Travel App - showing nearest tourism site using Haversine formula and directions with Google Maps

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Abstract. Travel App is a tourism-based application that aims to help travelers in providing easy access information on tourism destinations. It shows nearby tourism sites via Google Maps interface within the application and calculates the nearest tourism site with the help of Haversine formula. It calculates the distance between longitude and latitude of places in a sphere. Tourism data used are gathered directly from Yogyakarta, Indonesia. Not every traveler knows which places to visit or which nearest tourism site they could reach within certain distance and time. This application is able to provide essential travelling information, such as the location of tourist places, their opening and closing hours, address, and photos. Through this app, travelers could explore tourism destinations without being worried not knowing where they could make a stop in their itinerary. Travel App has been tested in the Yogyakarta area and has been shown to deliver its intended functional purposes.

Keywords: tourism, Haversine formula, directions, travel application

1. Introduction

Indonesia has been known for its tourism, in 2019 Lonely Planet put Indonesia as one of the top ten Countries for travelling [1] and more to that, Indonesia has won a lot of rewards in tourism industries such as Reisgraag Award for best tourism destination 2019, entitled Borobudur Temple as one of the seven wonders of the world, 3 Awards at the ASEANTA Awards for Excellence 2018. Even so, not every traveler directly knows places to visit in an unfamiliar country. This study aims to help provides tourism information for travelers who travels in certain part of Indonesia through technology. One of the results of advance technology are Smartphones, by January 2018 about 50% of Indonesia’s population are internet users and about 49% are active on social media [2]. This study embraces both Tourism sectors and the use of advance technology in smartphone. The application created was tested in Yogyakarta and was able to show reachable Tourism destination within 1 km radius around the user. It was created with Android Studio using XML and Java, connected to MySQL database through PHP and HTML.

2. Method and materials

2.1. Data Used

The method used to gather data was Fact-finding. Fact-finding is a technique of collecting data and information from samples of existing documents, research, observations, questionnaires, interviews and
joint planning [3]. It is used in a qualitative research, a research focused on the experiences of participants in order to answer the how, what and why to a problem and produce findings from problems in the real world. Those data were collected directly during field observations in Yogyakarta through research from August 1 - 8 2018 and continued on April 12 - 16 2019, firsthand interviews and spread out questionnaires. The outcome of information obtained were photograph, coordinates values, facts about tourism site, sites’ condition, opening and closing hours, etc.

2.2. Method
One of the methods used to calculate distance between tourism site and location of user is the Haversine formula. It calculates distances between two coordinates of longitude and latitude on a sphere [4], an equation that plays significant role in navigation.

\[
d = 2r \arcsin \sqrt{\sin^2\left(\frac{\theta_2 - \theta_1}{2}\right) + \cos(\theta_1)\cos(\theta_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}
\]  

Equation (1) is the formula for administering Haversine where r is the sphere’s radius, θ means latitude whereas λ is the longitude

3. Literature Review

3.1. Related Works
iTourism Travel Buddy Mobile Application [5] is a tourism application in Malaysia provides tourist information based on 4 main categories namely Entertainment, Food, Shop and Accommodations. In addition to providing information, it offers a variety of coupons that can be used in available merchants. iTourism Travel uses the Rapid Application Development (RAD) or known as superlative software development [6] method in making application models, on the initial stage a survey was conducted to determine user needs in a travel application. iTourism uses Geotagging, it meant putting coordinates values into metadata of a media like photos or videos [7] which is integrated with Global Positioning System (GPS) and Geographic Information System (GIS). Coordinates value obtained by the application is used to display the nearest tourist attractions and outputs are sorted according to their rating. However, iTourism does not provide navigation and it focuses on e-advertisement marketplace purposes.

Furthermore, Mobile Tourism Recommendation System (MTRS) [8] provides recommendations for tourists through Point of Interest (POI) based on specific location of someone captivation [9] in this point is user profiles that have been grouped based on users’ gender, occupation, and education level. MTRS provides Wireless Sensor Network (WSN), WSN is commonly used to monitor surroundings of a place [10] which is installed directly on the tourism site to help see the trajectory whether or not the users are nearby besides that users could provide reviews of places they have visited. The results of the reviews or referred as the concept of 'context-aware rating' helps MTRS in selecting tourism site for recommendation.

3.2. State-of-the-art
Internet has been the main source of information for travel and itinerary planning [11] and smartphones has the potential ability to change tourist experiences [12]. Contemplating on those facts and related
works that has been done, this study took the opportunity in pursuing chances in shaping the better travel information for Indonesia’s tourism. Allowing travelers to view nearest tourism site within one km from the user’s current position calculation by Harversian projecting interface using Google Maps API and more to that, the application provides directions to each destination using the direction API available at users’ fingertips.

4. Results and discussion

4.1. How it works

The way Travel App process summarization could be seen in Figure 1. First of all, Travel App will detect user’s location only when the users permit Travel App to access GPS tracking. Once the coordinates value are extracted, the program will throw them to a PHP webpage shown in Figure 2 that has been hosted in http://jawaindonesia.com/ and ran the Haversine Formula to get the nearest tourism site. Result from Json Array caught by StringRequest function like in Figure 3 where then each variable will be seen as Json Objects inside an Array. Those variables then get converted into double values and added to the maps as a marker using the function addMarker which is called inside the loop of JsonArray.

These markers will appear as icon depending on their category, once added users could see the nearest Tourism Site on the Maps Fragments like the one in Figure 4A. When the user tap on the marker, the name of the tourism site could be seen as a title and when the title is pressed it, users will be refersed to a new activity showing information which could be seen in Figure 4B where the button take me there would show the direction from the user’s location to the site as shown in Figure 4C.

```php
require_once 'config.php';

$start = $_GET['start'];
@end = $_GET['end'];

// Code in PHP for Calculating Haversons Formula
```
4.2. A state-of-the-art Application as a result

The final result of this study is an application created for Android users using Android Studio with the extra function of Google Maps Api and Directions Api. Google Maps Api is used to display maps fragment as shown in Figure 4A whereas Directions Api is used to show direction in the form of line between origin point to its destination as shown in Figure 4C.

Figure 4. Screenshot of the program (A) the interface once the application detects the user’s current location (B) when the user clicks one of the icons, it specifies the tourism site (C) the direction shows from around Patuk, Gunungkidul to Ecotourism of Ancient Volcano Nglanggeran

4.3. Testing Application

Travel App was tested around Yogyakarta from October 27 – 31 2019, the functionality of the app has shown promising results. In figure 5A there were only 2 tourism sites within 10 km from the user’s
current location, Ngingrong Market and Etalase Taman Batu. After a few km drives 2 other tourism site appears, Griyowono Restaurant and Baron Beach. Ngingrong Market and Etalase Taman Batu’s marker in Figure 5 seemed entangled since their distance is within 500 meters so when the map got zoomed out, it looked like there’s only one marker even though there are two markers.

Figure 5 Screenshot of Tourism site appearance (A) When user located around Jl. Baron, Karang Asem, Mulo, Kec. Wonosari, Kabupaten Gunung Kidul, Daerah Istimewa Yogyakarta it only shows 2 tourism site which are Pasar Ngingrong and Etalase Taman Batu (B) After a few km drives Baron Beach and Griyo Wono Restaurants starts to show

During testing, user’s opinion was gathered through simple questionnaire and 17 samples were taken. Where 93% would use Travel App in daily basis, 81% has used similar apps such as Google Maps, and in total they gave 4.5/5 score for the current functionality of the apps. Users asked for further development like giving information on tourism promotion, estimation of entry tickets, best time for visiting, travel diaries, sales ticket, and etc. Sample of the questionnaire is shown in Figure 6.

Figure 6 User’s Satisfaction Questionnaire for Travel App
5. Conclusion
Travel App shows promising uses in Tourism Industry and has given functionally as aimed. Even so, travel app needed to be upgraded and broaden it uses which in further works there would be tourism recommendation based on User’s Review from google review. The reviews would be classified using Naïve Bayes Classification to see whether the places are giving good or bad reviews based on the users’ comments.

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