Tourism Destination Grouping Systems With Partitioning Clustering Method from Geotagged Photo using Android

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Tourism Destination Grouping Systems With Partitioning Clustering Method from Geotagged Photo using Android

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Abstract. This application is focused on grouping photos that have information about the location of the photo. To get the location of the nearest tourism destination is by taking the location coordinate value from the uploaded photo then grouping it with a maximum distance of 1 kilometer. The main location for data collection is in Gunung Kidul Regency. This application uses Android for its development. For data processing and transforming scripts into the JSON file uses PHP and for storing the data uses MySQL.The metadata of the photo contains detail information about the photo. In the application shown the few information of its metadata such as the date and time took, image size and resolution, camera maker and model, also coordinate latitude and longitude. The location and metadata values will be shown in the application and stored in the database. Partitioning Clustering method used to find the nearest place within the 1 km radius. First of all by taking the coordinates value from an uploaded photo and stored to a database. The coordinate must be converted from Degree Minute Second Format into Latitude and Longitude Coordinate. After that, the calculation process starting with uses the Euclidean Distance formula to get the nearest distance of the attractions. To display the nearest location, sorting the result values from a minimum value to the maximum value as the final result. The application could be a reference for tourists who will visit Gunung Kidul Regency.

Keywords: Metadata, Geotagged Photo, Grouping, Partitioning Clustering.

1. Introduction

Indonesia is the biggest country titled with the largest archipelago in the world. Indonesia is come from Sabang in Aceh to Merauke in Papua, made up of thousands of large and small islands, connected by the strait and sea. Based on data from Ministry of Home Affairs of the Republic Indonesia in 2010 was as much as 17,504 islands, 7,870 of them have names, while the others do not have a name [1] With such widespread and beautiful islands, Indonesia has many natural resources and cultural diversity on each land and the sea. Because of that, Indonesia has become a tourist destination that is much desired by both local and international travelers from around the world. Based on data from the Ministry of Tourism in the period of January to May 2019, Indonesia was recorded as having 6,371,203 people who visited Indonesia or the same as 2.7% growth from the same period in the previous year. [2], A tourist destination refers to a product of tourism that may also be a place [3] or can be marketed is made up of 10 items, ranging from ítems, services, experiences, people, places, property, organizations, information to ideas [4].

Gunungkidul is currently a popular tourist destination that has many beautiful tourist sites. Gunungkidul still kept their rich Javanese culture and also the traditional performances and rituals are still well preserved. Gunungkidul is a regency located in the Southeast Yogyakarta Province [5]. According to data from Badan Pusat Statistik Kabupaten from 2011 until 2016 the number of visitors both from domestic and international in 2011 was much 616,696 people, in 2012 was much 1,000,387 people, in 2013 was much 1,337,438, in 2013 was much 1,337,438 people, in 2014 was much 1,995,887 people, in 2015 was much 2,642,759 people and in 2016 was much 2,992,897 people [6]. More detail looks at table 1. Gunungkidul has beaches, a karst mountain, a prehistoric river and mountains, parks, challenging caves to explore, rocky routes to adventure and attractive spots to take pictures in.

Table 1. Number of International and Domestic Visitors in Gunungkidul Regency, 2011-2016

Year	Visitors International	Visitors Domestic	Toal
2011	1,299	615,397	616,696
2012	1,800	998,587	1,000,387
2013	3,751	1,333,687	1,337,438
2014	3,060	1,952,757	1,955,817
2015	4,125	2,638,634	2,642,759
2016	3,891	2,989,006	2,992,897

Gunungkidul has many districts and sub-districts. Each district and sub-districts are connected. Because of it, travelers sometimes don't know where are the next destination and the closest tourism destination around them. Sometimes the travelers also forgot where is the photo was taken. The Tourism Grouping Destination System will help travelers. It works with Android and using geotagged photos. Usually, an ordinary photo of JPEG format can keep some useful data in its EXIF [7] data, such as taken time, resolution and name. The additional data of latitude and longitude can be also written as EXIF information to be saved in a photo and for geocoding.

2. Method and materials

2.1. Sample preparation

The data collection was taken in Gunungkidul Regency for many types of tourism destinations such as beaches, mountains, geo parks, religious sites, restaurants, etc. The questionnaire was given to the few millennials tourists at Gunungkidul who have the smartphone.

2.2. Method

The methods are used in this study are the analysis method, latitude, and longitude conversion formula and clustering method. For analysis method used the fact-finding technique. Fact-finding is a process of collecting and analyzing data, information and identifying research and user needs in the new system. Fact-finding techniques consist of five techniques such as evaluating documents, interviews, observation, research and questionnaire [8]. Data and information collection such as interview local people in Gunungkidul, distributing questionnaire research and tagging pictures. Fact-finding is originally from Conolly & Begg's book. Latitude and Longitude coordinate must be converted from Degree Minute Second format to Decimal Degrees format coordinate. The easiest way to calculate is assuming 1 minute is equal to 60 seconds, 1 degree is equal to 1 hour and that is equal to 60 minutes or 3600 seconds [9]. So, to calculate decimal degrees, use the DMS to decimal degree formula below :

$$= \quad + 1\frac{111}{}1 + (\frac{111}{}) \qquad (1)$$

DD=decimaldegree
d = degree (°)
min = minute (‘)
sec = second (“)

Before convert the coordinates value all we need is catch the coordinates value from the photos. The authors do converting the coordinates because, to process the coordinate in Java and show the map in Android is the coordinates must be converted to Decimal Degree format. Otherwise, the map doesn’t process and show in the application. In figure 1 is the picture with the DMS coordinates formula and in figure 2 is the picture with DD coordinates formula.

DMS Format

Latitude	8; 8; 41.5699999999997516
Longitude	110; 36; 14.219999999971...

Figure 1. The picture of Pantai Sadrananwith DMS Coordinates (Coordinates Before)

DD Format

Latitude : 8,14486111

Longitude : 110,603944

Figure 2. The picture of Pantai Sadranan with DD Coordinates (Coordinates After)

How the conversión works by using (1) formula to calculate it. First of all take the Latitude coordinate then divide the values into degree, minute and second. How to know if the value has degree nor minute nor second is just see the apostrophe or comma in each value. Look at figure 1 and the latitude coordinate is 8, 8,41,56999999999997516. The degree is 8°, the minute is 8‘, and the second is 41,5699999999997516”. After that, divide each value using the formula

DD = d + minute/ 60+ second/3600
DD = 8 + (8/60) + (41.5/3600)
DD = 8 + 0,13333333 + 0,01152778
DD = 8,14485111

After calculate the latitude coordinate, convert the latitude coordinate. The formula is same The latitude coordinate is 110,36, 14,219999999971
DD = d + minute/ 60+ second/3600
DD = 110 + (36/60) + (14,2/3600)

After convert the DMS coordinate into DD coordinate then grouping the photo location and tourism sites location. For grouping we catch the latitude and longitude coordinate from uploaded photo (its metadata) and collect tourism sites location. Each coordinates from uploaded photo must be converted to DD format. After it, calculate it using k-means formula. First of all specify and pick the first centroid for the first iteration. K-Means will stop the calculation if they got the same centroid values from previous centroids [10]. If not, they won’t stop and still calculate until they got the same value from the previous one. Formula (2) is Euclidean Formula which is for calculate the distance of each photo location and tourism sites location. This is to be reference for show the nearest tourism sites by sort the distance from minimum value to the greater value.

d= distance
j = amounts of data
c = centroid
x = data

$$d(x_j, c_j) = \sqrt{\sum_{j=1}^{n} (x_j - c_j)^2} \qquad (2)$$

For example, the photo location is in Candi Borobudur , so calculate the both location with formula (2) and put in grouping table. After 3 iteration, the result is in table 2.

Table 2. Grouping Result

No	obyekNama	Latitude	Longitude	Distance c1 (popularity)	Distance c2 (easily accesible)	Cluster	Photo
1	Candi Borobudur	-7.60608339310	110.21905517578	0.316477739	0.00844956978	Cluster 2 the location is location is easily accessible	
2	Gereja ayam	-7.60469436646	110.18277740479	0.3496975135	0.0278624929	Cluster 2 the location is location is easily accessible	

3	Candi Mendut	-7.605555534 36	110.23005676 270	0.306990666	0.019427280 4	Cluster 1 high popularity	

Based on hypothetically the result will be in Candi Borobudur. For the nearest location based on cluster 1 are Candi Mendut, Candi Borobudur and Gereja Ayam Bukit Rhema. In the cluster 2 are Candi Borobudur, Candi Mendut, Gereja Ayam Bukit Rhema. The radius of each location under 1 km.

2.3 Materials

The data and information obtained were photos with metadata information, latitude and longitude coordinate, facts about the tourism sites , the myths of the sites, history of the sites, open and closed hours, condition of the sites.

3. Literature Review

The similar research from Shih-Hsiang Lo in 2009 titled the Design and Implementation the Incremental Clustering Algorithm for Geotagged Photos on a Map-Enabled Photo Web Service. The authors looked back to the past which is traditionally when users want to add metadata on their photo or video they have to extract photos from a digital camera, upload them to a web server, and then edit the location information of each photo in the personal photo web page manually. The tool includes both sides from a client-side and a server-side program. After a user takes a photo, the client-side program in the mobile device first attaches the GPS information to the photo and then uploads the photo to the server in synchronous or asynchronous mode. Afterward, the server-side program automatically edits the location information of the photo with the Google Map service [11].

4. Results and discussion

4.1. Database Design

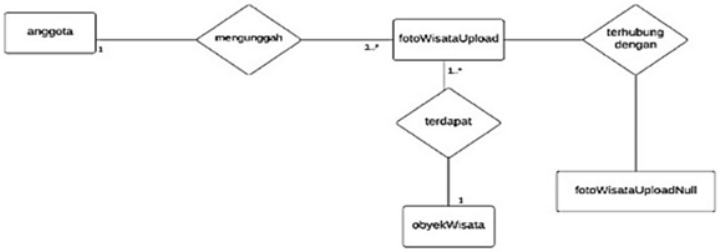

Figure 1. Entity Relationship Diagram

Table anggota is a table for storing the users' data such as user id, name, email, phone number, and user password. Table fotoWisataUpload is a table for storing the metadata of uploaded pictures such as picture id, date and time took, name of photos, latitude, and longitude coordinate of the photo. The obyekWisata table is stored attraction code, name of the attraction, category id, district id, attraction address, latitude and longitude coordinate, open and closed hours, duration visit time, popularity range, easiness range, and attraction photos. The obyekWisataNull is stored the grouping result who has null values.

4.2. Process Design

In this activity diagram, first of all, user do login and the system check then if match redirect to next page if not, display error message and reset the password then, user can upload photo and get information about the pictures and nearby location information.

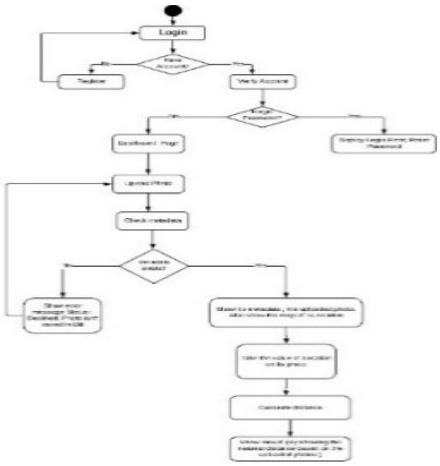

Figure 2 Activity Diagram

4.3. Application Test and User Interface Design

The test is to test the application whether the location of the photo will be accurate or not. So, the test was done on a few tests. One of the samples is in Pantai.Indrayanti. This section will tell you how the application works. Figure 3 is about upload photos. At this beginning of the test, the user must upload a photo. The photo must contain metadata and must be formatted in photo format. Figures 4 and 5 are about select the upload action. A user could choose the action whether they want to take the pictures from the camera or the gallery.

Figure 3 Upload Photo Form

Figure 4 Pick action

Figure 5 Toast the metadata information

After the application has successfully shown the pictures then, the application will toast the information about the pictures. In this section, the application put all of the information about the picture and the maps of its location.

Figure 7 Show some information about the photo

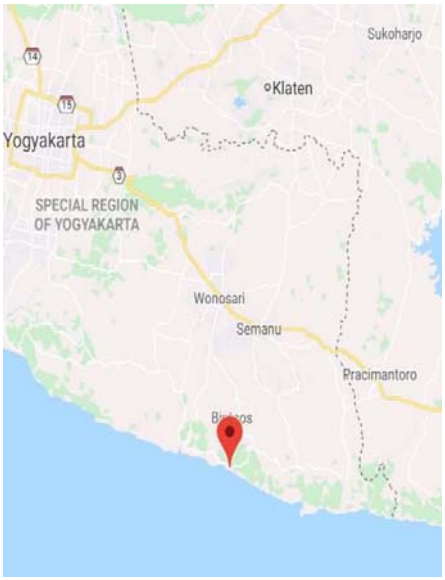

Figure 8 Show the actual location about the photo

5. Conclusion

This application has been tested in Gunungkidul by uploaded the pictures that were taken in many places in Gunungkidul. The result is the application shown the actual place and suits to the tourism location.. In each tourism site, the authors have distributed e-survey with Google Form. The respondent was 15 respondents. For 100% respondents said the application is useful for traveling and said how the application works very useful and also 42,9% of respondents gave the 4 and 57,1% gave 5 stars for the value of the application. For further information, we will develop more features like review and comment and also give information about the nearby location using clustering

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