MODELLING OF ELECTRICAL GSS USING AR-VR TECHNOLOGY

Dr. Megha Vyas, Harshit Vairagi, Rajat Sharma, Bhavesh Sonarthi, Siddharth Mehta, Mahipal Singh Rao
E-Mail Id: megha.vyas14@gmail.com, rajat.2001sharma@gmail.com, siddharthm679@gmail.com
Department of Electrical Engineering, Geetanjali Institute of Technical Studies, Udaipur, Rajasthan, India

Abstract—This project aims to develop a 3D model of a GRID Sub Station using Augmented Reality (AR) and Virtual Reality (VR). The 3D model will allow users to explore and interact with the GRID Sub Station in a virtual environment. The project will use Unity 3D software and the AR/VR SDK to create the 3D model. The model will include features such as electrical components, wiring, and other elements of a GRID Sub Station. This will enable users to interact with the 3D model in an immersive environment, allowing them to explore the Grid Sub Station in detail. The project will also develop a web-based interface to allow users to access the 3D model from any browser. This project will provide a cost-effective and user-friendly way to explore GRID Sub Stations and their components.
Keywords: GSS, AR/VR, 3D Model.

1. INTRODUCTION

3D modelling of grid substations using AR/VR tools is a process wherein a physical structure is recreated in a digital environment with the use of Augmented Reality (AR) and Virtual Reality (VR) technologies. It is a cost-effective, efficient and accurate way of creating an exact replica of any substation. This technique is gaining popularity in the energy sector due to its ability to help engineers and technicians in the management, inspection and maintenance of substations. The 3D modelling process of grid substations using AR/VR tools starts by capturing the existing physical premises of the substation in detail. This process utilizes advanced camera systems such as photogrammetry and laser scanning to capture data points from the substation. This data is then used to generate a 3D model of the substation with the help of software such as Autodesk ReCap, Leica Cyclone, NavVis and more. Once the 3D model of the substation is created, the next step is to use AR and VR technologies to enhance the realism of the model. This includes adding details such as texture, colour and materials to the model. Furthermore, with the help of AR/VR tools, users can also create virtual walkthroughs of the substation, allowing them to explore the substation from any angle. This helps in understanding the layout and structure of the substation better, as well as identifying potential issues. In addition to this, 3D modelling of grid substations using AR/VR tools can also be used to simulate various scenarios. This can be done by making changes to the model and observing the results in real-time. For example, engineers can test the impact of adding new equipment to the substation or making changes to the wiring. This helps them in making informed decisions before actually making any changes to the physical premises. Overall, 3D modelling of grid substations using AR/VR tools is an effective and efficient way of creating an exact replica of any substation. This technique can be used to enhance the realism of the model, create virtual walkthroughs, and simulate various scenarios. This makes the process of managing, inspecting and maintaining substations simpler and more efficient.
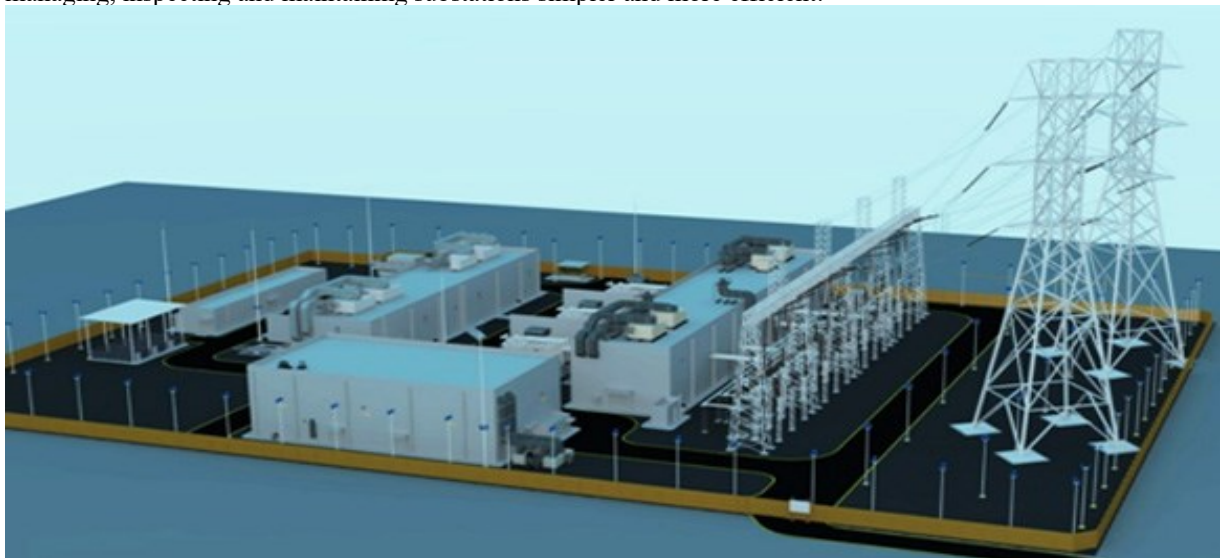

Fig. 1.1 220 KV Sub Station

2. TOOLS FOR CREATING AND HOSTING VIRTUAL TOURS

Blender and Unity Engine are two tools that can be used to create and host virtual tours of electrical substations. Blender is a free, open-source 3D graphics software that can be used to create 3D models of substations. This

allows technicians to create detailed and accurate virtual tours of a given substation. Additionally, Blender can be used to create interactive environments, such as simulations of different emergency scenarios. Unity Engine is a game engine that can be used to host and run the virtual tours. This allows technicians to access the virtual tours from any device with an internet connection.

2.1 Blender

Blender is an open-source 3D computer graphics software suite suitable for creating detailed 3D models of virtual environments. With the software's powerful 3D modelling and animation capabilities, users can quickly create realistic representations of a grid substation. The software's intuitive UI and extensive library of assets also allow users to quickly and easily create custom, lifelike animations, resulting in an interactive, immersive experience.

Using Blender, users can create a 3D-modeled environment of a grid substation that is indistinguishable from the real thing. The software also allows users to simulate events, such as switching current through circuit breakers, allowing viewers to explore real-world scenarios and gain a better understanding of the electricity grid.

2.2 Unity

Unity is an engine for developing, creating, and hosting virtual reality (VR) and augmented reality (AR) applications. The engine was designed to make it easier for developers to create interactive, immersive content, and it is well-suited for creating virtual tours of grid substations. With the Unity engine, developers can quickly and easily create an interactive, lifelike representation of a grid substation, complete with detailed 3D models and animations of circuit breakers, transformers, and other components.

Using the Unity engine, users can create an interactive, realistic exploration of a grid substation. By simulating real-world scenarios, users can gain a better understanding of the infrastructure, as well as its components and the underlying physics of the electricity grid. With its intuitive UI, Unity also makes it easy for developers to create custom content for public engagement events, technical seminars, and educational programs.

2.3 Other 3D Modelling Tools

In addition to Blender and Unity, there are many other 3D modelling tools available for creating detailed, lifelike components of a grid substation. Popular tools such as Autodesk Maya and Cinema 4D are commonly used to create detailed 3D models and animations of the various components of a grid substation, such as circuit breakers and transformers.

Using these 3D modelling tools, users can create realistic, lifelike representations of a grid substation, complete with accurate lighting and detailed textures. The tools also provide intuitive UI's and a wide range of features, such as simulation and animation, which can be used to create interactive, immersive experiences.

2.4 Hosting the Virtual Tour

Once the virtual tour of the grid substation is created, it can be easily hosted and shared online. Popular online platforms such as YouTube and Vimeo allow users to easily upload and share their interactive, immersive experiences with the world. Additionally, the virtual tour can be hosted on a website for easy public access.

Fig. 2.1 Representation of Objects During Simulation

3. PROBLEM FORMULATION/OBJECTIVES

➢ The objective of this project is to create a 3D virtual model of a grid substation using Augmented Reality (AR) and Virtual Reality (VR) technologies.

> ➢ The 3D model will provide an immersive way of visualizing the substation, allowing users to explore the different components, understand how the grid works, and gain a better understanding of the sub station's overall functionality and design.

Additionally, the 3D model could be used for educational and training purposes, providing a more engaging way to teach about grid sub stations.

4. RESEARCH METHOD

AR and VR technologies are extensively used in recent years for research purposes or experimentally in the construction project management. Different researchers get success in different sections of construction management such as quality management, safety management, planning and scheduling, defect identification, cost and time management and worker training. Hence, using opportunities and benefits of AR and VR in the construction management is spread out across the literature. To know and learn all the effective use of opportunities in various departments of construction management is very difficult without any summarized structured of information. In identifying the key research relating to the AR and VR technologies in the construction management, this paper provides a review in terms of various aspects. As it is a literature review, for conducting this study, comprehensive literature review was conducted through-out the distinguish sources, such as journal papers, conference papers, newspapers, websites, blogs, books and electronic media, which related to AR and VR in the construction sector. Relevant publications were identified by searching the Web of Science, Google Scholar, Research-Gate, Scopus and ASCE Library databases with the follow-ing keywords:
(1) Research topic: "construction safety management", "quality and defect management", "time management", "cost management", "planning and scheduling of project", "worker training", "visualization and inspection", "project progress tracking", "progress assessment", "construction communication" and "information collection/sharing/exchange", "advanced construction management', "AR in construction" and "VR in construction".
(2) Construction management: "construction", "construction management", "BIM", "CAD", "VR", "AR", "safety", "quality", "training", "progress", "QA/QC" and "technology'.
(3) Research direction and field: 'science and technology", "engineering management", "construction management", "civil engineering and construction", "automation in construction", "building technology", "computer aided design in construction" and "quality, risk and safety". The search words helped to identify 84 relevant papers in distributed sources. These are summarized in Figure 1 in terms of the number of annual publications from 1997 to 2018.

CONCLUSION

It is evident from this project that 3D modelling of grid sub stations is a very useful and efficient technological tool for the power industry in general. Using 3D modelling of grid sub stations, it is possible to analyze and assess the overall performance, safety measures, and other relevant aspects of the grid sub stations. This has been made possible by the combination of GIS and remote sensing technologies with 3D modelling, which has proven to be very effective in creating an accurate and up to date model of the grid sub station. Such an approach has enabled the power industry to gain a better understanding of their grid sub stations, and thereby, improve their overall operations.
Furthermore, by using 3D modelling of grid sub stations, the power industry is able to gain a better understanding of their power networks and to identify potential issues and hazards. The 3D model can also be used to accurately assess the power capacity of the power network and to identify potential congestion points. Additionally, the 3D model can help identify risks and opportunities for the power industry, and it can serve as a powerful tool to improve the overall safety of their operations.

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