**Indonesian Journal of Electrical Engineering and Computer Science**
Vol. 1, No. 2, February 2016, pp. 375 ~ 380
DOI: 10.11591/ijeecs.v1.i2.pp375-380


# 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 tourism attractions such as Owabong, Purbasari Pancuran Mas, Sanggaluri Park and BuperMunjuluhur. 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 promotioncontaining 3D models, animations, and sounds. The brochure provides information in of real attractions of the tourism objects in 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 islands of Sumatra, Java, Kalimantan, Sulawesi, Bali, andIrian Jaya.

The Purbalingga is one of the districts in Central Java that has many places of tourismobjects such as Owabong, PurbasariPancuran Mas, Sanggaluri Park and BuperMunjuluhur. The tourism development in Purbalinggahas 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 was 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 tourismobjects at the Purbalingga district that have not been well promoted [1].

Therefore, information of tourismobjects 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 [2]that can be supporting tourist promotions. The aim of this paper is develop an interactive tourismattractions that can be applied to Android smartphones platform to support tourism 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 [3]. 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 [4, 5].

*Received October 27, 2015; Revised January 4, 2016; Accepted January 26, 2016*

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 $1^{st}$–$6^{th}$ graders of 2 elementary schools. The results 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 [6-9].

In engineering field, Cirulis&Brigman is 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 allowed 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 [10, 11]. Lin and Zhang (2014) presented a new type film and TV shoot system called AR Filmmaking System (ARFMS). This application is combined with computer vision, human-computer interaction, VR and AR technology toachieve WYSIWYG (What You See Is What You Get) visual effects filmmaking. The results shows that ARFMS prototype has low cost and easy to use especially in some short VFX films (about 2 minutes) which costs about 32.7ms perframe [12].

Butchart (2011) compared the AR browsers of gateway and Layar platforms. The researcher stated that Layar application communicates over a wide area network with the Layar platform, customizable mobile browser along with a remote AR server, and have benefits to the users and developers in AR content. But then, the gateway offers vendors more control over content [13-15].

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 tourismobjects, and the properties of mobile AR applications, usability and experimental impact of application. Finally, we conclude the paper with a 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, and 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 [16].

In this study, layar application and extreme programming will be used to support the AR content. Layar is a mobile AR browser platform to attract the AR content. The Layar has established in 2009 by Blippar group. In principle, platform architecture of Layar has five

components, namely (a) Layar Reality Browser (LRB); client-side application on the smartphone device users, (2) Layar Server (LS); service center of layar which provides an interface to the LRB, layar publishing (LP) site and layarservice providers external (LSPE), (3) Layar Publishing Website (LPW); for the developers task (e.g.account register and dashboard), (4) LayarService Providers (LSP); the service provider created by the 3rd developers, and (5) LayarContent Sources (LSC); marker layer that provides the content. However, Layar's API requires developers to run their own web service to host application-specific POI providers and connection them to Layar's AR server [17].

Next, the extreme programming (XP) was developed by Kent Beck in 1996, as a methodology for software development. The XP purpose is to deal with the changes that normally occur during the process of software development. This study, is developed with adapted an XP especially in schedule the implementation of functionality, oral communication, tests, and source code to communicate system structure and intent, close collaboration of programmers with ordinary skills and continuing feedback from short cycles [18]. Therefore, developing mobile AR of tourism objects have main three phases includes design, implementation, and evaluation.

### 2.1. The Srchitecture 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 is illustrated in Figure 1.

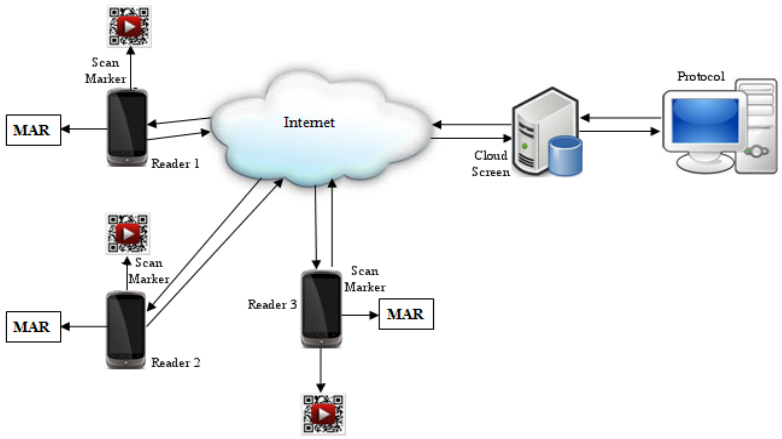


Figure 1. The mobile AR architecture

This architecture consists of the main actors, namely the readers and editors. The editors are the 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 details of the system architecture is presented in Figure 2.

A brief description of the architecture of mobile AR system is shown in Figure 2. First is determined news or advertisements will become the AR as a marker made by an editors (protocol). Next is 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).

On the other side, the readers or users architecture of the system interface app for Android platform is displayed in Figure 3. A brief explanation of the users AR system

architecture. In principle of layar, the audio and video are stored on the layar server (LS) for then the process of setting marker (scanning). After that, the audio and video recorded can be used by the user via the mobile. 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 including 3D image, video or animation, virtual buttons, or web links.

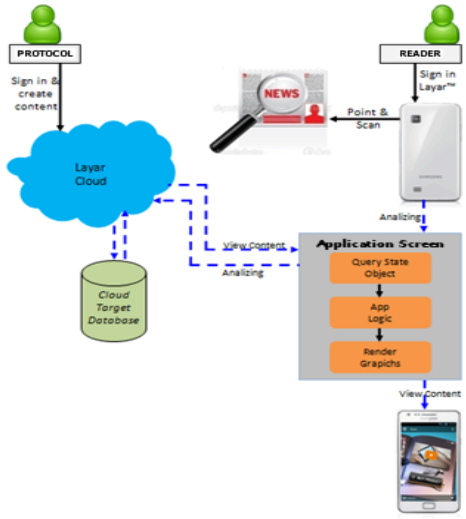


Figure 2. Detail architecture mobile AR system

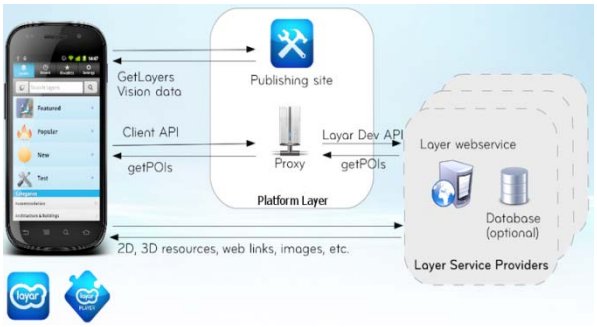


Figure 3. The user's architecture system [17, 19]

## 3. Results and Analysis

In this section we explainthe 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 including 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. Then, to capture an image, the camera is directed on the image or object. In this experiment, 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 tourismobjectsis 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 (tourismattractions) and tracking, computer and display devices for virtual augmentation (mobile device) and markers as tangible interaction devices as well as tracking target. The overall tourismobjects design divided into editor's page and reader's page. This prototype is used handheld (mobile device) for viewing the augmentation of the tourismattractions. 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 tourismobjects concept can be used directly as a normal reader reading a newspaper. This is focused on two parts which consist of physical newspaper (tourismobjectsbrochure) and mobile application.

In this experiment, *screen vision* technology for the development of tourismobjects have been used. The *screen vision* technology is to use the detection, tracking and computer vision techniques then insertthe objects that introduction of color descriptors into the AR. Then, *Dominant Color Descriptor (DCD)* based on the fixed number's MPEG-7is 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 recognizing the *screen* and displaying AR content into the real world.

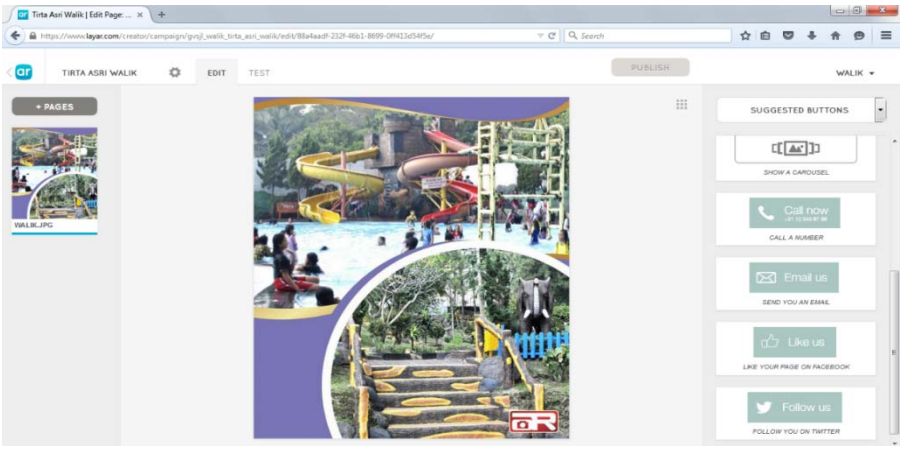


Figure 4. Interface design system


Figure 5. Image detection system

### 3.3. Observational Study

The observationalstudy 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. They were likely to use this mobile AR application with the tourism objects brochure because it is easily used. This observation shows that this mobile AR application with the tourism objects brochure is easy to use. They also showed their excitement with the tourism objects brochure's contents using their finger through 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 allow the users to engage in learning experince. Based on encouraging response from observational study, it motivates the development of the AR of others tourismobjectsat Purbalingga district as future work.

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