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Augmented Reality Based Applications - A Smart Survey and Future Direction

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Abstract:

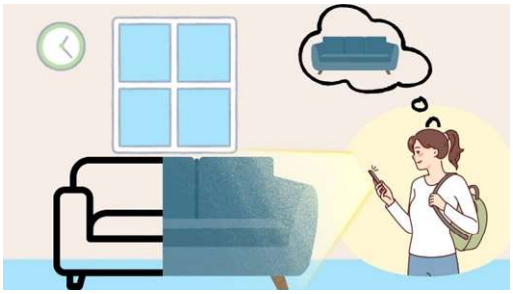
The "Home Decor using Augmented Reality" project explores modern technology's application in interior and home decoration, aiming to develop an app for homeowners and designers. This app facilitates virtual imaging of interior elements, employing machine vision and 3D modeling for realistic placement. Users can experiment with furniture, layouts, and colors without physically modifying their homes, enhancing creative decision-making and saving time and money. The project also prioritizes usability, accessibility, and aesthetic personalization, ensuring an intuitive and inclusive design. Overall, this innovative use of AR streamlines the home decor process, empowering individuals to create their dream homes efficiently and confidently.

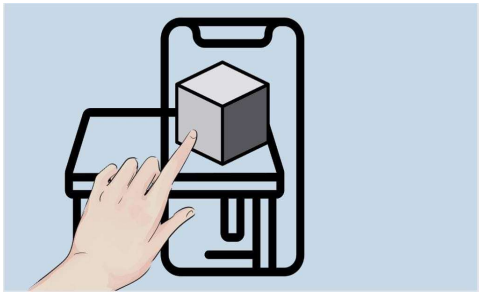
Keywords: Augmented Reality, Artificial Intelligence & MachineLearning, 3D Room Scanning, Virtual Furniture Placement, User centered design.

1. Introduction

The convergence of Artificial Reality with home decor is revolutionizing interior design in our dynamic technological era. Titled "Home Decor using Augmented Reality," this paper explores AR's potential to transform the creative and decision-making aspects of interior design.

Traditionally, home decor has been a subjective reflection of personality, with challenges like imagining the end result and the risk of costly design errors. Augmented Reality addresses these issues by allowing the users to virtually try out designs in their living spaces using smartphones or AR glasses. This project leverages AR's capabilities for a more efficient and cost-effective home decor process, empowering users to make knowledgeable design selections and visualize their





dream homes. The integration of vision and 3D modeling ensures the realistic placement of virtual decor items, while the AR application prioritizes usability, accessibility, and aesthetic personalization. "Home Decor using Augmented Reality" represents a significant advancement in the field, enhancing creativity, decision-making, and efficiency in indoor decoration. With newfound ease, confidence, and efficiency, individuals can embark on a journey to create their dream homes through this innovative application.

Fig. 1.1: Live Home 3D

Fig. 1.2: Markerless AR App

It begins with project planning and requirements gathering, where the goals, target audience and user needs are defined. A conceptual design is then created, emphasizing an immersive and user-friendly experience, including sustainability features. Technical development follows, encompassing computer vision, 3D modeling, AR integration, cross-platform compatibility, and real-time data connectivity. User-centered design and iterative development are central to the process, involving user feedback and usability testing. The integration with e-commerce platforms enables users to visualize and purchase decor items seamlessly. Sustainability features assess the environmental impact of design choices, promoting eco-conscious decisions. Rigorous testing and quality assurance ensure stability and performance. user schooling and documentation help user onboarding. User evaluation, through diverse participant testing, assesses usability, effectiveness, and overall satisfaction. Refinement based on feedback precedes the final deployment of the application. The project's success is evaluated, and a comprehensive report documents the methodology, design, development process, and user feedback. This methodology strives to address current gaps and limitations in this area by creating an innovative, accessible, and sustainable AR solution for home decor, enhancing user experiences, and making interior design more intuitive, cost-effective, and eco-friendly. Augmented Reality within the global of E-commerce reshapes a home decor App for furniture units as the best solution when shopping for online products. This conception of Artificial Reality helps the customer to virtually test the product before purchasing it from the retailer. The authors also talk regarding the AR core and framework system working model. In particular, the article authors have developed a new concept where the customers can see the furniture first hand to help in designing the house.

1.1. AR (Augmented Reality)

It is considered to be a game-changing technology that enhances our physical environment by superimposing virtual items on it, thereby making the experience more lifelike. The merger of the digital and bodily in this example bureaucracy is a road for several programs, starting from gaming and enjoyment to schooling and healthcare, among others. The merger of the digital and bodily in this example bureaucracy is a road for several programs, starting from gaming and enjoyment to schooling and healthcare, among others. The merger of the digital and bodily in this example bureaucracy is a road for several programs, starting from gaming and enjoyment to schooling and healthcare, among others. The merger of the digital and bodily in this example bureaucracy is a road for several programs, starting from gaming and enjoyment to schooling and healthcare, among others. The merger of the digital and bodily in this example bureaucracy is a road for several programs, starting from gaming and enjoyment to schooling and healthcare, among others.

1.2. Artificial Intelligence & Machine Learning

AI and ML are revolutionary aspects of technology. Artificial intelligence includes the designing of computers that can think as humans, perform solving of problems, and make decisions. The implementation of machine studying – a part of AI – is aimed at the development of algorithms enabling computers to gain experience and self-improve without explicit programming. AI ML is changing industries by automating activities, improving efficiencies, and generating knowledge from data. These ethical considerations are required to be put into place since responsible technology should promote positive development for the society.

1.3. 3D Room Scanning

3D room scanning is a cutting-edge technology that employs devices like 3D laser scanners or depth-sensing cameras to capture detailed spatial information. By collecting a multitude of data points and creating a point cloud, this technology enables the precise recreation of physical environments in a digital format. The application is diverse, varying from architecture and design, where it aids in visualizing new elements in existing spaces, to real estate, offering virtual tours for remote exploration. Its accuracy and time efficiency make it valuable in construction, renovation, and industries requiring precise spatial data. In spite of its advantages, challenges like cost and data processing complexity exist. As technology progresses, 3D room scanning is poised to play an increasingly integral role in various fields, reshaping how we interact with and understand physical spaces.

1.4. User Centered Design

Design is user-centered, where it puts the requirements of the users and their experience on top. The essence of this approach lies in creating sympathy towards the end-customers, learning their aims, habits, and problems. UCD involves a cyclical procedure of design, testing and feedback from end users. Active user participation is one aspect that ensures

that the final item speaks to the target audience. They are concerned with usability and accessibility in particular, in trying to make products useful, yet user-friendly while incorporating a wider range of needs in diverse users. Prototyping is important, it allows for quick visualization and testing of design concepts. As such, UCD takes note of the specific environment and scenarios where a product is anticipated to be used, and this approach is referred to as contextualization. The key principles include continuous feedback loop and embrace collaborative approach with user, designer, and developer. It allows flexibility as user needs and technology are ever-changing. Therefore, UCD tries to develop a product that is not only functional but pleasurable for the user.

1.5. Virtual Furniture Placement

Virtual furniture placement revolutionizes interior design by harnessing AR (Augmented Reality) technology. This innovative approach allows users to employ their device's camera to superimpose digital furniture onto their physical space, offering a realistic preview before making any purchase commitments. This interactive experience goes beyond visualization, enabling users to manipulate and experiment with different furniture arrangements. Online furniture retailers integrate these tools, enhancing the virtual shopping experience and aiding customers in making informed decisions. Beyond aesthetics, virtual furniture placement serves as a valuable space planning tool, optimizing room layouts for both functionality and style. The time and cost savings, coupled with the ability to avoid design mishaps, make it an invaluable resource for DIY home improvement enthusiasts. In essence, virtual furniture placement is a transformative technology, seamlessly blending the digital and physical worlds to redefine how we approach interior design.

2. Literature Review

We highlighted a few of the articles and also went through surveys that are accessible right now on Augmented Reality based Applications. Kadam et al. [2] explores an artificial reality home decor app that enables users to visualize furniture in their space via a mobile camera. It surpasses store limitations and can also integrate with AI for an enhanced user experience. Samant et al. [3] emphasizing tracking module analysis, use case diagrams, and AR benefits in streamlining assembly processes. It particularly pays attention on the second AR implementation method, which involves updating camera poses through 3-Dimensional reconstruction of unknown scenes.

Poudel et al. [5] allows users to visualize and relate with furniture in a 3-Dimensional space through their smartphones. The project aims to render a range of models and enhance user interaction with intuitive gestures. Kurtic et al. [6] presenting a new algorithm for automated, personalized furniture configurations. This algorithm integrates with mobile AR system, creating an interactive interior design try-out tool.

Gurcinar et al. [7] highlights AR's positive influence on spatial perception and space arrangement skills in the research of indoor designing. However, it records the want for extra training time in technology understanding, and findings on motivation and creativity remain inconclusive. Hui et al. [8] explores AR and AR3D interior models, advocating their creation through hardware, software, and mathematical methods. It concludes that AR is the future of interior design, streamlining collaboration between designers and consumers.

Syahputra et al. [9] introduces an AR (augmented reality) system employing SLAM (simultaneous localization and mapping) for furniture placement planning in a room. It details the markerless technique, application views, and implementation. The paper includes a general architecture diagram and an activity diagram to illustrate the application system's activity.

Krichenbauer et al. [11] compares AR and VR input devices in diminished reality, examining if AR excels in 3D tasks. It outlines methodology and questions how environmental complexity affects user engagement and task performance. Vittayakorn [12] suggests an AR (Augmented Reality) system for personalized furniture layout design, which allows users to physically arrange furniture in limited space. It assesses the system's performance and compares it with a leading commercial application SidraNasir et al. [14] examines an AR designing tool for designers and also architects, utilizing various methods of data collection. The user-friendly software aims to enhance satisfaction by bridging the gap between industrial companies and customers.

Kumar et al. [16] highlights AR's impact on image processing and tracking, revealing concealed details and converting 2D images into 3D objects. It also addresses minimizing errors between image and rendered graphics landmarks. Jansen et.al. [17] involved reviewing 35 open-access articles to gain insights into AR's features and limitations, aiming to analyze its role in planning while highlighting strengths and weaknesses.

Pasinetti et al. [19] reported results from testing on a Sawyer robot, highlighting the advantages of a vision-based interface for human-robot collaboration and outlining future development plans. Bhanu et al. [20] integrating AR technology enhances risk communication, improving performance, accuracy, and reducing task completion time, errors, and workload. The conclusion discusses findings and future research opportunities. Manuri et al. [21] highlights AR benefits in cost reduction, accuracy improvement, and enhanced user experience. It also addresses challenges and outlines future directions for AR in the industry. Feuchtner et al. [22] investigates AR awareness cues for remote assistance, finding that Virtual Hand + Color Cue outperformed other combinations in overall performance and user desire. The authors aim to contribute insights for future remote assistance design.

Kunitsky et al. [24] study reports constructive feedbacks from trainees and trainers on the easy setup and usability of the technology, with acceptable visual quality in the majority of cases. Romalee et al. [25] indicates a significant increase in participants' knowledge and self-efficacy, though suggesting improvements in the execution of the MAR system for future investigations. Ronaghi et al. [26] emphasize the crucial role of evaluating AR utilization, particularly at the Persepolis site, in shaping the tourism industry.

Iqbal et al. [27] integrates AR into robotic-assisted orthopedic surgery, emphasizing a valuable, strain-free workflow. Participants praised its intuitiveness and user-friendliness, offering insights for future research. Jiang et al. [28] published in an unspecified journal, the research automates adjacent tooth preparation with a robotic algorithm, demonstrating its viability and accuracy in

dental procedures. Kulkov et al. [29] analyzes design themes and elements of VR/AR applications across four key medical areas, concluding with reflections on study limitations and suggestions for future research.

Table 1: Referenced Papers

Title	**Journal**	**Published Year**	**Take away**
Inter AR: Interior décor Application using Augmented Reality Technology	Fifth International Conference: Cyber Security & Privacy	2019	Moares et al. [1] research provided interior designers by proposing a marker-less AR solution for home design based on colour, scale, and proportion principles.
USER-CENTERED DESIGN OF AUGMENTED REALITY INTERIOR DESIGN SERVICE	Journal: Arts and Sciences	2013	Siltanen et al. [4] investigates user groups' mindsets and surveys attitudes towards social platforms and design sharing, highlighting distinctions in perspectives between pro-users and consumers.
Design AR: Portable Projection-based AR system specialized in interior design	International Conference on Systems under IEEE	2017	Park et al. [10] suggests a user-oriented, portable pan-tilt projection-based AR (Augmented Reality) system for realistic interior design. It employs the projection-based AR technique along with its GUI for efficient prototype indoor design. The study outlines the methodology, algorithm, and usability evaluation scenario, along with the results.
Augmented Reality for 3D House Design Visualization	International Conference: Electrical Engineering and Informatics	2020	Auliaramadani et al. [13] suggests an app for visualizing 3D house designs from floorplan images using server-side deep learning. It enhances user engagement with a user-friendly approach.

from Floorplan Image			
An AR based Learning App	Recent Technology and Engineering	2021	Kannammal et al. [15] introduces an AR learning app showcasing detailed information & 3D models of human interior organs. Using special markers, it visually displays information and allows students to explore 3D organ models with interior parts, enhancing knowledge and memory.
Augmented reality for innovation: Education and analysis of the glacial retreat of the Peruvian Andean snow-capped mountains	Open Innovation: Technology, Market, and Complexity	2023	Paulini et al. [18] explored the glacial retreat of Peruvian Andean snow-capped mountains, assessing its impact on regional water supply. The research is deemed significant for future ICT-based environmental projects.
A Survey of Augmented Reality Technologies, Applications and Limitations	Journal of Virtual Reality	2010	Poelman et al. [23] provides a comprehensive view of Artificial Reality, detailing its definition, history, technologies, applications, and limitations, particularly in human factors. It concludes that despite immense potential, overcoming specific challenges is important for maximizing AR benefits.
Automated multiclass structural damage detection and quantification using augmented reality	Journal of Infrastructure Intelligence and Resilience 2	2023	Awadallah et al. [30] integrates human-sensor interaction and AI for automated structural damage detection, showing promising results indoors and outdoors, shaping the future of SHM.

3. Conclusion

In conclusion, the "Home Decor using Augmented Reality" project represents a significant step forward in the domain of interior design and home decor. This innovative AR application has successfully addressed numerous objections and drawbacks in the field, offering a range of benefits to users, including enhanced decision-making, improved user experience, and sustainability considerations.

The improvement of a feature-wealthy AR software program software has delivered the energy of virtual decor visualization to customers' fingertips. By seamlessly overlaying virtual furniture, decor items, and color schemes onto their physical living spaces, users can experiment with design options, significantly reducing the risk of costly mistakes. This newfound capability has empowered users to make more informed and confident design choices.

User evaluations have underscored the application's success in delivering an engaging and informative experience. Users expressed a high level of satisfaction with the interactive features and real-time feedback, making the home decor process not only more accessible to the customers but also enjoyable.

The project's commitment to sustainability is also commendable. The application's ability to assess the environmental impact of design choices and provide eco-friendly alternatives aligns with the growing interest in sustainable living practices, contributing to more responsible interior design decisions.

In essence, the "Home Decor using Augmented Reality" project has ushered in a brand-new generation of interior design, where creativity, informed decision-making, sustainability, and user-centric technology converge. It offers a promising future for the home decor industry, making the creation of dream homes more accessible, enjoyable, and responsible. It will undoubtedly play an increasingly pivotal role in shaping the way we design and personalize our living spaces.

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