IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

# Construction Site User Experience Using AR

**Harries Pandi, Selvinraj I, Benny S, M.Deepa**

Dept. of Computer Science and Business System, Francis Xavier Engineering College, Vannarpettai, Tirunelveli, India

Assistant Professor, Dept. of Computer Science and Business System, Francis Xavier Engineering College, Vannarpettai, Tirunelveli, India

**ABSTRACT:** This project aims to revolutionise the traditional visualization experience like 2D drawings by integrating Augmented Reality (AR) technology into Walkthrough experience in construction. The goal is to provide users with a more immersive and interactive way to explore and visualise their dream home before building it. The AR construction walkthrough will leverage smartphone or tablet devices to overlay virtual interior of your home onto the real-world environment captured through the device's camera.

In this project we are going to utilise AR frameworks such as ARKit (iOS) and ARCore (Android) for seamless integration into the mobile application. We are also going to develop markerless AR capabilities to overlay virtual furniture onto the real-world environment captured through the device's camera.

To make the augmented experience more realistic we are also going to create high-quality 3D models of the yet to build home using modelling tools like Blender or 3ds Max to optimise models for real-time rendering on mobile devices, considering performance and visual fidelity.

## I. INTRODUCTION

In later a long time, the development industry has experienced a momentous move within the way
ventures are planned, visualized, and executed, generally impelled by progressions in innovation. Among these mechanical developments, Expanded Reality (AR) stands out as a transformative apparatus with the potential to revolutionize the development handle. By impeccably mixing computerized substance with the physical environment, AR offers development experts colossal openings to improve extend representation, streamline decision-making, and progress generally extend proficiency.

Conventional strategies of venture visualization, regularly dependent on 2D drawings and outlines, have restrictions in passing on spatial data and may lead to misinterpretations among partners. AR innovation addresses these challenges by overlaying virtual components onto the real-world environment in real-time, giving an immersive and intelligently involvement that bridges the crevice between computerized plans and physical spaces.

AR walkthroughs give clients with the opportunity to investigate virtual situations overlaid onto the genuine world, advertising a
one of a kind viewpoint on structural plans, insides formats, and development ventures. Not at all like ordinary strategies of visualization, which regularly depend on inactive pictures or 3D models,

AR walkthroughs offer a energetic and intelligently involvement that locks in the faculties and cultivates more profound spatial understanding.

As AR proceeds to pick up notoriety inside the construction industry, it is basic for experts to get it its capabilities and suggestions completely. By grasping AR innovation, development firms can open unused roads for development, move forward extend results, and eventually rethink the way we construct the world around us.

## II. LITERATURE SURVEY

1] Building Information Modeling (BIM) by S. Azhar, A. Hasan, and F. Ozel: A Novel Approach to Visual Interactive Modeling and Simulation for Construction Projects
In examining Building Information Modeling's (BIM) revolutionary potential in building projects, this study highlights BIM's function as a visual interactive modeling and simulation tool. Through the integration of several data sources

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

into a single digital model, BIM facilitates collaborative exploration of building sequences and design possibilities. The use of BIM to improve decision-making, interdisciplinary coordination, and project visualization is covered in this study. Adoption prospects and challenges
related to BIM are also discussed, emphasizing the significance of further innovation and research in order to realize the full potential of this technology.

[2] Technological Innovations in Wearable and Mobile Computing for Augmented Reality in AEC by J. Teizer, M. König, T. Auberle, & R. Wimmer This article investigates how augmented reality (AR) and mobile and wearable computing technologies are integrating in the architectural, analyzing a number of case studies and implementation methodologies.

[3] T. Hartmann, D. Feigl, and B. Schwald, User-Centered Design of Augmented Reality Visualization Applications for Maintenance and Repair in the Construction Industry The user-centered design of augmented reality (AR) visualization applications for maintenance and repair jobs in the construction industry is examined by Hartmann, Feigl, and Schwald (2015). Their research focuses on developing user-friendly augmented reality solutions in order to improve task performance and efficiency. The study examines real-world applications and emphasizes the value of user input in streamlining AR applications for workflows related to construction maintenance and repair.

[4] Using Augmented and Virtual Reality in Combined Engineering and Construction Projects by P. S. Dunston and Y. Wang The writers examine the integration of virtual and augmented reality technologies in the context of civil engineering and construction in their work "Combining Virtual and Augmented Reality for Engineering and Construction Projects" (Dunston & Wang, 2015). Their study focuses on the ways in which these immersive technologies might work together to improve decision-making, collaboration, and project visualization in the construction sector.

[5] ARISTO: Construction Site Safety Training Application through Augmented Reality, Developed by P. Kalutara, V. Kamat, and A. H. Behzadan engineering, and construction (AEC) sector. It talks about how these technologies can improve decision-making, teamwork, and project visualization. The article focuses on the new uses of augmented reality in AEC as well as the prospects for more study and advancement in this quickly developing area.

[6] Infrastructure and Construction Safety Management Using Real-Time Augmented Reality by M. Lu, K. Chen, & L. Zuo The use of real-time augmented reality (AR) to improve safety precautions in construction environments is examined by the authors of the study "Real-Time Augmented Reality for Infrastructure and Construction Safety Control" (Lu, Chen, & Zuo, 2016). In order to improve safety results and reduce risk in building projects, this study investigates how augmented reality
(AR) technology can deliver real-time visualizations and alarms. This study provides an overview of the potential applications and real-world implementation of AR in construction safety control.

[7] S. Qian, X. Wang, & H. Li, A Review of Augmented Reality Applications in Construction Safety, Qian, Wang, and Li (2019) provide an extensive analysis of augmented reality (AR) applications in construction safety. Their study looks at how augmented reality (AR) technology can be used to improve on-site safety management, danger recognition, and safety training in construction projects. The authors demonstrate how augmented reality (AR) has the potential to enhance safety results and lower workplace accidents in the construction sector by
environments to improve construction workers' safety awareness and behaviours. In order to improve safety outcomes in the construction sector, the article highlights the potential of VR/AR in recreating hazardous scenarios and training workers to identify and minimize safety concerns.

[8] ARISTO, an application for augmented reality (AR)-based construction site safety training, is introduced by Kalutara, Kamat, and Behzadan (2016). In their study, they describe the creation and application of ARISTO, emphasizing how it may improve safety training by offering engaging and immersive learning opportunities in construction sites. The study highlights the importance of ARISTO in fostering a safety culture within the construction industry by discussing how well it works to increase safety awareness and decrease workplace accidents.

[9] A Comprehensive System of Augmented Reality and Building Information Modeling: A Method for Design and Construction Procedures by F. N. Ribeiro, W. Meira Jr., & C. Lima In order to improve the design and construction processes, Ribeiro, Meira Jr., and Lima (2016) suggest an integrated system that combines augmented reality (AR) and

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

building information modeling (BIM). The method for combining AR with BIM is described in their paper, with a focus on how it may enhance decision-making, coordination, and visualization in building projects. The study emphasizes how crucial this integrated system is to improving stakeholder participation and optimizing procedures.

[10] Construction Safety Education through the Use of Virtual and Augmented Reality by Z. Bu, X. Li, Y. Chen, and D. Wu The use of virtual and augmented reality (VR/AR) in construction safety education is examined by Bu, Li, Chen, and Wu (2021). Their study investigates how well VR/AR technology might offer interactive, immersive learning

**Methodology:**
**Existing System:**

**Creation of Assets**
Software for 3D modeling, like Blender, is a popular choice for 3D modeling. providing a multitude of features and tools. Its user-friendly interface makes modeling more efficient and

enables users to sculpt, texture, and animate virtual elements with ease. Blender's wide range of file format support guarantees that it is compatible with AR development platforms, which makes it easier to integrate 3D models into AR settings. They are essential in making AR walkthrough projects more realistic by letting
users explore and engage with virtual worlds that closely resemble their real-world equivalents.
**Integration to Game engine**
Game engine like Unity is integrated .Its integration with AR frameworks like ARCore and ARKit enables seamless incorporation of AR capabilities. Unity's asset creation tools facilitate the import of 3D models and textures, enriching AR environments with realistic content. With digital content overlay to the real world making
tailored to project needs. Unity's cross-platform compatibility ensures widespread accessibility, allowing AR walkthroughs to reach diverse audiences.
**Scripting in Engine**
Unity's scripting capabilities using C# enable developers to implement complex interactions, animations, and user interfaces within AR walkthrough applications. This level of customization empowers developers to tailor the user experience to specific project requirements, whether it involves interactive elements, gamification, or educational content.
**Software Development kit:**
SDKs (Software Development Kits) provide essential tools and libraries for integrating AR
functionality into the application, enabling features such as marker detection, plane detection, and object recognition.provide access to AR services and features, such as cloud anchors, cloud storage, and spatial mapping, enabling advanced AR experiences and
functionalities in the application.

**AR Environment**
The created 3D draft with factors like lighting and realism is imported in Game engines like unity which provides tools and frameworks in building AR applications, followed by Integration of AR frameworks like ARCore and ARKit which makes the Augmented reality experience more interactive
**Proposed System:**

**Selection of Development Platforms:**
The unity game engines have been selected as the right development platform is because they include several frameworks, such as ARKit and ARCore, that allow digital content to be superimposed over the actual environment, producing an engaging and dynamic real-world experience.
**Design of User Interface**
For creating the AR walkthrough application interface, a straightforward yet user-friendly layout that makes use of gestures for interaction, permits modification, provides clear feedback, and promises accessibility for all users is designed.
**Performance Enhancement**
Executing effective optimization to provide smoother tracking, rendering, and operation across a range of devices for the AR walkthrough experience.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

**Compatablity Testing and Feedback:**

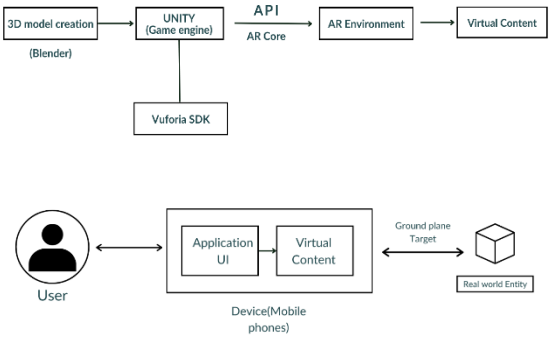
To guarantee cross-platform compatibility and improved tracking and device operation, test the application across a range of hardware and

operating systems. conducting user testing to get input and improve according to user experience and preference.

**Iterative Development:**

To find areas for improvement, the AR tour is iteratively refined by analyzing test results and
user feedback. Based on this information, developers modify the functionality, UI components, and performance. In order to make sure the program satisfies user expectations, a crucial statistic driving incremental improvements is user happiness. Testing and fee-continuous

**Architecture Diagram**




**Experimental result:**

Augmented reality walkthrough systems have the potential to revolutionize building projects by improving efficiency, cooperation, and
visualization. These systems provide real-time
access to project data and user-friendly
interfaces by utilizing augmented reality technology, which helps to improve decision-making and lower mistake rates.

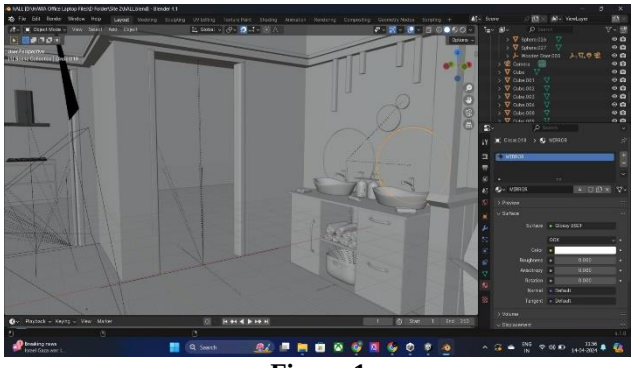


**Figure 1**

The 3D environment is designed in blender to create realistic and more immersive experience to the user.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

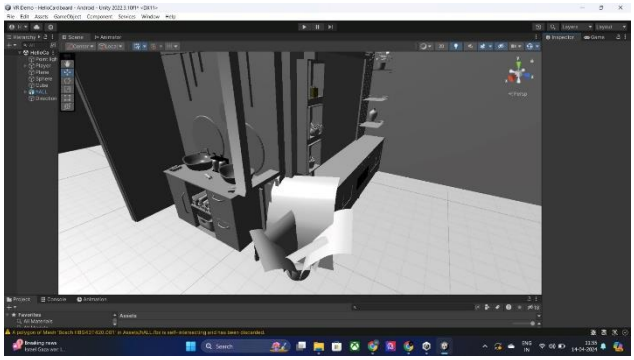


**Figure 2**

The rendered 3D models are integrated to the Game engine to create the Augmented environment.

**Result:**


## Conclusion

The AR interior walkthrough in construction may significantly change how we design, develop,
and oversee interior spaces. Conventional plans and static drawings are replaced with more immersive visualization through the use of augmented reality technology.This initiative has demonstrated its influence on the construction industry by providing extraordinarily dynamic and interactive visualization tools to architects, designers, clients, and contractors. With augmented reality (AR), users may experience all interior environment aspects at scale and in real time, such as lighting, materials, layout, and aesthetics. This level of involvement enhances teamwork and communication while encouraging well-informed decision-making and problem-solving throughout the construction process. With the use of this technology, clients can actively participate in the creative process and view the final product with a level of clarity and detail never previously possible, making for a more intriguing and engaging experience. By bridging the gap between imagination and reality, augmented reality interior walkthroughs help customers feel confident about their investment and make well-informed decisions.

## Future Scope

As we consider the potential applications of AR interior walkthroughs in the construction sector, a plethora of fascinating opportunities come to light. The most exciting of these is the potential for more engagement in the AR environment, which will enable real-time personalization of interior design elements and dynamic lighting simulation. Moreover, by visualizing designs in relation to current infrastructure, merging augmented reality walkthroughs with Building Information Modeling (BIM) data may provide stakeholders with previously unheard-of insights. The

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204089 |

advancement of mobile augmented reality (AR) technology presents a growing opportunity for remote collaboration using smartphones or tablets. This facilitates seamless communication
and decision-making, irrespective of physical location. The use of augmented reality interior walkthroughs goes beyond construction to a variety of sectors, including retail, real estate, and interior design, offering creative solutions catered to their particular requirements.
Combination with Artificial intelligence (AI) algorithms may provide individualized design recommendations based on user interactions and preferences, while Internet of Things (IoT) devices may let users to engage with smart home technology within the AR environment. In order to ensure inclusivity and promote sustainable design practices, accessibility features and environmental sustainability studies further increase the project's potential impact. Fundamentally, the AR interior walkthrough project's future is defined by unending innovation, which is set to transform interior space design, construction, and experience across industries.

## References

[1 ]Duenser, A. and M. Billinghurst (2012). Mixed Reality in the Constructed Space. Applications of Augmented Reality in Architecture and Civil Engineering, S. O. T. Sariyildiz (Ed.), pp. 3-26. IGI Worldwide.
[2] Kamat, V. R., and A. H. Behzadan (2015). Monitoring building progress with interactive augmented reality visualization. Construction Automation, 49, 123–133.
[3]Wang, X., and P. S. Dunston (2017). Applications of Augmented Reality to Construction Engineering Education. 143(1), 04016022, Journal of Professional Issues in Engineering Education and Practice.
[4] Djeffal, A. and Benali, A. (2018). A study of augmented reality applications in civil engineering and construction. 23, 371-398, Journal of Information Technology in Construction (ITcon).
[5] Gu (2017), Singh (2017), and Wang (2017). A Case Study of Mobile Augmented Reality Applications in Built Environment Education for Construction Safety Education. 13(4), 276-293, International Journal of Construction Education.
[6]Wang, X., and S. H. Hsieh (2016). Constructability assessment and architecture design applications of augmented reality. Computer Technology in Construction Journal (ITcon), 21, 47–64.
[7] Shen, L. Y., and Tam, C. M. (2014). Review of Using Augmented Reality in Construction. In the proceedings of the inaugural international conference on additive manufacturing progress (Pro-AM 2014), held in Singapore from March 3–4, 2014 (pp. 21–26). Springer.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details