

# **Design and Implementation Learning Media of a Computer Hardware Introduction as a Teaching Tool Based-on Augmented Reality Technology**

**Giva Andriana Mutiara**

School of Applied Science Telkom University  
Jalan Telekomunikasi, Ters. Buah Batu, Bandung 40257

**Gita Indah Hapsari**

School of Applied Science Telkom University  
Jalan Telekomunikasi, Ters. Buah Batu, Bandung 40257

**Rini Handayani**

School of Applied Science Telkom University  
Jalan Telekomunikasi, Ters. Buah Batu, Bandung 40257

Copyright © 2014 Giva Andriana Mutiara, Gita Indah Hapsari and Rini Handayani. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## **Abstract**

Learning media has changed along with the changing times. Modern instructional media technology advancements have been implemented in various multimedia, animations, and simulations in order to create the visualization of self-learning process. This research was aimed to create an application that contains a media introduction of basic computer hardware-based Augmented Reality technology and allowed users to perform self-regulated learning about the basic introduction to the computer hardware consisting of self-learning materials along with practice quizzes independently by using web camera. ICHAR (introduction of hardware computer augmented reality) was built based on the story board design flow, combined with multimedia (audio, video, animation) integrated with markerless

Augmented Reality technology, D'Fusion ® AR (free version), and 3D Studio MAX to create animation of 3D objects. ICHAR was also equipped with 2 types of interactions including control viewpoint and event generation. ICHAR was tested by measuring and analyzing the answer of the questionnaire about the performance of the application.

**Keywords:** Learning Media, Augmented Reality, Teaching Tools

## 1 Introduction

For many years, the learning was very traditional, where a lecturer and students met face to face according to a scheduled meeting and used black/whiteboard and chalk/marker. But nowadays, voice, audio, video, animation are used as materials teaching aids and internet could be their class.

Augmented Reality (AR) is one of visual technology combining two or three dimension virtual object from real object. AR-based applications can help the process of teaching and delivery of information, making it more interactive and conveyed properly. Besides that, it allows users to interact naturally with 3D impression and provides self learning education to become more interactive.

Device used for implementing AR technology is a web-cam, to capture images. Therefore, this research will produce self-learning processes that visualize computer hardware based on AR technology using a web-cam named ICHAR (Introduction of Computer Hardware by Augmented Reality).

## 2 Media

Media is a tool or means of communication also called audio-visual equipment, meaning that the tool can be seen and heard used in a learning process with the intent to communicate more effectively and efficiently. Allen (1975) suggests the relationship between media and aim of learning as shown in table 1.

Table 1. Relationship media and aim of learning

Type of Media	1	2	3	4	5	6
Static Image	M	H	M	M	L	L
Motion Image	M	H	H	H	M	M
Television	M	M	H	M	L	M
3-dimension Object	L	H	L	L	L	L
Audio Record	M	L	L	M	L	M
Programmed Instruction	M	M	M	H	L	M
Demonstration	L	M	L	H	M	M
Printed Text Book	M	L	M	M	L	M

Note:

L= Low, M= Middle, H= High

1= Factual Information of Learning

2= Visual Introduction of Learning

3= Concepts and Principles of Learning Rules

4= Procedur of Learning

5= Delivery

6= Developing Attitudes and Motivations opinion

The development of technology eases the learning process through various media. It can be directed at designing various sources and facilities used in learning something so that learning process more meaningful. This is based on triangle experience below.

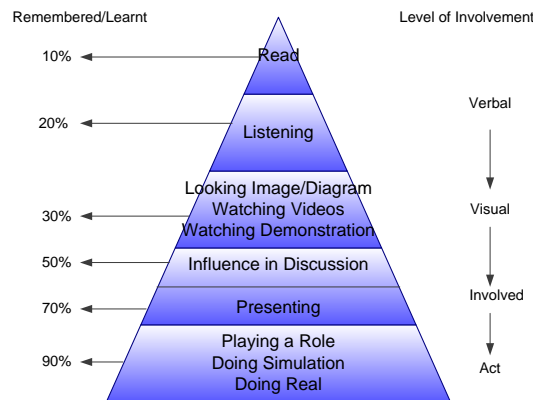


Figure 1. Triangle experience.

### 3 Augmented Reality

Augmented Reality (AR) is one of visual technology that combines two or three-dimension virtual object to a real 3D object environment and then project the virtual object in real-time. AR technology has been chosen because it has the following advantages: able to extend the user's perception of the object and provide a user experience on a 3D object displayed; allows user interaction that cannot be done in the real world; Possible to use a variety of tools (devices) according to needs and availability [1].

### 4 Interacting with Real and Virtual Objects

IRVO is modeling the interaction that aims to model the interaction between one or more users and is a mixed reality modeling. IRVO includes the phases of life cycle design and system models. The entity is a representation of an object that can be distinguished from other objects. There are three types of entities in IRVO: User (U), user entities within AR application; Object, entity that can be held or manipulated by user. Consists of a domain object (O) and tools (T). Domain object is an object that is manipulated by user while tools are object that used to manipulate domain object; Model Internal, application entity which is a computer application [2].

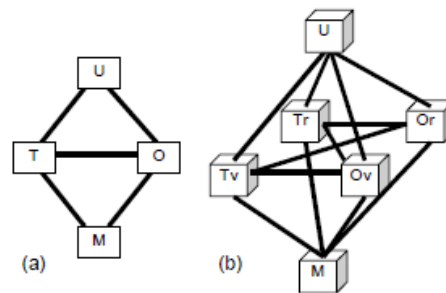


Figure 2. Entity and relationship in IRVO.

### 5 Design System

ICHAR is designed for self-learning of introduction of computer hardware components. By using AR technology, users can interact directly. They show the computer hardware components to the web-cam then a description of components captured by the web-cam appear on display and speaker.

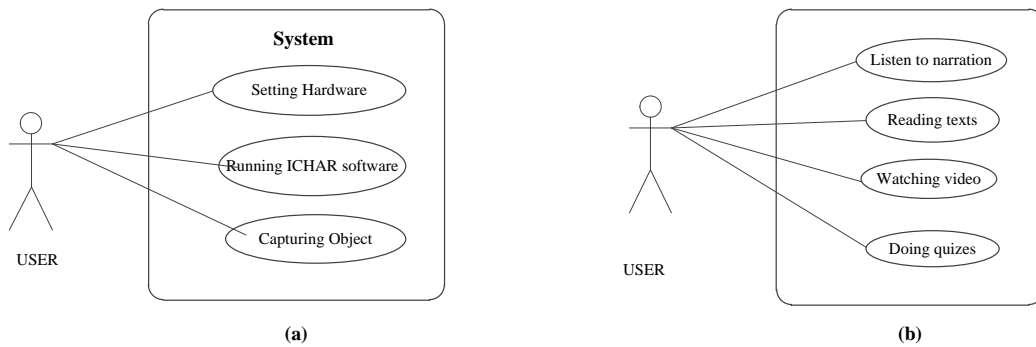


Figure 3. Global use case of ICHAR and Use case of ICHAR

### 6 Design of Interaction

Interaction of view point controls will be implemented on ICHAR’s menu with event generation of mouse usage. Designing interaction of ICHAR can be seen in figure 4 below.

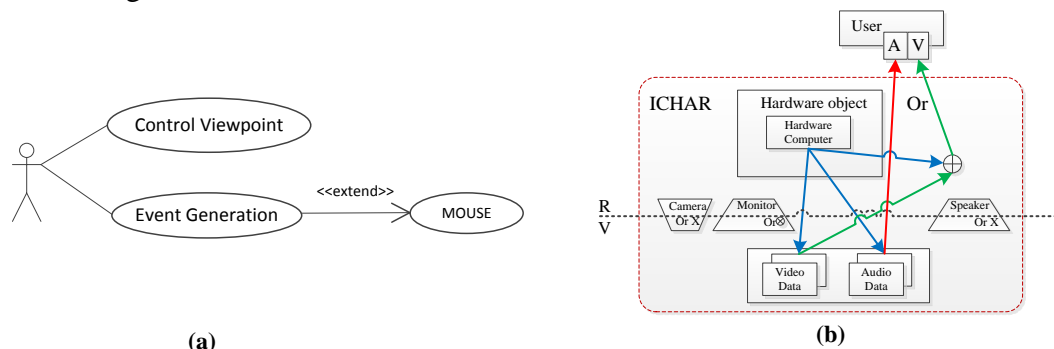


Figure 4. Use case and Model design of interaction ICHAR

According to IRVO, the entities of ICHAR are: Users (U), the entities in the application ICHAR users; Objects Real (Or), an entity that can be physically held/manipulated by users. Or a real object of a hardware component; Virtual Object (Ov), audio and text; Tool (T) is a device used to interact with virtual objects or to display the visualization objects, consisting of a marker, camera, speakers, and monitor.

### 7 Implementation and Testing

ICHAR implementation process involving the supporting object scenarios in the form of 3D and 2D visualization both animation and images are accompanied by a narrative voice and text, and the integration and interaction scenarios as follows: Lecturer explains how to run the application, ICHAR; Students use ICHAR and giving five responses for the application by filling out questioners; The response data were analyzed to determine the level of student response to the use of ICHAR applications.

Questions on the questionnaire given students focused on usability as shown in table 2, ease of understanding of the material, the completeness of the material presented and assist our staff. The completed questionnaire is then analyzed to determine the level of response from students as shown in figure 5.

Table 2. Question of questionnaires of application

No.	Question
1.	Do you like this application?
2.	Is this app makes you more understand of the material presented?
3.	In your opinion, if compared with the previous, does this application can be used as teaching aids?
4.	How the completeness of the material presented on this application?
5.	Is this application can allow you to be able to learn independently?

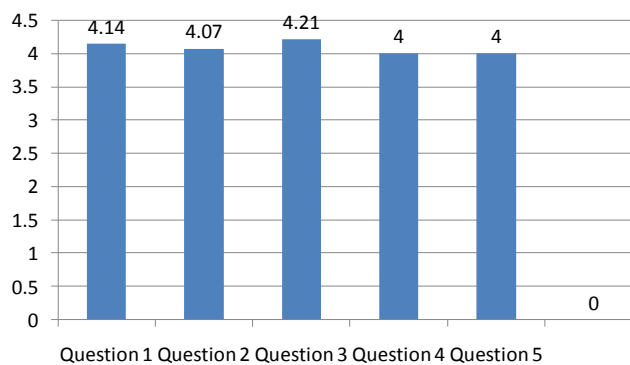


Figure 5. Chart of students responses of ICHAR

Based on implementation and testing to 56 students; 85% like this application, 80% are more understand by implementing this application, 78% said that the

application can be used as teaching aids, 85% said that the application is pretty complete and can be improved, 85% said that the application allow them to learn independently. Averages weight of each questions are above 4 as figure 5 shows us. It proves that ICHAR could facilitate their learning independently with different experience.

## References

- [1] R.T. Azuma., et. al., Recent advances in augmented reality. *IEEE Computer Graphics and Applications*, **6** (2001), 34-47.
- [2] R. Chalon, B.T. David, IRVO: an architectural model for collaborative interaction in mixed reality environments, CEUR Workshop Proceedings, (2004). CEUR-WS.org/Vol-91/paperD6.pdf
- [3] W.A. de Landgraaf, Interaction between users and augmented reality system: human-computer interaction of the future, an essay for HCI, Vrije Universiteit Amsterdam. (2003-2004)
- [4] G.I. Hapsari, Perancangan dan implementasi media pendidikan kesehatan gigi untuk anak-anak berbasis teknologi augmented reality, *Institut Teknologi Bandung*, (2012)
- [5] Bimber, O., Raskar ,R., Spatial Augmented Reality, *A K Peters*, Ltd, 2005
- [6] \_\_\_\_\_, *D'Fusion® 3.2 Technical Description*, Total Immersion, <http://community.t-immersion.com/>, accessed on July 14<sup>th</sup> 2012, 04:35 GMT+7.
- [7] \_\_\_\_\_, *D'Fusion® Augmented Reality Reference Manual*, Total Immersion, <http://community.t-immersion.com/>, accessed on July 14<sup>th</sup> 2014, 04:35 GMT+7.

**Received: May 1, 2014**