The Design of Basic Computer Networking Simulation Learning using Multimedia Development Life Cycle Method based on Augmented Reality at SMKN 1 Tangerang

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ABSTRACT
Augmented Reality has entered technology trends in all fields, both marketing and education, Augmented Reality media also requires users to be comfortable when interacting. SMKN 1 Tangerang organizes a distance education system with various methods, in this case the subject which is Basic Computer Networks uses mobile-based learning simulations with Augmented Reality which aims to develop students' abilities in the world of networked computers independently. This system also requires a user experience and user interface development method, namely Luther's Multimedia Development Life Cycle model because it has six stages, namely concept, design, data collection, merging, testing, and distribution, resulting in interactive applications.

INTRODUCTION
The rapid development of technology encourages humans to be more creative in managing science that is able to change their mindset to keep up with the world of technology in Era 4.0 [1] and with the process of keeping pace with the fields in the world of technology, making learning media is also growing [2] which makes the world of education more innovative in the era of 4.0 and beyond. The results of the observation that there were several obstacles in learning activities, such as limited resources for tools and materials because some expensive products resulted in learning about the introduction of network devices to the extent of explaining and introducing existing devices without seeing the whole thing. In addition, the lecture learning method also makes students less motivated, resulting in at least student feedback in enjoying learning, this is reinforced by several findings of researchers who state that the achievement of scores in the aspect of knowledge is low, if presented only 35% are complete while 65% of students are categorized as not. complete in mastering knowledge of computer network concepts. Conditions like this require teachers to be more innovative in the delivery of teaching materials, and be creative in making learning media, in order
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to get students' motivation and interest in learning activities so as to increase students' understanding of teaching materials [3]. Augmented Reality (AR) is a technology that combines computer-made objects, two-dimensional or three-dimensional, into the real environment around the user in real time. AR-displayed objects assist the user in generating new perceptions that allow them to interact with the real environment [4]. Learning media based on Augmented Reality is one of the tools created with the aim of being a teacher's aid in delivering material. Learning to use Augmented Reality learning media will certainly attract more students in elementary schools to attract and understand the material to be delivered [5]. Considering that technology Augmented Reality has also entered technology trends in all fields, both marketing and education [6] media Augmented Reality must also adjust users' comfort when interacting. To add to the impression of the user, the system in the media requires a method to develop the user experience and user interface. Basic Computer Networks is one of the learning activities at SMKN 1 Tangerang which aims to develop students' abilities in the world of computer networks. However, the resources for tools and materials are limited because some products require more maintenance and are fairly expensive, resulting in learning about the introduction of network devices to the extent of using the lecture method and introducing existing devices without looking at the whole.

I. LITERATURES REVIEW

Previous research concluded that the learning media is very feasible to use with the validation results obtained by an average value of 92.67% from 5 validators, namely ease, motivation, attractiveness, usefulness [4]. And the results of field trials to 30 students fall into the very good category with a feasibility value of 4.520625 and a percentage of the quality of educational game learning media 90.42% [7].

II. FRAMEWORK

<table>
<thead>
<tr>
<th>Problem</th>
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<tbody>
<tr>
<td>• Basic network learning methods currently still use lecture and presentation methods</td>
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<tr>
<td>• Lack Simulations Tools</td>
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<table>
<thead>
<tr>
<th>Strategy</th>
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<tbody>
<tr>
<td>• Using multimedia learning methods</td>
</tr>
<tr>
<td>• Using a mobile based simulation</td>
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<table>
<thead>
<tr>
<th>Method</th>
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<tbody>
<tr>
<td>• Using the Augmented Reality learning system</td>
</tr>
<tr>
<td>• Using Luther's model of Multimedia Development Life Cycle method</td>
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<table>
<thead>
<tr>
<th>Result</th>
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</thead>
<tbody>
<tr>
<td>• Increase student interest in basic computer networking lessons</td>
</tr>
<tr>
<td>• Simplify basic computer network lesson simulations</td>
</tr>
</tbody>
</table>

III. METHODS

In making this application, it is assisted by the Multimedia Development Life Cycle (MDLC) method which functions to coordinate the stages of making the application. The MDLC used here is Luther's version. Luther's MDLC version with 6 stages, that is:

1. The Concept
   Making Requirements Elevation and Flowcharts.
2. Design
Manufacture Wireframing for mapping the layout and Mockuping for granting the reference color, fonts, images, and animation concepts

3. Material collection
Where buttons and symbols are obtained from mockups and markers that are inspired by objects on Cisco Packet Tracer Stealthwatch made using Corel Draw X7 and also 3D objects obtained from the 3d SketchUp repository on thesite 3dwarehouse.sketchup.com which are converted into extensions .dwg

4. Merging
Applications made in C# with thegame engine tools Unity 3d and the Software Development Kit (SDK) Vuforia Engine.

5. Testing
Which at this stage the results obtained blackbox test from the application

6. Distribution
at this stage will be published to students of SMKN 1 Tangerang and the results of the assessment from students of SMKN 1 Tangerang are obtained.

![Figure 1: The Luther’s MDLC](image1)

### IV. RESULT

Mobile Application

1. Main Menu
Contains the main menu and there are several menu options namely Start, Tutorial, Theory, Exit and About developer which are located below. For the button, a moving animation is inserted to make it look dynamic.

![Figure 2: Main Menu](image2)

2. Tutorial Menu
The tutorial aims to provide steps for how to use the application and there is also a link marker in the form of the button. The tutorial is also shown in the form of animated movements.

![Figure 3: Tutorial Menu](image3)

3. Theory Menu
Theory serves to provide an explanation of the theme of the material used as an application, along with the theoretical appearance.

![Figure 4: Theory Menu](image4)
Augmented Reality

1. 3D Objects
View of Augmented Reality displays that appear 3D objects when the camera is pointed at the marker are below.

Figure 5: Augmented Reality Camera View

2. Topology
Display 3D objects that are connected by the Line-Connector when the button topology is active. The line-connector will follow the movement of 3D objects.

Figure 6: Topology display when the Topology button is active

3. Flowchart

Figure 7: Flowchart
V. DISCUSSION

Augmentable Vuforia Engine testing
The results of the augmentable marker ratings from the Vuforia engine are below.

Figure 8: Augmentable levels based on the Vuforia engine

Testing Distance and Light
The marker testing in Augmented Reality is done manually using the Lux Light Meter application to test the distance and light based on the calculation of lux light, and distance testing using a meter tool. The following results are obtained.

<table>
<thead>
<tr>
<th>No</th>
<th>Questions</th>
<th>Score</th>
<th>Good</th>
<th>Enough</th>
<th>Less</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Menu Display</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Guide / Tutorial Display</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Theory Display</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Development Display</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Augmented Display</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

User Acceptance Test
This test involves students of SMKN 1 Tangerang in the form of a response questionnaire to displays User Interfaces and User Experience. Obtained 10 students with name, email, and NISN data. With the assessment factors of “Good”, “Enough”, and “Less” as bellow.

Table 2. Questionnaire Results

<table>
<thead>
<tr>
<th>Distance</th>
<th>10 cm</th>
<th>40 cm</th>
<th>50 cm</th>
<th>60 cm</th>
<th>100 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lux</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 (dim lights)</td>
<td>Showing</td>
<td>Showing</td>
<td>Not Showing</td>
<td>Not Showing</td>
<td>Not Showing</td>
</tr>
<tr>
<td>34 (bright lights)</td>
<td>Showing</td>
<td>Showing</td>
<td>Showing</td>
<td>Not Showing</td>
<td>Not Showing</td>
</tr>
<tr>
<td>430 (outdoor lights)</td>
<td>Showing</td>
<td>Showing</td>
<td>Showing</td>
<td>Showing</td>
<td>Not Showing</td>
</tr>
</tbody>
</table>

Hypothesis

Present Condition
Learning of Basic Computer Networking still using the lecture and presentation method and lack of simulation tools

Indicator
Student interest tends to be low if the learning method is with lectures and presentations only

The Proposed System
Based: Augmented Reality
Value Attribute: User Interface, User Experience
Method: Multimedia Development Life Cycle

Result
Increased interest in student learning in learning basic computer networks

Figure 9: Hypothesis
VI. CONCLUSION
The conclusions about the basic network simulation application based on Augmented Reality that have been described are:
1. With this-based simulation application Augmented Reality, students of SMKN 1 Tangerang get the potential in its development.
2. Based simulation applications Augmented Reality have the potential to assist learning at home during a pandemic.
3. The importance of using the Multimedia Development Life Cycle method in making and developing applications, especially User Interfaces and User Experience. The

VII. ACKNOWLEDGEMENT
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REFERENCES

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