.

cARica: Enhancing Travelling Experiences in Wonosobo Through Location-Based Mobile Augmented Reality

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Article Info

ABSTRACT

Wonosobo, as a Regency in Central Java Province, Indonesia, has attractions including the Dieng Plateau Theater Kalianget, and Menjer Lake. The research is intended to provide more experience for tourists who visit the tour through Location-Based Mobile Augmented Reality (MAR), an application we developed, cARica. This application includes experience travelling in Wonosobo and is aware of other information displayed through AR content. It was an alternative medium for tourism promotion to be easy, attractive, and inexpensive. It is a practical guide to attract tourists to visit tourist sites. In its development, we use the prototyping method so that each stage is carried out under the procedures that have been prepared. To get the point of Interest (PoI) points of tourist sites, use Global Positioning System (GPS) data taken through Google Maps to get the Latitude and Longitude of each object. The results of this study present that cARica is a Location-Based Mobile Augmented Reality service platform that can be accessed using an Android smartphone and has three-dimensional animated character content with the Wonosobo regency icon. cARica is a form of innovation in providing exceptional services and experiences for tourists and has the potential to be continuously developed.
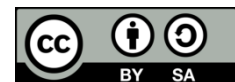
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1. INTRODUCTION

Wonosobo is a regency located close to the mountains in the Province of Central Java, Indonesia. Wonosobo has tourist attractions managed by the Department of Tourism and Culture of Wonosobo Regency, including the Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake. This study is intended to provide more experience to the tourists who come to visit attractions. The expertise provided is through Location Based Augmented Reality technology that is expected to positively impact tourism and increase the Regional Original Revenue target of Wonosobo regency while simultaneously supporting the increase in tourist visits.

As the development of android-based smartphones is so rapid, many applications are created innovatively with various creations, including the Augmented Reality (AR) application. Mobile Augmented Reality (MAR) combines the virtual world and the integration between digital elements added to the real-world space and can follow the environmental conditions in the real world [1], [2], [3]. MAR is an AR service intended for mobile devices that allows individuals to interact with virtual things on the mobile screen, which

is a mixed display of the actual world and virtual 3D objects [4], [5]. Because of the growth of mobile devices, MAR has emerged as the most popular and practical form of augmented reality [6]. This technology is considered an interactive, creative and innovative media that can enrich how humans interact interactively with the virtual world [7]. The interaction can be combined with information on websites, social media and video streaming so that MAR can improve how users interact with the physical world, buildings or places and add pieces of information to complement the destination objects of AR itself [8]. Augmented reality (AR) has transformed the visitor experience, allowing for meaningful engagement with unique culture and heritage [9], [10]. AR apps, which seamlessly integrate real-world photos with computer-generated material, provide a mediated perception of the real-world environment and hence have significant potential.

AR provides opportunities for more invaluable experiences and positive benefits, especially tourism. Utilize AR to increase tourist satisfaction with the attractions offered [11], [12]. On the other hand, the application of AR in tourism also needs to be continuously developed and improved so it does not create new problems [13]. Using appropriate AR technology in the field of tourism will give an impression and an interactive impression for tourists [14].

Through cARica, we integrate Mobile Augmented Reality, Location Based Services (LBS), and Wonosobo Tourism to contribute and add more value in providing a unique experience to tourists visiting the attractions in Wonosobo namely the Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake, so that they are more than just getting entertainment. Still, they will also get information and history about the tourist areas they visit in Wonosobo.

Location Based Services (LBS) is a service on software that can access data, files, pipes, memory objects, streams, and other online services. This access is controlled by location data and/or time constraints or a combination of both [15]–[17]. Thus, LBS is an information service that smartphone devices can access through networks [18] and the internet that uses information about the geographical position of the smartphone device [19], [20]. Is a method of determining the location of a mobile phone, whether it is fixed or moving. A variety of technologies, such as radio signal multilateration between cell towers, can help in localization [21]. LBS application in the world of tourism has been widely used to see the route of the nearest tourist attraction. Mobile devices can access this service through the network. It can directly display the geographical position and identify the location of a person or a specific object, including augmented reality [22]–[24]. In a broad sense, software services that employ geographic data and information to provide users with services or information.

The name of cARica is taken from the acronym excursion Mobile Augmented Reality Location-Based. This name is also taken from one of the famous fruits growing in the Wonosobo Regency. Carica fruit has the Latin name *Carica quercifolia*; *Carica goudotiana*, a relative of Papaya that grows in the wet highlands, 1,500-3,000 M above sea level, has a source of calcium, sugar, vitamins A and C [25]. Plant species in Indonesia are diverse, Papaya is a member of the Caricaceae family. Carica papaya and *Carica pubescens* are the two species of papaya found in Indonesia. *Carica pubescens* on the other hand, has greater potential for growth in mountainous or higher locations [26].

This study aims to improve the experience of travelling in Wonosobo. It is hoped that tourists and users of the cARica application will be aware of and know other information displayed through AR content. As well as being an easy, attractive, cheap and effective alternative media campaign and guide to attracting local and foreign tourists to visit tourist sites and facilities available in Wonosobo Regency.

2. METHODS

This research is in the application prototyping stage. Therefore, the steps in this study consist of two main stages, namely the method of data collection and the prototype design stage, as shown in Figure 1. The first stage in this research was Initial Requirements, which included several steps to collect data. Interview is one method of collecting data that has been recognized as an essential data or fact collection technique and is widely carried out in developing information systems [27], it is easier to make smarter decisions with an information system that delivers all of the necessary facts. At this stage, the interviews were conducted with local agencies in the form of the Wonosobo Regency Tourism and Culture Office profile, vision and mission, user segments, and tourism target visitors. The results of the interviews are used as data for the design and development of the cARica application, especially at the prototype stage.
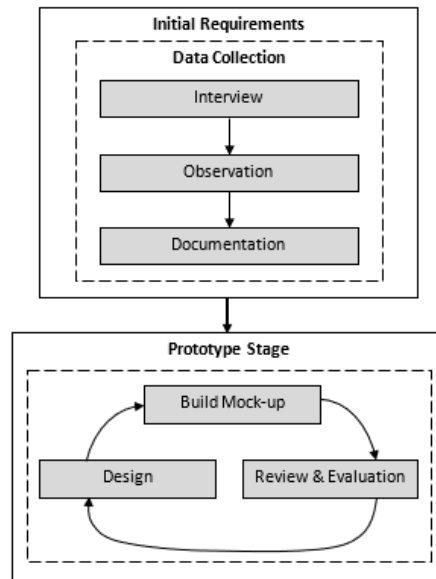
Figure 1. Stages of Methods

Observation is a technique or approach to get primary data by directly observing the data object [28], [29]. This data collection method is carried out by making direct observations to obtain data in the development of the cARica application. The data obtained is used to process and provide content on each page of the application and whatever needs are needed on the application. Information received in the form of descriptions (text), and images will be presented in the Location Based Augmented Reality application.

Documentation is the collection of qualitative data by viewing or analyzing documents created by the subjects themselves or others. Documentation is one-way qualitative researchers can get a picture of the subject's perspective through written media and other documents written or made directly by the subject concerned. At this phase, an analysis of existing data is also carried out to produce positive, negative or neutral data [30]. With documentation, researchers collect data from existing documents so the writer can obtain notes relating to research, such as a general description of objects, structures and personnel, letters, photographs, etc. Documentation is carried out to obtain data that has not been obtained through observation and interviews [31], [32], [33]. At this stage, several results of supporting data were obtained for the development of the cARica application, such as brochures, pamphlets, tourism posters, photographs, archives and some other supporting data.

After the Initial Requirements phase is felt fulfilled by gathering some data, the next stage is the development of a cARica application prototype. This stage is carried out from designing the concept to compiling the appearance of the user interface. The concept is composed by determining the objectives, identifying users, product types, basic rules, size, and targets, as well as determining the location-based services (LBS) points.

At the build mock-up stage, all data that has been collected is packaged according to the needs to be used. The data is processed in clip art, photographs, three-dimensional (3D) models, animation, video, and audio. cARica application was built to target the use of smartphones with the Android operating system. This Linux-based operating system provides an open platform for developers to create their applications, Android-based applications is built using the Java programming language and database hierarchy for data storage [34]. Built using the Unity 3D engine, a cross-platform-based game, application and another interactive development platform [35], [36]. Then for, LBS to use services from the Google Maps API (Application Programming Interface). In the context of APIs, the term Application refers to any software that performs a specific purpose. Interface can be viewed as a service contract between two programs. This contract specifies how the two will communicate with one another via requests and responses. Their API description explains how developers should organize those calls and responses [37]. The AR database uses services from Vuforia, a software development kit (SDK) issued by Qualcomm, for application development in the field of computer vision, particularly virtual reality and augmented reality technologies [38].

Evaluation is a process for getting information, measuring a job or things that are done, and knowing the extent to of the activity has been achieved. Evaluation is instrumental because it can determine the level of work and how to assess what has been done or done [39], [40]. At this stage, it is expected to see the extent to which the cARica application can be used and accepted by users, Wonosobo Regency tourism managers and tourists. The evaluation results are expected to show the advantages and disadvantages of the application to be mass-produced and applied.

3. RESULTS AND DISCUSSIONS

Wonosobo Regency is geographically located in the middle of the island of Java, with a landscape of primary mountains, administratively entering the territory of Central Java Province, Indonesia. Wonosobo is easily accessible to local and foreign tourists from all directions, and this is supported by adequate road infrastructure and infrastructure. Their potential is very diverse with their culture and natural attractions.

From the results of the data obtained, for the content that will be presented on the cARica application, Location Based Augmented Reality is Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake. Dieng Plateau Theater (Figure 2 - a) is a tourist attraction that presents films about the Dieng Plateau, starting from history, geographical conditions, culture, community conditions, and other things. Kalianget (Figure 2 - b) is a tour of warm water baths typical of active volcanic areas. Warm water contains sulfur, feels very refreshing, and is believed to cure various diseases. The Menjer Lake (Figure 3) originated from the eruption of Mount Pakuwaja, which was once active, initially only a tiny source of tears, which expanded after the explosion.

(a)   (b)

Figure 2. Dieng Plateau Theater (a) and Kalianget (b)

Figure 3. Menjer Lake

Content that appears on the application cARica (excursion Mobile Augmented Reality Location-Based) is the character of Carica fruit, according to the name of this application. The display of 3D objects is shown in Figure 4, Carica fruits and 3D character objects. This object will appear according to the location specified in AR.
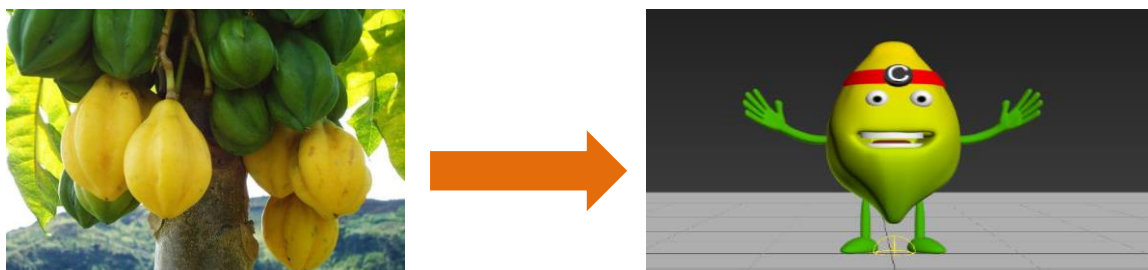

Figure 4. AR content objects

In the cARica application, AR content will bring up 3D character objects from Carica fruit. 3D characters will appear at the entrance of a predetermined tourist attraction, namely Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake. cARica application users must use a smartphone that has the application installed and is in a tourist location. Then, the user activates the application and directs the smartphone camera under the directions, and directions from the map or the location of the 3D object will be found.
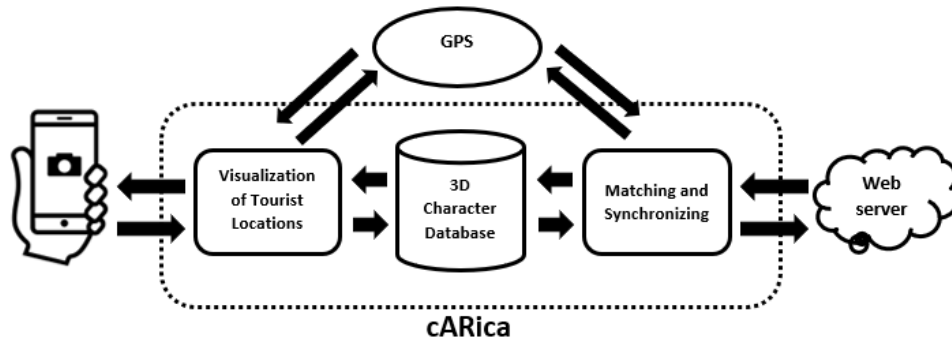
Figure 5. Architecture of cARica

Figure 5 shows how the system architecture of the cARica application runs. When the user activates the application and points the camera at the tourist site, the application will automatically read and match the GPS with the existing database. If the database has been synchronized, it will be sent to the web server and automatically returned to the smartphone by displaying 3D object content resulting from augmented reality visualization.

Attractions are identified into 3 locations: Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake. Data is taken through Google Maps to get a GPS point, as shown in Figure 6. Information is taken from the Latitude and Longitude of each object. Table 1 shows the identification of tourist attraction locations with Latitude and Longitude. Latitude and Longitude are coordinate systems that can be used to determine and describe the position or location of any point on the Earth's surface. Latitude is a measurement of location north or south of the Equator on a globe or map. There are three types of latitude: geocentric, astronomical, and geographic, with only small variances between them. Geographic latitude, which is utilized in mapping, is determined using a slightly different method. Because the Earth is not a perfect sphere—its curvature is flatter at the poles—geographic latitude is defined as the arc subtended by the equatorial plane and the normal line that may be drawn at a particular place on the planet's surface [41].

Tabel 1. Identification of Tourist Locations

No	Location	Latitude	Longitude
1	Dieng Plateau Theater (DPT)	-7.214873	109.899447
2	Kalianget	-7.337534	109.909444
3	Menjer Lake	-7.268937	109.924339

Figure 6. Identification of Tourism Locations

The cARica application has several menus (Figure 7 - a): Guidelines; Terms and Conditions; Location-Based; Maker. The "Guide" page contains procedures for using the application to facilitate users who are new to using the application. The "Terms and Conditions" page provides information on the minimum number of smartphone devices used by the user, one of which the user must activate GPS or Location on the smartphone. The " Location-Based " page (Figure 7 - b) is adjusted to which tour will be visited, namely Dieng Plateau Theater (DPT), Kalianget, and Menjer Lake (Figure 8) and the content will be displayed in the form of location based on 3D characters. The page "Maker" in the form of application information and application maker.

(a)　　　　　　　　　　　　　　　　　　　(b)

Figure 7.　Appearance of cARica Application

Figure 8.　　AR content for the choice of Menjer Lake tourism location

4.　CONCLUSION

cARica is a Location-Based Mobile Augmented Reality service platform that can be accessed using an Android smartphone to provide more experience in travelling at three tours, namely Dieng Plateau Theater (DPT), Kalianget, and Telaga Menjer, located in Wonosobo Regency, Central Java, Indonesia. This application allows users to find tourist destination destinations through GPS activation with enriched multimedia content in the form of 3D animated characters in the city of Wonosobo, the carica fruit. Although this type of AR application is widely used in several other tourist locations, cARica is innovative in providing unique services and experiences for tourists. cARica has the potential to continue to be developed to be better and perfect. The next stage in the research to be carried out is to focus on conducting field trials with real users, i.e., tourists visiting to assess the system's performance and usability, whether users are satisfied with the application also as their primary motivation for using the cARica application. It is hoped that cARica can help tourists to maximize their tourism activities because users can find far more accurate information when walking around the tour using only one smartphone. Hopefully, cARica can continue to be developed, getting a lot of support from all parties, including the government and tourists.

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