Building Applications Augmented Reality Simulation System Maintenance Carburetor & Spark Plug In Car-Based Desktop
(Case Study: SMK Puragabaya)

Muhammad Dzikrillah[1], Iskandar Ikbal, S.T., M.Kom[2]

[1, 2] Teknik Informatika – Universitas Komputer Indonesia
Jl. Dipatiukur 112-114 Bandung

Email : Muhammad.dzikrillah@yahoo.co.id [1], ikbal5710110014@gmail.com[2]

ABSTRACT

The learning method is still conventional provision of material that causes a lack of student understanding of the material provided. The purpose of this course is to explain to students how the system measures maintenance of engine in the car with a carburetor and spark plug components. Based on these problems, we need a media that is expected to help students and teachers.

Based on the problems that have been outlined required a learning media via a computer to facilitate students and teachers do the teaching, namely the media simulation. This learning media can help students understand and interact directly in engine maintenance system.

Based on the results of research and testing has been done, it can be concluded that the media learning and simulation engine maintenance system can help students and teachers in the learning process.

Keywords: Multimedia Learning, Interactive Media, Interactive Simulation, Systems Maintenance Engineering.

1. INTRODUCTION

1.1 Background

SMK Puragabaya is a private vocational school located in the province of West Java city of Bandung in the field of automotive engineering studies. One of these subjects in vocational Puragabaya are machine maintenance systems. The purpose of this course is to explain to students how a step - step system maintenance kaburator engine and spark plugs in order for a car to function properly. The tools used in the lab are four-wheeled vehicles (cars) but lack the tools used in the lab, and methods of delivery is still conventional materials which cause of student understanding of the material provided.

Of the problems outlined above, built a simulation applications using Augmented Reality technology. Augmented reality is a technology that combines three-dimensional virtual objects into a real three-dimensional environment and displays them in real time, Azuma [1]. Simulations are built to help students understand the maintenance of the machine, especially the carburetor and spark plugs.

Based on the above issue the purpose of building a simulation application is to build applications that can facilitate students in understanding the expected engine maintenance and more competent students in the lab. Submission of materials from teachers more detail, because students can interact directly on the system. The tools used in the lab more adequate and practical given the time to be shorter.

Based on observations to the father of the responsible subjects of basic technique, namely automotive, Mr Jatmiko. There is a problem of lack of students' understanding of the steps - steps engine maintenance system that resulted in many students do not pass the driving test held by the school. Population for class X and XI numbered 232 students, the sample for the study of only 58 people or two classes X and XI. Results of a questionnaire to 58 students in vocational Puragabaya also showed that a lack of understanding of the material, tool material practice, given the time and the means were inadequate.

1.2 Problem Formulation

Based on the above, the issues to be discussed in this research is how students can better understand the system and the lack of maintenance of the machine tools used in the lab.

1.3 Purpose and Objectives

The purpose of this research is to "Building Applications Augmented Reality Simulation System Maintenance Machine Car Based On Desktop".

The purpose is to make students better understand the system maintenance on the car engine and increasing practicum adequate tool.

1.4 Multimedia Based Learning

Multimedia is media that combine two or more media elements consisting of text, graphics, images, photographs, audio, video and animation in an integrated way. Multimedia is divided into two categories, namely: linear multimedia and interactive multimedia.

Linear Multimedia is a multimedia that is not equipped with any control device that can be operated by a user. Multimedia is running sequential (sequential), for example: TV and movies.
Interactive multimedia is a multimedia equipped with a controller that can be operated by the user, so the user can choose what you want for the next process. Examples of interactive multimedia are: multimedia interactive learning, gaming applications, etc..

While learning is defined as the process of creating an environment that enables the process of learning. So in the main learning is how students learn. Learning in terms of mental activity of students in interacting with the environment that produces behavioral changes yangbersifat relatively constant. Thus important aspects of the learning activities is the environment. How this environment created by arranging its elements so as to change the behavior of students. From the above description, if the two concepts we combine the multimedia learning can be defined as multimedia applications dignakan in the process pembelajran, in other words, to deliver the message (knowledge, skills and attitudes) and can stimulate piliran, feelings, concerns and willingness to learn thereby deliberately learning occurs, aims and control.

1.5 Computer Aided Learning (CAL)

Computer Aided Learning (CAL) is a method for Teaching and Learning with Computer Aid. CAL arguably the advancement of learning methods via computer in which, the user (User) can be more easily and quickly understand and apply what information is in learn it through an attractive image display (Audio Visual) on the Web.

By learning method that utilizes a computer, students are able to study independently. This gives a new learning alternative than to learn from a school teacher as the sole source of information. Students can also repeat the lesson independently by learning to use the software as a source of information. The education process is conventionally done using books and educational systems only involve teachers alone as an active party. Teachers teach students verbally or with the media in the form of the board, while the students attempt to memorize as much of the information provided.

2. CONTENT OF RESEARCH

2.1 Method of Learning

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Role of Computers in CAL, namely:

1. As an expert,
   Computers have the advantage, the ability to store more data and are also much more accurate than a human. With a computer with audio-visual facilities, can convey messages that are more memorable than the message delivered orally.

2. As a Supervisor or Tutor,
   By learning method that utilizes a computer, students are able to study independently. This gives a new learning alternative than to learn from a school teacher as the sole source of information. Students can also repeat the lesson independently by learning to use the software as a source of information.

2.1.1 Model Drills

Drills Model is intended to train the user so as to have proficiency in a skill or strengthen mastery of a concept. The program provides a series of problems or questions that are usually displayed at random, so every time it is used then the question or questions that appear always different, or at least in different combinations.

The program comes with the correct answer, with an explanation so hopefully users will be able to also understand a particular concept. In the final section, the user can see the final score which he accomplished, as an indicator to measure the degree of success in solving the problems posed.

2.1.2 Model Material

Multimedia learning is the learning that is simple and easily understood by the students. Since most of the multimedia this one like the delivery of learning material submitted by educators, but the difference form of a tutorial or ways to do things or work instructions.

Model tutorial is a conceptual framework that describes a systematic procedure for organizing learning experiences in tutorial activities to achieve certain goals (Wardani & Julaeha, 2006: 1). In the model tutorial, this conceptual framework is a step tutorial activities which can provide a learning experience about the students active learning, cooperation, interaction among students and so on.

Which have been and are determined tutor that suits the characteristics of teaching materials so special competence can be achieved by either.

2.1.3 Model Simulation

Multimedia learning is trying to match the dynamic processes that occur in the real world, for example to simulate the aircraft, in which users perform activities as if flying an aircraft, running a small business, or control of nuclear power plants and others. Basically this simulation tries to give real-world experience problems that are usually associated with a risk, such as aircraft to be dropped or bumped, the Vendor will go bankrupt, or a nuclear disaster.

2.1.4 OOP (Object Oriented Programming)

OOP (Object Oriented Programming) is a method to the object-oriented programming. The purpose of OOP is created to facilitate the development of the program by following the existing model in everyday life. So every part of the problem is an object, nah object itself is a combination of several smaller objects again. I take the example of Aircraft, Aircraft is an object. The aircraft itself is formed of several smaller objects again as the engine, wheels, propellers, chairs, etc.

Plane as the object formed from objects smaller interconnected, interact, communicate and send messages to other objects. So also with the program, a large object formed from some of the smaller objects, the objects communicate with each other, and exchanging messages to other objects.

2.1.5 Black Box Testing

Black Box Testing is a method of software testing is to test the functionality of applications as opposed to the internal structure or work. Specific knowledge of the application code / internal structures and programming knowledge is generally not required. Test cases are built around the specifications and requirements, ie, what the application is supposed to do. Using external software descriptions, including specifications, requirements, and designs to reduce test cases. These tests can be functional or non-functional, though usually functional. Test designer selects the input of valid and invalid and determine the correct output. There is no knowledge of the internal structure of the test object.

The test method can be applied at all levels of software testing: unit, integration, functional, system and acceptance. It usually consists of most if not all of the testing at a higher level, but also could dominate unit testing as well. Black Box testing techniques include:

1. Decision Table

Decision Table is a compact yet precise way to model complicated logic, such as flowcharts and if-then-else and switch-case statements, associate conditions with actions to perform, but in many cases do so in a way that is more elegant.

2. All Pairs Testing

All-pairs testing or pairwise testing is a method of combinatorial testing software that, for each pair of input parameters to the system, test all possible combinations of discrete parameters. Using carefully chosen test vectors, this can be done much faster than an exhaustive search of all combinations of all parameters, with "parallelizing" partner testing parameters. The number of tests typically O (nm), where n and m is the number of possibilities for each of the two parameters with the most options.

3. The State Transition Table

State Transition Table is a table that shows what country (or countries in the case of a limited robot nondeterministic) a semiautomaton limited or finite state machine will move to, based on current conditions and other inputs. A state table is essentially a truth table where some inputs are the current conditions, and output including the next, along with other output.

4. Equivalence Partitioning

Equivalence Partitioning is a software testing technique that divides the input data from the software unit into multiple partitions of data from which test cases can be derived. In principle, the test cases are designed to cover each partition at least once. This technique attempts to define test cases that reveal the class of errors, thereby reducing the number of test cases that must be developed.

5. Boundry Values Analysis

Boundry Value Analysis is a software testing technique in which the test is designed to include representatives from the boundary values. The values in the edge of an equivalence partition or at the smallest value on both sides of the edge. The values can be input or output range of software components. Because of these limits is a common location for errors that resulted in a software glitch they often do in the test cases.

2.1.6 Software Development Methods

The method used in the making of this software using the waterfall model. Waterfall is a classic model that is systematic, sequential in building software.

Many methods are used in the development of systems Prototyping method, Method

Waterfall by Pressman and Sommerville in 2010 [2], this method shall be composed of several steps, some of the waterfall include:

1. Requirements definition
   The search process needs intensified and focused on software. To know the nature of the program to be made, then the software engineer must understand the information domain of software, for example, required functions and user interface.

2. System and Software Design
   This process is used to change the need - the need for the above to be representation in the form of "blueprint" software before coding begins. The design must be able to implement the requirements mentioned in the previous stage.

3. Implementation and unit testing
   To be understood by the machine, in this case is a computer, the design had to be transformed into a form that can be understood by machines, ie into the programming language through a process of coding. This stage is the implementation of the technical design phase will be done by the programmer.

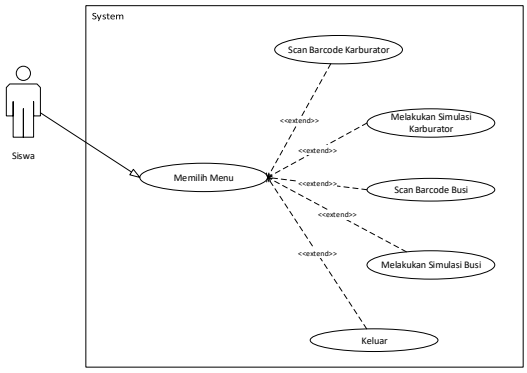
4. Integration and System Testing
   Something made must be tested. Likewise with software. All software functions to be tested, so that the software is free from error, and results should be strictly in accordance with the needs that have been defined previously.

5. Operation and Maintenance
   Maintenance of a software is required, including the development, because the software that made no forever just like that. When the run may still have minor errors that are not found before, or are there additional features that did not exist in the software. Development required when a change of external companies such as when there is a change of the operating system, or other device.

2.2 Use Case Diagram

Use Case Diagram is a technique to record the functional requirements of a system. Use case describes a typical interaction among the users of the system with the system itself, by giving a narrative of how the system is used. Tools used in Use case diagrams that Ms Visio and Visual Paradigm Diagram. Description use case:

1. A use case is where the system is used to meet one or more requirements of the user.
2. Use case merupakana excellent start for every phase of object-based development, design, testing, and documentation.
3. Use case illustrates the need for the system from the standpoint outside the system.
4. Use case determines the value given to the user system.
5. Use case only specify what should be done by the system, the system functional requirements. Use case is not to determine the nonfunctional requirements, eg work objectives, programming languages, etc..



Picture 1

2.1.7 *Augmented Reality*

Augmented reality (AR), known as augmented reality is a technology that combines the virtual object and the two-dimensional or three-dimensional lingkuangan into a real three-dimensional objects and then projecting the virtual -benda in real time. Real objects display information that can not be accepted by the user in his own senses. This makes it suitable as an augmented reality tool to help perception and its interaction with the real world.

Information displayed by virtual objects helps users carry out activities in the real world. AR can be applied to all the senses, including hearing, touch, and smell. Besides being used in fields such as health, military, manufacturing industry, augmented reality has also been applied in devices that people use a lot, such as on mobile phones. There are two definitions of AR commonly accepted, one definition of Ronald Azuma in 1997, Azuma [1] defines that:

1. Combining reality and virtual
2. Interactive in real time
3. Classified into the 3D environment

In addition, Paul Milgram and Fumio Kishino define Milgram's Reality-Virtual Continuum in 1994. To describe a continuum that stretches from the real environment to a pure virtual environment. Among them there were augmented reality (closer to 12 real environment) and augmented virtuality (closer to the virtual environment).

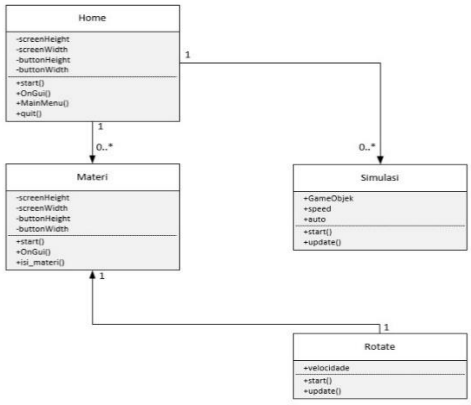
2.1.8 Marker

Marker is a real estate enviroment-shaped objects that will produce virtual reality, is used as a marker augmented reality emerged, following some type of marker used in augmented reality applications:

1. Fiducial marker is the form most often used by the AR technology because this marker is used to track objects in the virtual reality. black and white box is used as a reference point or to provide the scale and orientation to the application. When the marker detection and recognized it would be out of the augmented reality marker.
2. Marker Markerless functioning as fiducial markers but the shape Markerless marker should not be a black box and white, this Markerless can form images having many colors.

2.3 Class Diagram

The class diagram or class diagram illustrates the structure of the system in terms of defining the classes that will be created to build the system.



Picture 2

2.4 Hardware Requirements Analysis

Analysis of the hardware used to facilitate the design and implementation. Based on observations exist, the hardware specifications that are owned by SMK Puragabaya Bandung.

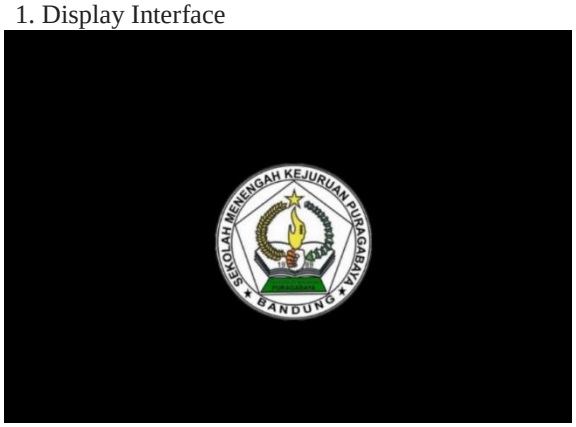
1. Processor: Processor 2.0 GHz
2. Monitor: Monitor resolution of 1024 x 768 px
3. VGA: 512 MB VGA
4. Hard drive: 80 GB
5. Memory: 2GB RAM
6. Camera: HD Camera

2.5 Interface Implementation

Interface implementation is an implementation of interface design. The interface is a display of the application in which the user will interact directly with the application.

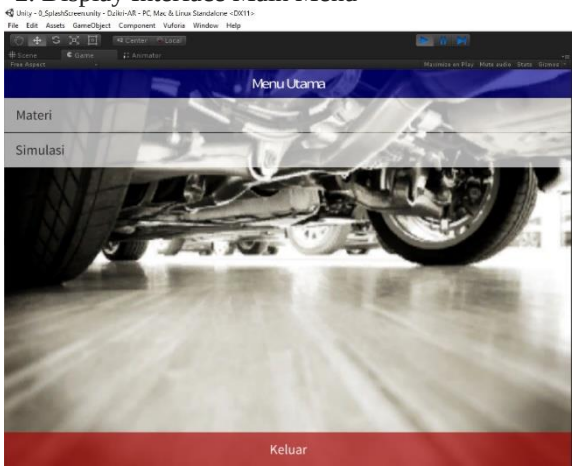
The interface is a display of the application in which the user will interact directly with the application through the interface. Displays the interface of the Application of Multimedia Learning System Maintenance Carburetor & Busi As Media Interactive Training At SMK Puragabaya can be seen in the following figure.

1. Display Interface



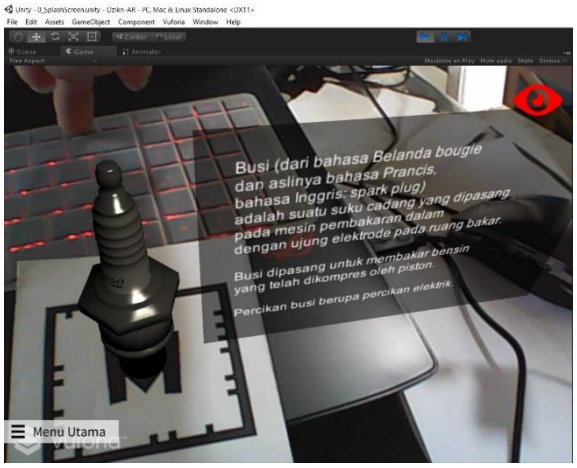
Picture 3

2. Display Interface Main Menu

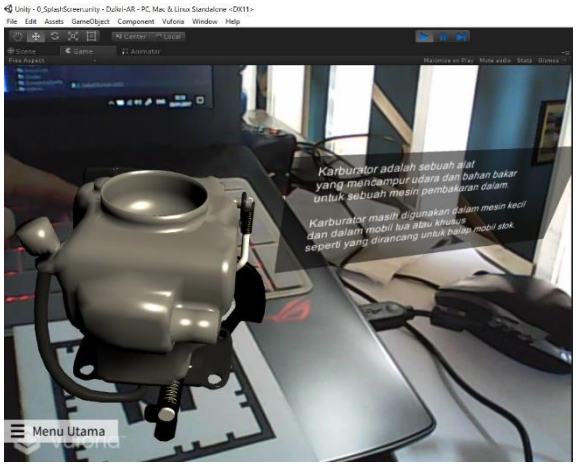


Picture 4

3. Display Interface Material



Picture 5



Picture 6

4. Display Interface Simulation



Picture 7

2.6 Testing Systems

Testing is the steps being taken to explain the operation of the software that is already built. The testing is done is done is divided into two tests, namely alpha testing and beta testing.

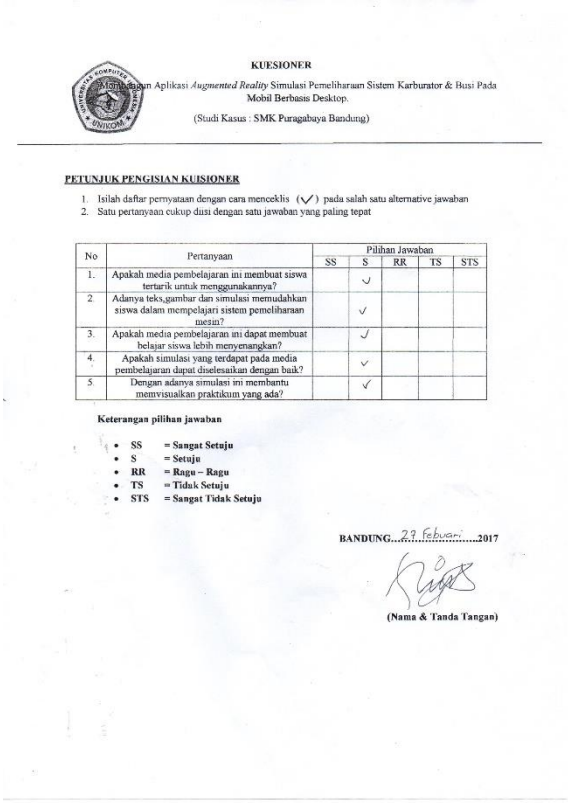
No	Class Test	Test Item	Type Testing
1	Main Course	Selecting Keys "material" to study the material	Black box
		Marker chose to "material" that will be studied	Black box
		Selecting the button "Simulation" to simulate the material selected	Black box
		Selecting Marker for "Simulation" to be simulated	Black box
		Selecting the button "Exit" to exit the application	Black box
2	Menu Content	Selecting Keys "material" to study the material	Black box
		Marker choose material for the desired material	Black box
		Selecting the button "Exit" to exit the application	Black box
		Selecting the button "Main Menu" to return to the main menu	Black box
3	Menu Simulations	Selecting the button "Simulation" to simulate the material selected	Black box
		Marker choose the desired Simulation for Simulation	Black box
		Selecting the button "Main Menu" to return to the main menu	Black box

4	Menu Exit	Selecting the button "Exit" to exit the application	Black box

Table 1

2.6.1 Beta Testing

Directly in the system environment without any intervention on the part of the application builder. This testing is done by distributing questionnaires to the users of the application. Here are the questions set forth in the questionnaire.



KUESIONER

Pembangunan Aplikasi *Augmented Reality* Simulasi Pemeliharaan Sistem Karburator & Busi Pada Mobil Berbasis Desktop.

(Studi Kasus : SMK Puragabaya Bandung)

PETUNJUK PENGISIAN KUISIONER

1. Isilah daftar pernyataan dengan cara menceklis (✓) pada salah satu alternative jawaban
2. Satu pertanyaan cukup diisi dengan satu jawaban yang paling tepat

No	Pertanyaan	Pilihan Jawaban				
		SS	S	RR	TS	STS
1.	Apakah media pembelajaran ini membuat siswa tertarik untuk menggunakannya?		✓			
2.	Adanya teks,gambar dan simulasi memudahkan siswa dalam mempelajari sistem pemeliharaan mesin?		✓			
3.	Apakah media pembelajaran ini dapat membuat belajar siswa lebih menyenangkan?		✓			
4.	Apakah simulasi yang terdapat pada media pembelajaran dapat diselesaikan dengan baik?		✓			
5.	Dengan adanya simulasi ini membantu memvisualkan praktikum yang ada?		✓			

Keterangan pilihan jawaban

- SS = Sangat Setuju
- S = Setuju
- RR = Ragu – Ragu
- TS = Tidak Setuju
- STS = Sangat Tidak Setuju

BANDUNG...27 Febuari.....2017

(Nama & Tanda Tangan)

Picture 8

3. CLOSING

3.1 Conclusions

Based on the results obtained in this thesis, it can be given the following conclusion:

1. Application Maintenance Machine Learning Media System can be a supporting tool to enhance value and also students can interact with a given lab.
2. Learning Media Application Maintenance System This machine can be a support tool to overcome the limitations of practical tools.

Learning Media Application Maintenance System This machine can help teachers better interact with students who do not understand the system of machine maintenance.

3.2 Advice

Suggestions for the development of instructional media applications are some suggestions that can be done, among others:

1. In this application using client-server system in order to facilitate the vote.
2. Can add content and change the material.
3. Make the features in detail, because the existing features in this application only the maintenance of main components in the engine maintenance system.
4. Creating a more complete feature, because the system is not only the maintenance of the engine spark plugs and carburetors are of course many other engine maintenance.
5. Create a view that is much more interesting because these applications are built to be very still simple.

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