IMPLEMENTATION AUGMENTED REALITY ON MAJALENGKA CITY TOURISM APLICATION

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ABSTRACT

Majalengka, a small town in West Java province of Indonesia, Indonesia. Majalengka has a very enchanting nature, evident from the various destinations that he found with a very beautiful scenery. For new travelers in the city of Majalengka especially new in the city of Majalengka sometimes will have difficulty in finding the location as well as information about tourist attractions in the city Majalengka. Based on this matter then made a system by using technology of geofence and. In this application, travelers will get push notifications when they are in the tourist location. Then the tourists activate the camera on the existing object location. Then comes the augemented reality into 3D objects as well as full text information along with the features that exist in the location. Test results from this app indicate this application is easy to use by users, easily accessible data data useful for tourism. Thus this application can be an alternative for tourists to get information.

Keyword : Tour guide, Augmented Reality, Geofencing, Markerless, Android.

1. INTRODUCTION

Majalengka, is a small town in the province of West Java, Indonesia. Majalengka District, but culturally, Majalengka is an emerging agrarian area to the metropolitan city. This is marked by the emergence of many industries, tourism, international airport West Java Kertajati, shopping centers, and start the opening of hotels. With the construction of BIJB or West Java International Airport which is targeted to operate in 2018 must have a very positive impact on tourism Majalengka city.

As new tourists visiting Majalengka especially newly visited Majalengka sometimes will have difficulty in finding the location as well as information about tourist attractions in Majalengka. Alam Majalengka is very fascinating, as evidenced by the many found tourist attractions with very beautiful scenery. Most of the tourist attractions in Majalengka is still hidden and still rarely visited by tourists. Because not yet known by most people, then tourism in Majalengka become so natural and still awake its authenticity. This hidden and unspoiled tourist attraction causes many travelers to find it difficult to find the location as well as complete and accurate information.

From the questionnaires distributed to 30 respondents ie tourists who are visiting Majalengka, known as many as 60.6% of tourists have difficulty in obtaining information and tourist locations. Tour guides, websites, and asking people who are met on the go can be one solution for out-of-town travelers to get location and information. However, this way is sometimes not enough and does not provide tourist locations and information needed by tourists.

The solution provided is to build mobile applications using geofence technology and augemented reality technology markerless method. In this application, tourists will get push notification while in the location diradius tour. Then the tourists activate the camera on the existing object location. Then comes the augemented reality of 3D objects as well as complete text information along with pictures of existing facilities on site.

The goals to be achieved in this application development are:

1. Notify the location of the tourist attraction.
2. Provide complete information in the form of description of the existing tourist attraction in Majalengka city.

2. RESEARCH CONTENT

2.1 Theoretical basis

2.1.1 Augmented Reality

By Ronald Azuma (1997) definition, there are three principles of augmented reality. Augmented Reality is a combination of the real and virtual worlds, the second runs interactively in real time, and the third is the integration of objects in three dimensions, ie virtual objects integrated in the real world.

Simply AR can be defined as a real environment that added virtual objects. The integration of real and virtual objects is possible with appropriate display technology, interactivity is possible through certain input devices [1].

2.1.2 Markerless Augmented Reality

With this method no longer need to use a marker to display the digital elements. Although markerless is called but the app still runs by scanning the object, but the scanned scope is wider than using the AR marker. Markerless Tracking Techniques as a technology include [1]:

1) Face Tracking.

Determination of coordinate points form facial pattern using Viola-Jones algorithm.

2) 3D Object Tracking

3D Object Tracking Techniques can recognize all the forms of objects that exist around such as television, mobile phones, cars, homes and others. This technique can visualize common things.

3) Motion Tracking

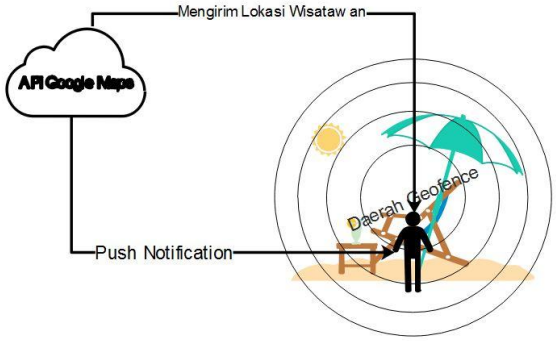
The markerless method with this technique is by capturing the movements the user performs.

4) GPS Based Tracking

This technique is useful as a guide as well as GPS function, but equipped with a marker of the intended direction information.

2.1.2 Geofence

Geofence is a virtual parameter for geographic regions in the real world. This specified virtual parameter can either be static or dynamic. Digital geofencing costumes can also be used, if devices that provide location based services (LBS) users enter or exit geofencing, the device will receive a notification message. This notification may contain information about the location of the device. Geo-fence notifications may be sent to the phone as an example of increasing every other form of action. [2]



Picture 1. *Geofence*

2.1.4 Andriod

Android is an operating system aimed at mobile devices (mobile) whether it be mobile or netbook. Android is built on Linux Kernel that gives openness from the developer side, so developers of Android developers are not only for certain circles only.

Android is developed by Google with Open Handset Allience (OHA). Open handset Allience is an open-ended mobile device alliance consisting of 47 companies Hardware, Software and telecommunication companies aimed at developing open standards for mobile devices [3].

2.2 Analysis And Design

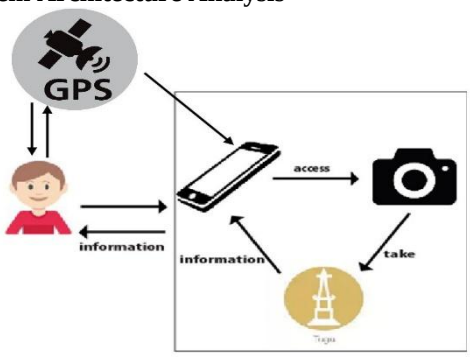
2.2.1 System Requirement Analysis

In building applications that suit the needs, of course, required analysis of the general system that is running. Before doing the design, firstly done needs system analysis is by way of questionnaires with tourists who are visiting Majalengka. The system requirements are:

1. The number of tourists who visit the city Majalengka, and the average tourist visit to the attractions such as monuments, historic buildings, natural attractions here tourists do not know the location of tourist attractions and routes to the tourist destination in the city of Majalengka.

2. Still lack of supporting information media and tourists who come to a tourist attraction who want to know information about the object of tourism in search of the surrounding people or existing figures. So the information obtained by tourists about the existing tourist attraction in the city Majalengka, is still less than optimal.

2.2.2 System Architecture Analysis



Picture 2. *System Architecture*

To get tourist information, tourists come to the tourist attraction in Majalengka city. After that tourists direct the camera from the smartphone to the existing tourist attraction on the location then the output of 3D icon icon tourist attractions, text information about the tourist attractions and photo facilities.

GPS serves as a determinant of the user's position at that time, so that the received location information is relevant to the user's location. To be fully implemented GPS combined with a compass and accelerometer that has been integrated with the handset device. Compass works to get the horizontal orientation of the handset. While the accelerometer serves to read the orientation of mobile phones held by users. If the user holds the position of the screen

facing front and flat to the ground then augmented reality visualization will be displayed parallel to the horizon. But if the user holds the device at a 45 degree down position then the augmented reality visualization appears on the top screen.

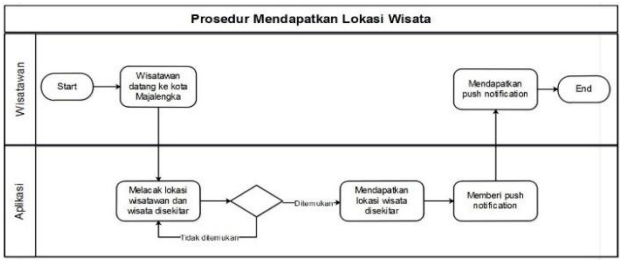
2.2.3 Analysis Application to be built

The system to be built is a mobile smartphone application by utilizing augmented reality technology and geofence. Augmented reality will be used to display 3D objects in the form of tourist attractions icons and complete information about tourist attractions Majalengka city in order to be expected to help wisatan in order to know the location of tourism around and get complete information about the sights visited.

2.2.2.1 Procedure to Obtain Location Information

Scenarios of the procedures for finding tourist sites in Majalengka city to be built include:

1. Tourists visiting Majalengka city
2. The application will track the point of the location of tourists and track the point of location of existing tourist attractions.
3. If found the location of the tour, the application will provide push notification to tourists.
4. Tourists will get push notification about the location of the tour around.
5. Tourists have been at tourist sites.

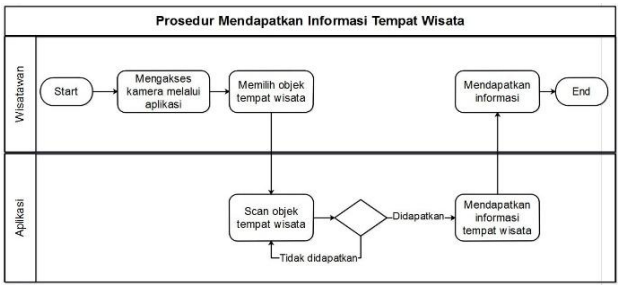


Picture 3. Procedure to Obtain Location Information

2.1.2.1 Procedure to Obtain Tourist Information

The scenarios of the tourist information gap procedure in Majalengka city to be built include:

1. Tourists have been at tourist sites.
2. Tourists open the app and immediately set up the camera.
3. Tourists Scan the sights, if successful application will display complete information about the sights in the form of augmented reality. If the traveler fails to scan again until the scan is tracked by the application.
4. After successful travelers will get complete information about the sights visited.

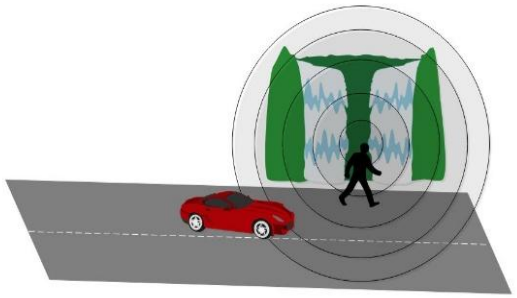


Picture 4. Procedure to Obtain Tourist Information

2.2.4 Geofence Analysis

Geofence technology is used in software programs that use global positioning system (GPS) to define geographical boundaries virtually. Geofance is used to create a radius that will provide information about the sights around application users. In the implementation of geofence technology, there are some data retrieval process lalitude and longitude users, displaying attractions and making a radius or boundaries to find tourist attractions. The following is a breakdown of the processes performed in the geofence process.

Broadly speaking, geographic coordinates are used to limit a particular area (mapping) as a virtual fence (geofence) of an area. The system specifies the traced object located within or outside the geofenced region. Notifications will appear when the object enters or exits the geofence region. This technology can also allow for the detection of proximity between mobile phones that are tracked with specific geofenced areas.



Picture 5. Geofence Area

2.2.5 Analysis Of The Markerless Augmented *Reality Method*

Markerless Augmented Reality is one of Augmented Reality method without using frame marker as detected object. there is a difference between marker based tracking and markerless tracking. On tracking camera-based marker position and camera orientation are counted with predefined markers. While markerless tracking, calculating the position between the camera / user and the real world without any reference, uses only natural feature points (edge, corner, line or 3D model). The Markerless method requires manual manual steps, as well as reference models or drawings for

initialization, then the accuracy of the information obtained from the traked objects would be better [4].

2.2.5.1 FAST Corner Detection Algorithm

FAST (Feture Form Accelerated Segment Test) is an algorithm developed by Edward Rosten, Reid Porter, and Tom Drummond. This FAST corner detection is made with the aim of speeding up real-time computation time with the consequence of decreasing the accuracy of corner detection [5].

The FAST corner detection begins by determining a point p at the (xp, yp) coordinates of the image and comparing the intensity of the point p to the 4 surrounding points. The first point lies in the coordinates (x, yp-3), the second point lies in the coordinates (x, yp + 3), and the fourth point lies in the coordinates (xp-3, y).

Vuforia uses the FAST Corner detection algorithm to define how well images can be detected and tracked using Vuforia SDK. This rating is displayed in the Target Manager and returns for each upload target through the web API. The augmentable rating can range from 0 to 5 for each given image. The higher the augmentable rating of the target image, the more powerful the detection and tracking capabilities it contains. A rating of zero indicates that the target is not tracked at all by the Augmented Reality system, while the 5 star rating indicates that an image is easily tracked by the Augmented Reality system.

FAST corner detecteion works on an image as follows:

1. Specify a p point on the image with the initial position (xp, yp)
2. Determine the four points. The first point (n = 1) lies in the coordinates (xp, yp + 3), the second point (n = 2) lies in the (xp + 3, yp) coordinates, the third point lies at the coordinates (n = 3) xp, yp-3), the fourth point (n = 4) lies in the coordinates (Xp- 3, yp).
3. Compare the intensity of the center of p with the four points around. If there are at least 3 dots satisfying the following conditions, then the center point p is the vertex.
4. To determine the point of an angle, all pixels will be divided by three subset namely; Pixel dark, Pixel similiar, and P brighter.
5. Repeat the process until all points on the image have been compared the intensity.

2.2.6 Nonfunctional Needs Analysis

In the analysis of the needs of non-functional systems is also described analysis of hardware (hardware), software (software) and users (users) as a material analysis of the shortcomings and needs that must be met in system design to be applied.

2.2.6.1 User Analysis

Table 1. User Analysis

Pengguna	Umur	Kemampuan	Pengalaman
wisatawan	5-50 tahun	Mampu menggunakan smartphone android	1 tahun

2.2.6.2 Hardware Analysis

Table 2. Hardware Analysis

No	Perangkat Keras	Spesifikasi
1	*Processor*	Quad-core 1.4GHz
2	Memory	RAM 2GB
3	Display	720 x 1280 px
4	Kamera	8mp
5	GPS	Gps

2.2.6.3 Software Analysis

Table 3. Software Analysis on Computer

No	Perangkat Lunak	Spesifikasi
1	*Sistem Operasi Komputer*	Windows 10
2	Tools Pembangunan	Unity 3D
3	Tools Desain	Adobe Photoshop

Table 4. Software Analysis on Android

No	Perangkat Lunak	Spesifikasi
1	*Sistem Operasi Andoroid*	Android 6.0 (Marshmallow)

2.2.7 Functional Needs Analysis

Functional requirements analysis describes the process of activities that will be applied in a system and explain the needs of the system needed for the system to run properly and in accordance with needs. Modeling system is modeled by using Use Case Diagram, Activity Diagram, Class Diagram and Sequence Diagram.

2.2.7.1 Specification of Functional Requirements

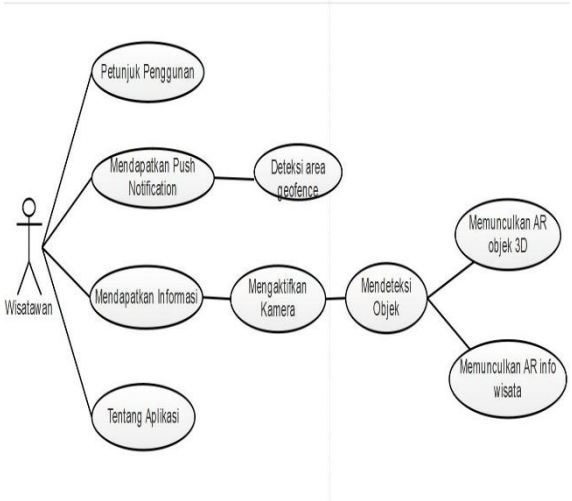
Table 5. Specification of Functional Requirements

Nomor	Spesifikasi Kebutuhan Fungsional
SKPL-F-001	Sistem dapat menamilkan petunjuk penggunaan
SKPL-F-002	Sistem dapat memberikan push notification
SKPL-F-003	Sistem dapat memberikan informasi lokasi tempat wisata
SKPL-F-004	Sistem dapat menampilkan tentang aplikasi

Nomor	Spesifikasi Kebutuhan Fungsional
SKPL-F-005	Sistem dapat mengakses GPS untuk device yang memasuki area geofancing yang sudah ditentukan
SKPL-F-006	Sistem dapat mengaktifkan kamera
SKPL-F-007	Mendeteksi objek untuk menampilkan gambar 3D dan informasi
SKPL-F-008	Sistem dapat menampilak Augmented Reality objek 3D icon tempat wisata
SKPL-F-009	Sistem dapat menampilak Augmented Reality informasi tempat wisata

2.2.7.2 Usecase Diagram

The following is the design of the processes contained in the development of tourism information application majalengka.



Picture 6. Usecase Diagram

2.2.7.3 Actor Definition

Table 6. Actor Definition

No	Aktor	Deskripsi
1	Wisata	Wisatawan yang menggunakan aplikasi untuk mencari tahu informasi tempat wisata kota Majalengka

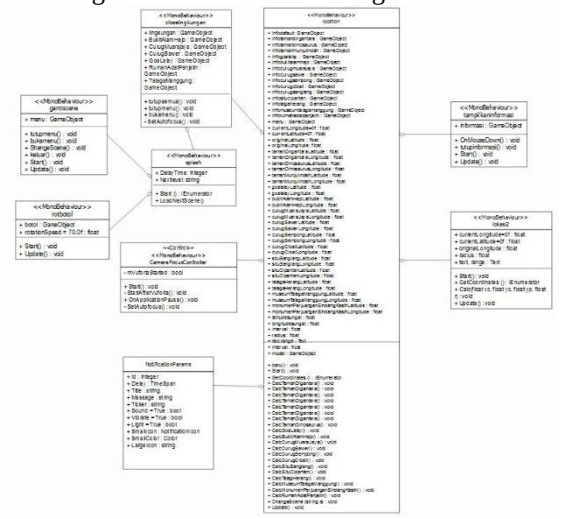
2.2.7.4 Usecase Definition

Table 7. Usecase Definition

No	Usecase	Deskripsi
1	Petunjuk Penggunaan	Fungsionalitas untuk menampilkan bagimana cara penggunaan aplikasi
2	Mendapatkan Push Notifikasi	Jika wisatawan masuk ke area geofance maka sistem akan memberikan notifikasi berupa tempat wisata terdekat dengan wisatawan
3	Mendapatkan informasi	Fungsionalitas untuk menampilkan informasi lengkap tentang tempat wisata
4	Tentang Aplikasi	Fungsionalitas untuk menampilkan tentang aplikasi
5	Deteksi area geofence	Fungsionalitas untuk mendapatkan notifikasi lokasi wisata terdekat dengan wisatawan
6	Mengaktifkan kamera	Fungsionalitas untuk mengaktifkan kamera
7	Mendeteksi objek	Fungsionalitas untuk mendeteksi objek yang telah dijadikan marker
8	Memunculkan AR objek 3D	Fungsionalitas untuk menampilkan augmented reality berupa objek 3D di tempat wisata
9	Memunculkan AR info wisata	Fungsionalitas untuk menampilkan augmented reality berupa informasi lengkap tentang tempat wisata

2.2.7.5 Class Diagram

Class diagrams are created so that the classes created in the application match the design of the class diagrams that exist in the design documentation.

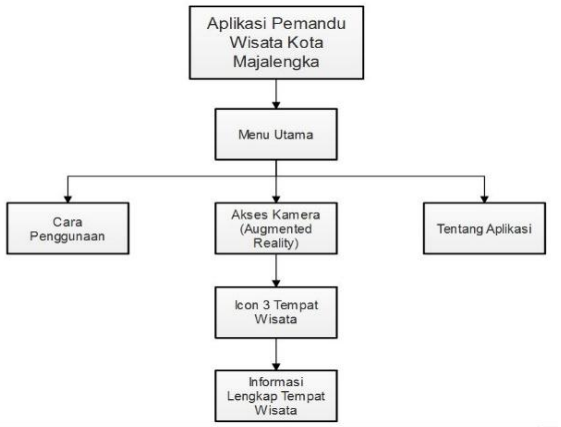


Picture 7. Class Diagram

3.7 System Planning

The design of the system is the depiction, planning, and manufacture of several elements of the system based on system analysis that has been done

before. The design of the development of tourism applications of this city of Majalengka augmented reality includes the design of menus, interfaces, and semantic networks.



Picture 8. Menu Design

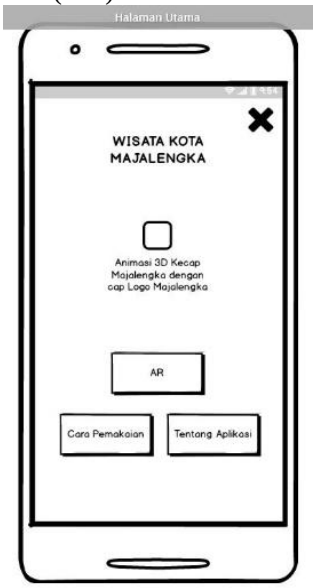
2.2.8 Interface Design

Initial View Of The Application (T01)



Picture 9. Inteface 1

Main Page View(T02)



Picture 10. Interface 2

Display How To Use (T03)



Picture 11. Inteface 3

Display Camera Access (T04)



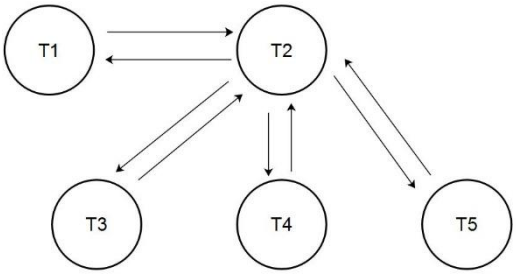
Picture 12. Inteface 4

Display About Application (T05)



Picture 13. Inteface 5

2.2.9 Semantic Network



Picture 14. Semantic Network

2.2.10 Implementation System

The implementation discussions consist of hardware implementation, software implementation, geofencing implementation and interface implementation.

2.2.10.1 Hardware Implementation

Table 8. Hardware Implementation

No	Perangkat Keras	Spesifikasi
1	*Processor*	Snapdragon 430
2	Memory	RAM 1 GB
3	Monitor	4 Inchi
4	Kamera	5 MP

2.2.10.2 Software Implementation

Table 9. Software Implementation

No	Perangkat Lunak	Spesifikasi
1	*Sistem Operasi Andoroid*	Android 6.0 (Marshmallow)
2	GPS	GPS

2.2.11 Testing System

Testing is done in order to find errors and deficiencies in the software being tested. Testing is intended to find software that is made whether it meets the criteria in accordance with the purpose of software design. Testing is done by black box testing techniques that focus more on finding functional fault program. In addition, testing is also done by distributing questionnaires to 30 respondents.

2.2.11.1 Black-Box Testing

Black box testing performed on this application is divided into three parts, namely test scenario, case and test results, and test conclusions.

2.2.11.2 Requiretment Testing

Requiretment testing is one of the blackbox testing techniques which in this research is used to test every functionality contained in the built application, there are test scenarios that expose the sequence and things tested in the testing process.

Table 10. Requitment Testing

No	Item Uji	Skenario Pengujian	Jenis Pengujian
1	Menampilkan Model 3D	Splash screen tampilan awal aplikasi	*Blackbox*
		Menampilkan gambar botol kecap 3D	
2	Menampilkan Lokasi Wisata	Mengklik push notification pada saat lokasi wisata terdeteksi	*Blackbox*
		Menampilkan nama lokasi wisata	
3	Deteksi Kamera	Mendeteksi kamera	*Blackbox*
		Kamera terdeteksi	
		Kamera aktif	
		Kamera tidak terdeteksi	
4	Deteksi Objek	Mengarahkan kamera ke objek wisata	*Blackbox*
		Menangkap objek wisata	
		Mencocokan pola	
		Objek wisata terdeteksi	

No	Item Uji	Skenario Pengujian	Jenis Pengujian
5	Memunculkan AR Deskripsi Tempat Wisata	Mengarahkan kamera ke objek wisata	*Blackbox*
		Menangkap objek wisata	
		Mendeteksi objek wisata	
		Identifikasi objek wisata	
		Objek wisata terdeteksi	
		Menampilkan AR deskripsi tentang objek wisata	
		Objek wisata tidak terdeteksi	
6	Menampilkan Cara Menggunakan	Memilih menu cara menggunakan	*Blackbox*
		Menampilkan informasi cara penggunaan aplikasi	
7	Menampilkan Tentang Aplikasi	Memilih menu tentang aplikasi	*Blackbox*
		Menampilkan deskrpsi tentang aplikasi	

3. CLOSING

3.1. Conclusion

Based on the results of analysis and implementation gained in making this final task. it can be concluded that, from the purpose of app development guides Majalengka city is to make it easier for tourists who will visit the city Majalengka. Here is the result of the purpose of app development guides Majalengka city that has been analyzed and tested so that the results obtained as follows:

1. Making the application of Majalengka city tour guides for tourist guides in Majalengka city has been met because the system uses geofancing technology.
2. Mobile applications that provide detailed information for every tourist spot in the city of Bandung has been met because the implementation of existing tourist attractions in the application contains complete information about the sights.

3.2. Suggestion

In building app guides Majalengka city is still a lot kekurangnnya. Therefore need to be developed and further refinement. As for suggestions that the system built to work better, should be done things as follows for further development:

1. Reception of tourist list information around the location.
2. The addition of routes to facilitate tourists in travel.

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