Smart tourist guide application for the introduction of Malang city tourism potential using hybrid technology

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Abstract. Tourism in Malang City with Strategic City Branding (Beautiful Malang) is one sector that contributes significantly to efforts to increase regional income. The variety of types of tourism that exist, it needs to be supported by the existence of a good information dissemination system. The existence of this system makes it easy for women to get access to regional tourism information. In this study, two technologies were used, namely geographic information systems and augmented reality. The use of GIS technology aims to provide information that is geographically related to a tourism object. While Augmented reality is used to bring up 3D objects along with information relating to the tourism object. In its application, this application was successfully used with 90% of respondents expressed satisfaction with the performance of the application. The rest complained about the delay when scanning the tourism object markers. The use of this hybrid technology is expected to be able to provide tourism information with more attractive packaging as well as an educational media for tourism promotion. For further development, it is necessary to apply an efficient data parsing concept so that there is no delay when there is a data request.

1. Introduction
Tourism in Malang City is one sector that contributes to regional income. Efforts such as Strategic City Branding (Beautiful Malang) were carried out to promote tourism in Malang City. However, the distribution of information about the tourist attractions is not maximal, because it is still done manually, by looking at the signpost boards which are sometimes unclear, asking questions to the tour guide or by coming directly to Malang Tourist Information Centre. This method is not effective, because of limited access time and less flexibility for tourists.

Lack of information regarding the distribution of tourist attractions can be minimized by using GIS (Geographic Information System). GIS is a special information system for managing data that is geographically referenced, in this case the GIS data used is vector, data that displays spatial patterns in the form of points, lines, curves or polygons from objects on earth [1]. This technology allows tourists to be able to find out where they are at the moment and the closest destinations around them. By utilizing this geographical information system, potential tourist attractions and public facilities can be mapped to the maximum, so that tourists can find a place more efficiently and do not take long.

Malang City still uses promotional patterns manually, for example using tourist guidebooks. This is less attractive to tourists because the display is very limited. To be more attractive, guidance is needed in the form of digital applications and can use technology augmented reality (AR). Augmented reality is a technology that adds virtual world objects into the real world in real time using camera media [2,3]. In this case, this technology can be used to display information content in the form of nearby destinations.
and public facilities. The use of this technology is expected to be something innovative in an effort to advance tourism in Malang City [4]. Based on this, it is necessary to make an android based application that combines GIS (Geographic Information System) and AR (Augmented Reality). With this application, tourists do not have to use manual instructions to go to a tourist spot located in Malang City. This application is expected to be useful to maximize the potential of tourism in the city of Malang as well as improve the safety and comfort of visitors [5].

2. Methodology

2.1. Data retrieval methods

The data collection phase used in this study is a study literature and observation. Study literature is a technique of collecting data by collecting data or information theoretically sourced from books literature. Researchers look for materials needed by reading books, articles, and journals related to tourism, GIS (Geographic Information System), and AR (Augmented Reality). While observations were made by visiting the Malang City Tourism Office to find and obtain information along with data on potential tourism sites. The method of data collection is the way researchers collect data to obtain information needed in order to achieve the research objectives [6]. In collecting this data, it is done by conducting field research into the Malang City Culture and Tourism Service.

2.2. Development Method

The development method used in this study refers to the development method of Software Development Life Cycle (SLDC) with the model waterfall [7]. The process of developing this software is carried out sequentially, where the execution of each phase in the waterfall must be done first before proceeding to the next phase. This method consists of several stages, namely as shown in Figure 1.

![Figure 1. Waterfall concept.](image)

- Requirement elicitation
- Analysis
- Design
- Implementation
- Testing
- Deployment
- Maintenance

2.2.1. Requirement elicitation. This stage is the initial stage used to analyze what needs are needed in making and implementing a Tourist Guide Application to introduce tourism potential in Malang City using hybrid technology. Data collection was carried out by means of studies literature on tourism, GIS, and AR as well as observing the Malang Tourism Office.

2.2.2. Analysis. Needs analysis is an important stage. Because from this stage it can be concluded whether the requirements of making the application have been fulfilled. Referring to the application that was made needed several supports, including poor city tourism data, maps, marker data, 3D modeling in each marker, and other needs [8].

2.2.3. Design. System design is the stage of the design process that translates requirements or results from requirements analysis into a software design that can be estimated before coding is made. This stage includes system flow design and making interface representations on the implementation of the
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2.2.4. Implementation. This process translates system design into program code using predetermined programming languages. The programming language used in making this application is C#.

2.2.5. Testing. Program testing is done by testing the application thoroughly. This process aims to find out whether the application that has been made is in accordance with the design and whether there are still errors. After being tested internally, this application will be tested on several tourists who travel to Malang City.

2.2.6. Deployment. The application is made using several software. To create a 3D object, researchers use Adobe Blendr software. Whereas to make augmenter reality concepts, researchers use unity and Vuforia. Whereas in map mapping, map boxes are used.

2.2.7. Maintenance. At this stage application will be applied and maintenance of applications is useful if there are various errors and changes in accordance with the wishes of the user.

2.3. The design of the system

Tourist Guide Application has two user access rights, namely admin and user. The flow of application usage for the first admin is the admin login to the website using a username and password. If verification of the login is successful, it will be directed to the admin page. Admin can manage data on tourism places, such as: adding, editing, and deleting data stored online in firebase. In addition, the admin can also accept or reject the proposed destination proposed by the user.

While the application usage flow for the user is the user opens the application, then directs the camera to the marker in the form of a tourist place. After that, the camera will scan the place and will appear nodes along with information about the nearest destination or public facilities that can be visited. Users can also choose locations that are raised by category. The categories in this case are restaurants, hotels, public facilities, and others. If the user is interested in visiting a location, the user can touch the node and the application will display maps and routes to that location. In addition, users can also propose the latest tourist destinations or destinations that have not been registered by selecting the Add Suggestion menu on the menu. The process scan utilizes technology augmented reality. The object that be acts as a scan marker the trigger to bring up the nodes. While GIS technology is used to display maps that serve to display the route to the place you want to visit. System process flow design for users can be seen in the image below [9].

![Figure 2. Admin business process.](image)

![Figure 3. User business process.](image)
2.4. Design
User uses a smartphone to scan the object that has been determined if the camera is pointing correctly the location nodes will appear around if one of the nodes is to be directed to that place with map box. Admin, in this case the task is to manage object data, namely adding, updating, and deleting data in the database. Not only that the admin can also see a suggestion from the user here admin who decides whether the suggestion is accepted or not. There are two actors involved in this application. The actor is the user and admin. User is an app user who can send location requests and use applications such as the specified scanned object. While admin is a person who has the authority to manage all reservation data, including input, update, and delete data. Admin can see incoming request messages. The main process that can be done by the admin is to enter new tourist objects in the application. Admin chooses form the tourist data, select add tourism object data, fill in all the fields provided. If there is data that is filled in the column does not match the data will not be able to be saved and if it is appropriate admin press the save button, then the new added object will enter the database. New data entered by the admin comes from recommendations for new tourist destinations recommended by the user. Recommendations for new tourist destinations are recommended by users by entering information on the send request content. The data entered is the coordinates of the data from the tourist attraction.

3. Result and discussion

3.1. Interface system
This Application there are two user interfaces, namely web base and mobile base. Content in the web is used to manage data from tourist attractions in Malang City. In the Data Object menu, the admin can do data processing about tourist attractions in Malang City. To add new tourist attractions, Admin can click the Add Place button. After that, the admin can fill in the fields that have been provided related to the data on the tourist attractions. In addition, the admin can also make changes or deletion of data regarding tourist attractions. Suggestion data contains suggestions from users who send data about tourist attractions that have not been registered in the application. The data displayed in this menu is only data sent by users who have confirmed email. Admin can only accept or reject suggestions that have been given by the user. If suggestions are accepted, then the data will enter the tourist data. If rejected, then the data will be deleted. The web admin page will be shown in figure 4.

![Figure 4](https://example.com/figure4.png)

Figure 4. The web admin's content.

The main content contained in the mobile application is the search location content of the tour. Actors who can access this content are users. To be able to use this content, the user must scan the tourist
location. As explained earlier that the parameters of this application are the user's location and the scanned marker. In figure 4 a location search content page will appear.

3.2. Performance
Performance from the application is carried out by conducting a trial directly at several locations of tourist attractions. When the user selects the start menu, the application will open the camera. The user's camera device is used to scan objects in the form of tourist attractions. If the place or object that is scanned by the user is correct and the coordinates match the data in the data base, objects will appear augmented reality. If the node is pressed, the user will be directed to maps that aim to the selected node along with directions and estimated arrival time.

![Image of application interface with augmented reality features]

**Figure 5.** Performance of the application.

3.3. Implementation
Software testing is very necessary to ensure the software / application that has been / is being made can run in accordance with the expected functionality. Testing or testing itself is a critical element of software quality assurance and is a part that is not separate from the life cycle of software development such as analysis, design, and coding. Black Box Testing focuses on functional specifications of the software. The tester can define a collection of input conditions and test the program's functional specifications. In table 1, the results of the application user's response will be displayed.

| No | Menu | Feature | Description |
|----|------|---------|-------------|
| 1  | Start| Location Detection | Successfully |
|    |      | Description name based on the location where nodes suggestion Raising similar places | Successfully |
|    |      | Raising where information | Successfully |
|    |      | Raising map | Successfully |
|    |      | Compliance with the selected node maps | Successfully |
|    |      | Search Button place | Successfully |
|    |      | Back Button | Successfully |
| 2  | Suggest| Input field | Successfully |
|    |      | Suggest button | Successfully |
|    |      | Back button | Successfully |
|    |      | Email Confirmation | Successfully |
| 3  | Help | Matching content with how to use the application | Successfully |
|    |      | Back Button | Successfully |
| 4  | About Us | Back | Successfully |
Implementation This application is done directly with users who are different from local, out-of-town, and foreign tourists. The following are some samples that have been tested, namely Slamet Park, Dinoyo Ceramic Village, Jodipan Colorful Village, Freedom Square, Kampung Biru Arema, Taman Trunojoyo. Figure 6 and figure 7 are Slamet Park located on Jl. Taman Slamet No.8, Gading Kasri village, Malang City. And maps Mapsbox that lead from Slamet Park to Tugu Park.

4. Conclusion
The use of hybrid technologies in one application is a new breakthrough. In this study, the merger of the two technologies was successfully carried out, as evidenced by the results of black box testing. All content in the application goes well. In this application, mapping in the GIS field is used to determine the current location and destination point. To get this, the application must be able to scan perfectly in the object marker field. The reference object is a photo of a tourist location. The scanning process is carried out by the user, then the user can see information from the tourist objects he visits. From the trials conducted, 90% of users feel helped by the existence of this application. The rest complained about the slow parsing of data from the server. For further development, a better concept of data parsing is needed. From literature studies, data parsing can take advantage of the concept of Socket, RMI or Json.

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