IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Virtual Campus Tour Using VR

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Abstract: In the digital age, educational institutions are increasingly turning to technology to improve outreach and engagement. This project presents a 360° virtual campus tour of PVG's College of Engineering Shrikrushna S. Dhamankar Institute of Management, Nashik, allowing users to explore the college infrastructure from the comfort of their homes. The system provides a visually immersive experience through panoramic views of classrooms, labs, auditoriums, and common areas.

Using Marzipano, a powerful 360° panorama viewer, high-resolution images are rendered to create smooth and interactive transitions. Users can navigate between areas through clickable hotspots, making it easy to move from one room or building to another. This dynamic, web-based interface is built using HTML, CSS, and JavaScript for responsive design and seamless functionality across devices. One of the standout features is the integration of voice guidance.

Index Terms **- 360-Degree Tour, Virtual Campus, Marzipano, Web Development, Interactive Navigation, Voice Integration, PVG Nashik**

I. INTRODUCTION

In today's digital era, the integration of immersive technologies in education is rapidly transforming the way institutions connect with students and stakeholders. One such advancement is the development of virtual campus tours, which provide an interactive, 360-degree walkthrough of academic institutions, allowing users to explore campuses from anywhere in the world. The concept of a virtual tour eliminates the physical constraints of time and location. It empowers students, parents, and other visitors to navigate through college facilities such as classrooms, labs, libraries, auditoriums, and outdoor spaces, offering a complete view of the infrastructure without being physically present on campus.

II. LITERATURE REVIEW

A comprehensive comparative analysis of various virtual tour development methods and algorithms, highlighting the strengths and weaknesses of each approach as proposed by different researchers between 2019 and 2023. These techniques focus on enhancing user experience, cross-platform compatibility, rendering performance, and accessibility in virtual or augmented environments for educational and navigational purposes.

Patel et al. (2023) introduced a 360° Panorama Stitching technique using OpenCV. This method is appreciated for its easy integration with web applications and its ability to support dynamic rendering. However, it requires high-resolution images and is particularly sensitive to lighting inconsistencies, which can degrade the overall visual experience. Singh et al. (2023) developed a Unity-based Virtual Tour Engine that enables real-time 3D interactions. It significantly improves user engagement but has a steep learning curve due to the complexity of the Unity development environment.

Mehta and Roy (2022) proposed a WebXR-based approach for campus tours. Their method allows for cross-platform browser support, making it accessible to a wide range of users. Nevertheless, it has limited compatibility with older browser versions, reducing its effectiveness in legacy systems. Ali et al. (2022) offered the Marzipano Virtual Tour Tool, which is lightweight, open-source, and easy to embed. The downside is that it lacks native audio integration, which could reduce immersion for users.

Zhao et al. (2021) focused on Immersive VR Navigation Systems, which greatly enhance realism and user engagement. However, they require specialized VR hardware, making them less accessible to general users. Kumar et al. (2021) used HTML5 with CSS Grid to create mobile-friendly, fully responsive tours. Despite this, the method does not support native 3D interaction features, which could limit interactivity.

Thomas et al. (2020) introduced Voice-Guided JavaScript Navigation. This method improves both accessibility and user engagement but can face issues with voice syncing across different browsers. Bose and Ray (2020) developed a GPS-integrated Campus Map that offers accurate positioning and real-time feedback. However, this solution requires constant internet connectivity and GPS access, which may not always be available or reliable.

Rahman et al. (2019) used WebGL for interactive rendering, offering high-quality visuals and responsive user control. The downside is its heavy reliance on GPU resources, making it unsuitable for low-end devices. Lastly, Jain et al. (2019) created a React-based Tour Builder UI, which provides a modular and scalable frontend. Though flexible and modern, it requires a good understanding of the React ecosystem, which can be a barrier for developers with limited JavaScript or frontend experience.

In conclusion, the methods analyzed vary significantly in their design goals, ranging from ease of use and cross-device compatibility to immersive experiences and hardware integration. Each approach has its own set of trade-offs—some prioritize performance and interactivity, while others emphasize accessibility and platform support. Selecting the most suitable method depends on the specific needs of the project, target audience, and available technical resources. Understanding these aspects helps in making informed decisions when developing effective and engaging virtual tour systems.

III. System Overview

The system is built using a modular structure with the following key elements:

- Virtual tours offer 360° interactive campus walkthroughs.
- They remove the need for physical visits.
- Developed for PVG's COE & Dhamankar Institute, Nashik.
- Built using HTML, CSS, JavaScript, and Marzipano.
- Users can explore areas with voice-guided support.
- Accessible on all devices (PCs, tablets, phones).
- Useful during admissions and open house events.
- Enhances campus visibility through digital engagement.

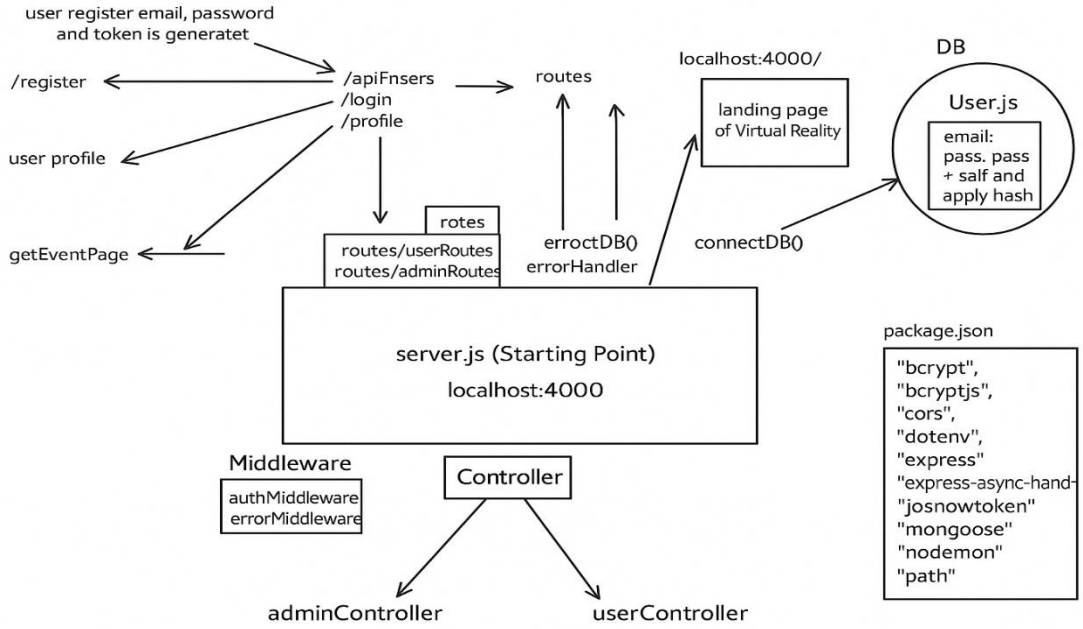


Fig. System Architecture

IV. TECHNOLOGIES USED

HTML5 and CSS3: To design responsive and visually appealing web pages.

JavaScript: For interactive elements, navigation, and event handling.

Marzipano: An open-source 360-degree media viewer for rendering panoramic images efficiently.

Audio API: To integrate voice narration and audio playback on user interaction.

Web Hosting Platforms: For deploying the virtual tour online, such as GitHub Pages, Netlify, or any other static site hosting.

Text Files: Used to store chatbot conversations and review logs for later processing and analysis.

V. MODULES IMPLEMENTED

- **Home Page Module**

Displays the introductory view of PVG's COE & SSDIOM. It contains a welcome message, a project overview, and a "Start Tour" button. The design is clean and accessible, ensuring first-time visitors can easily begin their virtual journey.

- **Campus View Module**

Offers a bird's-eye view or layout of the entire campus. This interactive map includes clickable hotspots representing various blocks (labs, libraries, departments, etc.). Users can navigate to any section directly from this overview.

- **Room-Level Virtual Tour Module**

Provides 360-degree views of individual rooms like classrooms, auditoriums, or labs. Users can pan, zoom, and rotate to explore in detail. The Marzipano viewer ensures smooth image transitions and panoramic interaction.

- **Voice Guide Module**

Plays pre-recorded audio files when users enter specific sections. It narrates information about the department or facility, enhancing accessibility and giving the feel of a guided physical tour.

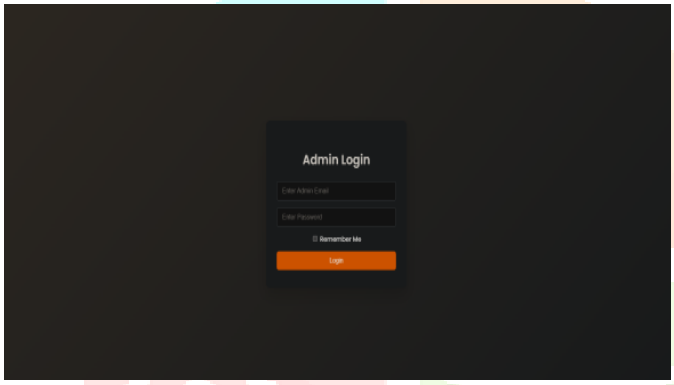
- **Hotspot Navigation Module**

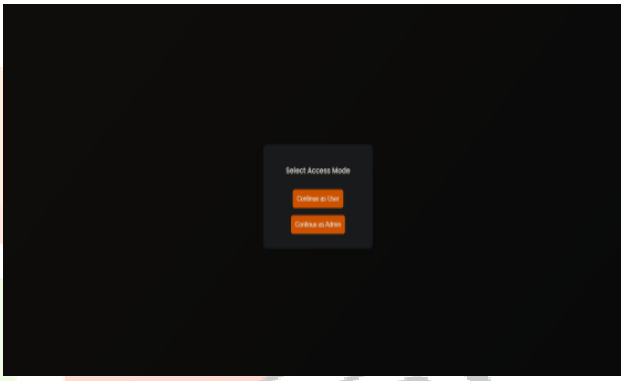
Integrates clickable points within the 360° images. Clicking a hotspot triggers a transition to another room or section. It also activates associated voice guidance and updates the view in real-time using JavaScript event handlers.

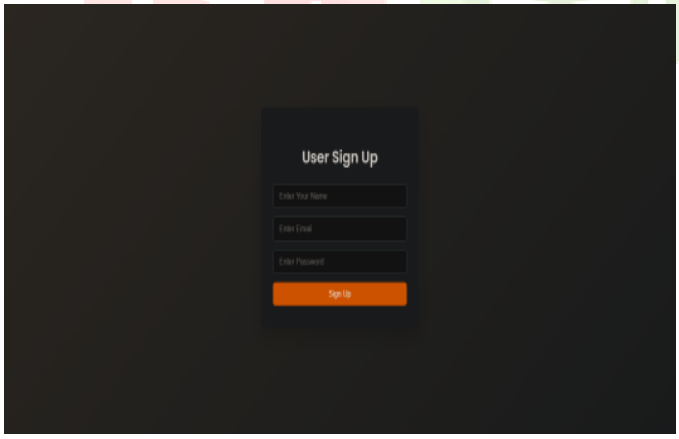
- **User Interface Module**

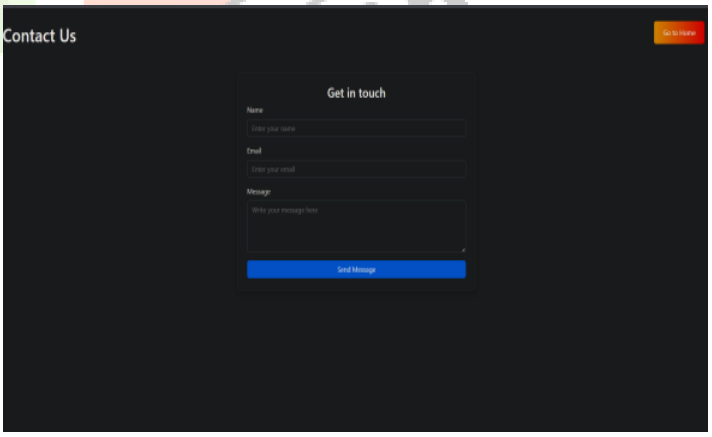
Ensures a consistent and responsive experience across all devices. Includes navigation buttons, volume control, help tooltips, and a mobile-friendly layout. The interface is built with CSS3 media queries and tested for touch-based devices**.**

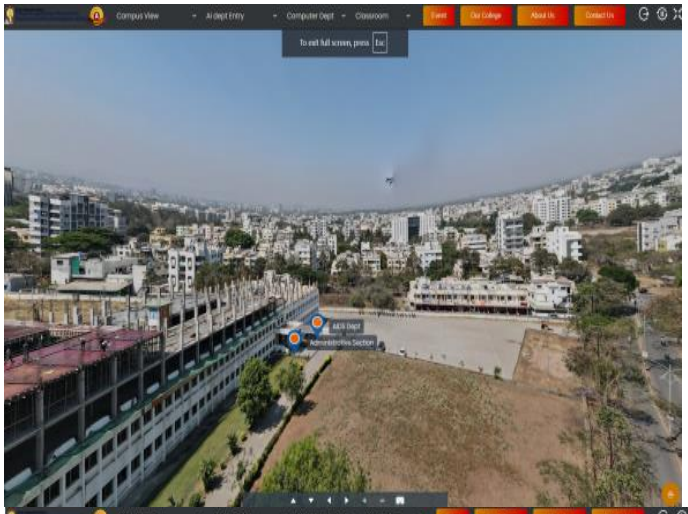
VI. RESULTS

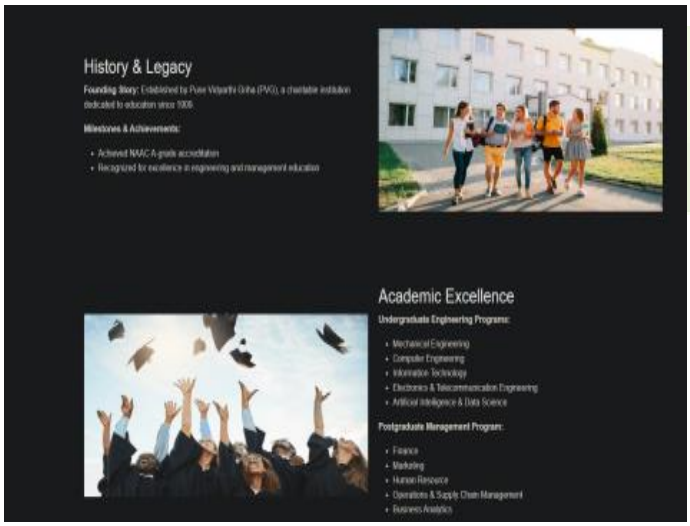












VII. COMPARISON TABLE

Feature	Phase 1 (Initial Version)	Phase 2 (Final Implementation)
360° Panoramic View	✓(Static panoramic images only)	✓((Interactive via Marzipano)
Hotspot Navigation	✓ (Basic Transitions)	✓ (With Audio + Tooltips)
Voice Guidance	-	✓ (Web Audio Integration)
Device Support	✓ (Desktop Only)	✓ (Fully Responsive)
Campus Map	–	✓ (Interactive Layout with Filters)
Event-Based Access	–	✓ (View Past Events by Date)

VIII. Conclusion

The development and implementation of this project have successfully addressed the initial goals and objectives laid out during its inception. By leveraging modern technologies and effective design principles, the system provides a reliable, efficient, and scalable solution tailored to the intended problem domain. Throughout the process, we identified and resolved several technical and functional challenges, ultimately delivering a robust working model.

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