APPLICATION OF AUGMENTED REALITY TECHNOLOGY BASED AS LEARNING ASSEMBLY PC AT SMKN 2 CITY BANDUNG

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ABSTRAK

Augmented Reality (AR) is a mixed concept of vitual reality dan world reality. In Assembly computer, the lecturer SMKN 2 Bandung City use the learning media like the text of the power point presentation that was put forward through the projector, web the student's portal and practical training.

Based on the result of question that was given to teacher, the media that was used was felt to be more uninteresting, and this matter was influential to students understanding against material that was delivered by the lecturer. To overcome this metter, the instructional media that was more interactive is very needed, by using Augmented Reality technology.

The development method of the system used Multimedia Development Life Circle (MDLC), whereas the production method of the application used marker. The position of marker to card that pointed the camera so it can produce the object, that is : Processor, Harddisk, Mainboard, Power Supply, RAM, VGA Card, DVD Room. And show simulation of assembly computer. After implementing the testing of the appropriateness of system used alpha testing and beta testing. The application was stated could run correctly in accordance with the requirement and the aim of this stuidy.

The result of this research was in from of Augmented reality-based interactive teaching assembly pc which can be install in computer. It can also demonstrate learning assembly pc in from of 3D. the production of 3D objec was used unity 3D, vuforia as software library for the Augmented Reality. The user's response to thr development of Augmented reality-base intercative teaching assembly pc in SMK Negeri 2 Bandung City can be categorized as very positive.

Keyword *– Augmented Reality, Marker, Application, Learning Medi, Assembly Personal Computer, Multimedia Development Life Circle (MDLC)*

1. PENDAHULUAN

Lesson Assembling Personal Computer (PC) is a vocational lessons in the Group C2 (Basic program) to class X (ten). In pc Assembly learning students are expected to understand the learning material because of the acquired competence is the basis or foundation for the competence further. Scope contained in the syllabus of the subjects of the PC Assembly include: development of computer technology, Understand the components of the input and output Components, process and storage media, understanding the map layout components – components, understanding types – types of casings of computers, understanding the equipment and materials used in the Assembly of computers, understanding the place and safety, understanding the procedures of loading plug computer, understand the bios configuration, understanding the testing procedure the results of the Assembly.

Based on interviews with subjects of Assembly PCs. here are some of the criteria of the study i.e.; Learning material based on a fact which can be explained by logic or reasoning, not limited to approximately, imagined or sheer fairy tale, teacher, educational interaction and student response student freed from prejudice and subjective thought, immediately –, or reasoning that deviate from the flow of thinking logically, and learning is formulated in a simple clear but also interesting system has become. However in the process of learning is often experienced problems that arise, namely the lack of attention the students at the time the teacher explains, the lack of encouragement to inspire students to think appropriately in identifying, understanding the material, solve problems, and apply the learning material.

Description the implementation of practice in learning Assembly pc, surely required a lot of tools and materials used. Given the number of students in one class averaged – averaged about 35 – 40 students, the tools available at the time of the practice there are only 5 in each device. Already dengab sure the limited tool used in turns. In the

implementation of the practice sometimes understanding the material students are very less only with presentation of a teacher in front of it, so the understanding of the students in understanding the learning material is insufficient or difficult when compared to using a video or animation. The author felt it took the presence of the representation of media objects are real, so that students can be more interested in terinpirasi and pelaksanaanya. On the regulation of the Minister of national education no. 24 year 2006 stating teachers are required to present the material in a form that is more varied and interactive.

Based on these problems then made an application using desktop-based Augmented Reality technology. Augmented Reality (AR) is a concept of a mix of virtual reality with the world reality and many developed especially in the field of information and education. In addition to assisting students in getting information, this application can also add new innovations in the learning process and add to the attractiveness of learning students in the understanding of the Assembly of the pc. AR technology was chosen because of its ability and, where users get information in real-time and using input form marker as well as the output form a three-dimensional image that is expected to provide more detailed information.

This application will be built with desktop-based due to the use of this application is used by teachers in order to make it easier as a medium of teaching. Through this research is expected to deliver a solution that is good for the students and the conclusion to be drawn as the title that will be raised is "the application of desktop-based Augmented Reality Technology as a medium of instruction, class X PC Assembly case studies computer and network (TKJ) SMK N 2 Bandung".

2. CONTENT OF RESEARCH

Based on the description of the background problems above, can dirumusakan the problem how to implement a desktop-based Augmented Reality Technology as a medium of learning Assembly PC.

2.1 KANJIAN TEORI

a. Review SMK Negeri 2 Kota Bandung

SMK Negeri 2 Bandung Is a nengeri vocational high school is the city of Bandung, West Java, Indonesia. The period of education in SMK Neger 2 Bandung is within three years of lessons, from classes X to XII class, such as the period of education in General and vocational secondary schools in Indonesia. There are vocational; TKI, Technique. [15].

b. History SMK Negeri 2 Kota Bandung

Removals of STM Negeri 1 Bandung gradually began the school year 1978/1979 and overall ended the academic year officially 1979/1980 STM Negeri 1 Bandung moved from the street to Dr. Wahid No. 2 to the No. 4 Area of Bandung. Change the name of STM Negeri 1 into CMS Land 2. Name change from STM Negeri 1 into CMS Land 2 Bandung based on DECISION LETTER of Minister of education Number 036/O/1997, October 1997, index number 1, 2, 3 are taken from the age of school since the founding of the school. [15]

c. Computer Hardware

Computer Hardware (computer hardware) are some of the physical components of a computer that is to be seen, touched, and real-shaped form a unified system of PC (Personal Computer). The function of the device – the device is very diverse among them as input devices, output devices, data processing, and also as an additional tool with many additional functions which do not always exist in all PC system.

Usually the device – the device is assembled, mostly in the computer casing and some are outside the casing. The following is a picture of sorts – a range of computer hardware can be seen in Figure 1: [1]



Image 1. Kinds Of Computer Device

d. Augmented Reality

Augmented Reality (AR) is a term for an environment that combines real world and virtual world created by the computer so that the boundary between the two becomes very thin. Ronald Azuma in 1997 mendenisikan Augmented Reality as a system that has the following characteristics:

• Combining real and virtual environments
• Run interactively in real time
• Integration in three dimensions (3D)

In a simple AR can be didenisikan as a real environment is added to the virtual object. Merging real and virtual objects is possible with the appropriate display, technologies of interactivity possible through device-specific input device.

e. Markerless

One of the methods of Augmented Reality that is currently being developed is the method "Markerless Augmented Reality" with this method, users no longer need to use a target to display elements of digital displays.

On a Markerless used and developed by Vuforia, in the perancangannya, as if virtual objects by combining real objects, in this case the virtual objects in the form of 2D or 3D objects and objects in the form of images with a certain pattern (Markerless). Augmented Reality Display system used is the technique of spatial display with screen display (can use a monitor or projector). In outline, in the design of the application, there are three main sections as follows:

• Initialization
• Tracking Marker
• Rendering 3D objects

Markerless AR using AR without tracking or tracking without a special marker. AR browser gravimetric analysis is an example of Markerless AR since points of interest (POI) and other data shown in the window of the camera but the data is not installed or is tracked for each particular visual object. Many mobile games who claimed AR is a game that was just turned on the camera in the background. In addition the camera provides locale settings for the user, the use of cameras superfi social. So, once again, some would claim that this is not a real AR.

Inisialisasi Model 3D

3D models to be displayed is loaded first. So that the application can display a certain 3D objects without changing or rebuild the application, required a configuration file to determine the 3D objects will be loaded according to the pattern of the Target being detected.

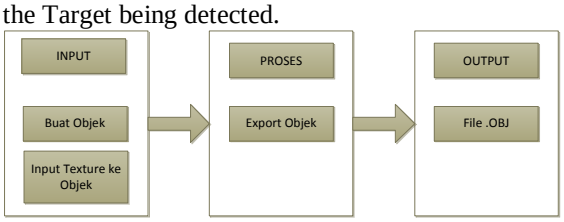


Image 2. The process of formation of the 3D Object Data

f. Tracking Target

Vuforia has the ability to detect image and calculate the position of the image using a standard webcam. Position information obtained will be used to put an object or a three-dimensional model or video into the position of an image or a Markerless. There are five steps in the work process, Tracking targets in Unity.

• Takes video from webcam

Get the input video from a webcam is the first step that must be done. System to process and analyze the frame perframe video streamed in real-time and results in the form of digital images to be used for the next stage. Before webcam webcam use, must dikaliberasi first. Kaliberasi webcam is a very important part in the process of retrieving input or video input. This is caused by the webcam lens distortion at each different camera characteristics. The purpose of calibration is to calculate the rate of webcam distortion of a lens webcam used to generated image approaches the ideal image. The calibration process images in real time.

• input the image Binarisasi (thresholding).

The first step in the application of computer vision on the detection of edge is to download the source image threshold or also called binarisasi as shown to convert the image to a binary image that makes it easy for computation. A binary image is created by converting the pixel brighter than the threshold value to a color, and pixels darker than the threshold value to an other color (didenisikan as a gray-scale or black and white).



Image 3. Thresholding

Threshold values are at a number 0-255 and by default, the threshold is worth 100. The function of this process is to help system so that can recognize the shape of a rectangle and patterns in Target on the image are accepted. Threshold values can be changed and adapted to the light conditions around the Target to keep making Targets appear as a rectangle, as when the light around the Target reduced or excess at a time when the process of thresholding, the system could not detect the Target.

g. Unity

Unity is developing gaming software, with built-in IDE developed by Unity Technologies. It is used to develop video games for web, desktop, console platforms and mobile devices, and is used by more than one million developers. Unity grew out of OS X supported game development tool in 2005 for developing game software gaming multi platform.

The latest updates, Unity 4.2.1, released September 2013. Currently supports development for iOS, Android, Windows, Blackberry 10, OS X, Linux, web browsers, Flash, PlayStation 3, Xbox 360, Windows Phone 8, and Wii u. game developing two versions of the software available for download, Unity and Unity Pro.

Graphics engine uses Direct3D (Windows, Xbox 360), OpenGL (Mac, Windows, Linux, PS3), OpenGL ES (Android, iOS), and proprietary APIS (Wii). There is support for mesh mapping, Parallax mapping, reflection mapping, dynamic shadows using shadow maps, render to texture and post-processing effect full screen.

Unity supports art assets and file format from 3ds Max, Maya, Softimage, Blender, modo, ZBrush, Cinema 4 d, Cheetah3D, Adobe Photoshop, Adobe Fireworks and Allegorithmic Substance. These assets can be added to the project, and managed through a graphical user interface Unity.

h. Vuforia Augmented Reality SDK

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. This technology uses Computer Vision to recognize and track a planar images (Image Target) and simple 3D objects, such as boxes, in real-time.

Image registration capability allows the developer to position and orient the virtual objects, such as 3D models and other media, in connection with the current real-world images seen through the camera of a mobile device. The virtual object and then track the position and orientation of the images in real-time so that the viewer's perspective on the object in accordance with their perspective on target image, making it appear that the virtual object is part of the real-world scenes.

Vuforia SDK supports various types of 2D and 3D targets including ' Target Image ', Markerless 3D multi-target configuration, and the Target form of Fiduciary addressed is known as the Target Frame. Additional features of the SDK including local Occlusion Detection using ' Virtual ' Buttons, runtime image selection targets, and the ability to create and reconfigure the targets set programmatically at runtime.

i. Sketchup

SketchUp is one of the many software that serves to make the picture 3D (3 dimensional). SketchUp can be used by the practitioner-practitioner in the field of architecture, civil, filmmakers, game developers, graphic designers, even Illustrator to create 3d images as needed. SketchUp differences compared to other 3D software is user friendly, meaning that SketchUp designed familiar and easy to use by anyone without having to master complicated techniques and full calculations. In addition this software is available in a free version that can be downloaded. This free version is not disappointing because it has many functions that allow us to create images with good quality and high complexity. Another advantage is the output that can be produced SketchUp can we change into a multi-faceted character images. Starting from a 2D vector drawings, 3D realistic, nor the very image resembles the sketch of a hand.

j. Blender

Blender is the open source software 3D computer graphics. This software is used to create an animated film, visual effects, 3D printed models, interactive 3D applications and video games. Blender has several features including 3D modeling, texturing, bitmap image editor, penulangan, simulation, simulations of smoke fluid and particles, animation, video editing, digital sculptors, and rendering.

2.2 METODOLOGI

a. Analysis of the Problem and Propose Solution

Development of interactive teaching with technology of Augmented Reality to Subjects of this PC Assembly using the method development research in English-language Research and Development (R D &), i.e. a process or steps-steps to develop a new products or refine existing products that can be accountable. The resulting product can be either objects or hardware (hardware) and can also be software (software).

Development model that was used in the development of this module is to use the Dick and Carey model. Step on the Dick and Carey model way shows a very clear relationship, and uninterrupted between the steps with each other. The system contained on the Dick and Carey is very concise, but its contents can be and clearly from one sequence to the next sequence.

The first stage is to determine the subjects become object of development, the second stage is analyzing the content needs, stage of development is the process of ketuga the media i.e. determine SK, KD, indicator and determine meteri learning, the fourth stage is the development of media, namely the development of learning modules using the technology of Augmented Reality that uses the Model of the Waterfall, and the fifth stage is the review experts and trial.

• Determine the Subjects

At the stage of determining the subjects become object of development, the development of this learning module take subjects for class X pc Assembly engineering program computers and networks at SMK Negeri 2 Bandung, because in the process of learning in the eyes of this learning students insufficient understanding of the material if it is only a theory course (text-based).

Based on the analysis of the problems above, the proposed solution can be the utilization of technology to participate in the development of learning modules, namely by developing technology-based teaching module of Augmented Reality. Berbantukan this Augmented Reality

Technology students can study material learning Assembly pcbaik in text as well as visually.

- Analyze the content Needs

The second stage, namely analyzing everything that is needed in the development of this module.

a. analysis of the objectives and characteristics of the subjects
b. analysis of learning resources
c. analysis of the characteristics of learning
d. Technology Readiness

- Media Development Process

The third stage, namely the stage of the process of developing learning modules. At this stage determine the Standard Kopetensi (SK), Basic Competencies (KD) and indicators of learning as well as to determine the material to be used in the learning module.

• Media development using Model Waterfall

The fourth stage, namely the stage of application development interactive learning modules. This learning module development stage using the model of the Waterfall. This model is the model that is most used by Software developers. On this model suggests a systematic and sequential approach to software development that starts at the level of system and move forward starting from the stage of the analysis, design, coding, testing, operation, and maintenance. In accordance with its name the Waterfall (waterfall), then the phases in this model are performed in sequence, one before the other.

a. Requirements Analysis and Definition

This step is the collection of information and the need of the complete then analyzed and defined needs which must be met by the application to be built. At this stage of the search conducted on the material – material pc Assembly learning required and how to apply it in a Desktop-based Augmented Reality technology. After all the necessary material is collected, performed needs analysis of restriction problem of application made with attention to the availability of time and the ability of the making of the application, as well as – whatever it takes in making the application.

1) Fuctional Requirments

Based on an analysis of the process – a process that can be implemented by interactive learning module-based Augmented Reality for pc Assembly subjects is as follows:

a) System capable of displaying device recognition in the form of 3D.
b) system capable of showing the Assembly of the pc in the form of 3D animation that appears related learning material.

2) Non – Functional Requirments

Non-functional requirements of the application are as follows:

a) Interactive learning module Development) berbabsis Augmented Reality for PC Assembly subjects is made with user friendly so that appeals to users of the application, as well as the dilengakapi with a flexible movement.
b) Interactive learning module) applications-based Augmented Reality for PC Assembly lessons running on the desktop.

b. System and Software Design

Design is the first phase in the development phase for each product. For the design of pc Assembly application development using the technology of Augmented Reality will be described in the form of storyboards.

1) Use Case Diagram

Use Case Diagrams describe the expected of a functional system. Describe the system requirements from the user's point of view, focusing on the process of computerization (automated process).

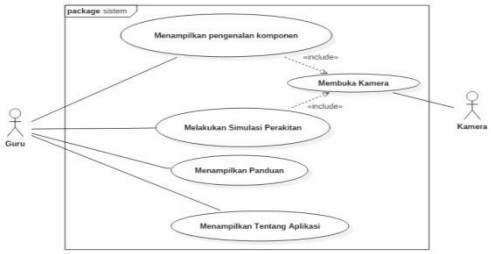


Image 4. Use Case Diagram

2) Activity Diagram

Activity Diagrams depicting the flow activity in a variety of systems that are being designed, how each flow beginning, decisions that may occur, and how they ended.

a) *Activity* Diagram Introduction of *Hardware*

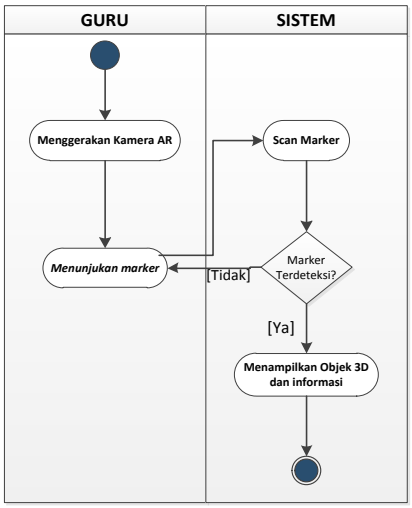


Image 5. *Activity* Diagram Introduction of *Hardware*

b) *Activity* Diagram Assembly PC

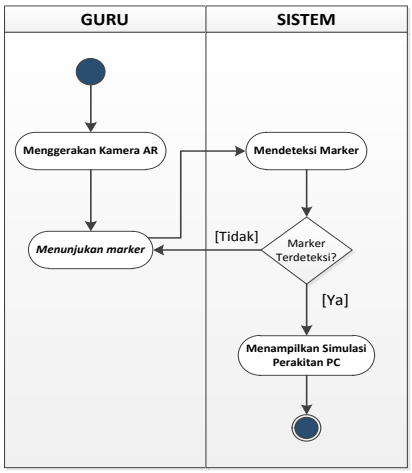


Image 6. *Activity* Diagram Assembly PC

c) *Activity* Diagram Guide

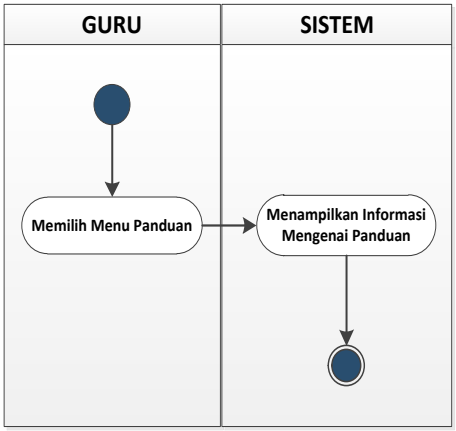


Image 7. *Activity* Diagram Guide

d) *Activity* Diagram About Application

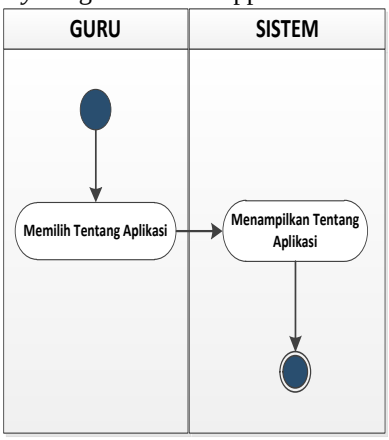


Image 7. *Activity* Diagram About Application

3) Plan Application

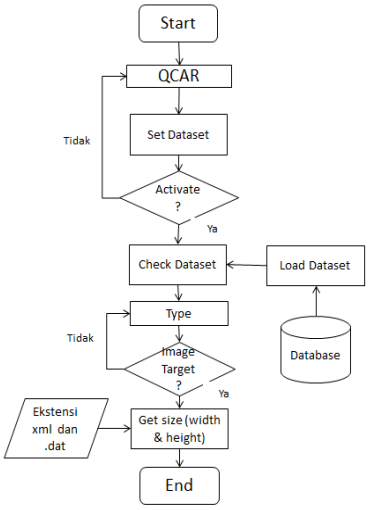


Image 8. *Flowchart*

c. Implementation and Unit Testing

1. Software Requirements

Based on the analysis of the needs in the development of interactive learning modules with Augmented Reality Technology for the Assembly of this pc are as follows:

a) Blender as the software used to create a 3D object.
b) Unity 3D and Vuforia as a software library for developing applications.
c) Adobe Photoshop used to create marker.

2. Hardware Requirements

These applications will be developed on a laptop with the following specs:

a) Monitor 13,3 inchi dengan resolusi 1366 x 768.
b) Memori 4096MB DDR3 dan Harddisk 640GB.
c) Prosessor Intel®core™ i7-3520M CPI@2,90 GHz.
d) Webcam Xtech 1.2 MP.

d. Intergration and System Testing

This stage of testing is the testing done to know the stages of the application of learning modules have been created in accordance with the design and still there is a mistake or not. The purpose of this stage is to find errors as much as possible that were previously not suspected during the making of the application to finish.

e. Operation and Maintenance

In this study the stages of maintenance was not done by researchers because researchers only make prototype applications only and have not set environment applications operated.

- Expert Review and trial

The fifth stage i.e. the review experts and uhi try against the product. At this stage carried out validation or review of the content or materials experts and media experts which aims to find out the feasibility of the product being developed. When in this stage there is an improvement against the media developed, then the enter on the stage of

recisi i. revision aims to refine the products developed based on the suggestions provided. Seterlah deemed worthy by the expert content and media expert, then conducted trials berorangan, small group, and field.

2.3 DISCUSSION

A. Implementation of the programme of the Assembly of the PC using the technology of Augmented Reality.

1. Implementasi of the PC Assembly Module

Implementation module assembling pc features the introduction of the device to the pc Assembly.



Image 9. Implementasi Module

2. Implementasi Software

Implementation of application software Assembly pc using Augmented Reality Technology for pc Assembly consists of subjects from the environment a software implementation, the implementation process of the software, as well as the implementation of the display interface software.

a. Software Implementation Environment.

Pc Assembly application implementation environment using the technology of Augmented Reality is done on the environment of the software and hardware device as follows:

1) Software Spesification

On the environment, the applications software pc assembly using Augmented Reality technology running on the environment as the following:

No	Perangkat Lunak	Keterangan
a.	Sistem Operasi	Windows 7 32/64 bit
b.	*Software* Pembangun	Unity3D 4.6
c.	*Software Design*	Skethup, Blender, Adobe Photoshop CS5

Table 1. Software Specification Table

2) Hardware Specification

On the environment, the applications hardware pc assembly using Augmented Reality technology running on the environment as the following:

No	Perangkat Keras	Spesifik
1	Processor	Intel® Core™ i3-3270M CPU @ 2.40GHz
2	Hardisk	500GB
3	RAM	DDR 3 4GB
4	VGA	Intel® HD Graphics 3000
5	Webcam	1,3 MP

Table 2. Hardware Specification Table

b. Implementation Marker

In accordance with the design of functional model has been made necessary a marker (Marker) that is placed on a magic card for tracked by camera webcam that already contains the applications of Augmented Reality. Software pc assembly using the device data base i.e. pictures – pictures of bookmarks that are ready-to-use upload official kesitus vuforia, then the marker image is processed so that it becomes the library file PerakitanPC. unitypackage for download. Application inimenggunakan 9 images that are implemented as a marker.



Image 10. Implementation *Marker*

c. Implementation 3D Object

At this stage, the creation of 3-dimensional objects made with Blender application mengguankan v 2.78. 3-dimensional object from each hardware device and animated Assembly PCs.

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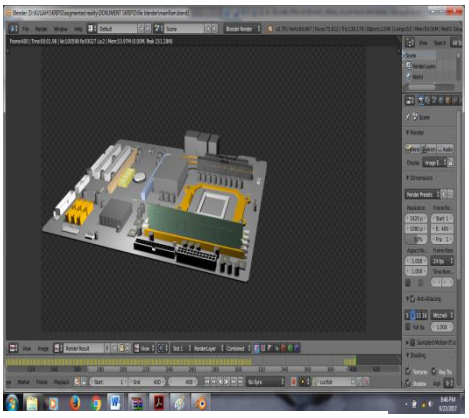


Image 11. Implementation 3D Object

d. Implementasi Of The Display Interface Software

Implementation of screen interfaces implemented using lunka device features – features that are present in unity 3D.

1. Implementation Main Menu

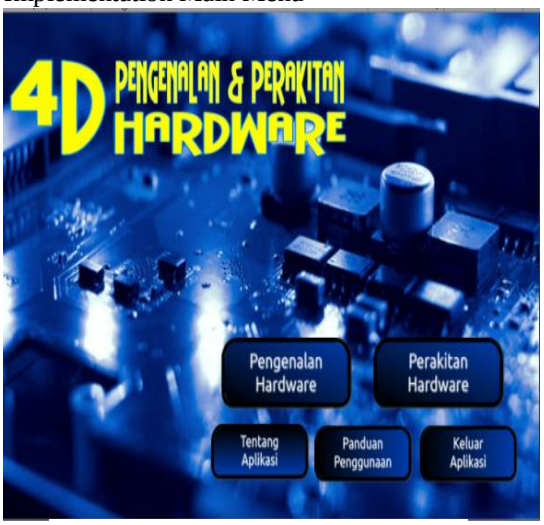


Image 12. Implementation Main Menu

2. Implementation Introduction Hardware

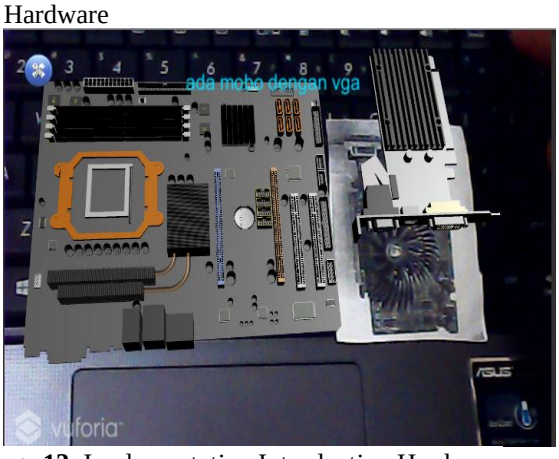


Image 13. Implementation Introduction Hardware

3. Implementation Assembly PC

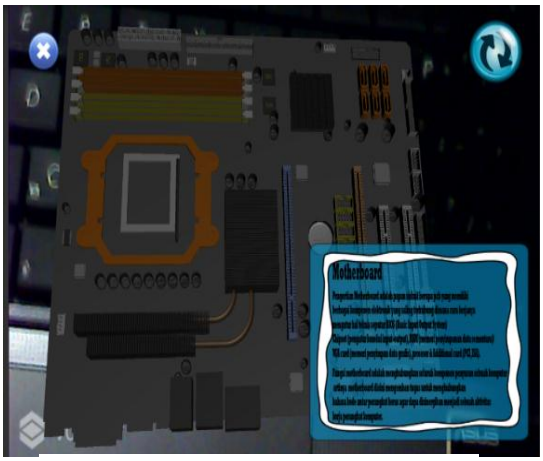


Image 14. Implementation Assembly PC

4. Implementation Guide



Image 15. Implementation Guide

5. Implementation About Application

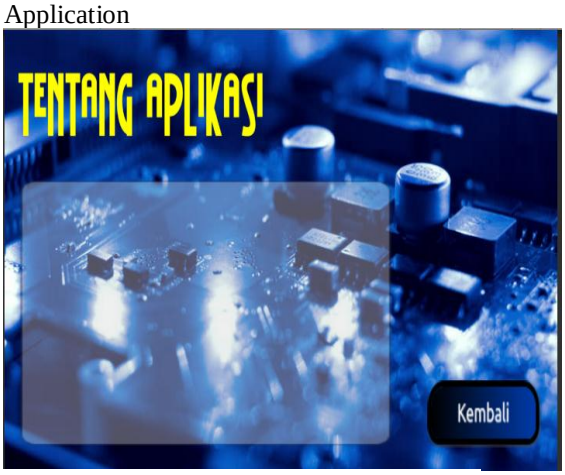


Image 15. Implementation About Application

B. Testing Application of Assembly PC *Augmented Reality*

On testing was performed against the learning material and software.

1. The Purpose of Software Testing

Test the truth of the application process the pc Assembly Augmented Reality according to the contents of the material that has been set using the manual and related resources, and test user response after using pc based Assembly application of Augmented Reality.

2. Fear and Testing Techniques

These will be spelled out tata engineering and testing an application Assembly of pc-based Augmented Reality.

Black Box Testing testing will be done by looking at the suitability of the Output that is generated by the application with a marker (marker), then do a trackback to all pc Assembly animations from start to finish. White box testing is conducted to know the workings of the software internally. Product testing is conducted to find out the response from the expert content, media expert, testing individuals, small groups, test and field test after using the application of Augmented Reality.

3. The Design of Software Test Case

Testing of application software Assembly of pc-based Augmented Reality done will be described in the question form using testing :

a. Whitebox Testing will be done by the developers themselves, will be made against examiners 2 Source Code, namely: MenuManager.cs and ButtonPopup.cs.
b. Blackbox Testing done testing by looking at the suitability of the Output generated by the application with a marker, testers conducted by three people at SMKN 2 Bandung City.
c. Testing the expert content will be done by the teacher pc Assembly subjects at SMK Negeri 2 Bandung City.
d. Testing will be done by media expert lecturer of Informatics Engineering education.
e. Trials of individuals, small groups, and by students of class X TKJ SMK Negeri 2 Bandung City.

4. Implementation of Software Testing

Testing is done using the now that it has been designed.

5. Evaluasi Hasil Pengujian

Black Box Testing on testing the suitability of input and output that is generated by the application with a marker (marker), then in the white box testing all functions of code can run well and true. Testing a product from expert content, media expert, testing individuals, small groups, test and field test results obtained can be based on the conclusion that the application Assembly of pc-based Augmented Reality is, worthy of use in the learning process of the Assembly of the pc. Response sisea Assembly towards the development of pc-based Augmented Reality is very positive.

3. CONCLUSION

Based on the results of data analysis and discussion on this research, it can be taken a summary of implementation of dali applications Assembly pc based Augmented Reality in the form of an application containing the Assembly pc learning material in the form of Augmented Reality that displays 3D object along with the Assembly of the pc. Response expert content and media experts stated that decent application modules and field trials, as well as the response of the students against the Assembly pc based applications of Augmented Reality is very positive.

Based on the author's observations on the field against some of the things that can be used as consideration for follow up dai include: perakian pc-based applications of Augmented Reality to subjects of this future pc Assembly can be developed for experimental research, application development of Augmented Reality on android next, so pay attention to the size of that application so that when running the application does not spend time further development, hope noticed auto focus on the main view (camera) so it will be easier in the capture or track marker , as well as to display the video at the same time so that it becomes more interesting AR applications.

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