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AUGMENTED REALITY FOR UNIVERSITAS ISLAM NEGERI WALISONGO'S PROFILE USING AGILE METHODOLOGY

Siti Nur'aini[*1], Muhammad Naufal Muhadzib Al-Faruq[2]

[1,2]Prodi Teknologi Informasi, Fakultas Sains dan Teknologi UIN Walisongo Semarang, Indonesia
Email: [1]siti_nuraini@walisongo.ac.id , [2]naufalfaruq082@gmail.com

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Abstract

The use of Information Technology for the process of delivering information has grown so rapidly. One of them is Augmented Reality. Augmented Reality is widely implemented for various things, including in the world of education, health, military, entertainment and many others. Augmented Reality is a technology that combines virtual objects and the real world in real-time and interactively. This research developed an Augmented Reality Application that can be used to introduce Universitas Islam Negeri (UIN) Walisongo more broadly, attractively, interactively, and competitively. This application is named AR UINWS. Agile methodology was chosen to develop AR UINWS. The results show that the agile methodology is suitable to be implemented because of its flexibility, so that the needs of developing applications can be easily adapted. AR UINWS works well on all types of android devices that have a minimum camera resolution of 720x1280 pixels. AR UINWS can detect markers if the marker surface is visible at least 65% of the total marker surface area. This application can detect markers of various sizes as long as the background is light. The size of the marker that can be detected is 1.5x2 cm with the minimum distance between the marker and the android device is 1 5cm. While the largest marker size being tested is 15x23cm with the minimum distance between the marker and the android device is 150 cm.

Keywords: *augmented reality, marker based tracking, agile methodology*

1. INTRODUCTION

The use of Information Technology for the process of delivering information has grown so rapidly. The development of technology and communication has resulted in people's demands for convenience, completeness of facilities, and sophistication in all aspects of life. The rapid development of information technology requires us to always innovate in solving various problems. Augmented Reality is one of the technologies that is currently developing rapidly [1].

Augmented Reality is a technology that combines virtual objects and the real world in real-time and interactively [2]. Milgram and Kishino show the same definition, Augmented Reality is an active and interactive environment that generated by adding virtual data through real-time images [3] [4]. Merging by adding information in the form of two-dimensional images, three-dimensional images, video, or sound [5][6]. After the systematization of Augmented Reality in 1997, the Augmented Reality ecosystem can be divided into interfaces, tracking systems, tracking techniques, displays, and additional content [7]. Augmented Reality can be characterized according to its tracking system into marker-based (MB), markerless (ML), and extensible tracking. The tracking system relates to different tracking techniques because each tracking system has different tracking techniques associated [8].

The use of Augmented Reality has been widely applied in various fields including entertainment, medical, military, education, design, robotics, promotional media, tourism, and so on [9]. For example in medical, Augmented Reality can be used in a wide range of medical practice ranging from pre-operative imaging training and education to image-guided surgery, as it provides the surgeon with a needed view of the internal anatomy and improved sensory perception, reducing the risk of an operation. The need for visualizing the patient and the medical information on the same physical space is why researchers thrive for Augmented Reality, as it provides the real-time visualization of heterogeneous data required for guided surgery [10]. In the military, a battlefield is a place of chaos and uncertainty where timely information decides the life and death of soldiers. Augmented annotated information in the real battlefield scenario with Head-Mounted displays (HMD) can be used with Augmented Reality [11].

In education, research shows that Education with Augmented Reality has proven to be extremely useful in increasing the students' motivation in learning process [12][13][14]. Besides medical, military and education field, Augmented Reality also has been developed in many various aims [1][15][16][17]. Augmented Reality is also applied

for promotion. One of them is the Sosro Heritage product at the Jakarta Fair. The image of The Borobudur Temple on their packaging appears a three-dimensional digital image [18]. As a promotion Augmented Reality is very interested for customers.

Figure 1 showed augmented reality ecosystem. It can be divided into 5 big aspects : Interface, Tracking system, Augmented Components, Tracking Techniques, and Display.

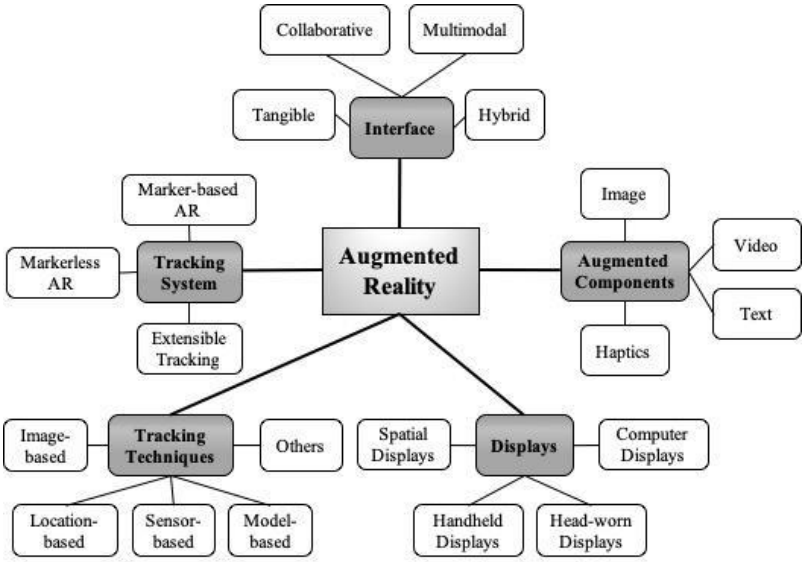

Figure 1 Augmented Reality Ecosystem[7]

This research will develop Augmented Reality for Universitas Islam Negeri (UIN) Walisongo's profile. Currently, information about UIN Walisongo Semarang can be accessed through the URL www.walisongo.ac.id. This application can be another choice how people access information about UIN Walisongo. Besides that, this application can use to introduce UIN Walisongo more widely, attractive, interactive, and competitive way.

2. METHODOLOGY

Agile development methodology was chosen to develop Augmented Reality for UIN Walisongo's profile application. Agile development methodology is a software development framework that relies on pre-existing incremental and iterative development principles [19]. This methodology uses continuous planning, development, and testing and continuous contact with system stakeholders [20]. Agile methodology in system analysis focuses on flexibility, continuous improvement,managing uncertainty and speed. The four values of Agile methodology guaranteed to the clients on change is always welcomed, evolving requirements can easily be adapted [21].

The agile process can be seen in Figure 2, follows the software development life cycle which includes requirements gathering, analysis, design, coding, testing, and delivers partially implemented software and waits for the customer feedback. In the whole process, customer satisfaction is at highest priority with faster development time [2s2].

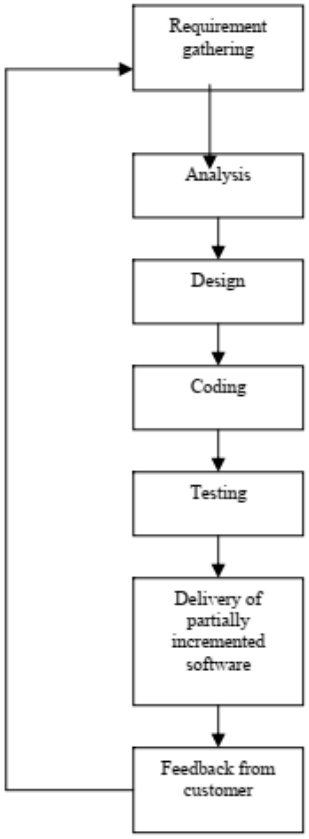

Figure 2 Phases of Agile Methodology[22]

The Agile process requires less planning and it divides the tasks into small increments. This process is meant for short term projects with an effort of

team work that follows the software development life cycle.

The involvement of software team management with customers reduces the risks associated with the software. This agile process is an iterative process in which changes can be made according to the customer satisfaction.

The Agile system development life cycle model begins with initial elicitation of requirements in order to conceptualize the system. Once the system concept is formed, requirements are estimated and prioritized in order to plan the development iterations. Within each iteration, requirements continue to evolve and are used in brief model storming sessions in order to design the functionality required to meet requirements allocated to the iteration. When the system model is developed/modified, the coding is initiated/continued using a test-driven approach. Once the functionality for the iteration is tested successfully, refactoring takes place. Refactoring is a disciplined technique for altering the structure of an existing code base without altering functionality. When refactoring is completed and functionality is confirmed, the code is deployed internally, completing the iteration.

If plans include deploying the code beyond the development iteration, the code is then deployed externally. Eventually, all iterations are completed, resulting in a system with full functionality that is accepted by stakeholders because it meets allocated requirements.

3. RESULT AND EXPLANATION

Kind of Augmented Reality that develop in this study is marker-based Augmented Reality. Flowchart of the application can be seen in Figure 3. from figure 3, we can see that the application starts with the unity splash screen. After that the user is required to tap on the "start" button. After that AR Camera will be activated. Then the user can scan the marker. The system will check whether the marker is detected or not. If it is not detected, then the process will be repeated from the scan marker. If the marker is detected, the 3D Logo will be shown.

From figure 3, we can see that This application uses the UIN Walisongo logo as a marker, can be shown in Figure 4. The user can tap on the 3D logo that is displayed, and the system will show the main menu as shown as figure 5. The application was developed using Unity 3D and Vuforia SDK.

The tests carried out the functionality of the features, size and medium of marker, and detection if the marker is not in a normal state. Testing was conducted twice. At the first testing, all type of Samsung smartphone can not run the application properly and users suggest to add the URL of Walisongo's website. Result of the second testing was shown on table 1-4.

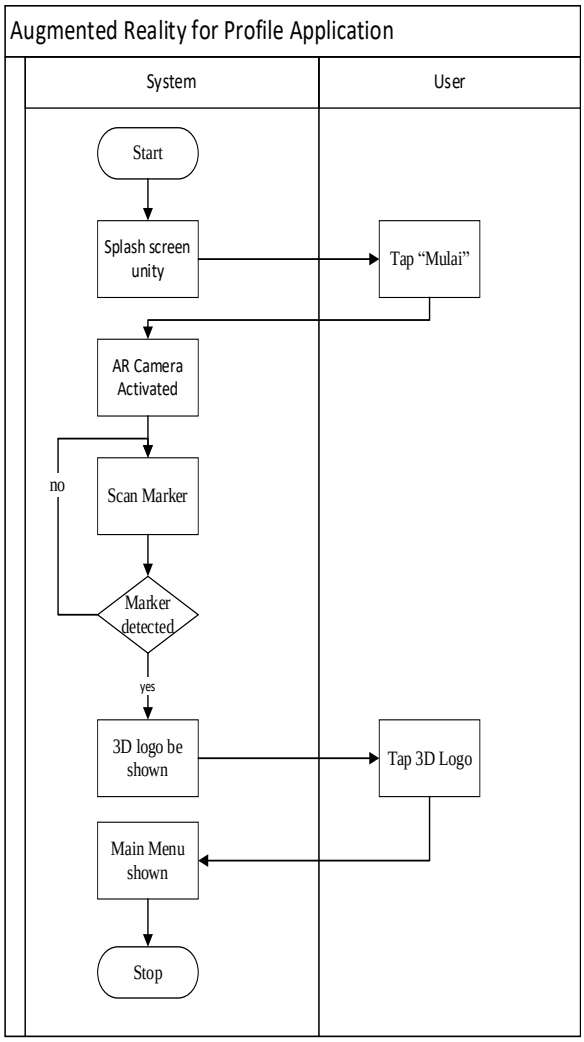

Figure 3 Flowchart of The Application

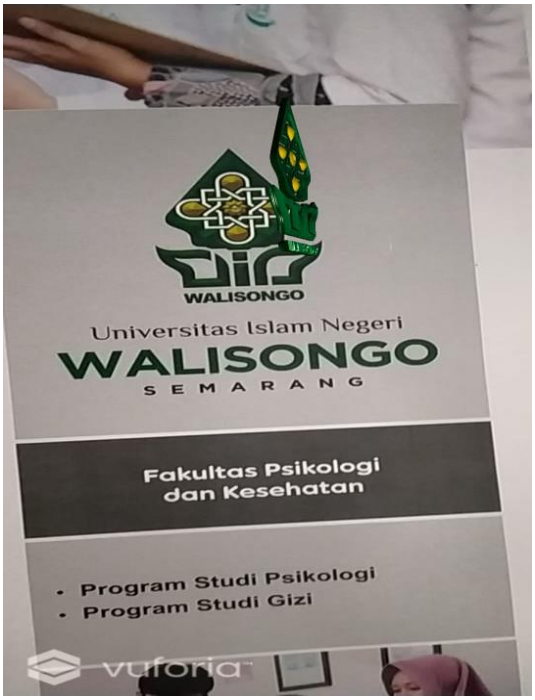

Figure 4 3D Logo as An Augmented Reality was shown

Figure 5 Main Menu

Table 1. Result of The Functionality

No	Type of Android Device	Starting Scene	Augmented Reality	Main Menu	Navigation Button	Sound of Button	Backsound
1	Redmi note 8	succeed	succeed	succeed	succeed	succeed	succeed
2	Sony Xperia Z5 Compact	succeed	succeed	succeed	succeed	succeed	succeed
3	Redmi Note 5	succeed	succeed	succeed	succeed	succeed	succeed
4	Asus Zenfone 3 Laser	succeed	succeed	succeed	succeed	succeed	succeed
5	Oppo A37	succeed	succeed	succeed	succeed	succeed	succeed
6	Vivo Y91	succeed	succeed	succeed	succeed	succeed	succeed
7	Redmi 9	succeed	succeed	succeed	succeed	succeed	succeed
8	Asus zenfone max pro m1	succeed	succeed	succeed	succeed	succeed	succeed
9	Coolpad E571	succeed	succeed	succeed	succeed	succeed	succeed
10	Samsung J7 Core	succeed	succeed	succeed	succeed	succeed	succeed
11	Samsung Galaxy A6	succeed	succeed	succeed	succeed	succeed	succeed
12	Samsung J2 Prime	succeed	failed	failed	failed	failed	failed

Table 2 Size and Minimum Distance

No	Size of Marker	Minimum distance
1	1,5x2 cm	15 cm
2	3x4 cm	25 cm
3	4x5,5 cm	34 cm
4	6x9 cm	50 cm
5	15x23 cm	150 cm

Table 3 Medium of Marker

No	Medium	Background	Result
1	File on smartphone	White	Detected
2	File on Computer	White	Detected
3	Book	White	Detected
4	UIN Walisongo's Calender	Grey	Detected
5	Cloth	Dark Blue	Not detected
6	Book	Black	Not detected

Table 4 Covered Marker

No	Marker	Result
1	50% covered	Marker not detected
2	35% covered	Marker detected
3	20% covered	Marker detected

4. DISCUSSIONS

Table 1 showed result of the functionality testing in several android device, as known as compability testing[23][24][25]. Table 1 was shown that Augmented Reality was not running properly on Samsung J2 Prime. The specification of Samsung J2 Prime are Android Marsmallow OS, 5MP front Camera, 8MP main camera and the resolution of main camera 540x960 pixels.

Table 2 was shown about the size of marker and minimum distance that Augmented Reality can be displayed. Table 3 was shown the various of medium marker. Marker can be a file on smartphone and print out on a paper. Table 4 was shown about how many marker surface that can be detected properly by the application.

5. CONCLUSION

Based on this research, it can be concluded that agile methodology is suitable to develop Augmented Reality for profile application because the flexibility so evolving requirements can easily be adapted. The application can be installed and run on all Android device with various specifications. The application works properly on all types of android devices that have a camera resolution of at least 720x1280 pixels. The application can detect marker if the marker surface is at least visible 65% of the marker surface area. Markers that can be detected by this application are markers with a light / white background with various sizes. The size of the marker that can be detected is 1.5x2 cm with the minimum distance between the marker and the android device is 1 5cm. While the largest marker size being tested is 15x23cm with the minimum distance between the marker and the android device is 150 cm.

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