Development of Jogja Tourism App using GPS-Based Tracking Augmented Reality

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Abstract

The number of tourists every year continues to increase, but the pandemic resulted in tourists experiencing a decrease, and activity also prioritized social distancing. With the reduction of tourists and human interaction, media are needed to help tourists still visit Jogja by minimizing interaction. The method used to build applications in Research and Development. The first stage is the need analysis and literature study. The second stage is a design that uses use-case diagram. The third stage is implementing or developing applications and quality assurance testing. The fourth stage is the stage of testing software for users and knowing the feasibility of the application. The results showed that the results of the application work were excellent, with a percentage of 85.11%, which means the application is suitable for the Jogja Tourism App.

Keywords: tourism, mobile application, GPS-based tracking, augmented reality

1. Introduction

The Covid-19 pandemic had a wide impact on many sectors, not only the education, hospitality, and trade, but also on tourism sectors have experienced significant impacts [1]. Yogyakarta experienced a fairly bad impact considering it was the second-choice tourist city after Bali. Jogja tourism sectors that became the bones of the Jogja community were closed during the pandemic [2]. Various efforts have been made to increase the number of return visits after implementing PPKM or opening the limited tourism sector.

However, the opening of the tourism sector will continue to be limited until the pandemic can be controlled [3]. Until the pandemic has not ended, community activities will continue to be limited, and interactions will also be reduced, especially for visitors from outside the area. Limited interaction to keep the community from contracting the covid-19 virus makes all sectors innovate, not tourism. Technology is needed that helps out-of-town visitors to be still able to enjoy limited culinary and Jogja tourism while maintaining interaction.

Geographically Yogyakarta is not too broad when compared to other provinces. Consisting of 5 level II areas, namely Sleman, Yogyakarta City, Bantul, Gunung Kidul, and Kulon Progo, each of which has a variety of tourism potential that can continue to be developed. Starting from geological and

volcanology tours on Mount Merapi, agro-tourism on the slopes of Mount Merapi, historical tours in Prambanan Temple, Ratu Boko, and surrounding areas, family tours in Kaliurang, shopping tours in the Malioboro area and Beringharjo Market, cultural tours in The Kasultanan palace and Pakualaman, craft tours in Bantul, karst tours in Gunung Kidul, beach tours on the south coast, to art tours in various museums and art galleries scattered throughout Yogyakarta.

According to Prastiyanti and Yulianto, media is a means or tool to convey messages from communicator to communicator [4]. Media plays an important role in helping to promote the results of production in the form of goods and services. Evans in Amaliah et al. explains that promotion is any form of communication used to inform, persuade, or remind people about products produced by organizations, individuals, or households [5].

According to Law No. 10 of 2009 on Tourism article 1, paragraph 5, Tourist Attractions or called Tourist Attractions are everything that has uniqueness, beauty, and values in the form of a diversity of natural wealth, culture, and manufactured products that are targeted or destinations of tourist visits. Culinary is a life activity closely related to daily food consumption and culinary is a lifestyle that cannot be separated from daily life; where culinary can develop the regional economy according to regional specialties that can create jobs and alleviate poverty through culinary tourism activities. Therefore, culinary needs to be incorporated into the creative economy development sector [6].

The medium of promotion of tourist and culinary objects in Yogyakarta until now continues to be developed. Some promotional media developed are using website platforms, social media, smartphones, and others [7]-[9]. The results of these studies revealed that the use of promotional media using information technology positively impacted the introduction of tourist or culinary objects in Yogyakarta. However, some media also require evaluation to be more optimal. One of them is research from Cornellia et al. l on the use of social media to introduce museums in Yogyakarta. The results will be optimal by considering several aspects, one of which is to add activities or other programs that can queue visitors to come [9].

Augmented Reality (AR) technology is one of the innovations that can increase user interest. Some research on the use of AR shows positive results, one of which is research on the use of ARBook Promotional Media for UMKM to increase the motivation of natural travelers to know UMKM products [10]. Augmented Reality technology using GPS Based Tracking can be an alternative for visitors to stay informed of tourist locations, accommodations, culinary even without a local tour guide. GPS Based Tracking utilizes geolocation on smartphones to provide specific location coordinates [11]. GPS Based Tracking can be utilized by combining Augmented Reality technology so that tourist locations, culinary, accommodation, or places of worship can be seen through maps and the user's camera.

In 2020, over 160 million smartphone users will be in Indonesia [12]. This makes smartphones a major commodity in the development of innovation in Indonesia. Some Jogja tourist applications have indeed been developed, but those that utilize the GPS Based Tracking Augmented Reality feature are still limited and have not followed the quality standards of media development. Several studies related to the development of augmented reality applications have been carried out by various researchers with several objectives, namely indicators of culinary locations [13], learning history and culture in the field of architecture [14], promotion of tourist objects in [15], and promotion of traditional food [16].

The facts about the need for media to help out-of-town visitors to be still able to do mobility amid a pandemic and reduce interactions, the covid-19 pandemic that has not been completed, as well as the need for special media that has been tested for quality standards, making the author develop a mobile-based travel guide application using GPS Based Tracking Augmented Reality called "Main ke Jogja". *Main ke Jogja* (in Indonesian) means Travel to Jogja in English, Indonesian used for the application's name to promote the Indonesian language.

2. Research Methodology

This research is conducted with research methods research and development. Sugiyono, in his book mentions that research and development is a method used to produce a particular product and test its effectiveness of the product [17]. Borg &Gall developed the stages used in the Research and Development method, which can be seen at Figure 1.
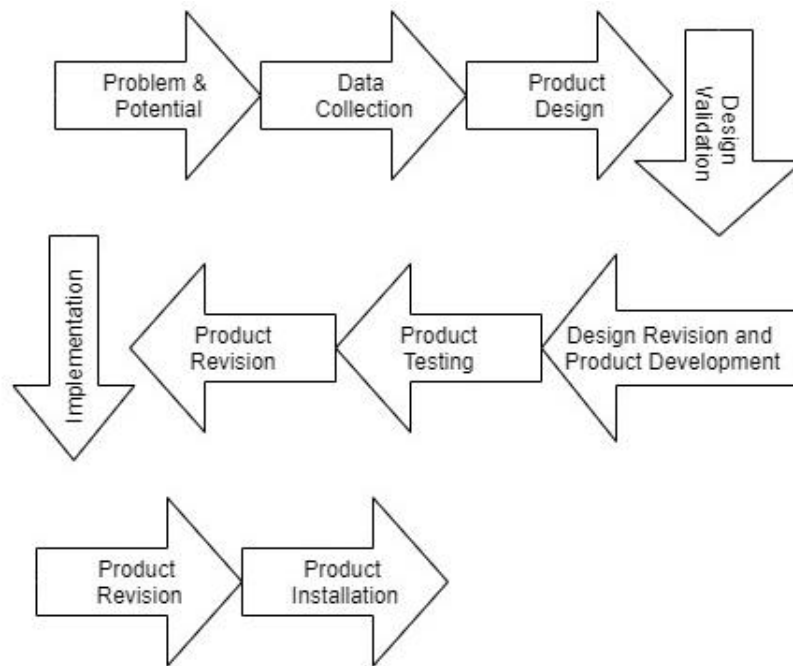
Figure 1 Stages of Research and Development.

Several software was used to develop the application, including visual studio and google API. In addition, system modeling was carried out using the Unified Modeling Language (UML). UML is a model that is used to describe a system being developed. Data collection techniques are to conduct library studies and observations and questionnaires. Literature studies is a method of writing using research study objects that focus on libraries. Data collection technique by observation is one of the techniques of data collection by making direct observations of the objects studied. A questionnaire or questionnaire is a method of collecting data using a list of questions.

Data analysis used in this paper uses quantitative data analysis techniques. In semantic differential scales, the author looks for the scale plan used using the division of 5 classes: very good, good, good enough, less good, and not good. According to Simamora, the calculation is by equation 1 [18].

$$RS = \frac{m - n}{b} \qquad \text{eq. 1}$$

where:
m = highest score on the scale
n = lowest score on the scale
b = number of classes or categories created

The authors interpret the measurement results through a five-scale semantic differential scale, where m = 7, n = 1, into five categories (b =5), hence the calculation is:

$$RS = \frac{7 - 1}{5}$$
$$RS = 1.2$$

So the standard for 5 categories formed with pole 7 as a positive is shown in Table 1. Then it can be made a continuous interval category percentage, as seen in Table 2.

Table 1 Interpretation Score

Score Range	Category
1 – 2,2	Bad
2,2 – 3,4	Less Good
3,4 – 4,6	Pretty Good
4,6 – 5,8	Good
5,8 – 7,0	Excellent

Table 2 Presentation Interval

Percentage	Category
0 %	Bad
0 % - 25 %	Less Good
26 % - 50 %	Pretty Good
51 % - 75 %	Good
76 % - 100 %	Excellent

The interval line above shows the categories of the resulting data that can be processed into percentage categories. The results presented then showed that they belonged to the category of bad, less good, pretty good, good, and excellent.

3. Results and Discussions
3.1 Application Planning and Performance

Usecase diagrams are used to determine what functions are in a system and who has the right to use them, as seen in Figure 2. This paper's resulting product is the application "Main ke Jogja". The actor and program scenario definition can be seen in the following Table 3 to Table 10.
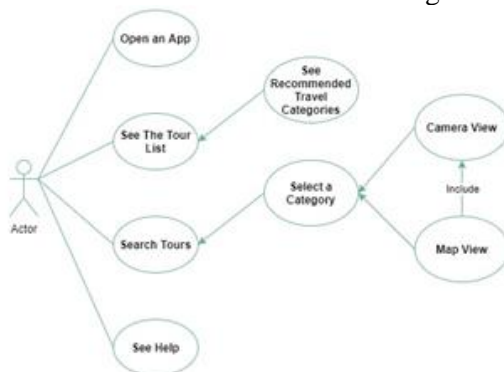

Figure 2 Usecase Main ke Jogja

Table 3 Definition of Actor

No	Actor	Description
1	User	People who will use the app

Table 4 Definition of Usecase

No	Usecase	Description
1	Open an App	Use case is the initial use case in running applications.
2	See Tour List	This use-case will display a list of Jogja travel and culinary information in several categories.
3	Search Tours	This use-case is a use-case to find locations using Augmented Reality. At this stage will be initialized internet connection and location. If the connection and location are not active, a notification will appear if the system goes to the location search page that contains the tourism category.
4	Choosing a category	It is a use-case that selects the category of the location you want to search for. At this stage, after selecting the category will be initialized the database. After the database is successfully uploaded, the location will be displayed, if it does not succeed it means there is a problem with the connection and brings up a notification that the internet connection is problematic.
5	Camera View	This use-case shows the location sought by using the camera in Augmented Reality. The location will be displayed on the camera through the category icon and place name.

No	Usecase	Description
6	Maps View	This use-case shows the location sought by using maps/maps in Augmented Reality.
7	See Help	This use-case serves to assist with the instructions for the use of the application.

Table 5 Use case Scenario: Open the App

Action Actor	System Reaction
Open an app	Featuring Splashcreen

Table 6 Use case Scenario: See Help

Action Actor	System Reaction
Clicking the help menu	View app usage instructions

Table 7 Usecase Scenario: The List of Tours

Action Actor	System Reaction
Select the travel list menu	Displays a list of tours of various categories, monuments, palaces, gudeg, bakpia, beaches, souvenirs.

Table 8 Usecase Scenario: Search Tours

Action Actor	System Reaction
Normal Scenario	
Choose a search tour menu	The system initializes the internet connection and the device's GPS is already active
	Display the category of the place you're looking for
Alternative Scenarios	
Choose a search tour menu	The system initializes the internet connection and the device's GPS is not yet active
	View notifications to have connections and GPS enabled
Mengaktifkan koneksi internet dan GPS	Enable internet and GPS connections

Table 9 Usecase Scenario: Camera View

Action Actor	System Reaction
Normal Scenario	
Clicking place category	Display Camera View
	The system initializes a database of sought locations, smooth connections
	View the location searched for according to the category
Alternative Scenarios	
Clicking place category	Display Camera View
	The system initializes a database of searched locations, problematic connections
	Displays notifications that the internet connection is problematic or weak.
Looking for a location with a good signal	Display Camera View
	The system initializes database of sought locations, smooth connections
	View the location searched for according to the category

Table 10 Usecase Scenario: See Help

Action Actor	System Reaction
Clicking help	View app usage instructions

The application work show begins by opening the icon of the main application on the mobile phone. The first display in the application "Main ke Jogja" is the opening splash screen as shown in Figure 3. Splash screen contains the title of the app that is displayed briefly only. After the splash screen page, the second page is the main menu page, as shown in Figure 4. The main menu page contains a list of tours, search for tours, and lastly is Help. Ui / UX design application "Main ke Jogja" is said to have met the applicable standards according to Gatot, CEO of Cracel, who graduated from Computer Science UGM (1/04/2014).

Figure 3 Splascreen page

Figure 4 Main Menu page

Before using the application, we should look at the instructions or how to use the application by selecting the help menu. The help menu provides information on how to use the application, displayed elegantly as in Figure 5.

Figure 5 Help page

To see the list of recommended tourist and culinary attractions, users can choose the tourist list menu. The tourist list menu will provide information to the user about the address and a brief description of the price of the tourist attraction or cuisine. The list of tours is displayed in a pivot and divided into several categories, including monuments, beaches, museums, palaces, gudeg, bakpia and souvenirs. The tour list menu display is shown in Figure 6.

Figure 6 Travel List Menu

The next menu is the tourist search menu, the main menu used to find out the tourist location, culinary to lodging in Augmented Reality. This application provides various categories: monuments, palaces, beaches, museums, batik, gudeg, bakpia, souvenirs, transportation, and lodging. To find travel, users can use two displays, namely a) camera view; and b) maps view.

Camera view in search tours is used to find locations using the camera. The user only needs to point the camera to find the location around it, as shown in Figure 7.
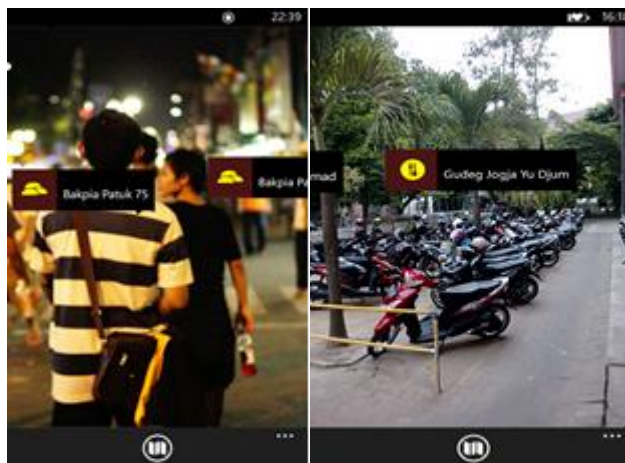
Figure 7 Camera View to Find Bakpia and Gudeg Culinary Locations

Next is to map view, maps view will provide an overview of the location with a maps view. Maps view provides information about the path or tracks users can pass to the destination, as shown in Figure 8.
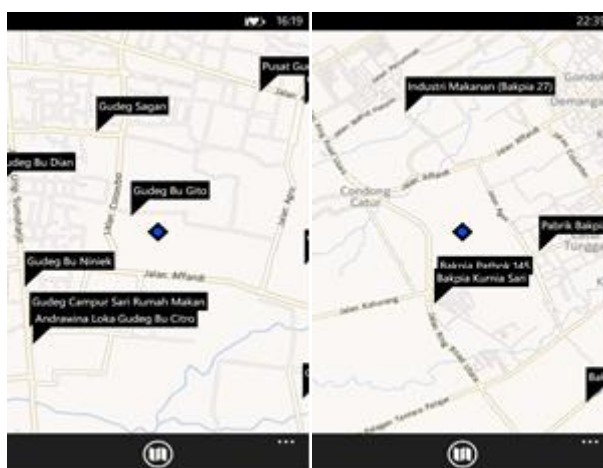

Figure 8 Maps View to Find Bakpia and Gudeg Culinary Locations

3.2 Results of The "Main key Jogja" Application Work Show

The result of the "Main key Jogja" application work show is an application work show conducted by users (users), the results of the work show data taken by the Usability Jr. Lewis questionnaire. The successful collection of data can prove the game's performance by using questionnaires with as many as 19 questions with 30 respondents in Yogyakarta as shown at Table 11. The total number of answers of 3396 was then divided by the number of respondents by 30 respondents, so the average number of answers per respondent was 114, with 19 questions. To find out the average of each item, then.

$$X = \frac{113.2}{19} = 5.95$$

The average result shows X = 5.95, then the average generated from the data includes Excellent categories. Then, the percentage of interval categories was created by calculating the percentage of data generated. The data is tabulated by calculating the number of criterium scores (when each item gets the highest score) = 7 x 19 x 30 = 3990. With the highest score per item = 7, the number of items = 19, and the number of respondents 30, the data collection results = 3396. Thus the usability rate of the Main ke Jogja application, according to the sample taken with 30 respondents, is (3396: 3990 x 100% = 85.11% of the criteria presented.

Table 11 Usability Test

Resp.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	7	6	7	7	8	7	7	8	7	6	7	7	6	6	5	5	6	7	7
2	7	7	6	6	6	7	7	7	7	6	7	7	7	6	7	7	7	7	7
3	7	7	6	7	7	6	6	7	7	6	7	7	6	6	6	7	7	7	7
4	4	6	4	4	4	5	6	4	3	3	4	5	4	5	5	4	5	4	4
5	6	6	5	5	5	6	6	4	7	6	7	5	7	4	6	6	6	6	7
6	6	7	6	6	6	7	7	5	5	5	6	6	6	6	7	7	6	6	6
7	6	7	6	6	5	6	7	5	5	6	6	6	7	5	6	5	6	6	6
8	7	7	6	6	5	5	6	5	5	6	7	6	6	6	6	6	6	7	6
9	7	6	5	6	6	7	6	6	6	6	5	5	6	6	7	6	6	7	6
10	6	6	6	6	6	7	7	7	6	6	5	5	6	6	5	5	6	6	7
11	7	6	7	7	8	7	7	8	7	6	7	7	6	6	5	5	6	7	7
12	7	7	6	6	6	7	7	7	7	6	7	7	7	6	7	7	7	7	7
13	7	7	6	6	5	5	6	5	5	6	7	6	6	6	6	6	6	7	6
14	7	6	5	6	6	7	6	6	6	6	5	5	6	6	7	6	6	7	6
15	6	6	6	6	6	7	7	7	6	6	5	5	6	6	5	5	6	6	7
16	7	7	6	7	7	6	6	7	7	6	7	7	6	6	6	7	7	7	7
17	5	6	4	4	5	5	6	4	3	3	4	5	4	5	5	4	5	4	4
18	6	6	5	5	5	6	6	4	7	6	7	5	7	4	6	6	6	6	7
19	6	7	6	6	6	7	7	5	5	5	6	6	6	6	7	7	6	6	6
20	6	7	6	6	5	6	7	5	5	6	6	6	7	5	6	5	6	6	6
21	5	6	5	5	6	5	6	4	4	5	4	5	5	5	5	5	5	5	6
22	6	6	5	5	5	6	6	5	7	6	7	5	7	4	6	6	6	6	7
23	6	7	6	6	6	7	7	5	5	5	6	6	6	6	7	7	6	6	6
24	6	7	6	6	5	6	7	5	5	6	6	6	7	5	6	5	6	6	6
25	5	6	5	5	6	5	6	5	5	5	4	5	4	5	5	4	5	4	4
26	6	6	5	5	5	6	6	5	7	6	7	5	7	4	6	6	6	6	7
27	6	7	6	6	6	7	7	5	5	5	6	6	6	6	7	7	6	6	6
28	6	7	6	6	7	6	7	6	5	6	6	6	7	7	6	5	6	6	6
29	6	7	6	6	6	7	7	5	5	5	6	6	6	6	7	7	6	6	6
30	6	7	6	6	7	6	7	5	7	6	6	6	7	6	6	6	6	6	6
Total	185	196	170	174	176	187	196	166	171	167	180	174	184	166	181	174	180	183	186
Average	6,1	6,53	5,67	5,8	5,87	6,23	6,5	5,53	5,7	5,57	6	5,8	6,13	5,53	6	5,8	6	6,1	6,2
Total Aver.	5,95																		
%	85,11%																		
Category	**Excellent**																		

3.3 *GPS-Based Tracking AR-based Tour Guide App*

The use of AR has grown in various sectors, such as education, the military, to tourism. Recent research results also revealed that AR could improve the morale of image and user ethics [19]. AR in tourism has been widely developed and proven to provide convenience for tourists in knowing the location more interactively and in real-time [20]. Some related research on the use of AR for travel is from Yovchewa et all (2012), which also revealed that Mobile Augmented Reality could provide relevant location information around tourists, provide real-time access assistance and updates, and provide more interactivity to users [21]. This is also in line with research conducted by Tahyudin et al. l, which developed an AR application to introduce tourism in Purbalingga Regency and showed that the use of AR in tourism has a positive impact [22].

To the Special Region of Yogyakarta, several applications related to the use of AR for tourism have been widely developed. Such as the 3D modeling of historic buildings developed by Evan [23], geographic and AR information systems for the creation of tourist maps in Yogyakarta by Purba [24], as well as the Yogyakarta Fun Guide application developed by Masitoh [25]. However, from these promotional media, it is still very rare to find the use of AR for tourism or those using GPS Based Tracking Augmented Reality. Related research using GPS Based Tracking AR is the development of a mobile application search public facility in Yogyakarta developed by Abimayu [26]. The results of these studies align with the application's performance, where users say the tour guide application is in the category is very good to be used as a tool for Yogyakarta tourists. However, application development still requires some improvements, including adjustments to existing operating systems. Nowadays, users use more android, no longer windows phones.

4. Conclusion

From the description and discussion carried out, several conclusions can be drawn. Namely, the application design "Main ke Jogja" has gone through a series of software engineering processes from design to testing has been by specifications. The application's performance, "Main ke Jogja" entered the category "Excellent", with details usability test results of 85.11%. This research still has things that need to be studied and redeveloped, including adjusting the type of operating system. Applications were developed using the windows phone operating system, but currently, the windows phone operating system is not widely used.

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