Immersia: A Virtual Reality Based Exploration System

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ABSTRACT

Virtual Reality (VR) has emerged as a transformative technology that enables users to experience and interact with computer-generated environments in an immersive and realistic manner. With the rapid advancement of mobile computing and powerful game development platforms such as Unity 3D, VR applications have become more accessible, portable, and cost-effective, especially in the domains of education, training, and virtual visualization. This project presents the design and development of an immersive virtual reality- based tour system aimed at providing a realistic and interactive representation of indoor environments.In conclusion, this project highlights the potential of mobile-based virtual reality systems in transforming the way users interact with digital representations of physical spaces. It provides a cost-effective and user- friendly platform that can be further extended with advanced features such as multi-user interaction, intelligent guidance systems, and integration with emerging immersive technologies.

CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

Virtual Reality (VR) technology has significantly transformed the way users interact with digital environments by providing immersive and interactive experiences. Unlike traditional visual media such as images or videos, VR enables users to explore simulated spaces in a more realistic and engaging manner. With the advancement of mobile devices and affordable VR headsets, virtual reality applications have become more accessible and practical for educational, architectural, and institutional visualization.

In the context of educational institutions, virtual tours have emerged as an effective tool for showcasing campus infrastructure and facilities to students, visitors, and prospective applicants. Traditional campus visits often require physical presence, which may not always be convenient for everyone. A virtual tour system allows users to explore important locations and understand the layout of facilities remotely, providing a convenient and informative alternative.

The IMMERSIA – 3D Mobile Virtual Tour System is designed to create a virtual representation of the Computer Science and Engineering (CSE) department facilities. The system recreates important areas such as classrooms, laboratories, staff rooms, and the Head of Department (HOD) office within a 3D interactive environment. Developed using the Unity 3D engine, the application allows users to navigate through the department using an Android smartphone combined with a simple VR headset.

Through first-person navigation and interactive elements such as clickable objects and information panels, the system provides users with a realistic experience of exploring the department facilities. By integrating mobile VR technology, the project offers a cost-effective and scalable solution for campus visualization and digital engagement.

1.2 OBJECTIVES

The primary objectives of the IMMERSIA – 3D Mobile Virtual Tour System are:

1. To develop an immersive 3D virtual tour of the CSE department facilities using Unity 3D and mobile VR technology.
2. To recreate important locations such as classrooms, laboratories, staff rooms, and the HOD office within a realistic virtual environment.
3. To enable first-person navigation within the virtual space using input devices such as a joystick or keyboard.
4. To integrate interactive elements such as clickable objects and information panels to provide additional details about department facilities.
5. To provide a cost-effective and accessible platform for campus visualization using Android smartphones and simple VR headsets.
6. To demonstrate the potential of mobile VR technology as an innovative tool for virtual campus tours, remote exploration, and institutional presentations.

CHAPTER 2 LITERATURE SURVEY

This chapter is dedicated to the comprehensive review of existing works and foundational technologies that are directly relevant to the development and implementation of the Mobile VR Virtual Tour. The survey focuses on the successful application of these tools in previous projects and the proven methodologies for achieving a high-quality, accessible mobile VR experience.

[1] R. K. McMahan, "Exploring the Role of Presence in Virtual Environments," Journal of Architectural Computing, vol. 25, no. 3, pp. 45– 52, 2021.

McMahan (2021) highlights the fundamental importance of presence—the subjective feeling of "being there"—in shaping user experiences within virtual environments. The study demonstrates that higher levels of presence directly enhance spatial understanding, emotional engagement, and task performance. For the Mobile VR Home Tour, this insight emphasizes the need to prioritize design elements that strengthen the illusion of reality, such as realistic lighting, accurate scale representation, and responsive interaction. By replicating the sense of walking through an actual home, the project can foster deeper engagement and more meaningful architectural exploration for users.

[2] S. A. Diniz, "Mobile Virtual Reality for Architecture: Democratizing Immersion," Procedia Computer Science, vol. 196, pp. 240–248, 2022.

Diniz (2022) introduces the notion of "democratizing immersion"—the idea that mobile VR technologies can make immersive architectural experiences accessible beyond professional environments. By leveraging affordable, portable devices, such as smartphones paired with low-cost headsets, architectural visualization becomes available to a broader audience. This principle is central to the Mobile VR Home Tour project, which aims to create a user-friendly and cost- effective solution for home exploration. The study reinforces the project's mission to balance immersion with accessibility, thereby enabling potential homeowners to experience virtual walkthroughs anytime and anywhere.

[3] T. Jones and K. Lee, "Smartphone-Based VR Systems: Design and Performance," IEEE Access, vol. 9, pp. 77645–77658, 2021.

Jones and Lee (2021) focus on the technical challenges inherent to smartphone-based VR systems, including limitations in processing power, display resolution, and motion tracking. Their research outlines strategies to optimize performance while maintaining user comfort— such as minimizing latency, stabilizing frame rates, and managing thermal load. For the Mobile VR Home Tour, these findings provide essential technical guidance to ensure smooth operation on consumer-grade mobile devices. Implementing these performance optimizations will help prevent issues like lag or visual artifacts, which can disrupt immersion and cause discomfort.

[4] P. Sousa et al., "Optimization Techniques for Real-Time Mobile VR Rendering," International Conference on Virtual Systems and Multimedia, 2021.

Sousa and colleagues (2021) explore various optimization techniques to enhance realtime rendering efficiency in mobile VR applications. Their research covers methods such as adaptive resolution scaling, dynamic texture management, and efficient shader utilization—all aimed at maintaining stable frame rates under hardware constraints. These findings directly inform the technical implementation of the Mobile VR Home Tour, where visual smoothness and real-time responsiveness are key to sustaining immersion. By applying these optimizations, the system can deliver a high-quality visual experience without exceeding the performance limits of mobile devices.

[5] C. Lin and H. Hsu, "Reducing Motion Sickness in VR Through Controlled Locomotion," Human–Computer Interaction Journal, vol. 37, no. 2, pp. 95–106, 2023.

Lin and Hsu (2023) address one of the most persistent issues in VR environments— motion sickness— by proposing controlled locomotion techniques such as teleportation, incremental movement, and adaptive speed adjustments. Their findings suggest that reducing sensory conflict through these methods enhances comfort and engagement. In the Mobile VR Home Tour, incorporating such movement systems ensures that users can navigate virtual spaces smoothly without experiencing discomfort. This contributes not only to a more enjoyable experience but also to longer interaction times and better spatial understanding.

[6] A. Patel and M. Kumar, "Gaze-Based Interaction in Mobile Virtual Environments," ACM Transactions on Interactive Systems, vol. 12, no. 1, pp. 1–18, 2022.

Patel and Kumar (2022) explore the use of gaze-based interaction as a hands-free method for engaging with virtual environments, particularly within mobile contexts where external controllers are impractical. Their study shows that gaze input can enhance accessibility and immersion by allowing users to intuitively interact with objects or navigate environments through natural eye movements. Applying this approach in the Mobile VR Home Tour simplifies user control, making the experience more intuitive for first-time VR users. It aligns with the project's goal of creating a seamless, user-centred interaction model that bridges technology and design.

[7] D. Ververidis, S. Nikolopoulos, and I. Kompatsiaris, "A Review of Collaborative Virtual Reality Systems for the Architecture, Engineering, and Construction Industry," Architecture, July 2022.

Ververidis et al. (2022) provide an extensive review of collaborative VR systems in the architecture, engineering, and construction (AEC) sector, focusing on multi-user platforms that facilitate joint design reviews, real-time modification, and shared spatial understanding. Their research highlights the value of VR for stakeholder collaboration, where participants can coexplore and discuss architectural models within a shared virtual environment. For the Mobile VR Home Tour, this research suggests a potential extension—multi-user virtual walkthroughs that enable remote collaboration between developers, agents, and clients. Incorporating collaborative features could transform the project from a solo experience into a participatory design and sales tool.

CHAPTER 3 SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Traditional methods of showcasing campus facilities mainly rely on physical campus visits, brochures, photographs, or simple web-based galleries. In many educational institutions, prospective students and visitors must physically visit the campus to explore the available infrastructure such as classrooms, laboratories, and departmental facilities. While this approach allows direct observation, it may not always be convenient due to geographical distance, time limitations, or accessibility issues.

Some institutions use digital alternatives such as image galleries, recorded videos, or 360-degree photographs to present their campus infrastructure. Although these methods provide visual information, they lack real-time interaction and immersive user experience. Users are limited to viewing predefined perspectives and cannot freely navigate or explore the environment.

Another limitation of many existing virtual tour systems is the requirement of expensive VR equipment or high-performance computers, which restricts accessibility for many users. In addition, several existing solutions provide only passive viewing experiences without interactive elements such as information panels or object-based interaction.

Due to these limitations, existing systems do not provide a fully immersive, interactive, and easily accessible platform for remote exploration of campus facilities.

3.2 PROPOSED SYSTEM

The proposed system, IMMERSIA – 3D Mobile Virtual Tour System, provides an immersive and interactive virtual environment that allows users to explore the facilities of the Computer Science and Engineering (CSE) department through mobile virtual reality technology. The system creates a detailed 3D representation of important locations such as classrooms, laboratories, staff rooms, and the Head of Department (HOD) office.

The virtual environment is developed using the Unity 3D game engine, while 3D assets and models are created using tools such as Blender and SketchUp. These models are integrated into Unity to construct a realistic digital replica of the department infrastructure.

Users can explore the environment in a first-person perspective using an Android smartphone placed inside a simple VR headset. Navigation within the virtual space is supported through input devices such as a joystick or keyboard. Interactive elements such as clickable objects and information panels are incorporated to provide additional details about specific facilities.

This system provides a cost-effective and scalable solution for showcasing campus infrastructure and enables users to experience the department virtually without needing a physical visit.

3.3 ADVANTAGES OF THE PROPOSED SYSTEM

The IMMERSIA – 3D Mobile Virtual Tour System provides several advantages over traditional campus tour methods.

1. **Immersive Experience** – The system provides a realistic 3D environment where users can explore department facilities in a first-person perspective.
2. **Remote Accessibility** – Users can access the virtual tour from any location using a smartphone and VR headset.
3. **Interactive Exploration** – Clickable objects and information panels allow users to learn more about specific facilities and rooms.
4. **Cost-Effective Technology** – The system utilizes affordable VR headsets and standard Android smartphones, reducing hardware costs.

5. **Improved Visualization** – The use of detailed 3D models allows users to understand the layout and structure of the department more clearly.
6. **Educational and Promotional Benefits** – The virtual tour can be used for campus orientation, academic presentations, and showcasing department facilities to prospective students.

3.4 IDEATION & BRAINSTORMING

The idea for the IMMERSIA – 3D Mobile Virtual Tour System emerged from the need to provide a modern and accessible way to showcase department facilities. During the brainstorming phase, different approaches were considered for improving the traditional campus tour experience. The goal was to develop a system that allows users to explore the department environment remotely while maintaining an immersive and interactive experience.

Several technologies and approaches were evaluated, including image- based virtual tours, video walkthroughs, and interactive 3D simulations. Among these options, virtual reality was identified as the most effective method for providing a realistic and engaging user experience. Mobile VR technology was specifically chosen because it is affordable and widely accessible through smartphones.

The brainstorming process also involved identifying the key areas of the department that should be included in the virtual tour, such as classrooms, laboratories, staff rooms, and administrative offices. Additionally, ideas were developed to incorporate interactive features such as clickable objects and information panels that provide details about facilities and equipment.

Through this ideation process, the concept of a mobile-based VR tour system was finalized, focusing on accessibility, interactivity, and realistic visualization.

3.5 PROBLEM–SOLUTION FIT

The IMMERSIA – 3D Mobile Virtual Tour System addresses several challenges associated with traditional campus tours and existing digital visualization methods. Many potential visitors and prospective students may not have the opportunity to physically visit the campus to explore its facilities. This creates a gap in accessibility and limits their understanding of the department's infrastructure.

The proposed system solves this problem by providing a virtual environment where users can explore the department remotely using a smartphone and VR headset. By recreating the department in a 3D interactive environment, the system allows users to experience the layout and facilities in a more realistic manner compared to static images or videos.

Interactive features such as clickable objects and information panels further enhance the experience by providing contextual information about different rooms and equipment. The use of mobile VR technology ensures that the system remains affordable and accessible to a wide range of users.

CHAPTER 4
SYSTEM DESIGN AND ARCHITECTURE

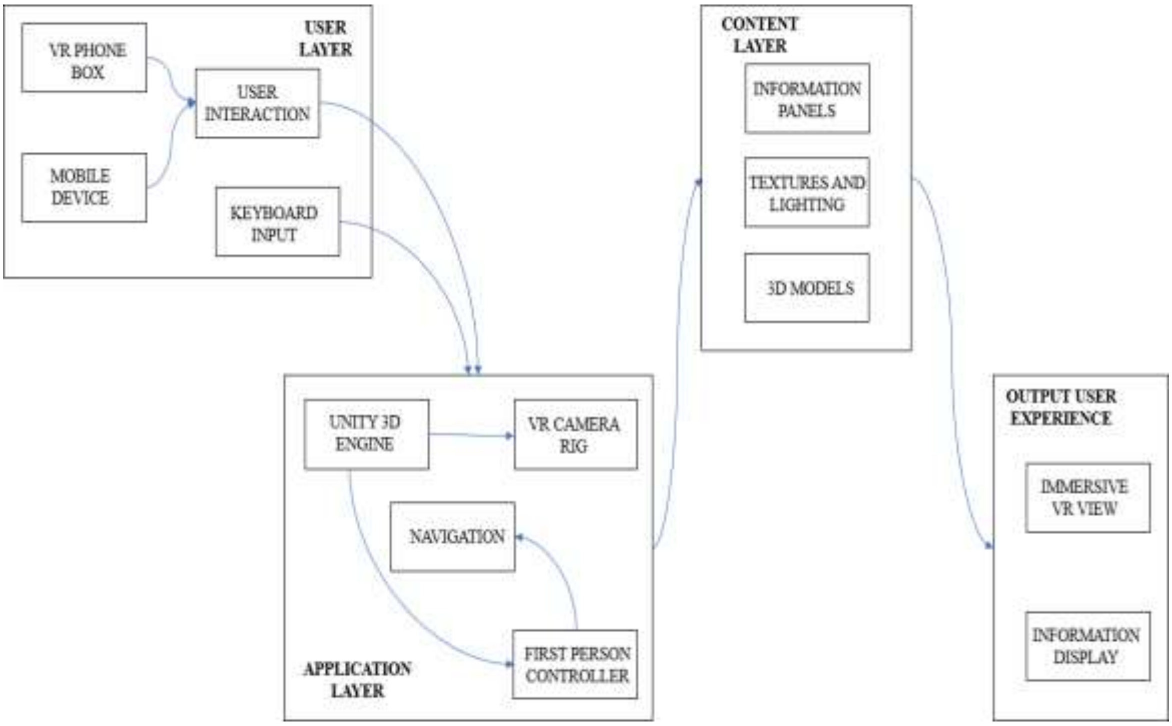

Figure 4.1 Architecture Design

4.1 HIGH LEVEL ARCHITECTURE

The IMMERSIA – 3D Mobile Virtual Tour System is designed using a layered architecture that integrates hardware components, software modules, and user interaction mechanisms to create an immersive virtual reality experience. The architecture is structured to support mobile VR functionality while maintaining smooth rendering and interaction within the virtual environment.

At the top level, the system consists of three major layers: the User Interaction Layer, the Application Processing Layer, and the Hardware and Device Layer.

1. User Interaction Layer

This layer handles the interaction between the user and the virtual environment. Users navigate the virtual department using input devices such as a joystick or keyboard. The VR headset allows the user to view the environment in stereoscopic mode, while the device gyroscope tracks head movement to adjust the viewing direction in real time.

2. Application Processing Layer

This layer contains the core functionality of the system and is implemented using the Unity 3D engine. It manages the virtual environment, user movement, object interactions, and rendering processes. It also processes input signals from the navigation controls and converts them into actions within the virtual environment.

3. Hardware and Device Layer

This layer includes the Android smartphone and VR headset used to run the application. The smartphone processes the VR application and renders the 3D environment on the display. The VR headset provides stereoscopic viewing and enhances the immersive experience.

Through the interaction of these layers, the system delivers a smooth and interactive virtual tour of the department facilities.

4.2 COMPONENTS AND INTERACTIONS

The IMMERSIA system is composed of several functional components that work together to create the virtual tour experience.

1. **User Input Module**

This component receives input from devices such as a keyboard or joystick. The input signals control movement actions such as moving forward, backward, or turning within the virtual environment.

2. **VR Camera System**

The VR camera is responsible for displaying the environment from the user's perspective. It also adjusts orientation based on head movement detected by the smartphone's gyroscope sensor, allowing users to look around naturally in the virtual environment.

3. **Navigation Controller**

The navigation controller manages user movement within the 3D environment. It ensures smooth movement and prevents the user from passing through walls or objects by implementing collision detection.

4. **Interaction System**

This module allows users to interact with objects within the virtual environment. Raycasting techniques are used to detect when the user focuses on or selects an interactive object. When an object is activated, an information panel appears to provide details about the location or equipment.

5. **3D Environment Module**

This component contains the digital models of the department infrastructure, including classrooms, laboratories, and offices. The models are created using 3D modelling software and imported into Unity to form the virtual environment.

6. **User Interface Module**

The UI module manages information panels and other visual elements that appear during interaction. These panels provide contextual information about rooms, facilities, and departmental features.

These components communicate with each other through the Unity engine to provide a seamless and interactive VR experience.

4.3 DATA FLOW & RUN TIME BEHAVIOUR

The runtime behaviour of the IMMERSIA system describes how data moves through the system during execution.

1. **Application Initialization**

When the application starts, the Unity engine loads the virtual environment, including 3D models, textures, lighting configurations, and user interface elements.

2. **Input Detection**

The system continuously monitors input devices such as the keyboard, joystick, or gyroscope sensor. These inputs determine the user's movement and viewing direction.

3. **Input Processing**

The navigation controller processes the received input signals and updates the user's position and orientation within the virtual environment.

4. Interaction Detection
The interaction system uses raycasting from the camera to detect interactive objects in the user's field of view. If an object is selected, the system triggers a corresponding action.
5. Information Display
When an interactive object is activated, the UI module displays an information panel with relevant details about the selected room or facility.
6. Rendering and Output
The Unity engine continuously renders the updated scene and displays it on the smartphone screen in stereoscopic VR mode. The VR headset allows the user to experience the environment immersively.
This continuous cycle of input detection, processing, interaction handling, and rendering ensures that users can smoothly explore the virtual department and interact with various elements in real time.

CHAPTER 5
SYSTEM REQUIREMENTS
Development System
- OS: Windows 10/11 (64-bit)
- Processor: Intel i5 / Ryzen 5 or above
- RAM: 8 GB (16 GB recommended)
- GPU: NVIDIA GTX 1650 or equivalent
- Software: Unity 6.x, Android Build Support, Visual Studio
- Storage: 10 GB free space

End-User Device (Mobile VR)
- OS: Android 10 or above
- RAM: 4 GB (6 GB recommended)
- Processor: Snapdragon 700 series or higher
- Sensors: Gyroscope (mandatory)
- Storage: 500 MB free space

VR Support
- Google Cardboard / Mobile VR Headset (optional)

Additional
- USB cable for testing
- Internet connection (for installation)

CHAPTER 6
IMPLEMENTATION AND TECHNIQUES
6.1 3D MODELLING AND ENVIRONMENT DESIGN
The development of the IMMERSIA – 3D Mobile Virtual Tour System begins with the creation of a realistic 3D environment that represents the Computer Science and Engineering department facilities. This process involves designing and modelling the physical infrastructure of the department, including classrooms, laboratories, staff rooms, and the Head of Department (HOD) office.

3D modelling tools such as Blender and SketchUp are used to create various assets required for the virtual environment. These assets include furniture, laboratory equipment, desks, chairs, computers, and other structural components. The models are designed with attention to scale and proportion so that the virtual environment closely resembles the real-world layout of the department.

Once the models are created, they are exported and imported into the Unity 3D engine, where the virtual environment is assembled. The models are placed according to the actual arrangement of the department spaces. Textures, lighting, and materials are applied to enhance realism and visual quality. The environment is also optimized to ensure smooth performance on mobile devices.

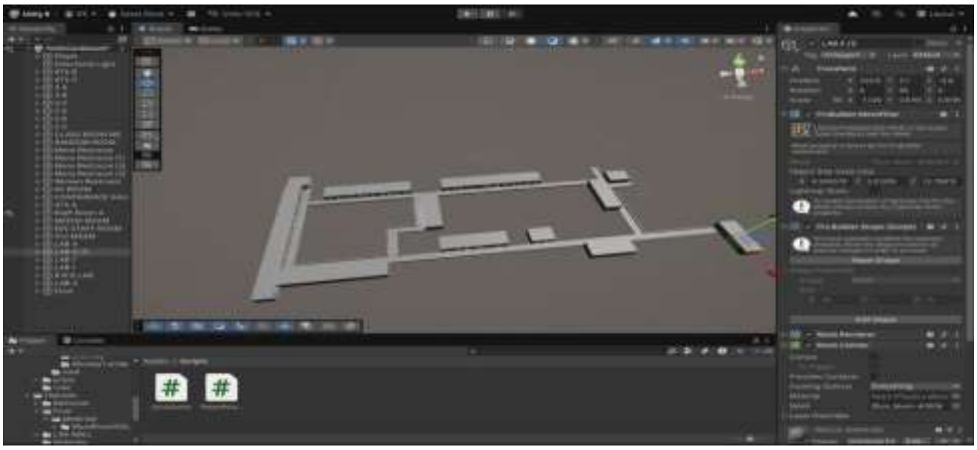

Figure 6.1 Department Blueprint

6.2 VR SETUP AND CAMERA CONFIGURATION

The VR setup is implemented using Unity's VR capabilities to create an immersive first-person experience. The system is designed to run on an Android smartphone placed inside a VR headset, which provides stereoscopic viewing and enhances the immersive effect.

A VR camera system is configured in Unity to simulate the user's perspective within the virtual environment. The camera represents the user's viewpoint and moves according to the navigation controls. The smartphone's gyroscope sensor is used to track head orientation, allowing users to look around the virtual environment naturally by turning their head.

The VR camera is responsible for rendering the scene in stereoscopic view, which allows the VR headset to display separate images for each eye. This creates the perception of depth and enhances the immersive experience.

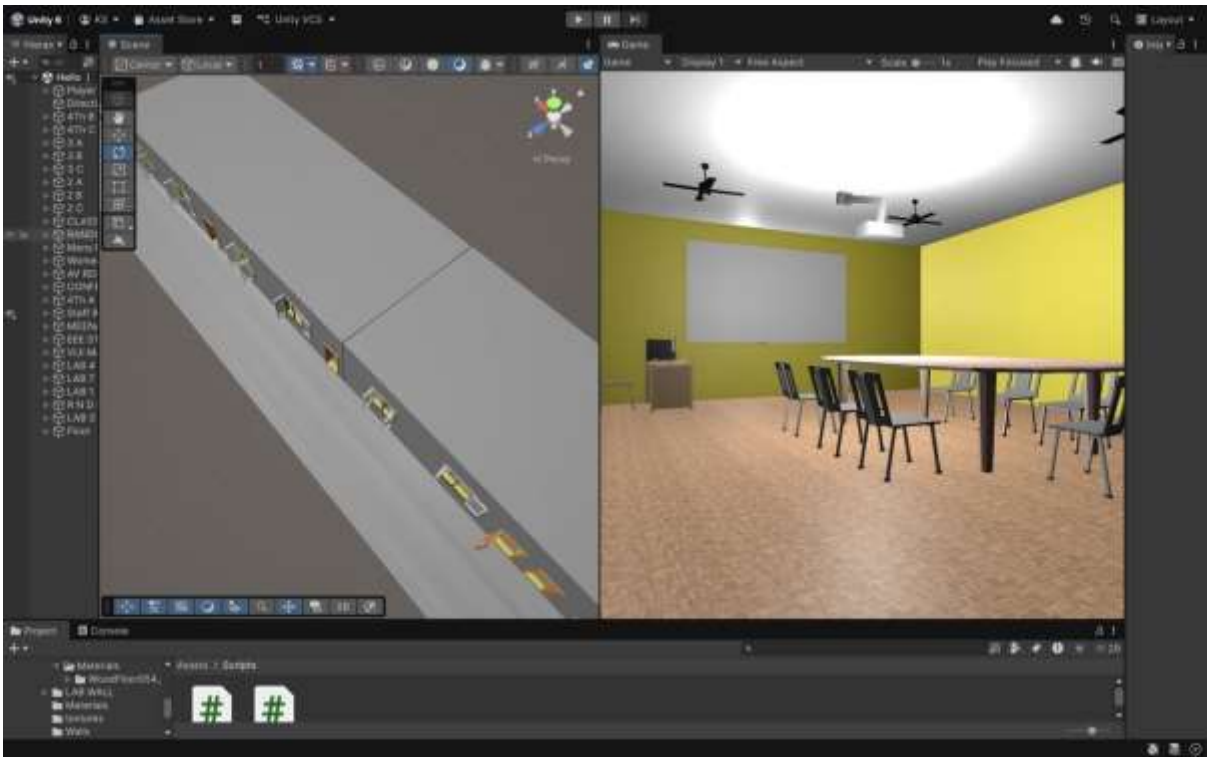

Figure 6.2 Camera View

6.3 NAVIGATION AND MOVEMENT CONTROL

Navigation within the virtual environment is implemented using a first- person controller in Unity. This controller allows users to move through the department spaces smoothly while maintaining realistic motion behavior.

During development and testing, keyboard input is used to control movement. Keys such as W, A, S, and D allow the user to move forward, backward, and sideways. In the VR setup, navigation can also be controlled using a joystick or external input device connected to the smartphone.

The movement system also incorporates collision detection, which prevents users from passing through walls, furniture, or other objects within the environment. This ensures that navigation remains realistic and consistent with the actual physical layout of the department.

6.4 INTERACTION SYSTEM AND INFORMATION PANELS

To enhance user engagement, the system incorporates interactive elements within the virtual environment. An interaction system is implemented using raycasting techniques from the camera perspective. Raycasting allows the system to detect when the user focuses on or selects an interactive object.

When the user interacts with a specific object or location, an information panel appears on the screen displaying relevant details about that facility. For example, selecting a laboratory or office may display information about the room's purpose, equipment, or department staff.

The user interface elements for these information panels are designed using Unity's UI system, ensuring that the panels are clear and easy to read within the VR environment. These interactive features make the virtual tour more informative and engaging for users.

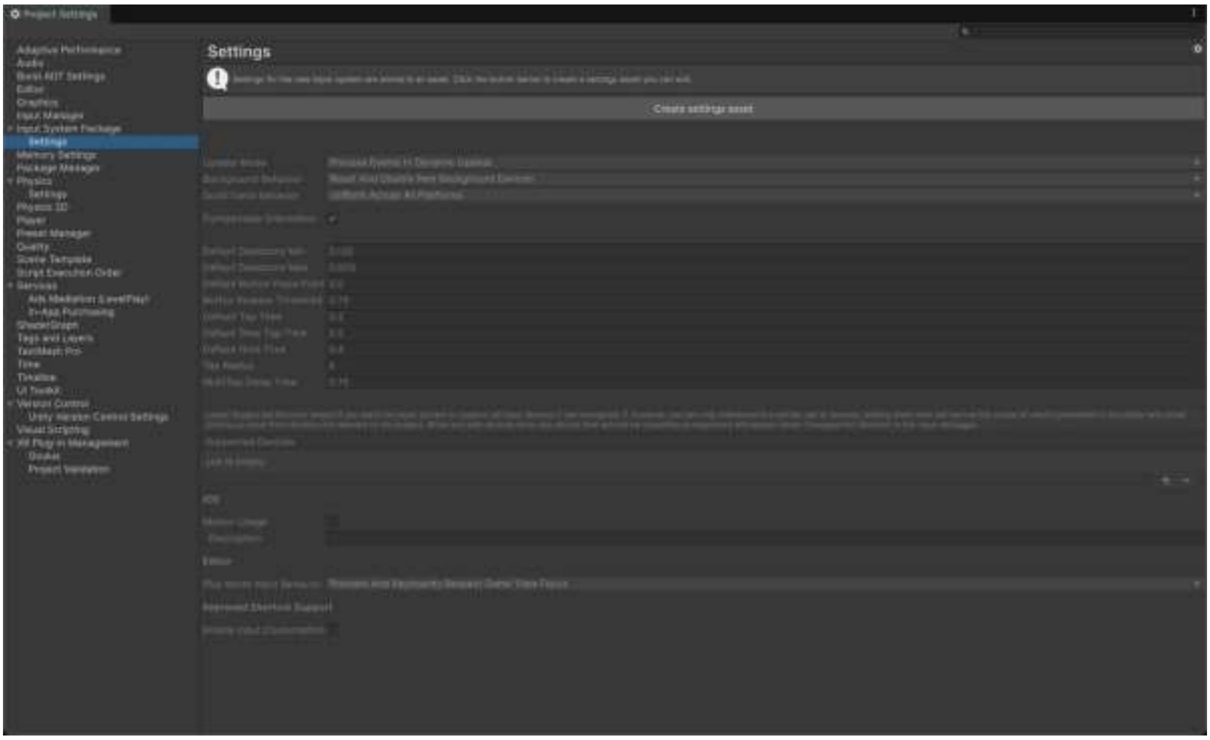

Figure 6.3 Information Panel

6.5 BUILD AND DEPLOYMENT

After completing the development and integration of all system components, the application is built and deployed for the Android platform. The Unity engine compiles the project into an Android application package (APK) that can be installed on compatible smartphones.

Testing is conducted on different Android devices to ensure smooth performance, stable frame rates, and responsive input controls. Special attention is given to optimizing graphics rendering and camera movement to prevent issues such as lag or motion discomfort during VR usage.

Once deployed, the application allows users to place their smartphone inside a VR headset and explore the department facilities through an immersive virtual tour. The final system demonstrates how mobile VR technology can be effectively used to create an accessible and engaging platform for virtual campus exploration.

Figure 6.4 output 1

Figure 6.5 Output 2

CHAPTER 7

RESULTS AND PERFORMANCE EVALUATION

7.1 SYSTEM OUTPUT

The IMMERSIA – 3D Mobile Virtual Tour System was successfully developed and implemented as a mobile-based virtual reality application. The system creates an immersive 3D environment that represents the facilities of the Computer Science and Engineering department, including classrooms, laboratories, staff rooms, and the Head of Department (HOD) office.

The final application allows users to explore the virtual environment from a first-person perspective using an Android smartphone placed inside a VR headset. Users can navigate through different areas of the department using input devices such as a keyboard or joystick during testing and development. The environment responds smoothly to navigation inputs, enabling users to move freely within the virtual space.

Interactive features such as clickable objects and information panels are integrated into the system. When users interact with specific objects or locations, relevant information about the facility is displayed, making the virtual tour both informative and engaging.

7.2 PERFORMANCE EVALUATION

The performance of the IMMERSIA system was evaluated based on several factors including usability, navigation smoothness, system responsiveness, and compatibility with mobile devices.

1. **Navigation Performance**

The navigation system allows users to move through the virtual environment smoothly using first-person controls. The movement and camera orientation respond effectively to input commands, providing a natural exploration experience.

2. **Rendering Performance**

The 3D environment is optimized to run efficiently on Android smartphones. Proper texture management and optimized 3D models ensure that the application maintains stable rendering performance during execution.

3. **Interaction Responsiveness**

The interaction system accurately detects user focus on interactive objects using raycasting techniques.

Information panels appear promptly when objects are selected, improving the overall user experience.

4. Mobile Compatibility

The system was tested on Android devices to ensure compatibility with standard smartphones. The application runs successfully without requiring expensive VR hardware, demonstrating the effectiveness of mobile VR technology.

5. User Experience

The immersive VR environment provides users with a realistic experience of exploring the department facilities. The integration of head orientation tracking and interactive elements enhances engagement and makes the virtual tour more informative.

7.3 DISCUSSION OF RESULTS

The implementation results demonstrate that the IMMERSIA system effectively achieves its objective of providing an immersive virtual tour of the department facilities. Users are able to explore the environment, interact with objects, and gain information about different areas of the department through a simple and accessible mobile VR setup.

The system proves that mobile VR technology can be used as a practical solution for campus visualization and digital engagement. By combining 3D modeling, real-time rendering, and interactive elements, the project successfully delivers a realistic and informative virtual exploration experience.

7.4 CHALLENGES OVERCOME

During the development of the IMMERSIA – 3D Mobile Virtual Tour System, several technical and design challenges were encountered. These challenges were addressed through careful planning, optimization, and iterative testing during the implementation process.

One of the major challenges was creating accurate 3D models of the department environment. Reproducing classrooms, laboratories, and offices in a virtual space required proper measurements and reference images to maintain realistic proportions. This issue was resolved by carefully analyzing the physical layout of the department and designing the models with correct scale and structure using 3D modeling tools.

Another challenge involved optimizing the 3D environment for mobile devices. High-polygon models and complex textures can reduce performance on smartphones. To overcome this, the models were optimized by reducing unnecessary polygon counts, compressing textures, and organizing assets efficiently within the Unity engine to ensure smooth rendering and stable frame rates.

Implementing smooth navigation and user movement within the VR environment was also a challenge. Without proper control systems, users may experience sudden camera movements or motion discomfort. This issue was addressed by implementing a well-configured first-person controller with controlled movement speed and proper collision detection to maintain natural navigation.

The integration of interactive elements such as clickable objects and information panels required careful scripting and UI design. Ensuring that interactions were detected accurately in the VR environment was solved by using raycasting techniques and well-structured user interface components.

By overcoming these challenges, the project successfully delivers a functional and immersive mobile VR application that demonstrates the potential of virtual reality technology for campus visualization and interactive exploration.

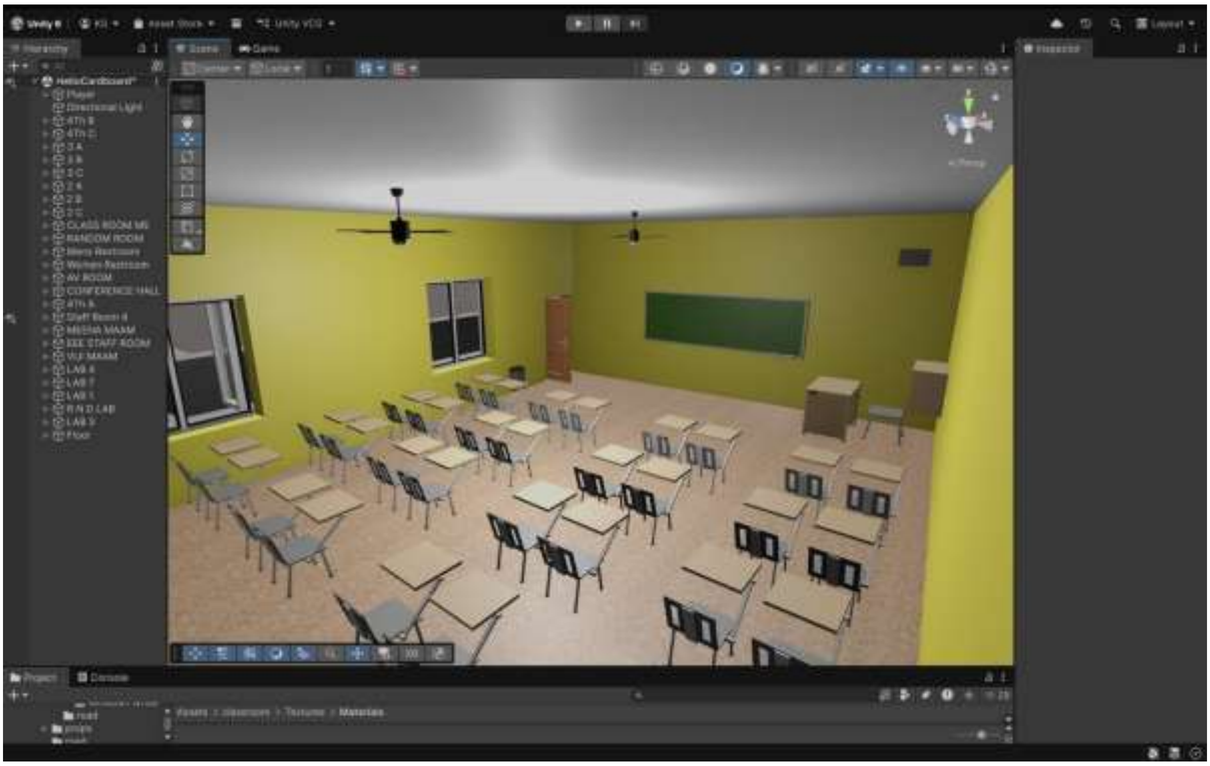

Figure 7.1 Classrooms

Figure 7.2 Computer Lab

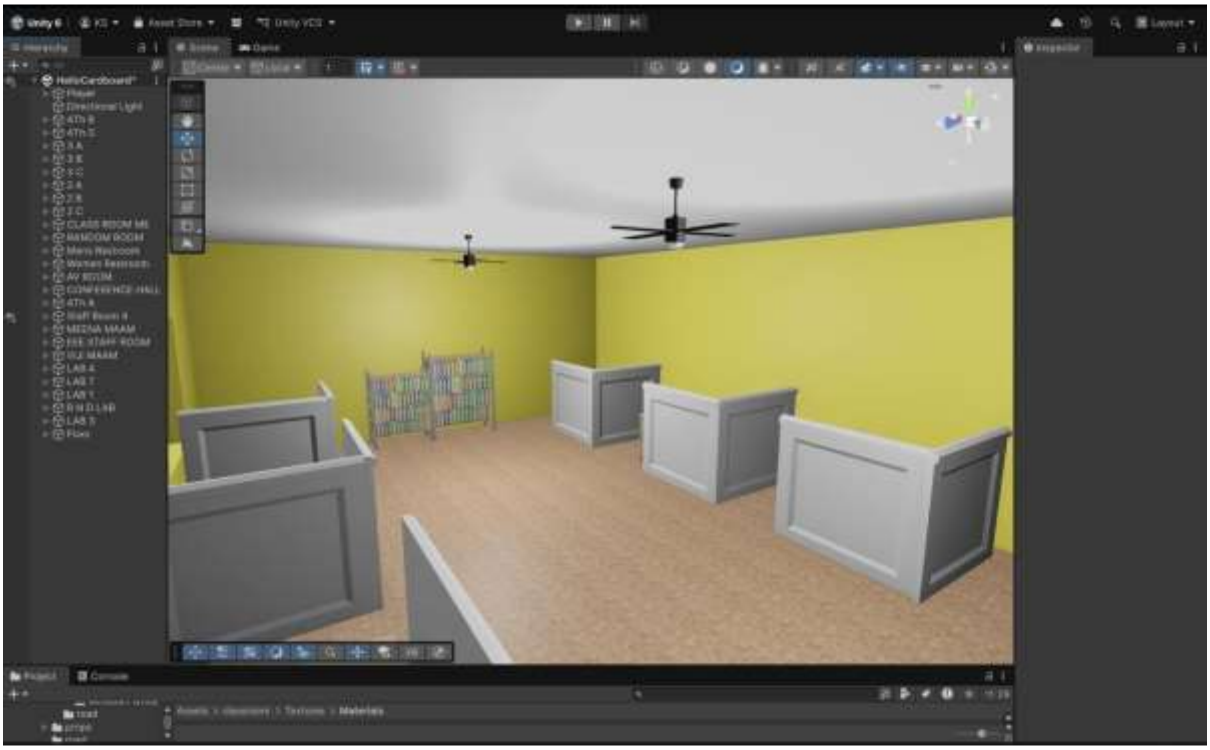

Figure 7.3 Faculty Room

CHAPTER 8 CONCLUSION

The IMMERSIA – 3D Mobile Virtual Tour System successfully demonstrates the use of mobile virtual reality technology to create an immersive and interactive representation of the Computer Science and Engineering department facilities. The system provides users with the ability to explore important locations such as classrooms, laboratories, staff rooms, and the Head of Department (HOD) office within a realistic 3D virtual environment.

The project integrates several technologies including Unity 3D for application development, Blender and SketchUp for 3D modeling, and C scripting for navigation and interaction functionalities. By combining these tools, a functional VR application was developed that allows users to navigate the virtual environment using first-person controls and interact with various objects through information panels.

One of the key achievements of the project is the development of a cost- effective and accessible VR solution. By utilizing an Android smartphone and a simple VR headset, the system eliminates the need for expensive VR hardware while still providing an immersive experience. The application allows users to explore the department remotely, making it useful for campus orientation, institutional presentations, and student engagement.

The performance evaluation of the system indicates that the virtual environment runs smoothly on mobile devices with responsive navigation and effective interaction mechanisms. The integration of interactive elements enhances the informational value of the virtual tour and provides a more engaging experience compared to traditional image-based or video-based tours.

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