

IMPROVING EFFICIENCY OF OPERATIONAL EDUCATION BY USING VIRTUAL REALITY

Gazi Kocak

Istanbul Technical University, Turkey

Yalcin Durmusoglu

Istanbul Technical University, Turkey

ABSTRACT: Virtual reality is one of the novel technologies used mostly for entertainment purpose. It is really a good environment to enhance the feeling of user during playing the game and to obtain a realistic environment. Besides, this technology can be utilized as an educational tool. By this way, the students will learn the subject by using more senses in a funny method. The meaning of operational education is a kind of hands on education in which a series of procedures should be completed in a correct order and a limited time. However, the tools and hardware are needed for hands on education which means high cost. Virtual reality is one of the solutions to achieve operational education without using many hardware and tools by it is capability to simulate the realistic environment. Actually, it has been already started to use in education of military and medical students. In our case, we focus on the education of marine engineers which includes many operations of a very complex power system. Therefore, it will be possible to teach many kinds of mechanical operations with only virtual reality tools and eliminating a large amount of expensive hardware.

Keywords: virtual reality, marine engineer, operational education, innovation, technology

INTRODUCTION

The virtual reality (VR) is providing an environment to the user in which the activation of more senses is possible. The VR studies are actually not very new. In the literature, the study “Sensorama Simulator” was carried out in 1962 by Morton Heilig. In this study, a machine was designed aiming to make feel a theatrical drama with all senses of a human which is shown in Fig.1. The machine consists of wide angle stereoscopic view, a vibration mechanism, stereo audio system, and aromatic odor release system.



Figure 1. The “Sensorama” Simulator

In 1963, Ivan Sutherland studied SKETCHPAD in his doctoral theses which integrated stereo head mounted display (HMD), position tracking, and graphics engine. Then, Sutherland made another study in 1968 which is closer to the modern technology. In this study, he designed a head mounted 3D display which is called “The Sword of Damocles” because it was very heavy and hanged on the ceiling. The term “virtual reality” was firstly used by Jaron Lanier in an interview in 1989. In the following years, there was an improvement in entertainment and game sector. Therefore, the VR studies are also improved. For example, Nintendo Company produced “Virtual Boy” in 1995 which is the first mobile game console with 3D display supplying device.

In the last decade, VR has started to be more popular especially in the entertainment sector due to its user friendliness, flexible interface, simplicity in design, and realistic features. Especially VR glasses have serious advancement in 3D games in which the player sense the environment much more realistically with immersed features. Using immersed environment play a serious role for influencing the senses. Essentially the visual sense is used which has a great influence on other senses. It can be understood by playing a 3D game that despite you are stable you feel as you are really moving only with visual effects. This can be seen in Figure 2.



Figure 2. The Effect of Visual Sense

It is very well-known that activation of more senses makes the education much better and long lasting. In this respect, VR is getting more interesting for education purpose, as well. The education can be more interesting, funny, interactive, realistic, and clear by using VR environment. The learning period can be shorter by this way. Besides, the new generation is immersed in technology. They met with cell phones and tablets when they were only a baby. As a result, they are almost addicted to games. The fondness of them to game technologies can be seen in Figure 3. These are images from a game fair in Istanbul (GAMIST 2017 Exhibition).



Figure 3. Interest of Young Generation to Game Technologies in GAMIST 2017 Exhibition

Therefore, we have to make the education environment suitable for them. The game like lessons will be more effective for them. In brief, developing the educational materials with VR and its adaptation to the educational life is very flexible, easy and effective way. Actually, it has started to be used in some sectors such as military, medicine, etc. but it is still not sufficiently popular.

In this study, the effect of VR on operational education is focused on and its usage for education of marine engineers is discussed. The courses which are related to operation of machines are shown in the syllabus of marine

engineering education and the necessity of improving the education environment with VR is stated. By this way, a wide variety of ship and machinery environments can be developed with very few hardware which is a great opportunity for the students to meet very different ship types.

OPERATIONAL EDUCATION

Most of the occupations need some applications besides the theoretical background. That is why the education programs consist of theoretical courses and application courses such as laboratories. However, the laboratory studies are not sufficient to express all kinds of applications. For example, the training of operations in a terrain or a medical operation cannot be categorized as a laboratory study. At this point, we categorize some of the application trainings as operation. The meaning of operation here is mainly covering the applications which consists of some sequential steps and carried out in a special area or terrain. For example, the training of a soldier in a terrain can be categorized as operational education.

VR has been used for such kind of training purposes mainly in medical training and military training sectors. In Figure 4 some of the sample trainings for medical and military sectors are shown.



Figure 4. Sample Trainings for Medical and Military Sectors

Operational Education of Marine Engineers

Marine engineering is one of the operation dense occupations. In this context, the meaning of operation is taking the necessary tasks and steps in a sequence to run a system and maintaining it running without problems. The main job of the marine engineer is to run and maintain an existing marine power system. There is an educational standard of marine engineering which is determined by International Maritime Organization (IMO). This standard is called Standards of Training, Certification and Watchkeeping (STCW) and it is mandatory to keep the mariners occupational knowledge at a certain level who work around international waters. In this standard, the minimum level of the necessary course content is determined and every maritime training institution should meet these standards to be able to get international certificate. In these standards there is an operational level and management

level categorization. When we have a close look at the STCW, we come across many definitions and necessities about the operations on marine systems. Besides one of the obligatory item is having an engine room simulator (ERS) which is for training of students to have overview knowledge about the systems on board the ship and to be able to operate them truly. Even more the necessary actions to be taken in case of troubles are considered. To be able to reflect the meaning and importance of “operation” in maritime education we listed the courses related to operation of marine systems in ITU Marine Engineering Department in Table 1. As it can be seen in the table, there are numerous courses directly related to operation of different marine systems.

Table 1. The Courses Related to Operation of Marine Systems

#	Course name
1	Operation and Maintenance of Marine Engines
2	Marine Boilers and Operation
3	Operation of Steam and Gas Turbines
4	Marine Diesel Engines I
5	Marine Diesel Engines II
6	Engine Room Simulator (ERS) I
7	Engine Room Simulator (ERS) II
8	Terminal and Tanker Operations
9	Marine Auxiliary Machinery I
10	Marine Auxiliary Machinery II

One of the important courses is engine room simulator in which the student can see the whole systems in a schematic form. There are two modules of ERS: one of them is PC Workstation and the other is mimic panel which can be seen in Figure 5. In workstation and especially mimic panel, the student can see the whole system but it is only a schematic drawing. In mimic panel the student can see the whole systems at once and operate the system through the buttons on the panel. The situation of the equipment can be seen through the lamps (For example green light for running or open). For example, to open a valve or to run a pump they push the related button. However, the student doesn't know about the real shape of that system or equipment. For instance, while preparing the main engine to operation, the indicator valves should be closed. In mimic panel, the student can see these valves but in a real ship they will most probably not be able to recognize and find these valves. Besides, in real ship they will not be able to see the whole system and their situation through the pilot lamps. Even more, the present simulators which are based on hardware have limitations of ship type. This kind of simulators can be only one type of a ship. You should prefer a ship type such as crude oil tanker, container ship etc. and you are dependent on that type.



(a)



(b)

Figure 5. Engine room simulator (a) Mimic panel, (b) Work Station

In case of virtual environment, you can generate any kind of ship type and any kind of machinery type freely. There will not be a hardware dependency. Besides, the maintenance options will be much better and cheaper. In a hardware dense simulator, the parts will be broken and will have some troubles by time resulting in very high expenses which will be eliminated by virtual reality environment. Some kinds of 3D virtual environments can be seen in Figure 6. As it can be seen, the whole environment is virtual and there is no hardware such as relays, lamps, buttons etc. You can freely simulate any kind of environment and walkthrough and take actions through that environment. Therefore, the students will be able to see many different kinds of machinery. It will be possible to simulate latest types of machinery and the students will learn the newest technology.

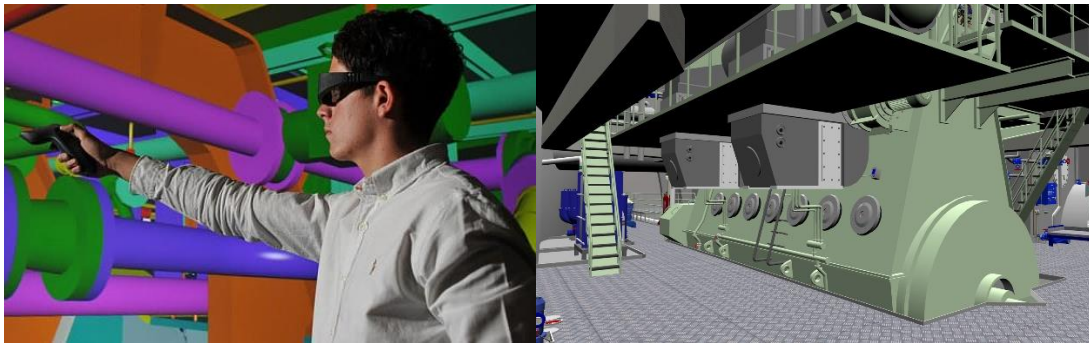


Figure 6. Virtual machinery environment and 3D Simulated Engine Room (Courtesy of BAE Systems and Unitest Marine Simulators)

CONCLUSION

Improvement of technology gives us many usable tools which makes our life more easy and efficient. The new generation grows up with computers, tablets, and games. They spend a serious time with playing computer games. These days we have an opportunity to educate them in a way they will like. Therefore, we should find some methods to make education more game like which will be more interesting for contemporary students. We have necessary tools to do that. Besides, it will be very effective to show the students as various types of equipment as possible especially in engineering sector. As we mentioned above we can also introduce some feeling and sensing to learning process which will be much more effective and long lasting. We can and should achieve this by utilizing virtual reality environments.

REFERENCES

- Heiling, M. (1962). Sensorama simulator. <http://www.mortonheilig.com>
- Sutherland, I.E. (1963). "Sketchpad: A man-machine graphical communication system", *PhD Thesis, University of Cambridge*.
- Sutherland, I.E. (1968). "A head-mounted three dimensional display". *Proceedings of AFIPS 68*, pp. 757-764.
- Jaron Lanier, an interview (1989, Fall). "Whole Earth Review," 64,108-119. https://en.wikipedia.org/wiki/Virtual_Boy.