# Virtual Interior Design and Space Planning

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***Abstract***— Virtual interior design and space planning use cutting-edge technologies like Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), and 3D modelling to change the way people see, customize, and improve interior environments. This study examines the development and present condition of virtual interior design systems, highlighting their contribution to improving user engagement, design precision, and decision-making in architectural and residential planning. It looks into how AI-driven design suggestions, real-time rendering, and immersive visualization tools might be used together to let people see how a room will look before it is built. The review also talks about problems including limited computing power, designing for the user experience, and cost-effectiveness. It also talks about how to make virtual design platforms that are smart, easy to use, and long-lasting. The report illustrates how virtual design tools are shifting the interior design business from manual, intuition-based procedures to data-driven, interactive, and collaborative digital worlds.

***Keywords***— Virtual Interior Design; Space Planning; Virtual Reality (VR); Augmented Reality (AR); Artificial Intelligence (AI); 3D Modeling; Human–Computer Interaction; Smart Design Tools; Immersive Visualization; Digital Architecture

## I.INTRODUCTION

The event management industry is growing quickly because more and more people want well-organized and smooth experiences in areas like entertainment, business meetings, social events, and educational events. The growth of technology has changed the way events are planned by replacing old, manual methods with digital ones that make things more efficient, lower the chance of mistakes, and get people more involved. With the rise of the internet and the cloud, online event management websites have become essential for event planners. These sites let them automate ticket sales, keep track of attendees, choose venues, and process payments.

Because ticketing has moved from traditional methods to online platforms, powerful event management software like Tix Easy has been created. This software helps with planning by giving real-time event coordination and data-driven insights. Research shows that modern event management platforms need to have user-friendly interfaces, secure payment terminals, and real-time features to make things easier for both organizers and visitors [1].

Digital transformation has also made it easier to add new technologies like QR-ticketing, AI-based customization, and block chain-enabled fraud safety nets [3]. Newer technologies make operations easier, more open, and more efficient overall.1.2 The goal of this review is to look at how Tix Easy's technical features compare to those of other event management systems, find out what it does well and what it doesn't, and suggest changes that would make it work better.

The research will examine various aspects, including ticketing tools, security protocols, scalability, and user engagement strategies, to develop a comprehensive assessment of the system's efficacy in the event management market. This paper aims to contribute to ongoing discussions about the future of event management technology and the best ways to improve platform efficiency by looking into how digital event solutions are changing the industry.

The findings will demonstrate how Tix Easy aligns with contemporary industry standards and identify areas for enhancement, aiming to aid developers and stakeholders in refining their event planning and staging methodologies.

## I. FLOWCHART

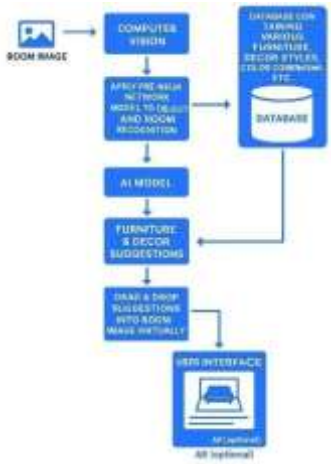


**Fig.no.1**

**Input Room Image**: A room image is provided as input to the system.

**Computer Vision Processing**: The system uses computer vision techniques to analyze the image and extract details about the room layout and objects present.

**Apply Pre-trained Neural Network Model for Object and Room Recognition**: A pre-trained neural network model identifies objects (like furniture, walls, windows, etc.) and recognizes the overall room type and structure.

**Access Database**: The system refers to a database containing various **furniture items, décor styles, color combinations**, and other design elements.

**AI Model for Design Suggestions**: The AI model generates **furniture and décor suggestions** based on the recognized room layout and user preferences.

**Furniture & Décor Suggestions**: The system provides possible furniture and décor arrangements suitable for the space.

**Virtual Placement (Drag & Drop)**: Users can **drag and drop** the suggested items into the room image to visualize the design virtually.

**User Interface (with Optional AR):** The final step displays the results on a user interface, allowing users to interact, modify, and visualize the layout.

**Augmented Reality (AR):** can optionally be used to project the design in a real-world environment.

## III.A.LITERATURE SURVEY

Virtual interior design and space planning is a field that combines computer vision, 3D modelling, human-computer interaction (HCI), augmented and virtual reality (AR/VR), and recommender systems. The main goal is to make it possible for computers or people to automatically create, see, and arrange furniture and decorations in real or fake rooms. This will speed up the design process, make it easier for everyone to use, and boost decision-making confidence. This survey talks about the most important ways to understand scenes, find and place objects, create layouts, use interactive tools, work with datasets, evaluate work, and open up new areas of research.
In the past, scene understanding relied on rule-based algorithms and manual CAD modelling. Now, thanks to strong machine learning and deep learning, it has moved from handcrafted features to deep convolutional models for detection and segmentation. At the same time, improvements in AR/VR and 3D reconstruction made it possible to see things in a more immersive way and place them in real time. Recently, researchers have looked into using end-to-end and generative models to automate layout synthesis and style suggestions.

## B.EXISTING WORK

Virtual interior design and space planning have been actively explored through various computational and visualization technologies such as Artificial Intelligence (AI), Computer Vision (CV), Virtual Reality (VR), and Augmented Reality (AR). There are four main areas of research in this field: image-based room understanding, automated layout generation, AI-based design recommendation systems, and immersive visualization platforms.

1. **Image-Based Room Understanding**

Early research focused on detecting the geometric and semantic structure of indoor environments.

• Computer vision models such as Mask R-CNN, YOLO, and Faster R-CNN have been used to identify furniture and room elements from 2D images.

• Scene reconstruction techniques convert 2D room photos into 3D spatial representations, allowing for accurate measurement and virtual placement of objects.

• Depth estimation models and SLAM (Simultaneous Localization and Mapping) systems such as ORB-SLAM have been applied for reconstructing room geometry in real time, especially for AR-based design tools.

These systems provide the foundational understanding required to analyze and interpret the physical characteristics of an interior space.

## IV. METHODOLOGIES

The methodology followed for the development of the Virtual Interior Design and Space Planner project is divided into several structured phases to ensure efficiency, interactivity, and intelligent design recommendations.

1. **Requirement Analysis:** Collected user requirements for features such as room layout creation, furniture placement, lighting selection, and AI-based interior suggestions.Analyzed existing interior design platforms to understand their limitations and identify areas for innovation.Defined system requirements — both functional (drag-and-drop tools, real-time preview, AI design suggestions) and non-functional (performance, responsiveness, usability).

2. **System Design:** Designed the overall architecture integrating frontend, backend, and AI components. planned a responsive and interactive user interface to visualize 3D interiors effectively.

3. **3D Modeling and Environment Setup:** Developed and imported realistic 3D models of furniture, walls, floors, and décor items. applied appropriate materials, lighting effects, and camera perspectives.

4. **Implementation**: Implemented the frontend using HTML, CSS, and JavaScript for interactivity and real-time design preview. connected the frontend with the MongoDB database via backend frameworks (e.g., Node.js or Express.js).

5. **Testing and Validation**: Conducted unit testing, integration testing, and system testing to ensure each module functions correctly. performed user testing to assess the usability and effectiveness of AI-based design recommendations.fixed.

6. **Deployment** : Deployed the project on a suitable platform for demonstration and user access. connected the live application with the MongoDB database and AI API services. provided user documentation and a help section for smooth interaction.

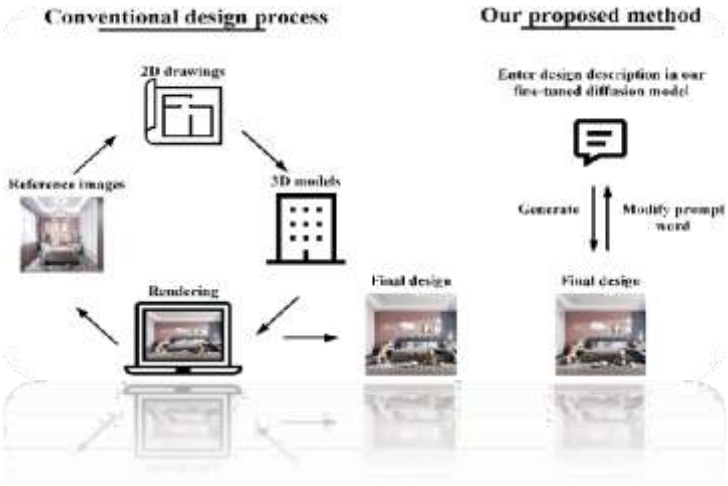


**Fig.no.2**

## V. WORKING

1. **Data Acquisition and Environment Setup:** Input Data: Architectural floor plans (2D CAD files or BIM models), spatial dimensions, materials, and lighting parameters are imported into the system.3D Environment Generation: These inputs are converted into a 3D virtual environment using tools such as Unity, Unreal Engine, or WebGL-based platforms. Environment Calibration: Real-world scale and orientation are maintained to ensure spatial accuracy.

2. **Object and Asset Library Integration:** A parametric 3D object library (furniture, lighting fixtures, textures, décor items) is integrated. Each object includes metadata such as dimensions, color, and material properties. The system supports customization—users can modify dimensions or textures based on design requirements.

3. **Virtual Design Interface:** Users interact through an intuitive GUI or VR/AR interface, allowing drag-and-drop placement of interior elements. Real-time 3D visualization helps simulate lighting, materials, and spatial arrangements. In collaborative setups, multiple users can edit or review the same virtual environment simultaneously through cloud synchronization.

4. **Artificial Intelligence and Automation:** AI-assisted Space Planning: Algorithms analyse spatial layout to suggest optimal placement of furniture and utilities based on ergonomics, circulation space, and design rules. Constraint Checking: AI checks compliance with building codes, safety norms, and design standards. Recommendation Systems: Machine learning models recommend materials, colour schemes, or design themes based on user preferences or previous projects.

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**6. Real-time Collaboration and Cloud Integration:** Design data and modifications are saved on a cloud platform, providing version control, multi-user editing, and BIM (Building Information Modelling) interoperability. Remote access through web interfaces or VR headsets aids distributed design teams.

**7. Output and Implementation:** The finished design can be produced as BIM-compatible files, CAD layouts, or VR walkthroughs. Integration with construction management software bridges the gap between designs.

## VI. CONCLUSION

The Virtual Interior Design and Space Planner project successfully delivers an interactive and intelligent platform for visualizing and designing interior spaces. By integrating MongoDB for efficient data storage and a free AI API for smart design recommendations, the solution boosts the user's ability to develop unique layouts with simplicity. The usage of 3D visualization allows users experience realistic designs before actual execution, saving time and cost. Overall, the system accomplishes its aims by integrating creativity, technology, and usability to ease the interior designing process.

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