

## Development of Android Based Hajj and Umrah Pilgrims Monitoring Application In Dago Wisata International

Muhammad Ilham Budiawan<sup>\*1</sup>, Irawan Afrianto<sup>2</sup>

<sup>1,2</sup>Informatic Engineering, Indonesia Computer University, Bandung, Indonesia

e-mail: <sup>\*1</sup>[budiawanilham0@gmail.com](mailto:budiawanilham0@gmail.com), <sup>2</sup>[irawan.afrianto@email.unikom.ac.id](mailto:irawan.afrianto@email.unikom.ac.id)

### Abstrak

*Ibadah Haji dan umrah merupakan kegiatan ibadah yang dilakukan oleh umat muslim di seluruh dunia. Masalah yang sering terjadi saat pelaksanaan ibadah haji dan umrah yaitu jamaah sering kali tersesat dan terpisah dari rombongan. Jamaah juga kesulitan untuk mencari doa amalan karena masih menggunakan buku panduan karena harus mencari doa satu persatu di keasaan tanah suci yang ramai dan panas. Studi kasus dilakukan di Dago Wisata Internasional. Solusi yang digunakan yaitu memanfaatkan teknologi geofencing dan Firebase Cloud Messaging yang memungkinkan proses pemantauan jamaah dilakukan secara mudah serta jamaah bisa mendapatkan notifikasi doa amalan sesuai dengan lokasi jamaah. Data pendukung penelitian diperoleh dari hasil wawancara dengan pegawai Dago Wisata Internasional dan studi literatur. Berdasarkan pengujian pada aplikasi yang telah dibangun, didapatkan hasil sebagai berikut 93,33% pembimbing menyatakan aplikasi ini mempermudah proses pemantauan jamaah, 84% jamaah menyatakan dapat meminta bantuan dengan mudah kepada pembimbing menggunakan aplikasi ini, dan 86% jamaah menyatakan aplikasi ini memudahkan jamaah dalam mencari doa amalan.*

**Kata kunci**—Haji dan Umrah, Android, Geofencing, Push-notifikasi, Firebase Cloud Messaging (FCM)

### Abstract

*Hajj and Umrah are worship activities carried out by Muslims around the world. The problem that often occurs during the implementation of the Hajj and Umrah is that pilgrims are often lost and separated from the group. Pilgrims also find it difficult to look for prayers because they are still using guidebooks, they have to look for prayers one by one in the feeling of a busy and hot holy land. The case study was carried out at Dago Wisata Internasional. The solution used is utilizing geofencing technology and Firebase Cloud Messaging that allows the process of monitoring pilgrims to be carried out easily and the pilgrims can get prayer notifications in accordance with the location of pilgrims. Research supporting data obtained from interviews with employees of Dago Wisata Internasional and literature studies. Based on testing on the application that has been built, the following results are obtained 93.33% supervisor states that this application simplifies the process of monitoring pilgrims, 84% worshipers claim to be able to ask for help easily from the supervisor using this application, and 86% worshipers claim this application makes it easy for pilgrims in looking for the practice deeds.*

**Keywords**— Hajj and Umrah, Android, Geofencing, Push-Notification, Firebase Cloud Messaging (FCM)

## 1. INTRODUCTION

Hajj and Umrah are worship activities carried out by Muslims around the world. Dago Wisata Internasional is a tour and travel agency that provides Hajj and Umrah services that was established on August 28, 2007. In the practice of Hajj and Umrah, problems that are often encountered are the pilgrims that are missing or lost. In Medina, a week after the pilgrims arrived, precisely on Monday, July 17, 2018, as many as 328 pilgrims got lost when they wanted to return from Masjid Nabawi, it is a report from Indonesia Hajj Committee[1].

In the practice of Hajj and Umrah, the travel agency provides guides to accompany and give direction to the pilgrims. Problems that are experienced by the mentors are the pilgrims are often separated from their group and the pilgrims that go alone without informing the mentors. To monitor the pilgrims, mentors only use radio transmissions that are one-way. The pilgrims also experienced some problems, they are often separated from the group because the situation in the holy land is crowded, and Indonesian people bodies are relatively smaller than pilgrims from other countries. The difficulty that is also felt by the pilgrims is finding directions or gathering points, because directions only use English and Arabic, and even the officer in the holy land only speaks Arabic. Another problem is the pilgrims have the lack of knowledge about Hajj and Umrah practice and prayers. Travel agency provides guidebook for the pilgrims, but this guidebook sometimes confuses the pilgrims, because the pilgrims must look for prayers in the crowded situation, especially in dark conditions.

Android currently dominates more than 90% of the smartphone market in Indonesia[2], so pilgrim monitoring tools will be built on the Android platform. In this research, the technology used is Geofencing, Google Maps API, and Firebase Cloud Messaging (FCM). Geofencing is a virtual fence that fences in certain areas by using the Google Maps API [3]. By integrating Geofencing, Google Maps API, and FCM is expected to be the solution of the problems that are experienced by the mentors and pilgrims. Therefore, this research will conduct "DEVELOPMENT OF ANDROID BASED HAJJ AND UMRAH PILGRIM MONITORING APPLICATION IN DAGO WISATA INTERNASIONAL"

The objectives of this research are (1) Facilitate the mentors in monitoring pilgrims with a two-way digital tool, (2) Make it easy for pilgrims to ask for help from the mentors when they get lost or separated from their group, (3) Provide practice information that must be done by the pilgrims based on location automatically using Firebase Cloud Messaging (FCM).

## 2. METHODS

### 2.1 State Of The Art

Based on several previous studies[4]-[5], the application that was built for prayer information is still less effective, that is because pilgrims still have to search for prayer in difficult situations, that is why in this study, the application that was built was given push notification technology. Push notification technology needs on applications that are built are implemented using FCM (Firebase Cloud Messaging), based on several studies[6]-[8], FCM will be effectively used in this application because it can provide notifications in real time.

Based on the research with the same case study, the technology that is often used for pilgrim monitoring is GPS tracking [9]-[11], GPS tracking only works to send the location of the objects that are being tracked while geofencing can limit certain areas so that when pilgrims enter the geofencing area, geofencing will trigger FCM to send notification [12], then the application can provide prayer notifications according to the pilgrims' locations.

The application has a panic button feature, this feature can be used when pilgrims are needed help or getting lost. Panic button report will go directly to the mentor's phone, with the rule that if the panic button was pressed by more than 1 person, it will be set based on the closest distance to the mentor by using the Haversine method. According to a research [13], Haversine is a formula that can calculate the shortest route between two points, by using the Haversine method, mentor

will not be confused choosing which pilgrims will be picked up first because it has been given a recommendation according to the closest distance.

After conducting studies with previous studies, it can be concluded that the advantages of this application are, this application will be effectively use by user because it can provide prayer information notification in real time based on pilgrims location, and as a monitoring support, this have real time monitoring fitur that using panic button, pilgrims can use this panic button if they are need help from the mentor.

## 2.2 Theoretical Basic

### 2.2.1 Android

Android is a Linux-based operating system for cell phones. Android provides an open platform for developers to be able to create their own applications and can be used by a variety of mobile devices [14].

### 2.2.2 Firebase Cloud Messaging

Firebase Cloud Messaging (FCM) is cross platform messaging that allows to send notifications or messages to users at no cost and reliability [15].

### 2.2.3 Geofencing

Geofencing is a location-based technology that allows software to set boundaries or virtual fences around geographic locations, by regulating geofencing, software that is created can receive notifications when a device is triggered by geofencing (for example, such as exiting or entering a geofencing area) [16].

### 2.2.4 Google Maps API

The Google MAPS API has more than 150 million place data and can help users find places using telephone numbers, addresses and signals in real-time [17]. API (Application Programming Interface) is a collection of protocols, functions, and commands that can be used to build certain software [18]. Based on the explanation above, it can be concluded that the Google Maps API is a function to connect applications with Google Maps, so that applications can access the features available on Google Maps.

## 2.3 Software Development Methods

The Software development model uses is the prototyping development modle, which is a systematic software development model [19]. The prototyping model consists of communication, rapid design, rapid modelling, development, and implementation of testing. The stages in the prototyping model can be seen in Figure 1.

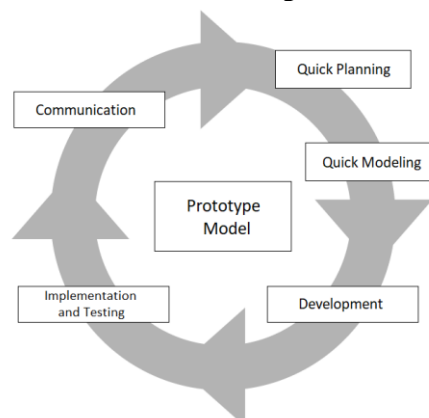


Figure 1 Prototyping Development Model

## 2.4 Problem Analysis

Based on interviews with the head of the IT department at Dago Wisata Internasional (DWI), Mr, Dani, it is known that in one trip the pilgrims consisted of 70% elderly, 20% adults, and 10% teenagers or children. It is also known that DWI does not yet have a capable monitoring system, because it still uses radio transmission, so it is still difficult for mentors to monitor the pilgrims who are separated from their group. The next problem was that the guidance given to the pilgrims is still in the form of a small guidebook.

## 2.5 Analysis of Built Application

The system that built is named “Go-Jiroh”, Go-Jiroh can be used if the user has installed the Go-Jiroh application on their smartphone and have an internet connection. The Go-Jiroh Application has two access rights, the guide and the pilgrims, and it has backend application that can used by administrators to input the pilgrims, mentors, and prayers data. The following general application architecture can be seen in Figure 2.

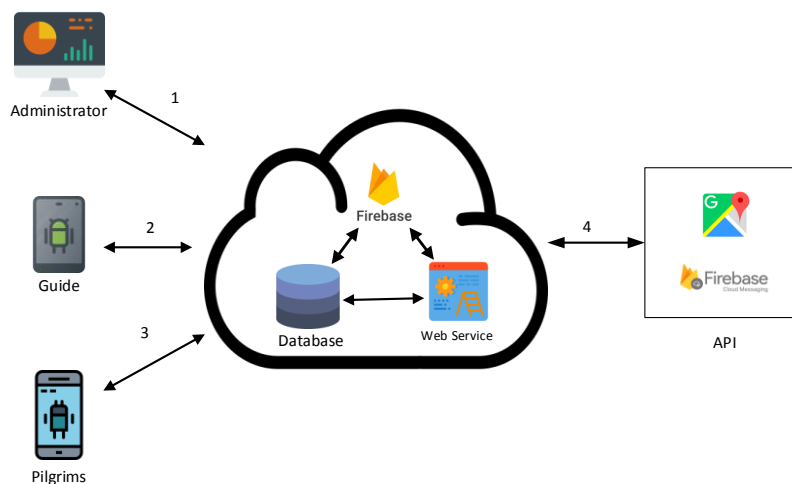


Figure 2 General Application Architecture

General description of the application architecture built are (1) Admin enters the guide and pilgrims data into the database and then creates a mentor and congregation account, (2) The mentors can log in and access data provided by the database, (3) Pilgrims can login and access data provided by the database, (4) Google Maps provides maps that can be accessed by mentors, and admins can enter the practice data into firebase and firebase can push notifications.

## 2.6 Technology Analysis

### 2.6.1 Firebase Cloud Messaging Analysis

Firebase Cloud Messaging (FCM) is a technology that allows to send notifications from different platforms. The following is a general description of how FCM works in a system which can be seen in Figure 3.



Figure 3 FCM General Flow on System

Description of the general flow of the FCM on the system are (1) Pilgrims enter the geofencing area, (2) Geofencing triggers Firebase to send notifications to the user's application (3) Firebase sends notifications to user applications

### 2.6.2 Geofencing Analysis

Geofencing is a technology for creating virtual fences in certain geographical areas. The following is a general geofencing path in the system that can be seen in Figure 4.

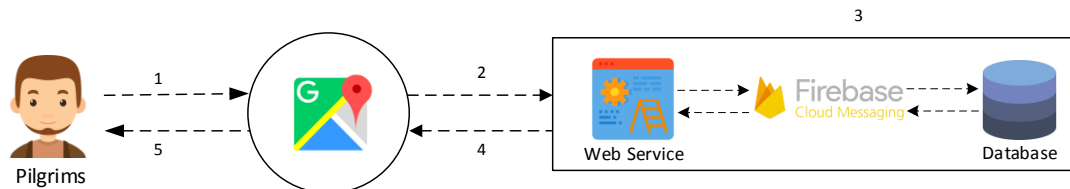


Figure 4 Geofencing General Flow on System

Description of the general geofencing path in the system are (1) Pilgrims enter the geofencing area, (2) Geofencing requests to the database, (3) Web service bridges requests for tokens and geofencing data to the database, (4) Web service sends geofencing location data from the database to Google Maps, (5) Google Maps displays geofencing data in the application. The locations used as geofencing points for Umrah can be seen at Table 1.

Table 1 Umrah Geofence Location

No	Location	Radius	Longitude	Latitude
1	Bir Ali Mosque	0,5 Km	24.413924	39.542951
2	Masjidil Haram	2,5 Km	21.423069	39.825722
3	Safa Hill	0,2 Km	21.422009	39.827398
4	Marwah Hill	0,2 Km	21.425358	39.827235
5	Nabawi Mosque	0,5 Km	24.467528	39.611072

The locations used as geofencing points for pilgrimage can be seen at Table 2.

Table 2 Hajj Geofence Location

No	Location	Radius	Longitude	Latitude
1	Bir Ali Mosque	0,5 Km	24.413924	39.542951
2	Masjidil Haram	2,5 Km	21.423069	39.825722
3	Safa Hill	0,2 Km	21.422009	39.827398
4	Marwah Hill	0,2 Km	21.425358	39.827235
5	Mina	8 Km	21.418324	39.875574
6	Arafah	1 Km	21.355133	39.984108
7	Muzdalifah	1 Km	21.389146	39.923650
8	Nabawi Mosque	0,5 Km	24.467528	39.611072

### 2.6.3 Google Maps API Analysis

The Google Maps API is a technology for facilitating technology exchanges for maps, routes and locations. The following is a general flow of the Google Maps API on the system which can be seen in Figure 5.

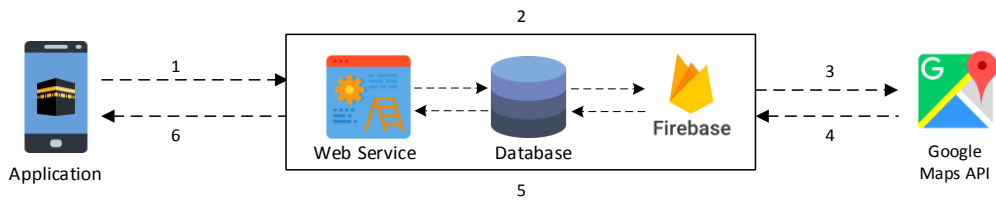


Figure 5 Google Maps API General Flow on System

Description of the general flow of the Google Maps API on the system are (1) The application requests the current location of worshipers and mentors (2) Web service bridges requests made by applications, (3) Web services send requests made by applications to the Google Maps API, (4) The Google Maps API responds by providing the location of pilgrims and mentors, (5) Web service bridges the response provided by the Google Maps API, (6) Web service sends responses provided by the Google Maps API to the pilgrims and mentors application, (7) The application displays the map.

2.6.4 Use Case Diagram

Use case diagrams are diagrams that illustrate the sequence of interactions between actors and systems. Actors are humans or machines that interact with systems to do certain jobs [20]. Use Case diagrams are used in the analysis phase of developing and gathering software requirements [21]. Use Case for applications that are built can be seen in Figure 6.

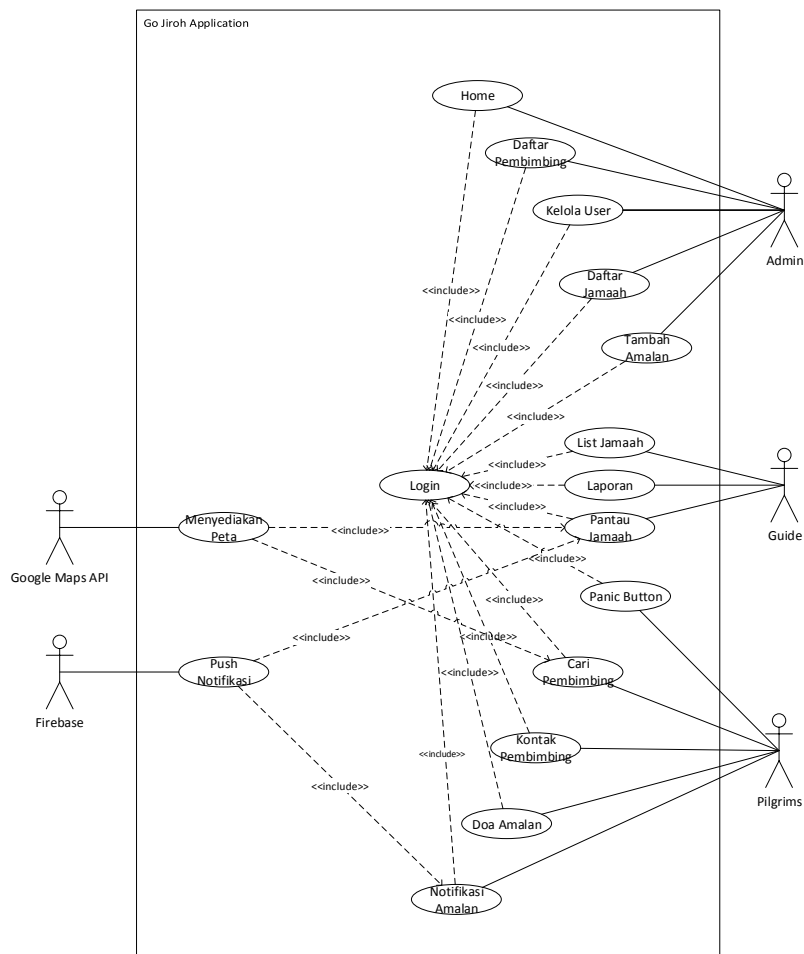


Figure 6 Use Case Diagram

## 2.7 System Planning

Mentor home page interface planning can be seen in Figure 7.

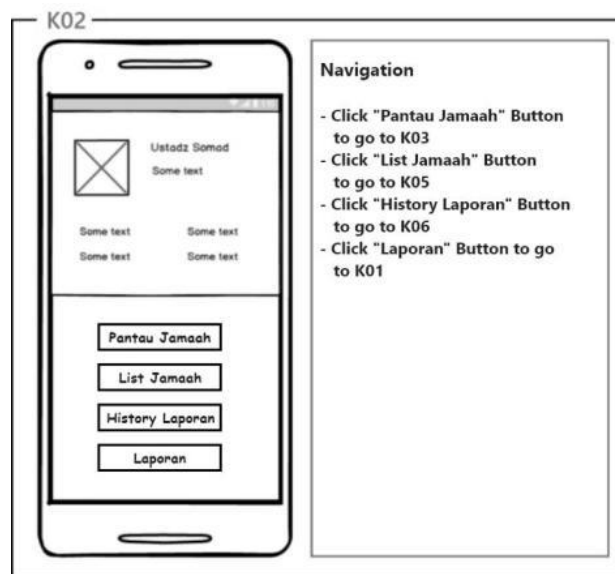


Figure 7 Mentor Interface Planning

Pilgrims home page interface planning can be seen in Figure 8.

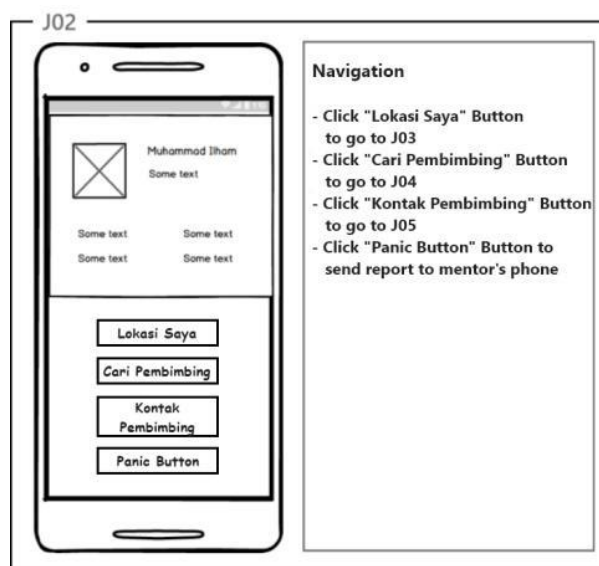


Figure 8 Pilgrims Interface Planning

## 2.8 Implementation

Mentor home page interface implementation can be seen in Figure 9.

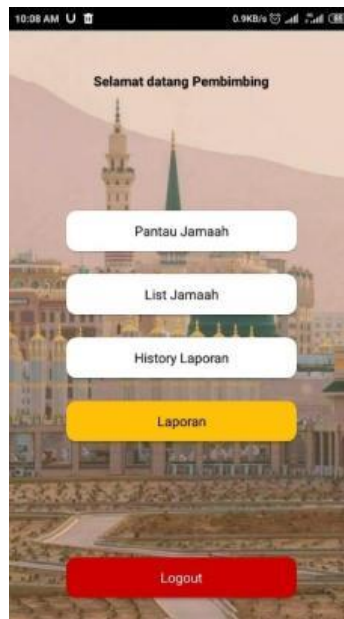


Figure 9 Mentor Home Page Interface Implementation

Pilgrim home page interface implementation can be seen in Figure 10.

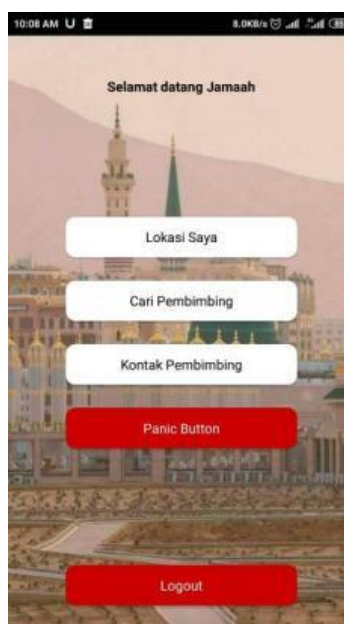


Figure 10 Pilgrims Home Page Interface Implementation

### 3. RESULT AND DISCUSSION

#### 3.1 Blackbox Testing

Blackbox testing is done for functionality testing of the built system. The result of blackbox testing for admin backend application can be seen in Table 3.



Table 3 Admin Blackbox Testing Result

No	Testing Component	Testing Point	Result
1	Login	Empty input data	Success
		Wrong input data	Success
		Correct input data	Success
2	Tambah user	Incomplete or empty input data	Success
		All filled and correct input data	Success
3	Ubah user	Empty input data	Success
		input data changed and filled	Success
4	Hapus user	Press the delete button and do cancellation	Success
		Press delete button and do confirmation	Success
5	Halaman list pembimbing	Displayed mentor list	Success
6	Tambah pembimbing	Incomplete or empty input data	Success
		Correct and filled input data	Success
7	Ubah pembimbing	Empty input data	Success
		Input data changed and not empty	Success
8	Hapus pembimbing	Press the delete button and do cancellation	Success
		Press delete button and do confirmation	Success
9	Halaman list Jamaah	Displayed pilgrims list	Success
10	Tambah jamaah	Incomplete or empty input data	Success
		Correct and filled input data	Success
11	Ubah jamaah	Empty input data	Success
		Input data changed and not empty	Success
12	Hapus jamaah	Press the delete button and do cancellation	Success
		Press delete button and do confirmation	Success

The result of blackbox testing of mentor frontend application can be seen in Table 4.

Table 4 Mentor Blackbox Testing Result

No	Testing Component	Testing Point	Result
1	Login	Empty input data	Success
		Wrong input data	Success
		Correct input data	Success
2	Pantau jamaah	Displayed all pilgrims location	Success
3	List jamaah	Display all pilgrims list	Success
5	History Laporan	Display pilgrim help request list history	Success
4	Laporan	Display pilgrim help request	Success

The result of blackbox testing of pilgrims frontend application can be seen in Table 5.

Table 5 Pilgrim Blackbox Testing Result

No	Testing Component	Testing Point	Result
1	Login	Empty input data	Success
		Wrong input data	Success
		Correct input data	Success
2	Lihat map	Display current location and mentor location	Success
3	Doa amalan	Display prayers and practices list	Success
4	Cari Pembimbing	Display mentor location and route to mentor	Success
5	Kontak pembimbing	Display mentor phone number on phone call	Success
6	Panic button	Send help message to the mentor	Success
7	Notifikasi doa dan amalan	Receive prayers and practices notification when entered geofencing area	Success

### 3.2 Likert Scale Testing

Likert scale testing is done by giving a statement directly to 3 admins, 3 mentors, and 10 pilgrims to see and observe how users think about the application. The maximum assessment of a Likert scale test is 5, so the formula to calculate the criteria can be used, as can be seen formula 1 [22].

$$Kriterium = \text{Max Ratings} \times \text{Number of Respondents} \tag{1}$$

Then, the value of the questionnaire obtained for the admin is  $5 \times 3 = 15$ , for the mentor is  $5 \times 3 = 15$ , and the pilgrims is  $5 \times 10 = 50$ . To calculate the answers from respondents in the form of a percentage can be seen in formula 2 [22].

$$P = \frac{\text{total value}}{\text{ideal score}} \times 100\% \tag{2}$$

Information:

- P = Percentage value sought
- Total value = Number of frequencies times the specified value
- Ideal score = Criterion score

Admin Likert scale test results can be seen in **Error! Reference source not found..**

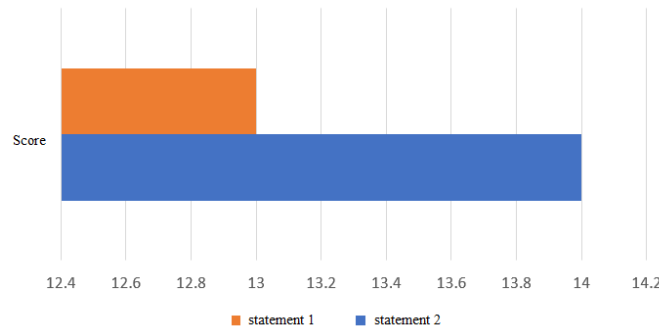


Figure 11 Admin Likert scale test results

Mentor Likert scale test results can be seen in Figure 12.

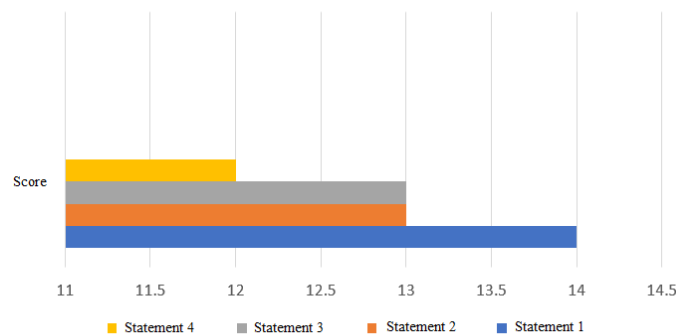


Figure 12 Mentor Likert scale test results

Pilgrims Likert scale test results can be seen in **Error! Reference source not found.**

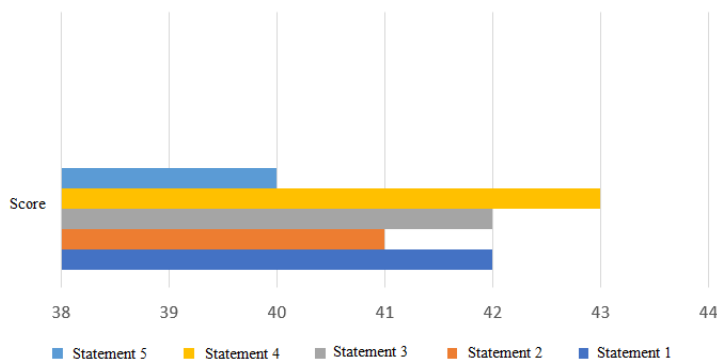


Figure 13 Mentor Likert scale test results

#### 4. CONCLUSIONS

Based on research that has been done, it can be concluded that (1) Advisers can monitor pilgrims easily by using this application, and this application is two-way, (2) Pilgrims can easily ask for assistance to the supervisor with the features of the panic button and telephone supervisor in this application, (3) Pilgrims can easily search for the prayer practice with the practice notification feature automatically based on location.

#### 5. SUGGESTION

Suggestions for future application development are, (1) Solve problems experienced by users if there is no internet network, (2) Complete prayers and practices on the application, (3) Add prayer and practice features with sound for worshipers who cannot read Arabic, and make it easier for elderly worshipers who are already difficult to read, (4) Add a chat feature that can send pictures to mentors and pilgrims to make locating easier.

#### REFERENCES

- [1] A. Amarullah, "Sepekan di Madinah, 328 Jamaah Haji Tersesat saat Hendak Pulang dari Masjid Nabawi : Okezone Haji," *OkeHaji*. [Online]. Available: <https://haji.okezone.com/read/2018/07/22/398/1925739/sepekan-di-madinah-328-jamaah-haji-tersekat-saat-hendak-pulang-dari-masjid-nabawi>. [Accessed: 18-Sep-2019].
- [2] K. S. Permana, "Ketika Pengguna Internet dan Smartphone Terus Meningkatkan, Android Dominasi Pasar Indonesia dan Dunia - Tribun Jabar," *Tribun Jabar*. [Online]. Available: <https://jabar.tribunnews.com/2019/01/24/ketika-pengguna-internet-dan-smartphone-terus-meningkat-android-dominasi-pasar-indonesia-dan-dunia>. [Accessed: 18-Sep-2019].
- [3] R. Segara and S. Subari, "Sistem Pemantauan Lokasi Anak Menggunakan Metode Geofencing Pada Platform Android," *J. Teknol. dan Manaj. Inform.*, vol. 3, no. 1, pp. 72–85, 2017.
- [4] J. D. Santoso, "Buku Saku Ibadah Manasik Haji dan Umrah Berbasis Android" *Jurnal Pseudocode*, vol. 6, no. 2, pp. 156–163, 2018.
- [5] D. S. Sucipta, Isnanto and Kridalukmana, "Aplikasi Panduan Ibadah Haji Berbasis

- Android” *Jurnal Teknologi dan Sistem Komputer UNDIP*, vol. 4, no. 3, pp. 442–449, 2016.
- [6] Muharir and N. Alamsyah, “Pemanfaatan Mobile Push Notification Dalam Penyampaiana Informasi Perkuliahan Mahasiswa Pada Fakultas Teknologi Informasi Berbasis Android” *Jurnal TECHNOLOGIA*, vol. 2, no. 11, pp. 111–118, 2020.
- [7] F. A. Azis, Munawarah and P. Airlangga, “Mobilisasi Penyebaran Informasi Kampus Berbasis irebase Cloud Messaging (FCM)” *SAINTEKBU*, vol. 11, no. 1, pp. 45–56, 2019.
- [8] A. Faisol and F. Rahmadianto, “Real Time Notification Pada Aplikasi Berbasis Web Menggunakan Firebase Cloud Messaging (FCM)” *Jurnal MNEMONIC*, vol. 1, no. 2, pp. 14–17, 2018.
- [9] I. W. Kirana, M. F. Yudhanata, E. M. N. Apriana, and A. D. Prabaswari, “Inovasi Garmaps Tracker (Gelang Identitas berbasis Mobile Application Dengan GPS Tracker) untuk Memonitor Keberadaan dan Aktivitas Jemaah Haji & Umrah,” *Semin. Nas. IENACO*, vol. 7, 2019.
- [10] B. Sisephaputra, A. Supriyanto, and T. Sutanto, “Sistem Pemantauan Keberadaan Jamaah Haji Menggunakan GPS Tracking Pada Smartphone Android (Studi Kasus : Kbih Al Ishlahiyyah Al Ghozaliyyah Tuban),” *J. Sist. Inf. Komput. Akunt.*, vol. 1, no. 1, pp. 1–8, 2012.
- [11] Sugiyanto, E. Nugroho, and W. Najib, “Prototype Sistem Informasi Haji Untuk Menangani Jemaah Tersesat/Hilang Di Daerah Kerja (Daker) Mekah Menggunakan Sms Gateway,” *Semin. Nas. Teknol. Inf. dan Multimed. 2014 STMIK AMIKOM Yogyakarta*, vol. 2, no. 1, pp. 63–68, 2014.
- [12] A. S. Ahmasyosari and T. Fatimah, “Aplikasi Presensi Siswa pada PT. Samudera Anugerah Menggunakan Metode Geofencing dan Perhitungan Jarak menggunakan Algoritma Euclidean Distance Berbasis Android,” *SKANIKA*, vol. 1, no. 2, pp. 481–485, 2018.
- [13] S. I. Purnawan, F. Marisa and I. D. Wijaya, “Aplikasi Pencarian Pariwisata Dan Tempat Oleh-Oleh Terdekat Menggunakan Metode Haversine Berbasis Android,” *JIMP*, vol. 3, no. 2, pp. 9–16, 2018.
- [14] I. Afrianto and R. M. Furqon, “The Herbalist Game Edukasi Pengobatan Herbal Berbasis Android,” *J. Sist. Inf. Bisnis*, vol. 8, no. 2, p. 27, 2018.
- [15] “Set up a Firebase Cloud Messaging client app on Android | Firebase.” [Online]. Available: <https://firebase.google.com/docs/cloud-messaging/android/client#next-steps>. [Accessed: 02-Nov-2019].
- [16] R. B. Kuncoro, “Pembuatan Website Tempat Pariwisata Rumah Dome New Nglepen,” *J. Speed-Sentra Penelit. Eng. dan Edukasi*, vol. 4, no. 1, pp. 36–41, 2012.
- [17] Google, “Custom Maps | Google Maps Platform | Google Cloud.” [Online]. Available: <https://cloud.google.com/maps-platform/maps/>. [Accessed: 16-Oct-2019].
- [18] I. Afrianto and S. Atin, “Rancang Bangun Model Agregator Jurnal Online,” *Semin. Nas. Apl. Teknol. Inf.*, pp. 9–16, 2017.
- [19] R. Susanto and A. D. Andriana, “Perbandingan Model Waterfall dan Prototyping Untuk Pengembangan Sistem Informasi,” *Maj. Ilm. UNIKOM*, vol. 14, pp. 41–46, 2016.
- [20] A. D. Hidayat and I. Afrianto, “Sistem Kriptografi Citra Digital Pada Jaringan Intranet Menggunakan Metode Kombinasi Chaos Map Dan Teknik Selektif,” *J. Ultim.*, vol. 9, no. 1, pp. 59–66, 2017.
- [21] T. Connolly and C. Begg, *Database System: A Practical Approach to Design, Implementation, and Management*, 4th ed. 1996.
- [22] R. Agustina, D. Suprianto and I. Muslimin, “Analisis Perancangan Pemesanan Makanan Menggunakan Smartphone Berbasis Android,” *SMATIKA Jurnal*, vol. VII, no. 2, 2017.