer and navigate back to the final destination seamlessly. The application also adopted big data technology in its search and query functions for better user experience (UX). With the absence of distinct application for musafir in Malaysia, myMarhalah is the first one-stop mobile GIS application that provides convenient solution for them to implement the concession concept in their journey. It is also in line with the Malaysian Government's Digitalisation Strategy to improve public service delivery using emerging technologies.

1.0 INTRODUCTION

Internet of Things (IoT) is triggering expeditious development in mobile applications. As most of the devices around us are interconnected, vast amount of data can be channeled, processed and displayed interactively in our mobile phones. People are relying on mobile applications in every aspects of life. The number of mobile phone users in Malaysia was estimated to reach 29 million in 2021 (Statista, 2021). This shows that there is a global positive impact where the whole society can be facilitated in many areas using mobile applications, such as communications, leisure, multimedia, productivity, utilities and travel (Rashedul, 2010).

Mobile application has long been used in travel as it greatly improves efficiency and safety. According to Saidi & Judith (2016), travellers can benefit from mobile applications especially those related to route planning, navigation, ridesharing/carpooling, parking, traffic safety, and travel information. With the evolution of embedded technologies in mobile phones, in addition to available application framework components and APIs, navigation mobile applications can be further elaborated and customised. myMarhalah is a GIS based mobile application developed to facilitate Muslim travellers in fulfilling their obligation during their journey with ease and tranquility.

1.1 Concession in Prayers for Muslim Travelers

One of Islamic key principles is to ease people's life or eliminate the difficulty (Mahmudin, 2018). Therefore, concession concepts known as rukhsah are allowed to lightened act of worship, transactional, relationship and other matters. Musafir is addressed to the person who travels to a destination that is determined with the distance exceeding two (2) marhalah, has a purpose and with good intentions (Wan, 2018). The Malaysian Islamic Authority has decided to define two (2) marhalah as 81km (Umar, 2019). One of the rukhsah permissible for musafir that is addressed by myMarhalah is the leniency in performing their prayers.

Musafir are allowed to merge two obligatory prayers to be performed at the same time (jama') and abbreviate four rakaah of prayer into two (qasar). However, in order to practice this leniency, they need ensure that they are out of their permanent resident area (qaryah) boundary. The main concerns faced by musafir are to identify the qaryah boundary and whether their travelled distance is sufficient and legitimate for them to perform the jama' or qasar prayer.

myMarhalah is designed to resolve the issues by accurately measures the distance between the origin and the destination and most importantly notifies the user when they have entered or left the qaryah during their journey. This will allow musafir to plan ahead and become aware of the starting and last point where they are allowed for rukhsah in their prayers. Beside standard navigational functionalities, myMarhalah alerts the users with location of nearby mosques along their travelled route and prayer times if they decide to stop and perform their prayers. Smart navigation allowed dynamic change of routes as and when required by the users without interfering with ongoing routing session. As the first mobile application tailored to assist musafir in the determination of qaryah boundary and eases the implementation of concession concept, myMarhalah promotes digitalisation in the society and proves that technological advancement is beneficial, as well as revolutionising.

2.0 FRAMEWORK

Considering majority of mobile phone users in Malaysia are using either iOS or android, myMarhalah exploited cross platform feature in react native for development framework. Using JavaScript universal programming language, the framework enables DevOps to develop full native application for iOS and android simultaneously. In addition, the maintenance and updates for the application can also be done at the same time seamlessly. React native also shows great performance as the programming language is optimised for mobile devices by taking advantage of the utilisation of graphics processing unit (GPU) instead of overburdening the central processing unit (CPU). As an open sourced framework, it is free, constantly updated and community driven giving the opportunity to the developers to explore, share their knowledge and expertise.

myMarhalah uses android studio and Xcode as its integrated development environment (IDE) for android and iOS operating system respectively. They are chosen because of their functionality that enables DevOps to load the system faster and instantly view all changes made in the system. Firebase database is used for login module to enable single sign on using users' Google account. The application uses GPS to identify real-time location of the user, GIS to suggest routing and multiple APIs for smart navigation, identification and notifications. Several tools in Google Map API were applied in myMarhalah for background map display, accurate positioning, as well as distance measurement. Mosque API and Prayer Time widget provides the functionality to locate nearby mosque and alert the users of local prayer times. The design also adopted big data technology to enable users to search for places and equipped with artificial intelligence and machine learning capabilities for dynamic routing and navigation.
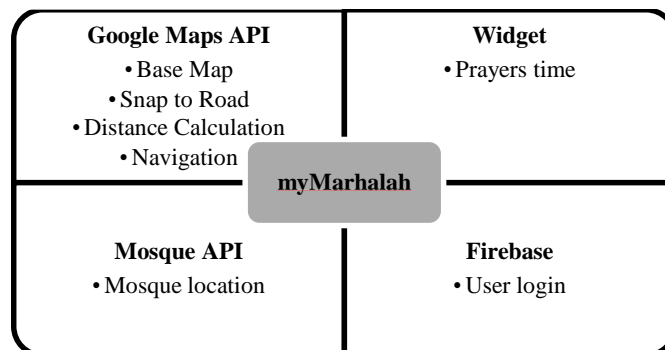

Figure 1: Concept Design of mymarhalah Application

3.0 METHODOLOGY

One very important thing to consider when developing mobile application is the rapidly changing mobile operating system's version. Thus, mobile applications need to be updated regularly to catch up and maintain its relevance. Highly volatile requirements require adaptive software development methods (Vaishnavi, 2016). To ensure risk minimisation and quick wins, agile development methodology is used in the development of myMarhalah. The application is divided into small modules to lower the possibilities of errors and make it easier to troubleshoot; and several modules are developed in parallel to accelerate development time. Prototypes with minimum viable features are built and demonstrated to the stakeholders to ensure the objective of the development is fulfilled. Improvements and additional features are included in later versions. This ensures bug-free, fast delivery as supported by agile (Harleen, 2014).

The application is designed based on two main modules which are departure module and return trip module. The system flow of the application is summarised in Figure 2 and Figure 3.
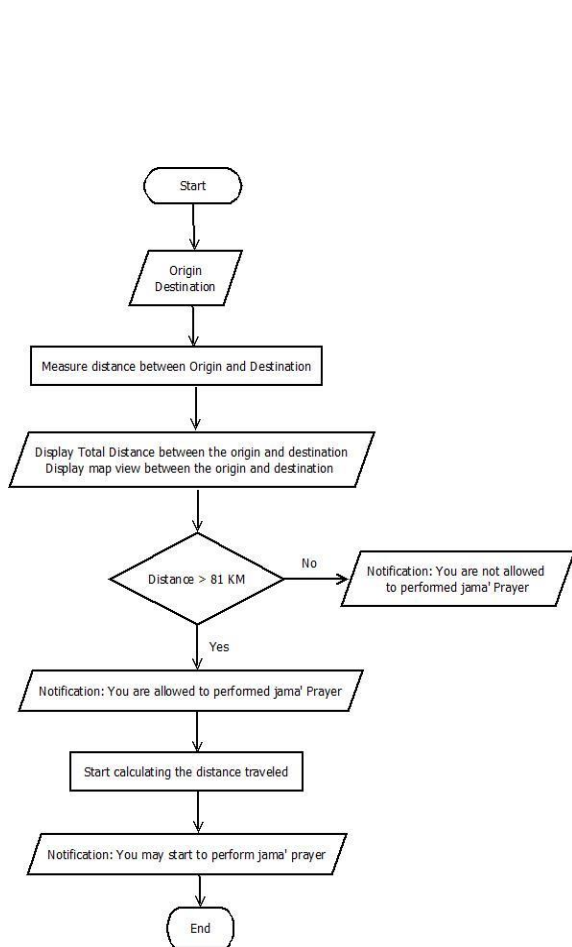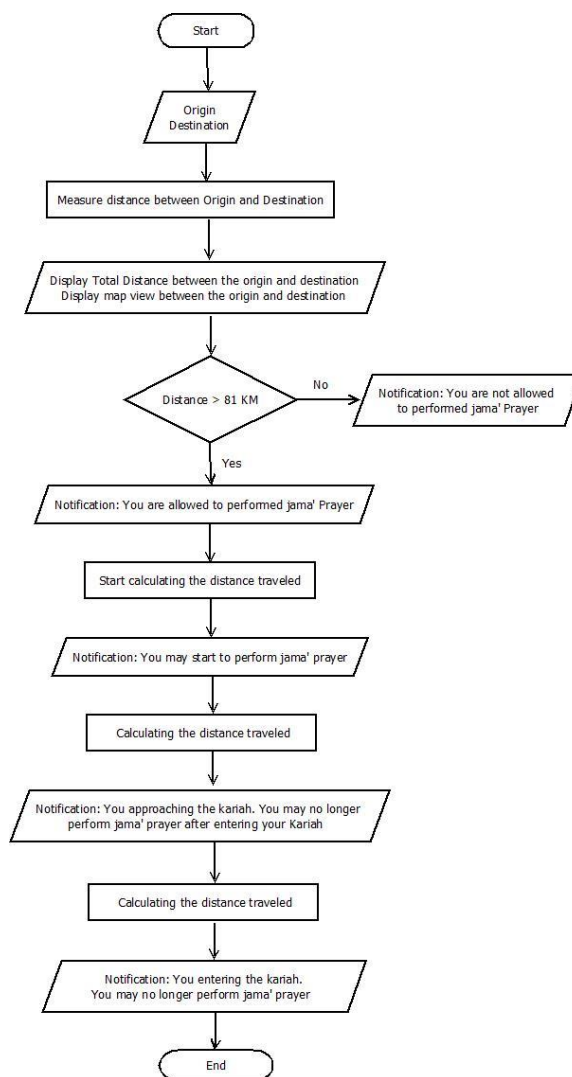

Figure 2: Departure Module

Figure 3: Return Trip Module

4.0 MODULES

myMarhalah is classified into few modules. The modules are designed according to their functionalities as follows.

a) Login
The user can log into the application using their existing google account. This provides single sign on facility as the user do not have to create another account to use the application.
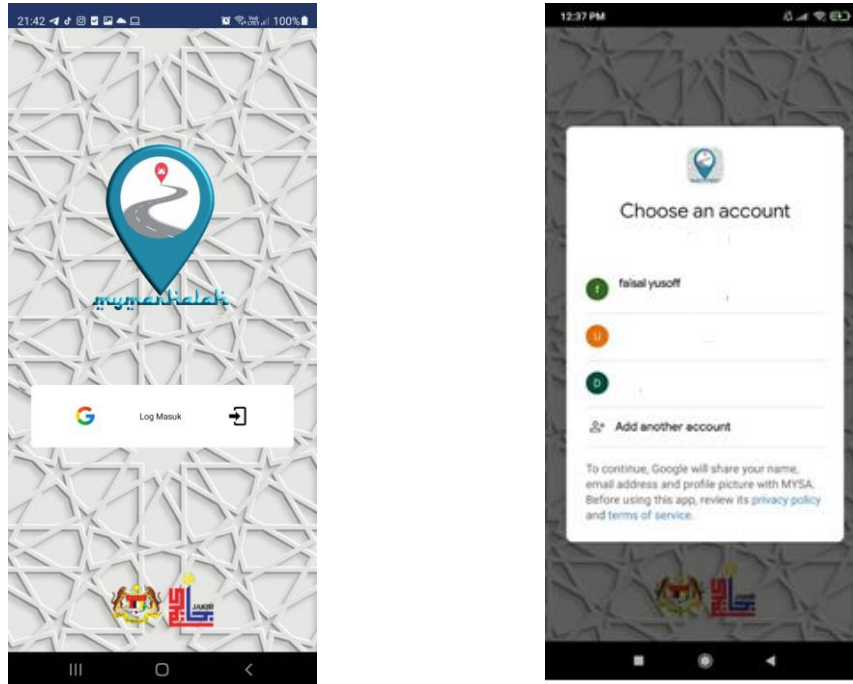

Figure 4: Login Function Using Google Account

b) Search and Determine Origin and Destination
There are a few ways this function can be performed. Users can key in the exact name of the place of their origin and destination and the application will search for the place. It will also automatically suggest known places in the database if the keyed in places are not found. Otherwise, user can request for the application to detect their current coordinate location using GPS for more accurate result. The functions are illustrated in the figure below.
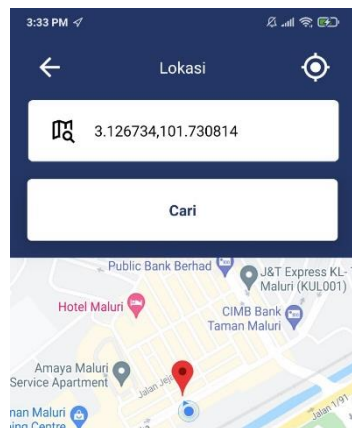

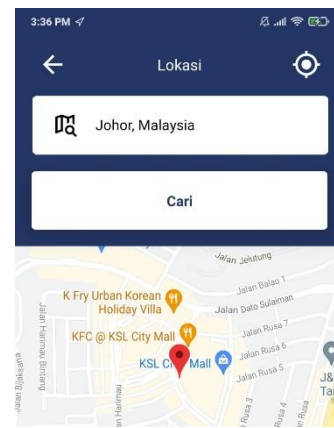Figure 5: Detecting User's
Current Location

Figure 6: Destination Suggested
Based On User Input

c) Distance Measurement and Qaryah Boundary Identification

The application will calculate and display the distance from origin to the destination keyed in by users. The two important features of the application are performed by this module, which is identifying the perimeter boundary for qaryah and determining whether the total distance travelled is allowed for concession in prayers.

d) Tracking

myMarhalah uses GPS keep track of users' real time location. Integrated with artificial intelligence and machine learning, the application is capable in determining the cut off points when the users are leaving or approaching the boundary set.

e) Navigation and Routing

myMarhalah displays best route from the origin to the destination when users click on the start button. Users can choose to follow the route suggested or they can change and use their own route as the application has the capability to reroute to the final destination. This feature is very important especially if the users decide to make a detour to the nearest identified mosque along the route to perform their prayers. Routing and navigation functionalities will resume once the application detects the users are continuing their journey.
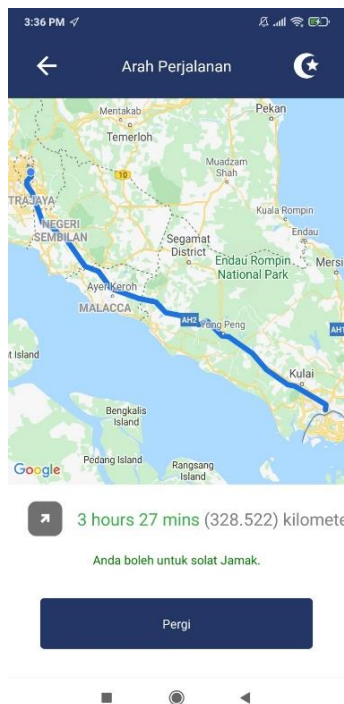

Figure 7: Displaying Total Distance, Estimated Travel Times and Concession Permission Notification.
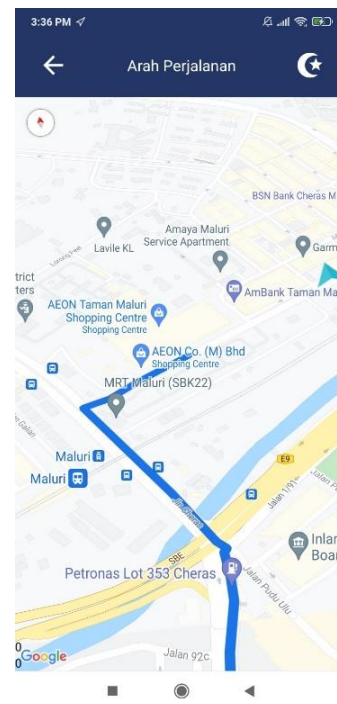

Figure 8: Tracking Current Location and Providing Navigation.

f) Notifications

myMarhalah will automatically notify users when they are travelling out of or into their qaryah. In departure module, a notification will pop up once the users are reaching the distance of 15km from their origin showing that they have exited their qaryah. In return trip module, a reminder will pop up 20km before they are entering their qaryah (35km from final destination) to ensure the users can perform their prayers before they enter their qaryah at any nearby praying area if they have not done so. This is because once the application notifies that they are inside their qaryah, the concession in prayers is no longer valid.
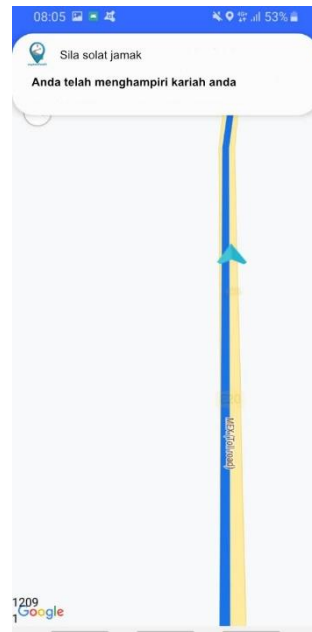
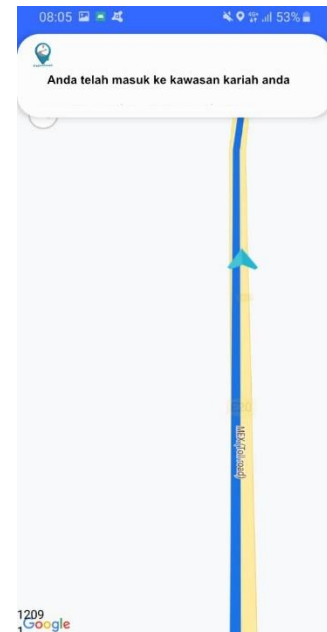| Figure 9: Exiting from Qaryah | Figure 10: Approaching Qaryah | Figure 11: Entering Qaryah |

g) Location of Mosque and Available Praying Areas

myMarhalah displays nearest mosque location according to the routes chosen and travelled by the users throughout the whole journey. The mosques location is integrated with the functionality of navigation and routing. Hence users only need to click on their chosen mosque and the application will route and navigate the users to the mosque, and continue the journey afterwards seamlessly.
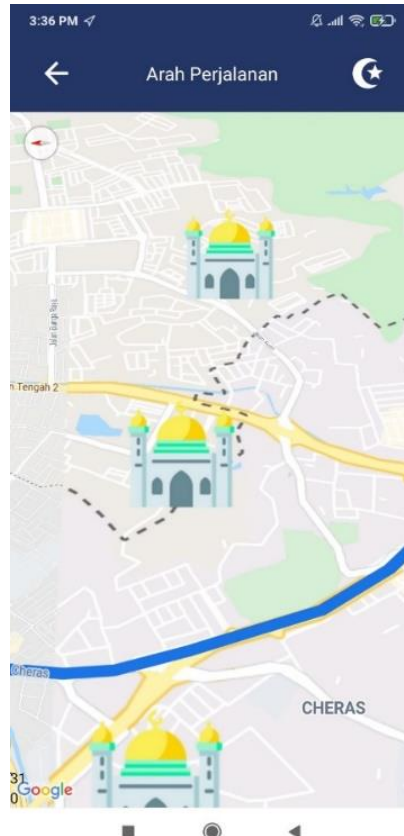

Figure 12: Displaying Nearest Mosque
Locations Throughout the Journey

h) FAQs

mymarhalah listed frequently asked questions to provide some information on the concession in prayers for musafir as illustrated in Figure 13.

i) Prayer Time

myMarhalah uses web API provided by the Department of Islamic Development Malaysia (JAKIM) to display prayer time according to the location selected by the users.
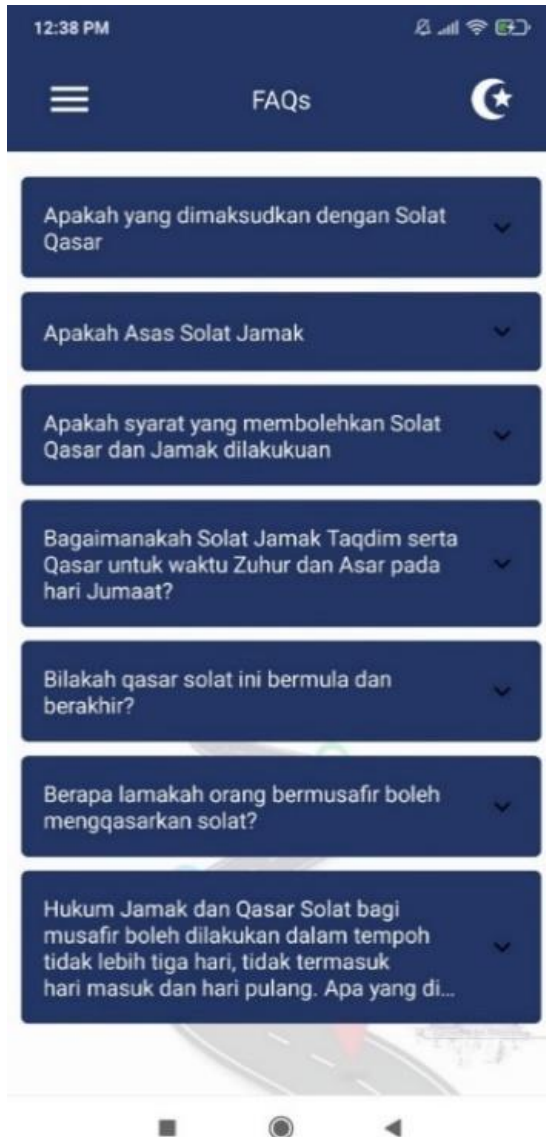

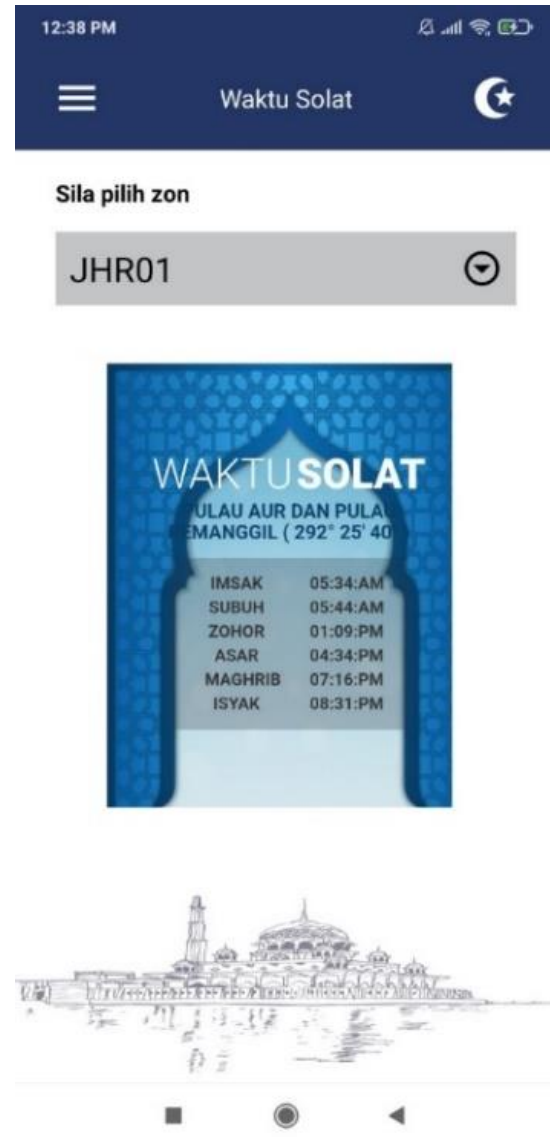Figure 13: Displaying FAQs About Concession in Prayers

Figure 14: Displaying Prayer Time

j) About

Displays background information and current version of the application.

k) User Manual

Users can easily refer to the manual provided for guidelines on how to use the application.

Figure 15: About Page

Figure 16: User Manual

5.0 CONCLUSION

myMarhalah is a GIS based mobile application developed to simplify the implementation of concession concept in prayers for musafir in Malaysia. Taking the advantages of technologies offered by the 4th Industrial Revolution (4IR), the application is built with minimal cost by utilising available resources, using open source software and strategic collaboration with related agencies. Based on the functions and features described in this paper, myMarhalah has the potential to become a high impact application as it provides accurate single point of reference for users, without them having to look up for multiple resources to achieve their objective.

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