An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic

Jesica Uli Panggabean[1], Bela Firmantoyo[2], Darmeli Nasution[3]

[1,2,3]Polytechnic Aviation Medan, Penerbangan Street, no 85 Jamin Ginting, Medan, North Sumatera, Indonesia

Article Info	ABSTRACT
Keywords: DVOR, virtual reality, navigation equipment, Oculus headset.	Information and communication technology has experienced rapid development, which can be utilized in the field of education. This final project aims to design the virtualization of the Doppler VHF Omni-Directional Range (DVOR) operating procedure based on Virtual Reality (VR) as a learning medium for students of the Air Navigation Engineering Program at Medan Aviation Polytechnic. This virtualization is expected to provide a learning experience that closely approximates reality, facilitating the understanding of the DVOR concept and function, which is often difficult to explain verbally. This research employs software design and development methods, where the VR DVOR is designed using Unity 3D and the Oculus Quest VR Headset. The research results indicate that using VR as a learning medium positively affects students' understanding of the DVOR operating mechanism. Moreover, VR provides students the opportunity to perform interactive and realistic simulations of DVOR operations, which are challenging to conduct with physical equipment directly. The benefits of this research include creating innovation in practical learning methods, enhancing students' understanding of air navigation equipment, and developing better technical skills. It is hoped that the results of this final project can serve as a reference for developing other VR-based learning media in the field of air navigation.
	Corresponding Author: Jesica Uli Panggabean Polytechnic Aviation Medan, Penerbangan Street, no 85 Jamin Ginting, Medan, North Sumatera, Indonesia jesicapanggabean0801@gmail.com

INTRODUCTION

In the era of increasingly developing modern aviation, technology continues to experience increasingly rapid development. The Telecommunications and Air Navigation Engineering Study Program (TNU) tries to keep up with the increasingly modern aviation era by developing new learning methods to support the practice of communication, navigation, surveillance and automation equipment. One of them is for the practice of navigation equipment, namely the Doppler VHF Omni-Directional Range (DVOR).

Learning media functions as an important non-verbal communication tool in the education system. Currently, learning media that combines print and computer technology can be realized through Augmented Reality (AR) and Virtual Reality (VR) technology

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1302 | P a g e

(Alfitriani et al., 2021). VR technology allows the integration of digital elements that are displayed as if they were real and follow the conditions of the real-world environment, and can be used on mobile devices. Virtual reality is very useful for simulating situations that are difficult to present directly in the real world. The main advantage of VR is its ability to provide an experience that makes users feel the sensation of the real world in a virtual environment.

Along with technological advances, especially in the field of virtual reality, opportunities have emerged to integrate VR technology with existing air navigation systems. Virtual reality offers the ability to create highly realistic and interactive simulation environments, which can be used by anyone, especially aviation students. The design of virtual reality-based DVOR virtualization as a supporting media for introductory practice is expected to be used as a supporting introduction to operational practicum activities in the laboratory. By utilizing VR, students can experience experiences that are close to the real situation in air navigation operations. This allows for a better development of the understanding that is possessed, thus supporting the national education goal of creating individuals who are faithful, have noble character, and are knowledgeable.

Literature Review

Doppler VHF Omnidirectional Range (DVOR).

Doppler VHF Omnidirectional Range (DVOR) is one of the short-range navigation aids that uses very high radio frequency (VHF/Very High Frequency) (Mulia, 2022). This equipment functions to help aircraft fly to their destination by utilizing DVOR stations located on land, without depending on weather conditions. DVOR technology uses the Doppler effect in its signal modulation process, allowing for more accurate navigation. DVOR works by sending radio signals received by the aircraft. This signal is then analyzed to determine the position of the aircraft relative to the DVOR station. Thus, the pilot can know the direction and distance of the aircraft from the station, so that he can determine the right flight path to the destination. The working frequency area of DVOR is 108 to 118 Mhz (Nugraha et al., 2019).

Figure 1. DVOR

Virtual Reality

Virtual Reality (VR) is an experience that can be felt wherever the user is. VR is a technology for interacting virtually with a simulated environment using a computer (Nurrizqa et al., 2021). Technically, VR technology can be used to illustrate three-dimensional conditions created by a computer (Riyadi et al., 2017).

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1303 | P a g e

One example of the use of this technology in the world of education is the creation of DVOR in virtual form as a learning medium. The virtual reality form of DVOR is a digital representation of the DVOR (Doppler VHF Omni-Directional Range) air navigation system in a virtual environment that allows users to feel and interact with DVOR equipment realistically, even though they are not physically in the actual location.

Oculus Quest VR Headset

Oculus was founded in 2012 as a subsidiary of the Facebook group. Oculus is a wearable device developed by the Oculus VR company. This device is capable of displaying virtual reality images with two screens for each eye. Oculus was part of the VR development that occurred in 2014. Developed for about four years, the company experienced quite a lot of obstacles until it was finally ready to market this device in March 2016.

Figure 2. *Virtual Reality Oculus Quest*

Sketchub

SketchUp is a software that has the advantage of displaying 3D models on 2D layers. Using three-dimensional technology, it allows users to see 2D views of 3D projections. Creating models in SketchUp is great for fast modeling because everything you need is in SketchUp. SketchUp is generally used for professionals in the fields of civil engineering, architecture, game creation, and related designs (Harmanto, 2017). According to Djoko Darmawan (2009:2), the advantages of SketchUp software include the ability to produce quality images for presentations, ease of operation, and high flexibility in receiving and sending data to other applications. (Djoko, 2009).

METHOD

This research is included in the category of development research or Research and Development (R&D) is a research method that aims to produce certain products. According to Syaodih Sukmadinata, R&D research is a process or steps to develop a new product or improve an existing product. (Syaodih, 2016). Research in the form of a VR navigation tool DVOR was carried out using the ADDIE development method. According to Sugiyono (2009) the ADDIE instructional design model, namely Analysis, Design, Develop, Implement, Evaluate developed by Dick and Carey (1996) is a design model that can be used generically in developing applications or training programs.
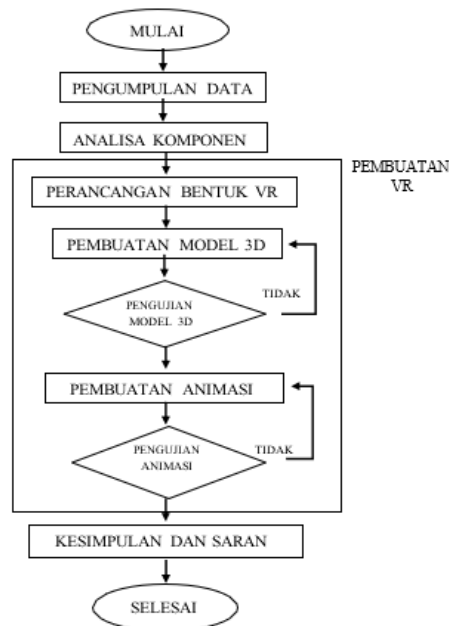
An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1304 | P a g e

Figure 3. Design System.

The following is a tool design that includes Software design and Unified Modeling Language (UML) Design

1. Software Design
2. Unified Modeling Language (UML) Design

a) Use-Case Diagram This design describes the interaction between the user (student) and the system being developed. This diagram helps in visualizing the main functions offered in the application.
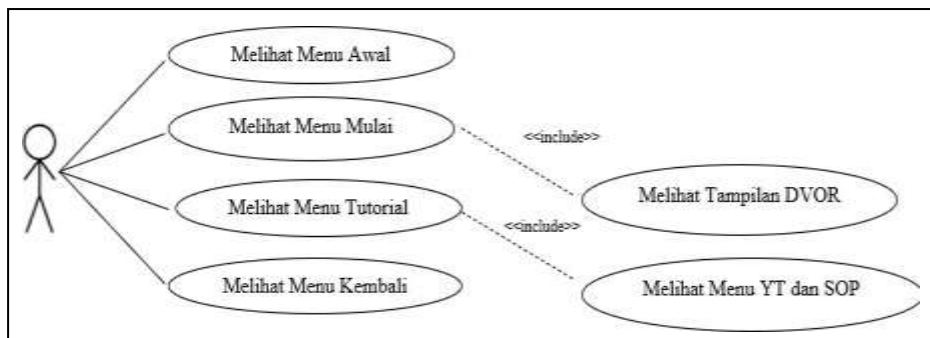

Figure 4. Use Case Diagram

b) Activity Diagram Design This design is used to describe the workflow or activities in a system (Haq, 2024). This design helps in visualizing the steps to complete a task, as well as how the control flow moves from one activity to another.

Based on the design of the tool above, this system works by creating assets in the form of shelves from DVOR which are made using an application, namely SketchUp, then after the assets are formed, the shape is changed into 3D so that we can see the virtual shape of the DVOR equipment. In order to be visible, we will use the help of the oculus tool. In this virtual oculus DVOR will be in the form of .apk which can later be operated using oculus.

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1305 | P a g e

RESULT

Analysis of the Current System

Currently, DVOR learning at the Medan Aviation Polytechnic is still done manually. The delivery still uses media such as whiteboards along with pictures in books or manuals or directly to the DVOR/DME laboratory on the Medan Aviation Polytechnic campus. Of course, this can cause boredom which can cause users or students to feel less interesting and interactive. While we know that DVOR material is quite difficult to find in everyday life.
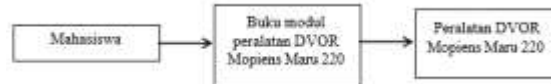

Figure 5. Current Condition.

The expected system after the application design can operate is that students can learn on the DVOR navigation aid virtually with the help of Oculus.
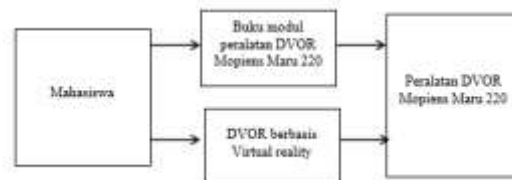

Figure 6. Applying Condition.

Application Development.

In the development or application creation stage, it begins with finding assets and creating any assets needed such as 3D objects in the form of DVOR Mopiens Maru 220, projector screen, tablet stand, video player and room. After the assets are available, the next step is to create an application design in unity.

1. Main Menu
   The main menu contains programming if the main menu button is executed, the application will run the program to the home page/main page
2. Training Button
   The training button contains commands to run DVOR operations virtually
3. Tutorial Button
   The tutorial button is a feature used to display features that have been provided such as to display SOPs and YouTube displays as learning media
4. Exit Button
   The exit button contains programming to exit the application or stay in the application.

Tool Testing Results.

In the tool design, testing was carried out on the application design.

No	Features	Steps	Function	Output
1.	Procedure 1	The user turns it on at the butt section.on	Brings up the equipment startup procedure	In accordance
2.	Procedure 2	User clicks on the icon on the CSP	Brings up equipment change over procedure	In accordance
3.	Procedure3	User clicks on tutorial menu icon	Bring up the tutorial procedure by playing learning videos and SOPs on	In accordance

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1306 | P a g e

No	Features	Steps	Function	Output
			the tool.	
4.	Procedure 4	User of the "i" icon	Displays function information on each DVOR module	In accordance
5.	Procedure 5	The user turns off the section	Brings up the equipment startup procedure	In accordance

CONCLUSION

Based on the results achieved in the study entitled "Design of Doppler VHF Omni-Directional Range (DVOR) Operation Based on Virtual Reality as Learning Media at Medan Aviation Polytechnic" several conclusions were obtained, namely: The design of DVOR Mopiens Maru 220 virtualization can be made into Unity 3D software. This application can provide convenience in conducting learning and providing DVOR operating procedure material in an interesting way in visualizing how to turn DVOR on and off and changing over between TX1 and TX2

REFERENCES

Alfitriani, N., Maula, W. A., & Hadiapurwa, A. (2021). Penggunaan Media Augmented Reality dalam Pembelajaran Mengenal Bentuk Rupa Bumi. Jurnal Penelitian Pendidikan 38(1), 30–38. https://doi.org/10.15294/jpp.v38i1.30698

Djoko, D. (2009). Google Sketchup Mudah dan Cepat Menggambar 3dimensi. Yogyakarta: ANDI.

Harmanto. (2017). PENGEMBANGAN MEDIA ANIMASI PEMBELAJARAN DETAIL KONSTRUKSI BANGUNAN GEDUNG 2 LANTAI MENURUT STANDAR PERENCANAAN STRUKTUR DENGAN 3D GOOGLE

SKETCHUP. Jurnal Pendidikan Teknik Sipil dan Perencanaan Tahun 2017, 1-9.

Haq, A. (2024). RANCANG BANGUN WEBSITE MEDIA INFORMASI DIGITAL MENGGUNAKAN METODE WATERFALL (STUDI KASUS : FOR PEOPLE MEDIA). 12(3), 2873–2881.

Hidayatullah, A. F., Stefanie, A., & Hidayat, R. (2022). Analisis Peran dan Fungsi Dvor (Doppler Very High Frequency Omni-Directional Range) Sebagai Alat Bantu Navigasi yang Memberikan Informasi Azimuth ke Pesawat. JE-Unisla, 7(1), 5. https://doi.org/10.30736/je-unisla.v7i1.754

Hudhzuh. (2015, Juli). Perbedaan Oculus Rift, Leaf Motion, Intel Real Sense Teknologi dan Vuforia Smart Terrain. Diambil juli, 01 2024, dari https://hudhzuh.wordpress.com/2015/07/27/perbedaan-oculus-rift-leaf- motion-intel-real-sense-teknologi-dan-vuforia-smart-terrain/

Jabbar, A. A. (2020). Perancangan Aplikasi Virtual Reality Menggunakan Multimedia Development Life Cycle Untuk Menunjang Proses Pembelajaran Explore Engine Di Laboratorium Sistem Manufaktur Uii. Yogyakarta.

Matondang, F., Astuti Hasibuan, N., Saputra, I., Teknik Informatika STMIK Budi Darma, M., Tetap STMIK Budi Darma, D., Sisingamangaraja No, J., & Limun Medan, S. (2016).

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1307 | P a g e

Perancangan Aplikasi Text Editor Dengan Menerapkan Algoritma Knuth-Morris-Pratt. JURIKOM (Jurnal Riset Komputer), 3(4), 16–21. https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom/article/view/332

Mulia, Y. K. W. (2022). Pengaruh Pathloss dan Redaman Power Link Budget terhadap Efek Doppler pada Antena DVOR. Jurnal Pendidikan Sains Dan Komputer, 2(02), 261–267. https://doi.org/10.47709/jpsk.v2i02.1557

Nugraha, Y. T., Evalina, N., Zambak, M. F., Rezkika, S. I., & Novalianda, S. (2019). Analisis Sistem Navigasi Udara Model 432 (DVOR) untuk memandu pesawat menuju bandara. Seminar Nasional Teknik, 1(1), 120–126.

Nurbadi, M. S. (2018). Aplikasi Berbasis Virtual Reality Untuk Mendukung Proses Pembelajaran Organ Pencernaan Manusia. Yogyakarta.

Nurrizqa, Syahrial, Rizal Munadi, & Yunidar. (2021). Penerapan Metode Perancangan Virtual Reality. Jurnal Nasional Informatika Dan Teknologi, 5(2).

Riyadi, F. S., Sumarudin, A., & Bunga, M. S. (2017). Aplikasi 3D Virtual Reality Sebagai Media Pengenalan Kampus Politeknik Negeri Indramayu Berbasis Mobile. JIKO (Jurnal Informatika Dan Komputer), 2(2), 75. https://doi.org/10.26798/jiko.2017.v2i2.76

Sarkiah. (2017). Aplikasi Virtual Reality Media Ajar Bangun Ruang (Trigonometri) Berbasis Android (Studi Kasus : Smp Pgri Bajeng Barat). Makassar.

Sugiyono. (2009). Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta.

Syaodih, N. S. (2016). . Metode Penelitian Pendidikan. Bandung: PT Remaja Rosdakarya.

.

An Operational Design Of Doppler Vhf Omni Directional Range (DVOR) Based On Virtual Reality As A Learning Media At Medan Aviation Polytechnic—Jesica Uli Panggabean et.al

1308 | P a g e