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Development of E-Travel Mobile Application Using Geofencing Technique

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ABSTRACT

Nowadays, mobile applications have become a reliable source of information for potential tourists. Existing tourism mobile applications use cutting-edge technology to improve the quality and experience of tourists. Therefore, this study's objective is to identify the tourist attractions in Gugusan Kepulauan Tumpat, Kelantan based on the geofence area and to develop an e-travel mobile application using the geofencing technique to provide information about the locations. This study was motivated by the difficulty in finding relevant information and the amount of time spent looking for it regarding the local attractions. Additionally, there are not many mobile applications that give tourists enough information. Consequently, by creating the e-travel mobile application known as E-Derak, it will assist travelers in obtaining real-time information about tourist attractions in Gugusan Kepulauan Tumpat. Due to its suitability for a small and quick project, this mobile application was created using the Agile methodology. As a result, this study developed a user interface to promote three different travel package types, as well as a geofencing feature to guide users' paths and notify them of noteworthy nearby locations. On top of that, users are given more information by scanning the QR code that is present at the chosen tourist attractions. Indirectly, E-Derak might make it easier for visitors to travel through Gugusan Kepulauan Tumpat in less time.

Keywords: e-travel, geofencing, mobile application, tourists.

1 INTRODUCTION

Travel is something that almost everyone enjoys. People travel for a variety of reasons, including pleasure and business. Tourist information is widely available throughout the nation in the form of printed materials and maps [1]-[2]. Currently, tourists search the tourist spots such as interesting places to go, nearby restaurants, pictures and reviews about the place and other information through websites and social media.

Recently, the use of mobile applications to help tourists to get information about the tourist attractions has become more popular. This is because mobile applications are one of the most critical aspects of everyday life and a part of many people's everyday routines. Technology and the globalisation age require convenience and automation in many forms of human existence, including

tourism [2]. Tourists find mobile applications useful since they make booking process easier, simplify transaction apps, offer improved services and provide exclusive offers with exciting deal packages.

However, there are only a limited number of applications that cater to all tourist attractions [3]. Therefore, this study aimed to develop an e-travel mobile application using geofencing technique that able to locate tourist attractions close to tourists' location and push related information about the places to them. Geofencing is a feature in a software program that uses the global positioning system (GPS) or radio frequency identification (RFID) (such as Wi-Fi nodes or Bluetooth beacons) to create virtual boundaries around a location [4]. Administrators can set up triggers that send an alert when a device enters the boundaries that have been set.

1.1 Mobile Application for Tourism Industry

The Industrial Revolution (IR4.0) has increased the number of tourism mobile applications [5]. The growth of smartphones and tablets, as well as the related increase in mobile application development, are projected to have a significant influence on the tourism field [6]. Many of the functions of tourist professionals have been handled by these mobile applications in the tourism sector. Smartphones with multi-functionalities are emerging as a result of enhanced mobile technology for individuals to utilize while travelling [7]. People used media social and video sharing to plan their trip made the use of computer becomes less [8]. Mobile applications are easy to use and tourists can get real-time information about the tourist attractions. Therefore, mobile applications have become a choice compared to web systems. Mobile application has many advantages for both the tourism industry and tourists [9].

The increasing use of mobile applications required the tourism industry to invest in apps to give optimum facilities prior, during and after a holiday for consumers because smartphones and tablets support more tasks and have more capability that allows tourists to leave their computers at home. For instance, iTourism [1], Smart Travelling [10] and Exploresia [11] are examples of apps that provide helpful travel features through animated slideshows, landmark detection through map and GPS features. These applications allow people to communicate directly with tourists and build long-term connections with customers. Data about consumer's lifestyle and location that can be obtained by using data gathering and big data technologies can add economic value to the business [8]. With the advancement of technology, distributing information has become easier, and potential tourists now have more alternatives for information sources [12]. Aside from that, the material delivered by a mobile application may be tailored to the preferences of tourists. They may obtain focused, precise communications that they are more responsive to, due to this personalized information content [9]. Mobile applications also make it easier to communicate with other businesses. Electronic reservation delivery systems, for example, save time and reduce mistakes between tour operators, travel agencies, and hotels. Moreover, mobile applications may be used to plan transportation around trip locations, access destination information, and order food without having to go to the restaurant [5]. Tourist behavior influences their destination selection together with the natural beauty of the place, safety and security, festivals and events held at the tourist destination. They are also more likely to choose destinations with a good brand image which are assessed individually as well as holistically [9].

1.2 Geolocation and Geofencing Technique

Geolocation refers to a broad socio-technical phenomenon that includes the current proliferation of spatial big data, the incorporation of locational functionalities and affordances as native features of digital technologies, and the positional awareness of 'smart' objects and connected devices participating on the internet of things (IoT) as facilitated by technologies [13]. Geolocation prediction (GP) may be used for geolocation-based services (GBS), which might give future services for app users and broaden its scope. GBS's mobility big data-based geolocation prediction has become increasingly essential in human activities which are based on moving object sets, observation time of data sets, geolocation data records, geographic coordinates and a time stamp [14].

Geofencing is the process of using a geofence where it allows to send notification to tourists who are in the area of tourist location [15] through latitude and longitude to indicate a precise place. Geofencing combines knowledge of the user's present position with knowledge of the user's proximity to potentially interesting destinations [4]. According to [16], the monitored object's geographic coordinates are automatically and on a regular basis related to a control centre via mobile phone networks. Geofencing is divided into three categories which are application based, network based and hybrid geofencing [17]. Application based macro-geofencing requires the use of a GPS-enabled app to calculate beacon proximity that make up the geofence. Non-GPS based geofencing is a type of network based geofencing which can be categorized into micro and macro geofencing. Meanwhile, hybrid geofencing is when geofencing technologies are integrated to function together in the same area, taking into account technologies that complement each other.

1.3 Case Study: Gugusan Kepulauan Tumpat

Gugusan Kepulauan Tumpat (see Figure 1) consists of eleven villages from several small islands located in Tumpat district, Kelantan Darul Naim. It is located about 15 km from the city of Kota Bharu, Kelantan. There are over 2,000 residents in these islands where the majority of the population are fishermen and small entrepreneurs. Furthermore, these islands have many small rivers or canals that flow between the islands and have great potential to become the main attraction for domestic and international tourists. Together with Tumpat Local District and Land Office, Community-based Tourisn (CBT) initiative has been introduced to the communities to improve their livelihood. The strategy has been proposed to develop sustainable tourism development on these islands by introducing three clusters known as natural heritage; art and cultural heritage; and traditional food. Study done by [18] sees initiatives in product renewal as a necessity in supporting community tourism goals, especially involving cultural heritage tourism. Therefore, the use of mobile e-travel applications (E-Derak) is seen as a catalyst for innovation in tourism and serves to help tourists while visiting interesting places around Gugusan Kepulauan Tumpat.

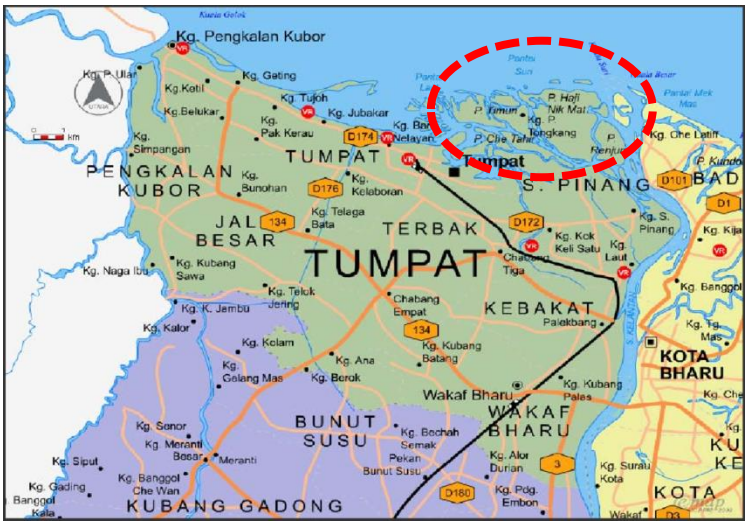

Figure 1: Map of Gugusan Kepulauan Tumpat

2 METHODS

For this study, Agile methodology is adopted because of its iterative process that allows in changing the functions in any phase. Daily testing also can be done during the development. In this case, this project needs frequent testing after each page of the application has finished to make sure it is working properly. The following processes depict the steps of the Agile methodology in gene ral:

2.1 Requirements

The requirements of the mobile app like the features are obtained from literature and users. Apart from that, the research data such as the latitude and longitude of the tourist attractions, details of the tourist attractions, and pictures are obtained from a research team of the Faculty of Architecture, Planning and Surveying (FSPU), Shah Alam. Such data is required to be provided to the users so that they can know the details and location of the tourist attraction. User requirements and system requirements are detailed as follows:

User requirements:

a) The application shall let the user create an account and login into the application.
b) The application shall give details about the tourist attractions in Gugusan Kepulauan Tumpat.
c) The application shall provide available tour packages that tourists can choose.
d) The application shall provide photos of each tour package for the user to view the places there.
e) The application will guide tourists to the location by using a map.
f) The application shall give notification when user enter the tourist attractions area.
g) The application shall let the user scan the QR code provided at the tour location.

System requirements:

Software

Android Studio Arctic Fox
Java programming language

Hardware

Computer with at least 8GB RAM
Android emulator
Smartphone with an operating system of at least Android 5 (Lollipop)

2.2 Design

Use case diagram and entity relationship diagram (ERD) were designed to represent the project details. Use case diagram is a visual representation of the details of a system and its users. ERD is a diagram that shows the relationship between entity sets contained in a database. In other words, ER diagrams aid in the explanation of database logical structure. On top of that, the storyboard is also presented.

Based on the Figure 2 below, there are nine use cases and three actors that are available in the mobile application. The first actor is tourist and the use case started from register then login into the application. Tourist then will select nearby tourist attraction and view tourism package details. Tourist can book tourism package and make payment. After tourist have select the tourist attraction, they can follow the map to go to their selected destination. For tourism operator, he/she have to register first and then login into the application. Tourism operator can view the tourism package details and add, update and delete the details. Admin will manage users account by adding or deleting the users account.

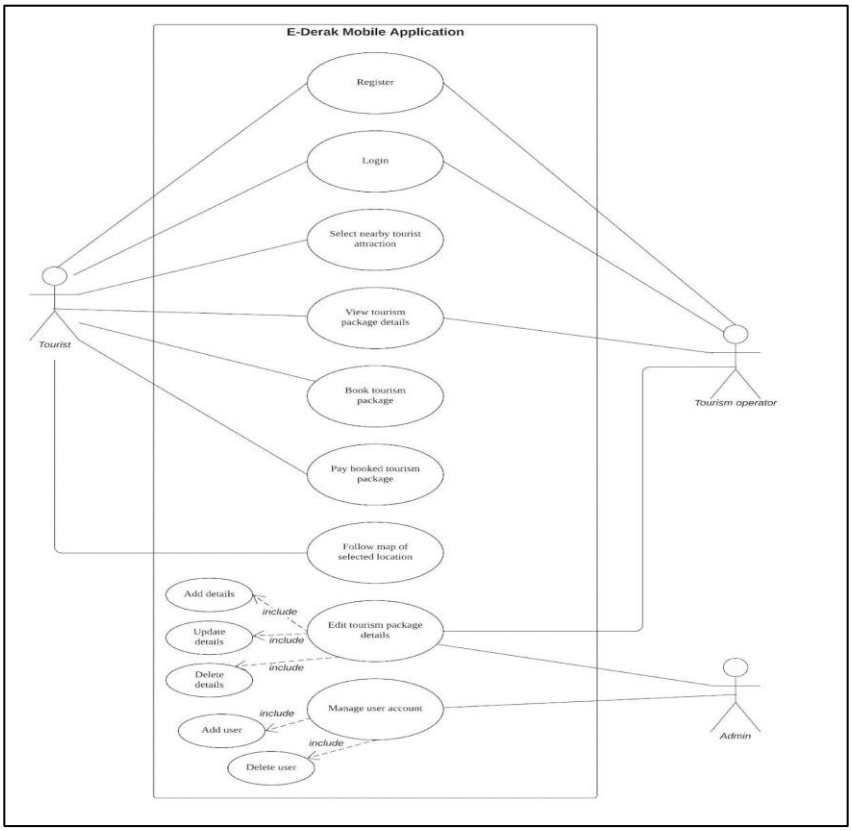

Figure 2: Conceptual Design for E-Derak

The business rules for the case study are as follows: A tourist may select many tourist attractions that they prefer. Each tourism package may be viewed by one or many tourists and a tourist may view one or many tourism packages. A tourist may book one or many tourism packages and a tourism package may be booked by one or many tourists. Each booking will receive payment. A tourist will follow a selected location on a map. A tourism operator may edit one or many tourism package details and a tourism package detail will be edited by a tourism operator. Admin may manage one or many user accounts and a user account will be managed by an admin. The flow of E-Derak process, illustrating the functionality and user interactions of the E-Derak mobile app also was sketched as

shown in Figure 3 below. It's an efficient technique to understand the overall structure and user experience across multiple screens and functions as well as a guidance in the development phase.

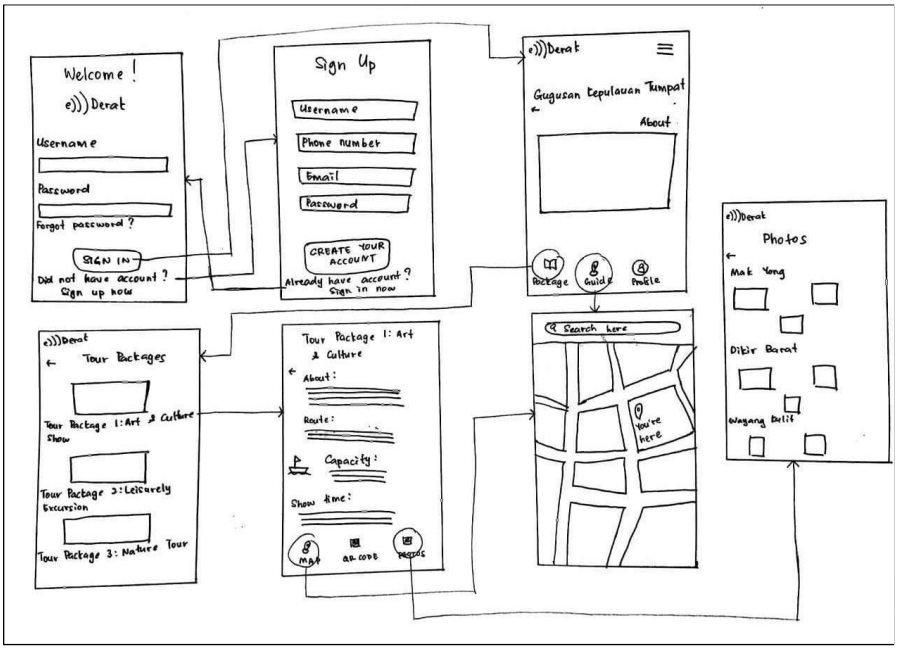

Figure 3: The flow of E-Derak Mobile App process

2.3 Development

In this phase, the source code is written according to the requirements. The physical design specifications are translated into code. The initial step for this project was to download and set up the development tool which is Android Studio Arctic Fox. E-Derak mobile app uses Java as the programming language and SDK Android 5 with API 21. Firebase is used to store data. Figure 4 below shows part of the coding for setting up the geofencing area. The latitude and longitude of the geofencing area as well as the radius of the area are used in setting up the geofencing.

2.4 Testing

Testing must be done once the application has been properly developed to check that it is working as planned. This is also to ensure that the system satisfies the previous requirement. Two types of testing were used for this project to make sure it is working properly and does not have errors. Functional testing is a sort of software testing that evaluates a software system's functionality against functional requirements and specifications [19]. The functions, usability, accessibility and error

messages were tested during the development from time to time to make sure it works properly as shown in Table 1 below.

Table 1 : Results of Functional Testing

No.	Event	Expected result	Result
1	Login	Users can login into the application after keying in the username and password.	Pass
2	Sign up	Users can key in their details and an account will be created.	Pass
3	Tour packages	User can view the pictures and click the package to see the details.	Pass
4	Google Map	User can view the Google Map and search location by using the search button.	Pass
5	Geofencing notification	Notification pops out when user enter and leave the geofencing area.	Pass
6	QR code scanner	User can use the QR code to scan the QR and information will appear.	Pass
7	Gallery of photos	User can view photos of selected tour package and can click on the picture to view bigger picture.	Pass

Meanwhile, in geofencing testing, the Android emulator is used to test the functionality of the geofencing. The location simulator in the emulator is used to simulate user's movement in the geofencing area. A route nearby the geofencing area is set and then it moved to the geofencing area. When a user enters the geofencing area, notification is pop out to notify user that they have enter an interesting place to go. Figure 4 below shows how the simulator works. The blue marker is the user

and the red marker is the geofencing area. The route with label A and B is the start and end point of user's movement.

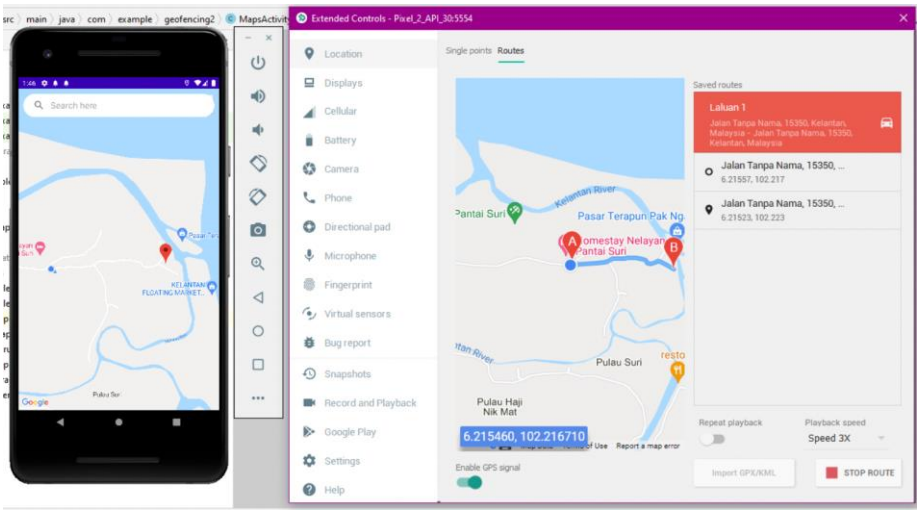

Figure 4: Geofencing Testing

3 RESULTS

This section displays the interfaces of E-Derak mobile app such as of login page, homepage, tour package, map page and photo page. Login page allows user to fully utilised the features provided by the app as shown in Figure 5. Homepage display information about Gugusan Kepulauan Tumpat including packages, guide and user profile. Tour packages page provides more details on each of packages offered such as route, boat capacity, show time of the performances and activities at the place. Map page incorporates Google Map that shows the location of tour package and how to get there. Photo page provides photos of the tour package such as the activities and attractions there.

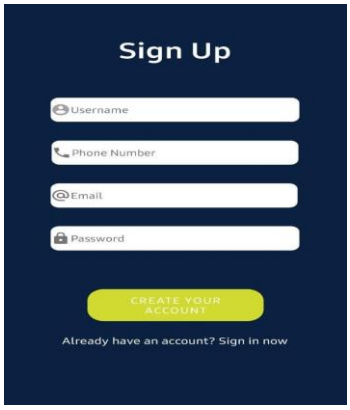

Figure 5: Interfaces of E-Derak Mobile App

Apart from that, E-Derak also provide QR Code facility to tourist to get more information on the selected places from the tourism packages. It allows tourists to click on the QR code button and use the scanner by using their own smartphone. Some of the tourist locations is provided with a QR code that have more information about the place or attractions there as shown in Figure 6 below.

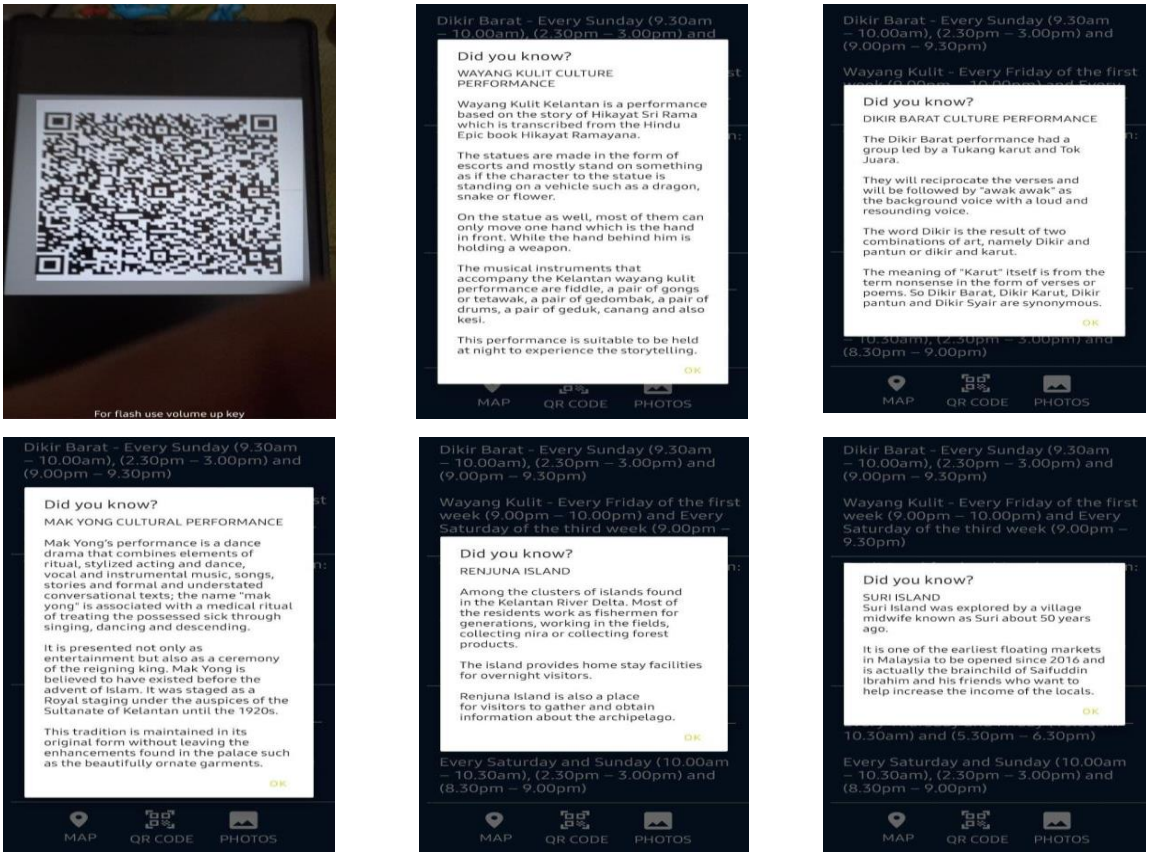

Figure 6: Information on Tourist Attractions using QR Code

Google Map is embedded in this app to guide tourists to the location of the tourist place. For a first time user, an access permission message will appear to allow the mobile app to get to their location. After users have entered the geofencing or the tourist area, a notification will be displayed to notify them. A notification also will be displayed when users have to leave the area. Figure 7 below shows the map as well as the notifications that users get.

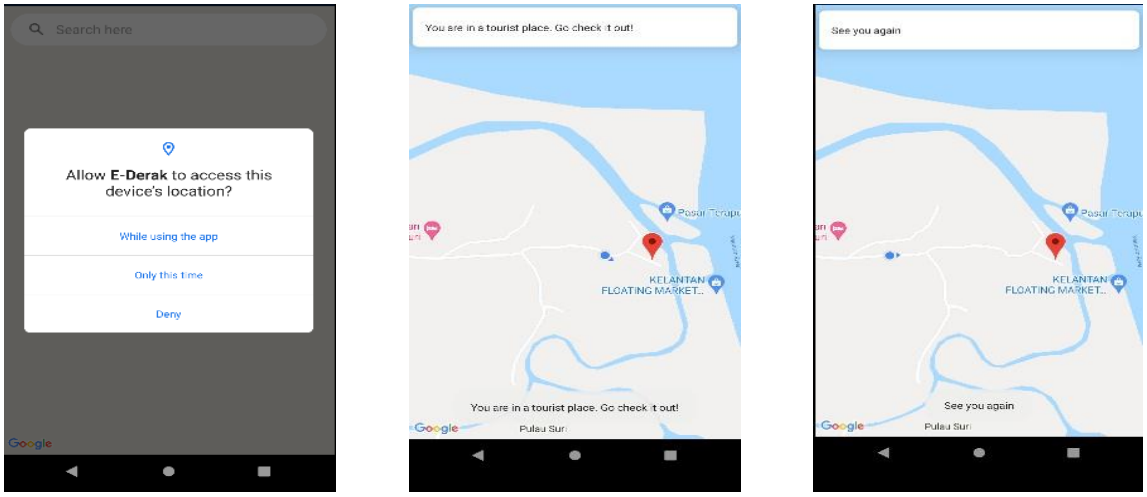

Figure 7: Notification When Users Enter or Leave the Area

4 CONCLUSION

The aim of this project is to use geofencing technique to identify and provide information to tourists on tourist attractions in Gugusan Kepulauan Tumpat. By using E-Derak mobile app, tourists can get notification when they enter the area on tourist attractions that they can visit there. They can view the details and photos of the place. Tourists also can get additional information by scanning the QR code that is provided at the selected tourist locations. This mobile app can help tourists have a wonderful experience exploring new tourist attractions in Gugusan Kepulauan Tumpat. It also can help to promote the tourist attractions there not only to locals but also foreign tourists. Indirectly, this will be able to help increase the demand for the products and also the tourism packages offered. Therefore, the E-Derak mobile app will also help to achieve the conservation of traditional and local cultural heritage as well as the uniqueness of the biodiversity of the delta through digital technology. On top of that, this initiative is in line with the current need to help increase the household's economic income to achieve the Sustainable Development Goals (SDGs) of no poverty (Goal 1), zero hunger (Goal 2) and appropriate employment and economic development (Goal 8) [20].

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