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Application of Augmented Reality Technology as an Alternative Media for Campus IT Telkom Purwokerto

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Abstract−Augmented Reality is a technology that involves graphics on a computer in the real world, which in the virtual world of three dimensions is brought to the real-world environment in real-time. The application of Augmented Reality technology is currently growing rapidly, including in the field of promotional media. IT Telkom Purwokerto is a private university in Central Java engaged in Information and Communication Technology (ICT). In introducing the campus environment, IT Telkom Purwokerto still uses the manual given to students when PKKMB is also rarely read, and the introduction of buildings uses 3D miniatures by utilising styrofoam where these miniatures are displayed. Based on a survey conducted by researchers to find out the level of difficulty in finding a room at IT Telkom Purwokerto, 70% of respondents obtained that IT Telkom Purwokerto students agreed that they had trouble finding a room for the first time at IT Telkom Purwokerto. This recognition media is made using Augmented Reality with marker-based tracking technology; in the manufacturing process uses Unity and Vuforia a container for storing markers or markers. Development for this software uses the Agile model. Testing is the final stage before the application is presented to the user, using black-box and system usability testing. The test results on this application obtained results for black-box testing of 97.7% and System Usability Scale of 83.6, which can be concluded that users can use the application easily. Based on these results, it can be supposed that it is also included in the Excellent category with a B rating.

Keywords: Augmented Reality; Black Box; IT Telkom Purwokerto; Marker Based Tracking; Campus Introduction Media; System Usability Scale

1. INTRODUCTION

Telkom Purwokerto Institute of Technology, better known as IT Telkom Purwokerto, is an institution under the management of the Telkom Foundation, a foundation owned by PT Telkom Indonesia. IT Telkom Purwokerto is an educational institution engaged in Information and Communication Technology (ICT) or Indonesian known as Information and Communication Technology (ICT) or Telematics (Telecommunication and Informatics). IT Telkom Purwokerto is at this moment offering a complete study program in the realm of Telematics Technology, which is a continuation of the trend of telecommunication technology and information technology from year to year the demand is increasing until now the number of students is around 5,000 people, and also the IT Telkom Purwokerto campus which is located on Jl. DI Panjaitan No. This 128 is not too wide and is an educational area with SMK and SMP Telkom Purwokerto. So far, the IT Telkom Purwokerto promotion department has carried out several promotional methods in introducing and promoting its institution, and some have even been discontinued, such as radio advertisements and newspaper advertisements. Meanwhile, promotional media such as bumpers, brochures, banners and billboards are only carried out around Banyumas[1].

The design of the promotional media that has been done on average uses the same design, so there is no innovation in the promotional press [2]. So that the media that provides information, persuades, and reminders to the public are felt to be significantly less effective. The manual given to students during the PKKMB is also rarely read by the students themselves. The introduction of the building uses 3D miniatures by using styrofoam where these miniatures are displayed. However, the 3D model has several weaknesses. Namely, it is not practical in terms of size because it requires ample space. It can only be seen by people visiting and in terms of technology utilisation. It seems that it does not keep up with technological developments[3].

However, even though they have participated in the OSPEK program, many new students still do not know their campus details . Based on a survey conducted by researchers to find out the level of difficulty in finding a room at IT Telkom Purwokerto, 70% of respondents obtained that IT Telkom Purwokerto students agreed that they had trouble finding a space for the first time at IT Telkom Purwokerto. With the existing campus introduction media, the public can only know and know the campus environment briefly and in the form of 2-dimensional images [2]. For every student, of course, it is essential to know the location of the building that has been provided as a facility provided by the campus for the process of learning information or lectures later[5].

Based on this, we need an appropriate technology that can be used by the campus to disseminate information about its building resources and can help parties who need this information. One of the technologies that can be adopted is Augmented Reality (AR) . In this, case, Marked Based Tracking Augmented Reality will be combined with mobile devices that have the Android operating system[6].

Augmented Reality (AR) is a technology developing and involves overlaying computer graphics in the real world, where a three-dimensional virtual world can be brought into the natreal-world environment in real-time, unlike virtual reality, which is entirely in a virtual world, AR is virtual reality. An effort to unify the real world with the virtual world created through a computer so that the boundary between the two becomes very thin and projects it in real-time and is

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interactive[7]. For example, when reading a brochure, with Augmented Reality the brochure will not only display text and photos in 2D, but can see images in 3D that look like real. So Augmented Reality can also be used as an effective campus introduction media[3]. This research applies technology. This application uses marked based tracking which uses a unique pattern or image that can be recognized by the application which is analyzed with a camera [8].

Creating an application is a software development process. Application development also requires a method, because application development without an inappropriate method or method tends to exceed the estimated time and contains many bugs. One of the development methods that can be used is Agile Development, in this agile model in its application to carry out a simulation and overall test in the use of software that is needed to review and revise[9]. The agile model is a rapid system development model and is more concerned with interacting with users than processes and tools. Because client satisfaction is a top priority for agile software development[10]. The agile model consists of five phases or stages, namely requirements analysis, system design, implementation, testing and system deployment [11].

The discussion in this study includes making an application with the aim of producing an application for the introduction of the IT Telkom Purwokerto Campus as an alternative medium for introducing campuses with marked based tracking. Introduction Media for IT Telkom Purwokerto Campus which can display 3D objects for 3 Main Buildings, namely the Rectorate Building, DC Building and DSP Building and can display information on each building. The tests carried out in this study were to test the functional aspects using the black box testing method and usability testing using the System Usability Scale (SUS) method.

2. RESEARCH METHODOLOGY

This study uses several stages in designing applications, namely using the Agile method. Agile Software Development Life Cycle is a short-term development that requires quick adjustments and development to changes made. The agile model consists of five phases or stages, namely requirements analysis, system design, implementation, testing and system deployment as shown in Figure 1 below[11].
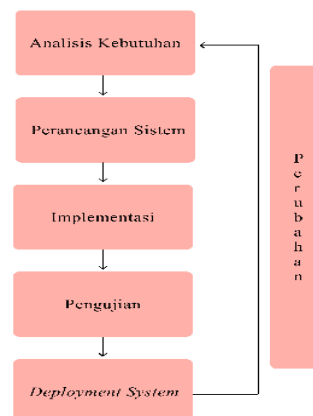
Figure 1. Agile Model Research Stages

2.1 Analysis

At the Needs Analysis stage to determine functional and non-functional needs, a literacy study process is carried out because in conducting this research a reference is needed as a basis for carrying out the research stages, and the reference used by the author uses previous journals that are still related to this research as a reference. In addition to using previous journals, the author also uses books to expand knowledge in understanding the methods used. The data collection process is used to obtain information about the software that will be developed according to user needs. Data collection techniques for this analysis phase can be by observation, interviews or questionnaires.

2.2 System planning

System design is to design for software requirements from the previous stage. The stages of designing this research system using a derivative of the Agile method with the Scrum method are divided into 5 stages, namely, the product backlog, sprint backlog, sprint and working increment of the software stages [12], as in Figure 2.

Figure 2. Scrum Development Process

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2.2.1 Product Backlog

Product backlog is the stage of classifying user needs resulting from the data collection and analysis process consisting of a list of features and products that must be completed according to a priority scale. This stage performs a needs analysis of campus recognition applications such as data on the Rectorate Building, DC Building and DSP Building for the manufacture of 3D objects, markers for each target image and information related to the Rectorate Building, DC Building and DSP Building.

2.2.2 Sprint

Sprint is a process in which product results are presented in the form of prototypes to related parties in the work process of campus introduction applications using marked based augmented reality to supervisors and IT Telkom Purwokerto.

2.2.3 Working increment of the software

Working increment of the software is a test engine development stage in accordance with the results of the sprint (prototype). The development process in this phase is adjusted to the needs by communicating directly with IT Telkom Purwokerto and its users [13].
The stages for system design in the Scrum method are divided into 2 stages, namely, pre-sprint and sprint stages to get the results that have been designed in the previous stage [14].

2.3 Implementation

Implementation is the stage of making from according to the initial design concept. Coding implementation using Vuforia with C# programming language with Unity engine and 3D object creation using Blender.

2.4 Testing

Testing or testing is carried out to find out whether the application is in accordance with the initial concept. The test used uses the alpha method which helps find errors in the application.
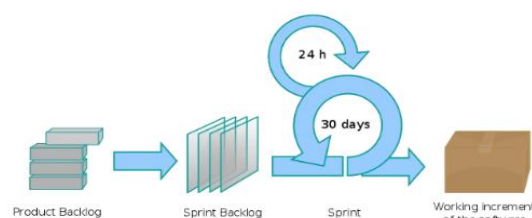
2.5 Deployment System

Deployment System is the stage where the application is suitable for consumer use. If there is an error at this stage, it is returned to the analysis stage to improve the application.

3. RESULT AND DISCUSSION

The implementation stage in this research is a process carried out using the Scrum model. The stages for system design in the Scrum method are divided into 2 stages, namely, pre-sprint and sprint stages to get the results that have been designed in the previous stage. This stage will explain several ways of making applications, starting with making 3D objects for the IT Telkom Purwokerto Building, UI application design, marker design in the form of brochures and using existing room markers and the coding process as the design implementation stage from the previous stage.

3.1 Result

This research produces an android-based augmented reality application that displays information about the building at IT Telkom Purwokerto. The implementation of each stage that has been carried out produces 3D Building Objects, User Interface designs and promotional brochure designs as well as at the coding implementation stage that has been carried out displayed in accordance with the design of the design system design. The marker design in this application is applied to brochures and room markers at the IT Telkom Purwokerto Building. The markers in the brochure use photos of three buildings at IT Telkom Purwokerto, namely the Rectorate Building, DC Building and DSP Building where the photos will be used for markers in the AR application that is made, the results can be seen as shown in Figure 5 front and Figure 6 section back of the brochure.

Figure 3. Promotional Brochure Front

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Figure 4. Promotional Brochure Back

As for the markers used in the scan of each class, namely the Room Markers that already exist in each IT Telkom Purwokerto Room as shown in Figure 5 below.

Figure 5. Marker Scan of the Rectorate Room 101

The results of the design of augmented reality applications as an alternative media introduction to the IT Telkom Purwokerto campus can be seen in Figure 6 (a) for the initial display when opening the application will be directly directed to the Home or Main page of the application.
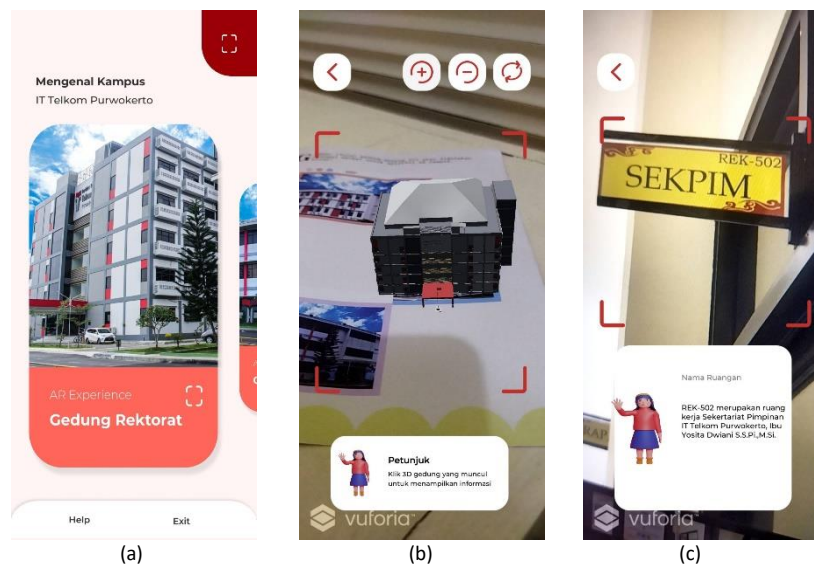
Figure 6. (a) Application Main Page Display (b) Building Scan Marker Display (c) Room Marker Board Scan Display

The Home or Main Page display in this application has 4 buttons, the first is the swipe button section which is useful for scanning markers in promotional brochures and each button is different on the scan marker according to the name of each button. Furthermore, the scan button which is symbolized by the scan area icon in the upper right corner, the button serves to scan the classroom, information about the room will appear at the bottom of the screen. The other part is the help button on the home which serves to display information about how to use the application. Finally, the exit button is used to exit the application.

Furthermore, the results of the implementation on the Scan Building menu display after scanning with one of the examples of markers used will display a visualization of the scanned building and information about the building as shown in Figure 8(b). While the implementation results on the Class Scan menu display after scanning with one of the examples of markers used, information about the room will appear as shown in Figure 8(c).

3.2 Testing

Application Testing is the final stage carried out by testing (testing) to measure the quality of the software. This testing stage uses the black box testing method with a sample testing model where later testing will focus on the functional

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specifications of the software and usability testing using the System Usability Scale (SUS) method to see how easy it is to use the application by users. Testing is carried out based on the analysis of the software specifications which aims to test the feasibility of the application and other components. This test is carried out at the final stage after the implementation stage is completed. The testing stages in this study involved 20 respondents. Black box testing is done by running the application and using the features that exist in the application. At this stage of testing conduct interviews directly. The results of the black box test are in Table 1 below.

Table 1. Blackbox Test Results

No.	Scenario	Amount	Maximum Score
1.	Opening the AR Campus App	20	20
2.	Click the Scan Building button	20	20
3.	Scan the building marker on the brochure	19	20
4.	Scan the building marker on the original building	20	20
5.	Rotating the 3D building	19	20
6.	Zoom In on the 3D building	19	20
7.	Zooming out on the 3D building	18	20
8.	Click 3D building to display information	20	20
9.	Click the class scan button	20	20
10.	Scan the class marker on the class nameplate	19	20
11.	Click the Help button	20	20
12.	Click the Exit button	20	20
13.	Click the back button on each page	20	20
	Total	**254**	**260**

Based on the results of black box testing in Table 4. shows the results of application testing carried out by 20 respondents. The test results obtained a feasibility presentation as follows.

$$Eligibility\ Percentage\ (\%) = \frac{Total\ Test\ Score}{Maximum\ Total\ Score} \times 100 \tag{1}$$

$$= \frac{254}{260} \times 100 = 97,7\%$$

So, from the results of calculation (1) above, it shows the percentage figure of 97.7% which can be concluded that all features can run well based on their functions. As for the results of the System Usability Scale (SUS) test in Table 2, respondents were given 10 questions as in the previous explanation and for each statement there were 5 response options, namely as follows: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree. The score scale from strongly disagree to strongly agree is 1 to 5 [15].

Table 2. System usability scale test results

No.	Question	Total
1.	I think I will use this system again.	86
2.	I find this system complicated to use.	42
3.	I find this system easy to use.	87
4.	I need help from someone else or a technician in using this system.	51
5.	I feel the features of this system are working properly.	87
6.	I feel there are a lot of inconsistent (incompatible) things in this system.	46
7.	I feel like other people will understand how to use this system quickly.	81
8.	I find this system confusing.	41
9.	I feel there are no obstacles in using this system.	89
10.	I need to get used to it first before using this system.	59
	Total value *2,5	1672,5
	Average	83,6

So, from the calculation results above, the average number for SUS testing is 83.6 which can be concluded that users can use the application easily. Based on these results, it can be concluded that it is also included in the Excellent category with a rating of B.

4. CONCLUSION

The introduction of the IT Telkom Purwokerto Campus Application was created and developed using marker based tracking technology based on augmented reality with the Agile method and the Scrum model as an alternative to the introduction of the IT Telkom Purwokerto campus. This application can display information about the Rectorate Building,

DC Building and DSP Building and display information about the rooms in the IT Telkom Purwokerto Rectorate Building. The test results on this application obtained results for black box testing of 97.7% which can be concluded that all features can run well based on their functions. As for the System Usability Scale testing of 83.6 which can be concluded that users can use the application easily. Based on these results, it is in the Excellent category with a B rating. Further research for the Classroom Marker marker section may be able to be completed again by using the front of the classroom so that the impression of using the application feels more real. Further research if possible to complete all the information in every building in IT Telkom Purwokerto.

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