An Interactive Mobile Augmented Reality for Tourism Objects at Purbalingga District

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Abstract

   This paper presents the development of an interactive mobile Augmented Reality (AR) for tourism promotion with eXtreme programming (XP) at Purbalingga district, Central Java that has many places of tourist attractions such as Owabong, Purbasari Pancuran Mas, Sanggaluri Park and Buper Munjuluhur. By applying the AR concept it is expected the tourism objects could be enhanced by augmenting the virtual brochures which could be viewed over a mobile device. In this study, mobile device Android platform is used to display interactive brochures of tourism promotion containing 3D models, animations, and sounds. The brochure will provide information in of real attractions of the tourism objects in the Purbalingga district.

Keywords: augmented reality, extreme programming, tourism objects, android

1. Introduction

   The tourism sector as an economic activity has become a major income and priority for a development of many countries, especially for developing ones. Indonesia as a developing country has many potential tourism attractions such as natural resources, a variety of cultural historical heritage, and unique community life. Wherein, the tourism potential is spread from the island of Sumatra, Java, Kalimantan, Sulawesi, Bali, and Irian Jaya.

   The Purbalingga is one of the districts in Central Java that has many places of tourism objects such as Owabong, Purbasari Pancuran Mas, Sanggaluri Park and Buper Munjuluhur. The tourism development in Purbalingga has continued to show positive trends. In 2012, the *own-source revenue* (PAD) of Purbalingga district was more than Rp. 644.000.000 or USD 47,928.38 obtained from the tourism sector which is an increase of 33% from the target of Rp. 485.000.000 or USD 36,095.13. Hence, in 2013, Purbalingga the only district in Central Java that won "The Most Improved TCTA Award 2013". Nevertheless, there are still many places of tourism objects at the Purbalingga district that have not been well promoted [1].

   Therefore, information of tourism objects with an interactive media (i.e. video and audio) is one of the solutions of the tourism promotion. Hence, the Augmented Reality (AR) is an alternative technology to give users the sense of the real world while interacting with the virtual and physical object that can be supporting tourist promotions. The aim of this paper is develop an interactive tourism attraction that can be applied to Android smartphones platform to support tourist promotion at the Purbalingga district.

   The AR is getting more important now days as it can be used in many fields and encouraged by the new smartphones and tablets revolution. Furthermore, several studies in the implementation of AR have been carried out, such as Kourouthanassis, et.al, have presented that mobile augmented reality (MAR) travel guide, named CorfuAR for supporting mobile tourism applications at the principal city of Corfu island in Greece. The research showed that behavioral intention to use the system was positively affected through feeling of pleasure and excitement. Huang, et al, also has implemented a mobile Augmented Reality (AR) to capture images of the book. The captured of images are stored into the cloud, then the image features are checked. If the images match then it will be sent to the Android smartphone platform. Meanwhile, the Chunghwa Telecoms Hicloud as a cloud was used [2, 3].

In education area, some AR experiments have been performed. Huang et.al, have developed an interactive application that provided AR effect and corresponding video on puzzle to facilitate children to learn geometry in the AR-supported with mobile phone, called Aurasma-Augmented Reality (AAR). In this study, the participants were 21 from 1st–6th grade of 2 elementary schools. The result of this study indicated that the method adds a new dimension to the presentation of original image at education for special needs children by permitting users to view scientific data and techniques on mobile devices as videos or as three dimensional environments at their own leisure. Jorge et.al, combined every learning process from the electrical machines course in the electrical engineering degree using the AR and traditional learning based on textbooks "magic books". The experiment was used the course of six groups of 25 students each (random chosen) during the semester between February and May. The result showed that the usability results offered very high scores according to the ease of the use. Zarzuela et.al, have developed a learning game with educational purposes about different kind of animals living in a zoo using two concepts: Augmented Reality and Serious Games. This application can be played on any mobile device Android (smartphone or tablet) platform, iOS, and printed marker and also open for everyone. Tekkesinoglu et.al, have developed web based AR for preschool children to provide educators a way to teach students with deeper and more meaningful academic experiences in the especially animal names with instructive and fancy way [4-7].

In engineering field, Cirulis & Brigmanis have developed the application virtual city 3D-AR for urban planning which provide wide functionality, including spatial visualization for more precise evaluation of new constructions and objects look and visual influence on environmental surrounding. This application allowing to merge real city with virtual three dimensional (3D) buildings and its logical structure. Hardiansyah has made an application pedestrian navigation, detecting the position of buildings and roads have been successfully performed by this application. Other capabilities of the application is to provide position location of users and to indicate the direction of the road that has been successfully created [8, 9].

The paper is organized as follows. Section 2 discusses the methodology used in this study. Section 3 is the results of the study that we performed in order to assess the performance including functionality of mobile AR tourism objects, and the properties of mobile AR applications, usability and experimental impact of application. Finally, we conclude the paper with practical implications of our research pertaining to the development and evaluation of mobile AR tourism objects application.

2. Research Method

An interactive application requires at least designer (i.e. 3D designer, screen designer, interaction designer), programmers, and usability engineer. The 3D designer is concerned with 3D interaction. The screen designer is focused the actual screen layout that is what is presented to the user on screen. Then, the interaction designer is to fine-tune the interaction the user can experience. Programmer is the implementation of the user interface by writing and editing low level code. Therefore, usability engineer is point of interest for the usability engineer that combines all the roles of the quality assurance (i.e. selects, briefs, debriefs, prepares the evaluation materials, conducts and logs) and analyzes and evaluates the results. The users is actually uses the user interface by navigating [10]. In this study, developing mobile AR tourism objects have main three phases includes design, implementation, and evaluation.

2.1. The Architecture of System

The applications will be constructed through several stages. The first stage is to design the layout of the promotional brochure. The second stage is the determination of the image to be used as a marker application. The last stage is to upload the content to be displayed on the marker as AR information (tourism objects). The system architecture as illustrated in Figure 1.
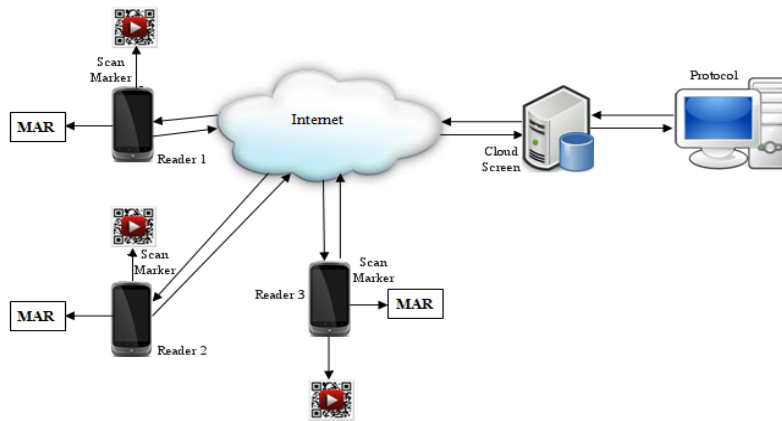
Figure 1. The mobile AR architecture

This architecture consists of the main actors, namely the readers and editors. The editors are AR content that creators who connect to the cloud interface. Meanwhile, the reader is a user who views a content by running the AR with app for Android interface platform. The detail of the system architecture is presented in Figure 2.

A brief description of the architecture of mobile AR system in Figure 2. First is determined news or advertisements that will be the AR as a marker by an editors (protocol). Next, printing promotional tourism objects brochures such as location, attractions, and logos. Second, the image is uploaded and stored in the cloud database as an interface that can be called up by *point and scan* using interface of app for Android platform. Third, readers are given the tourist destinations on brochures, then can be called to display the AR. Fourth, to view the images, the reader should run their Android smartphones. Then, the camera is used to view a particular image or marker in a promotional tourism objects brochure by using the application interface app for Android platform. Fifth, if there is the same picture in a cloud database then it will be displayed via the AR with interactive content (i.e. video and audio).
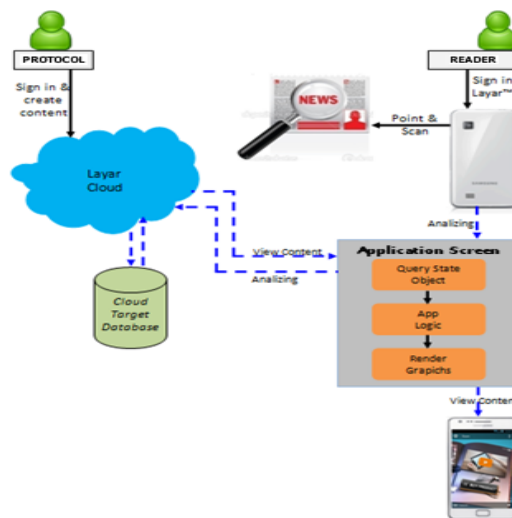

Figure 2. Detail architecture mobile AR system

On the other side, the readers or users architecture of the system interface app for Android platform in Figure 3. A brief explanation of the users AR system architecture. Firstly, users or readers run the application in an interface app for Android platform. Then, a selected

image or marker will be delivered and matched in the database cloud server. Secondly, images or marker in which received will be verified. If the images match and fit on the interface then the data will be delivered in *getPOI* type to the users or readers in the form of AR includes 3D image, video or animation, virtual buttons, or web links.
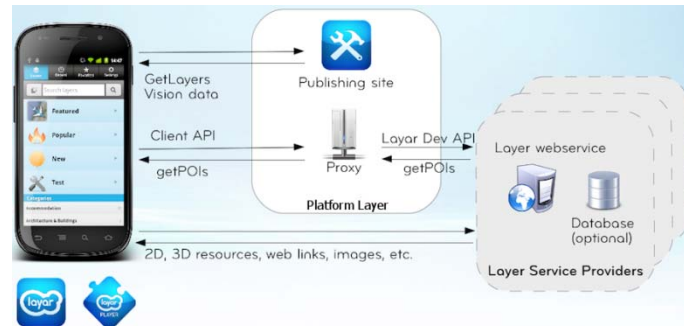

Figure 3. The user's architecture system

3. Results and Analysis
In this section we explained the design and development prototype concept of mobile AR tourism objects on the Android smartphone platform. The discussion can be made in several sub-sections.

3.1. Functionality of System
In general, the task of the editor is to determine markers and filling content includes images and videos, set the page on a web browser, upload content (i.e. images and videos), and conduct experiments that application. Furthermore, to launch the AR application, users or readers should be download and install the application screen app on the Android smartphone platform. The camera on the smartphone is used to find markers mobile AR in the local newspaper "Harian Umum Radar Banyumas".

3.2. The Marker Reading Process
In this experiment, the prototype concept of AR tourism objects as shown in Figure 4. The interface of app for Android platform is used to perform image or marker detection in the brochure then display the information of AR content includes video, images, animation, and virtual buttons that contain a particular link, Figure 5. It is based on general AR application set up that consists of four main component which are a camera to capture the real environment (tourism attractions) and tracking, computer and display devices for virtual augmentation (mobile device) and markers as tangible interaction devices as well as tracking target [11]. The overall tourism objects design divided into editor's page and reader's page. This prototype is using handheld (mobile device) for viewing the augmentation of the tourism attractions. It means, handheld display will help readers to experience the AR concept while maintaining the context of reading normal newspaper. Furthermore, mobile devices nowadays advanced in computing power and also in 3D graphic processing with the introduction of embedded Graphic Processing Unit (GPU). This mobile AR tourism objects concept can be used directly as a normal reader reading a normal newspaper. This is focused on two parts which consist of physical newspaper (tourism objects brochure) and mobile application.

In this experiment, *screen vision* technology for the development of tourism objects has been used. The *screen vision* technology is to use the detection, tracking and computer vision techniques then insert the objects that introduction of color descriptors into the AR. Then, *Dominant Color Descriptor (DCD)* is used for the distribution of color in patches that display the capacity of color in large quantities but still efficient. The editor has to upload certain image to be used as a marker. Furthermore, the *screen* will detect the image and converted into a form of *fingerprint* then appropriate to be delivered to the user. The final step is recognize the *screen* and displays AR content into the real world.
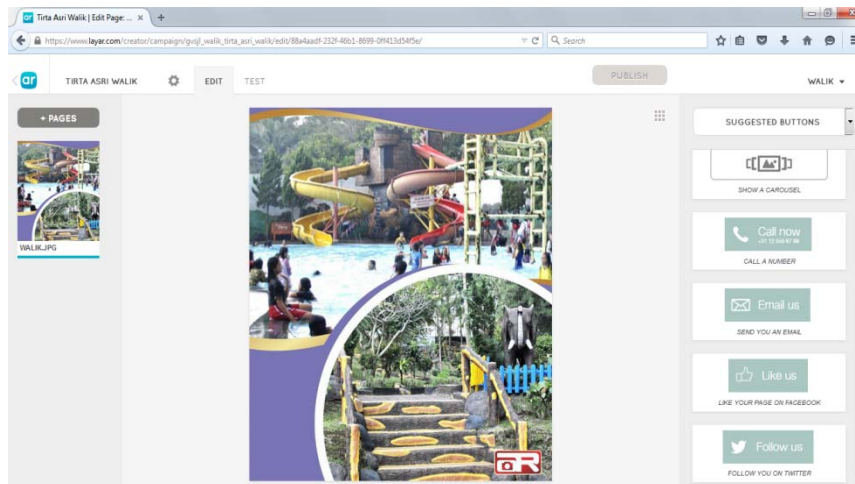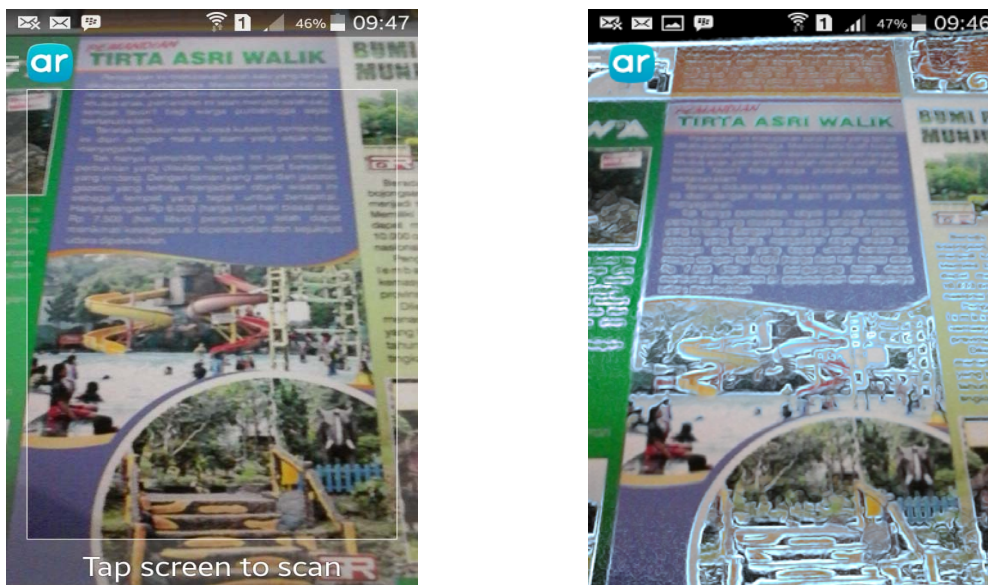
Figure 4. Interface design system

Figure 5. Image detection system

3.2. Observational Study

The observational study of the prototype is based on user feedbacks gathered from tourist promotions. The users who tried the prototype were from different background and age. Based on the observation, most of targeted users were excited with the AR technology concept applied on the tourism objects. The AR concept of the tourism objects successfully grabs their attention. The users were likely to use this mobile AR application with the tourism objects brochure. This observation shows that this mobile AR application with the tourism objects brochure is easy to use. The excitement of interacting with the tourism objects brochure's contents using their finger can be shown based on their reaction.

4. Conclusion

This paper has presented the development of an interactive mobile AR tourist destinantions brochure. This application consists of mobile AR application and interactive brochure interface design. Based on observational study on the prototype, this tourist

destinations brochure was interactive design and engaging learning experince. Based on encouraging response from observational study, it motivates the development of the AR others tourism objects at Purbalingga district as future work.

References
[1] Hardiyanto. Pengembangan Pariwisata di Purbalingga Perlu Gebrakan Monumental. *Jateng Time.* 2014.
[2] P Kourouthanassis, C Boletsis, C Bardaki, D Chasanidou. Tourists responses to mobile augmented reality travel guides: The role of emotions on adoption behavior. *Pervasive and Mobile Computing.* .2015; 18: 71-87.
[3] HR Bai. Mobile Augmented Reality Based on Cloud Computing. 2012.
[4] CY Lin, HC Chai, JY Wang, CJ Chen, YH Liu, CW Chen, CW Lin, YM Huang. Using free augmented reality app in teaching programs for children 4 with disabilities. *Displays.* 2015: 1-4.
[5] J Martín-Gutiérrez, P Fabiani, W Benesova, MD Meneses, CE Mora. Augmented reality to promote collaborative and autonomous learning in higher education. *Computers in Human Behavior.* 2015; 51: 752-761.
[6] MM Zarzuela, FJD Pernas, LB Martínez, DG Ortega, MA Rodríguez. *Mobile Serious Game using Augmented Reality for Supporting Children's Learning about Animals.* In 2013 International Conference on Virtual and Augmented Reality in Education. 2013: 375-381.
[7] S Tekkesinoglu, MS Sunar, CS Yusof. Towards Building Web Based Augmented Reality Application for Pre-School Children. *TELKOMNIKA.* 2013; 11(6): 3134-3141.
[8] FF Hardiansyah. Augmented Reality Untuk Mengetahui Fasilitas Umum Berbasis Android. Institut Teknologi Sepuluh Nopember. Surabaya. 2012.
[9] A Cirulis, KB Brigmanis. *3D Outdoor Augmented Reality for Architecture and Urban Planning.* In Procedia Computer Science. 2013.
[10] C Kulas, C Sandor, G Klinker. Towards a Development Methodology for Augmented Reality User Interfaces. 2003.
[11] DWF v Krevelen, R Poelman. A Survey of Augmented Reality Technologies, Applications and Limitations. *International Journal of Virtual Reality.* 2010; 9(2): 1-20.