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The Use of Augmented Reality to Build *Occupational Health and Safety* (OHS) Learning Media

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Abstract. Occupation Health and Safety (OHS) has a purpose to ensure a safe and healthy work environment. Occupation health and safety must be apllied by an industry that have potential hazards arising from the production process carried out. The potential hazards include work accident such as explosion, fire, pollution, and disease

The technological development brought us to the next level of invention. One of the invention that found in 21ˢᵗ century is Augmented Reality. Augmented Reality is an revolutionaty invention which combines virtual object into reality environment. Augmented Reality widely use as a learning media, promotional tools, and for some special purpose. Augmented Reality can be use in desktop, mobile device, and wearable technology.

The purpose of this research is to build Occupational Health and Safety learning media based on Augmented Reality. The learning media will be made mobile based with android devices. The method of software development using the waterfall method. The output of this research is marker card that can display objects in the form of images about Occupation Health and Safety. Images will reveal if card scanned using android mobile device that has the Augmented Reality application installed.

1. Introduction

Occupation Health and Safety (OHS) management system is part of the overall management system in a company. Occupation Health and Safety (OHS) management system contain of organizational structure, planning, responsibility, implementation, procedures, processes and resources. All of it is necessary for some development, implementation, achievement, assessment and maintenance of occupational safety and health policies in order to control risk. The purpose and objective of the OHS management system is to create a safety system and health in the workplace by engaging elements of management, workforce, integrated working conditions and environments in order to prevent and reduce workplace accidents and illnesses and create a safe, efficient and effective workplace.

Occupation Health and Safety (OHS) management system must be applied by any company that has potential hazards posed by process characteristics or materials that may result in work accidents such as blasting, fire, pollution and disease due to work. Based on Article number 1 [1] of

the Indonesian Ministry of Manpower regulations about Occupation Health and Safety (OHS) management system, there are five provisions that must be implemented by the company among others : establishing Occupation Health and Safety (OHS) policy and ensuring commitment to the implementation of Occupation Health and Safety (ohs) management system; plan the fulfillment of policies, objectives and purpose of Occupation Health and Safety (OHS) implementation; effectively implement Occupation Health And Safety (OHS) policies by developing the capabilities and mechanisms of support needed to achieve Occupation Health And Safety (OHS) objectives; Measure, monitor and evaluate Occupation Health And Safety (OHS) performance and take corrective and preventive action; regularly review and improve the implementation of the Occupation Health And Safety (OHS) Management System with the aim of improving Occupation Health And Safety (OHS) performance.

Knowledge of OHS needs to be understood and practiced by students, but in some universities the knowledge of OHS is still taught conventionally only in theory according to what is in the books. Therefore, there needs to be a new learning strategy that can attract students to learn OHS. Technology is the answer, by using augmented reality we can create attractive learning media about how to learn OHS.

According to Borko [2] Augmented Reality (AR) is a direct or indirect view of physical objects by adding information can then be displayed virtually. According to Azuma [3] Augmented Reality (AR) is a technology that combines two and or three virtual objects dimensions into a three dimensional real environment and then projecting objects virtual environment in a real environment. Milgran and Kishino [4] in that in his publication entitled A Taxonomy of Mixed Reality Visual Displays mentions formulate a framework of the possibility of merging and fusing the real world and the virtual world into a Continuum Virtuality, its shows in figure 1

Figure 1. Continuum Virtuality concept by Milgran and Kishino

Based on the picture above we can see that on the left side is a real environment that contain a real things and the opposite side (right side) is a virtual environment that contain a virtual things. Augmented Reality combine this two side into one environment called mixed reality, its show a virtual things into a reality environment.

AR can work if there is one important component, namely marker. Fiducial images or better known as marker are image which consist of a collection of reference points to acilitate computation of the measurement parameters required in image processing[5]. The example of an marker shows on figure 2
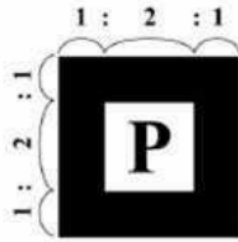
Figure 2 example of an Augmented Reality marker

Marker is one of the methods commonly used as a medium for estimating camera position in AR applications with video-based tracking. Markers can be color or can be images. The simplest and best working marker is the matrix marker, like its shown in figure 2.

The result of previous relevant research, Andi Pramono [6] conducted a research entitled " *Media Pendukung Pembelajaran Rumah Adat Indonesia Menggunakan Augmented Reality*" which produces a medium to study the traditional house in Indonesia which is part of the IPS subjects grade IV Elementary School. The weakness of this research is the learning media created by inaccessible from all places.

Research conducted by Setia Wardani [7] entitle " *Pemanfaatan Teknologi Augmented Reality (AR) Untuk Pengenalan Aksara Jawa Pada Anak*" produces a catalog book contains marker about the introduction of Javanese alphabet. The weakness of this research is web-based application, so to use it requires an internet connection.

My previous research entitle "*Rancang Bangun Media Pembelajaran Sholat 5 Waktu Berbasis Augmented Reality*" [8] produce an AR-based 5 time prayer learning application for Kindergarten students.

Based on the previous relevant research our research purpose is to create a card shape learning media using Augmented reality to help college student understand of Occupation Health And Safety (OHS). The application can be installed on an android based smartphone, this application also need no internet connection to use, so user can use it anywhere and anytime.

2. Methodology

The concept of this research is to use the Microsoft Solution Framework (MSF). MSF is application design and development methods introduced by a large software vendor, namely Microsoft Corporation. The principles of the software development method using the MSF method have milestone-based planning (waterfall model) and provide predictable results (spiral / iterative models) accompanied by feedback and creativity from the developer team and must be sequential. Whereas the system approach method used is Object Oriented Development (OOD), which is software / application development based on object abstraction in the real world, where in this method usually uses a tool, namely UML (Unified Modeling Language).

Research Stages: There are several steps that must be done to produce Occupation Health And Safety (OHS) learning media based on Augmented reality. These steps are

    a. Problem Identification.

       This stage is to collect all the information about user need and system need. The information obtained is then analyzed to determine the objective, benefit, and scope of the application to be made.

    b. Planning

       This stage is the stage where application to be made is is modeled, designed, and planned according to the purpose and benefits that have been set in the previous stage. In this stage

apart from designing the application / interface, markers must also be designed, in addition to designing Occupation Health And Safety (OHS) modelling.

c. Developing Stage

The stage where all the planning results are made. At this stage we produce the AR Marker and android based application.

d. Trial Stage

After producing the marker and the application next step is to try hether the application can run properly. At this stage its important to analyzed and take a note if there is an errors found during test. if no errors are found then it can be continued to the next stage, but if there are still errors that must be corrected.

e. Implementation Stage

This is the final stage where application that made is being used by a user. During this stage user can give an advice and suggestion regarding the application used.

This research requires some software and hardware in making AR applications, here the list. Hardware:

a. Macbook Pro with 2,4 ghz Intel core i5 processor, 8 Gb RAM DDR 3 1600 Mhz, minimun MacOS Mojave 10.14.4

b. Android Smartphone with minimun Android OREO 8.1 Operating system, minimun 3 GB RAM

Software:

a. Unity Unity 2018.4.5fl
b. Handbrake video transcoder
c. Google Chrome
d. Visual Studio Community 2019
e. Adobe After Effect CC
f. Adobe Photo Shop CC
g. Adobe AI Ilustrator CC

3. Result

As it say in the beginning that to make an Augmented Reality work properly we need to create a marker. Here it is the marker designs used in the Occupational Health and Safety learning media based on Augmented Reality application.
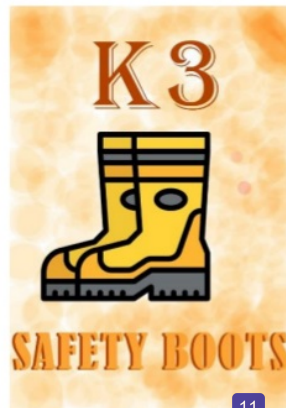
Figure 3 2D picture Occupational Health and Safety learning media based on Augmented Reality Augmented Reality marker

Occupational Health and Safety learning media based on Augmented Reality application in the form of a mobile device application that can be installed on an Android based smartphone with minimal specifications of the Android OREO 8.1 operating system. After the installation process is complete, then you can run the application by pointing the rear camera at the marker that has been made. If the application runs well, the mobile phone screen will display an animated 3D image containing Occupational Health and Safety learning media based on Augmented Reality as shown below.

Figure 4 Occupational Health and Safety learning media based on Augmented Reality application view

We did several tests on the app to find parts that weren't working properly. Based on experimental results we have yet found any errors in the application.

4. Conclusions

Occupational Health and Safety learning media made using Augmented Reality. Augmented Reality (AR) is a direct or indirect view of physical objects by adding information can then be displayed virtually. The application is installed on an Android-based smartphone. the way it works is by pointing the rear camera of the cellphone to the marker object that has been created. Occupational Health and Safety learning media made using Augmented Reality has been tested several times and work properly.

Suggestions for further research, research can be developed to make AR applications for various fields not only for education. Further research can also be developed to make AR applications without using markers but using objects that exist in daily life.

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