**Research Paper on “How Augmented Reality Is Utilized In Furniture Industry”**

1: Enhancing E-commerce furniture shopping with AR and AI-driven 3D modeling

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### Literature Review:

The integration of augmented reality (AR) and AI-driven 3D modeling into e-commerce platforms is a growing field of study, with the potential to transform online shopping experiences, especially in industries like furniture retail. Previous research has highlighted the value of AR in allowing customers to visualize products in their own environment, addressing one of the key limitations of online shopping: the inability to physically interact with items. Machine learning algorithms, such as Scale-Invariant Feature Transform (SIFT), have been instrumental in generating detailed 3D models, enhancing the precision of visual representations.

While 3D modeling has been widely explored in various industries, its specific application in e-commerce furniture shopping is relatively new. Studies suggest that AI-driven dynamic pricing tools, powered by web scraping, can offer competitive advantages for sellers by ensuring that prices reflect market trends in real time. Combining this with AR-enabled features allows customers not only to visualize products but also to make more informed purchasing decisions based on accurate price comparisons.

However, a major challenge for e-commerce platforms remains the creation and management of high-quality 3D models. Existing literature points to the importance of large, accessible datasets like ShapeNet for sourcing 3D models, although customizing these models for specific products is often required. By leveraging both AR and AI, platforms can optimize the user experience, potentially increasing sales and customer satisfaction. This research aims to build upon these findings by proposing a streamlined solution for integrating AI-driven 3D modeling and AR within e-commerce furniture portals, further improving user engagement and shopping efficiency.

Reference:

Saeed, A., Zahoor, A., Husnain, A., & Gondal, R. M. (2024). Enhancing e-commerce furniture shopping with AR and AI-driven 3D modeling. International Journal of Science and Research Archive, 12(2), 40-46. <https://doi.org/10.30574/ijsra.2024.12.2.1114>

2: Development of Augmented Reality Application for Made-to-Order Furniture Industry in Pampanga, Philippines

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### Literature Review:

Augmented reality (AR) has become increasingly influential in enhancing customer experiences across various industries, including retail. Previous research suggests that AR technologies, particularly marker-based AR, have been successfully integrated into retail environments to allow customers to interact with virtual models of products in real-world settings. However, the use of marker-less AR, which doesn't rely on physical markers to project virtual objects, represents a more user-friendly and adaptable approach, particularly relevant for customized products like made-to-order furniture.

Existing literature emphasizes the value of AR in improving customer engagement by offering visual and interactive experiences that bridge the gap between online and in-store shopping. In the made-to-order furniture industry, AR can simplify the visualization of custom furniture pieces, allowing customers to see how these products would fit into their specific spaces before making a purchase. This capability reduces uncertainty and enhances decision-making.

Previous studies also suggest that mobile applications featuring AR improve accessibility, allowing customers to visualize products directly from their mobile devices without needing specialized equipment. The literature also underscores the importance of user-centric design, with stakeholder feedback playing a critical role in shaping AR applications to meet both business needs and customer preferences.

This study builds upon these findings by developing a marker-less AR mobile application tailored to the needs of the made-to-order furniture industry in Pampanga, Philippines. It aims to address the industry's need for customizable visual experiences, offering customers and business owners a practical tool that enhances the furniture-buying process.

Reference: Yambao, J. A., Miranda, J. P., & Pelayo, E. L. B. (2022). Development of augmented reality application for made-to-order furniture industry in Pampanga, Philippines. International Journal of Computing Sciences Research, 6, 1-11. <https://doi.org/10.25147/ijcsr.2017.001.1.112>

3: Augmented Reality in Retail: Metrics in the Furniture Department.

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### Publication Date:

* 2024 (Vol 51, Issue 8)

### Literature Review:

The use of augmented reality (AR) in retail, particularly in the furniture sector, has been widely acknowledged for its ability to enhance consumer experiences and improve business outcomes. Prior research has demonstrated how AR can bridge the gap between online and physical retail by enabling customers to visualize products in their real-world environment, leading to more informed purchasing decisions. This technology not only improves customer satisfaction but also helps retailers by reducing product return rates, a common issue in the furniture industry where sizing and fitment uncertainties frequently arise.

The study emphasizes the importance of proof of concept (POC) in obtaining buy-in from business managers before deploying AR solutions. Earlier literature suggests that AR POCs often utilize tools like storyboards to convey potential benefits, such as increased sales and operational efficiency, allowing stakeholders to visualize the business impact before full-scale implementation. Moreover, metrics for evaluating the quality and performance of 3D model suppliers are critical in ensuring that AR solutions deliver realistic and accurate representations of furniture.

This research builds on the foundation of previous work by focusing on the practical development of AR platforms, specifically through Google’s ARCore technology. The internal development of such platforms offers insights into the technical challenges and solutions faced when integrating AR into retail systems. The study contributes to the growing body of literature on AR by highlighting key metrics and business applications that can drive consumer engagement and improve sales in the furniture retail sector.

Reference:

Leal-Enríquez, E., & Gutiérrez-Antúnez, A. R. (2024). Augmented reality in retail: Metrics in the furniture department. IAENG International Journal of Computer Science.

4: The design and implementation of an interactive mobile Augmented Reality application for an improved furniture shopping experience

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### Publication Date:

* 2021 (Vol. 31, No. 3)

### Literature Review:

The traditional method of furniture shopping, involving multiple store visits and considerable time spent comparing products, has long been considered inefficient. Augmented reality (AR) technologies have emerged as a solution to this challenge by offering consumers the ability to visualize furniture items in their own space before purchasing. Previous research on AR in retail has highlighted its ability to improve customer engagement, satisfaction, and decision-making by enabling immersive shopping experiences. Mobile applications featuring AR have also gained traction, especially in industries where product visualization is critical, such as furniture retail.

The literature on AR applications in furniture shopping suggests that integrating AR with mobile platforms can reduce uncertainties related to size, color, and fit. This technology addresses one of the key issues customers face when buying furniture online or in-store—ensuring that the selected items will match their existing decor and space.

This study builds on these existing findings by designing an AR-based mobile application that enhances the user experience in furniture shopping. By using the Vuforia platform, the authors have created a system that allows users to interact with both the virtual and physical environment, testing furniture items from different stores in real time. The study also follows a structured development approach, adhering to the waterfall software engineering model, which ensures that all aspects of the application are systematically designed, implemented, and tested.

The results confirm that the application effectively improves the furniture shopping experience, and comparisons with related work suggest that further advancements, such as incorporating AI-based shopping assistants or machine learning-based recommender systems, could enhance its usability and personalization in future iterations. This research contributes to the growing body of literature on AR in e-commerce, particularly in the context of furniture retail.

Reference: Alharbi, B., Aljojo, N., Alshutayri, A., & Alshehri, M. (2021). The design and implementation of an interactive mobile augmented reality application for an improved furniture shopping experience. Revista Română de Informatică și Automatică, 31(3), 69-80. <https://doi.org/10.33436/v31i3y202106>

5: Bridging the gap: integrating AR and VR production line training to enhance furniture carpentry students’ understanding of production processes

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### Publication Date:

* Received: October 9, 2023
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### Literature Review:

Furniture production education traditionally relies on hands-on learning, but many schools face challenges such as limited space, resources, and access to large-scale manufacturing equipment. This restricts students' ability to fully engage with real-world furniture production processes, resulting in a theoretical understanding but a lack of practical experience. Previous studies highlight that immersive technologies like Augmented Reality (AR) and Virtual Reality (VR) offer new pathways for education by allowing students to simulate real-world environments and processes without the need for physical resources.

AR has been used in various technical training environments to visualize complex processes, and VR has enhanced immersive learning experiences, particularly in fields like carpentry, engineering, and manufacturing. Prior research suggests that the integration of AR and VR can bridge the gap between theoretical knowledge and practical application, especially in industries like furniture production, where understanding large-scale processes is critical.

This study builds upon existing literature by focusing on a dual AR and VR approach for teaching furniture carpentry students in Taiwan. AR helps students navigate miniaturized production stages, offering a more practical grasp of semi-automated processes, while VR immerses them in large-scale production environments similar to those found in overseas facilities. The experimental results, which compare AR and VR-based learning with traditional methods, demonstrate that students exposed to the mixed-reality approach gained a more comprehensive understanding of the furniture production process. This approach not only improves their adaptability to various manufacturing environments but also equips them with skills essential for future employment in the furniture industry.

In conclusion, AR and VR integration has the potential to revolutionize technical training in furniture carpentry, enhancing both the depth and scope of students' understanding of complex production processes.

Reference: Lee, I.-J., & Lin, Y.-T. (2024). Bridging the gap: Integrating AR and VR production line training to enhance furniture carpentry students’ understanding of production processes. Journal of Technology Education, May 2024. <https://doi.org/10.1080/10494820.2024.2351178>

6: Augmented Reality Versus Web-Based Shopping: How Does AR Improve User Experience and Online Purchase Intention

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### Publication Date:

* 2024

### Literature Review:

Augmented Reality (AR) has gained significant attention in e-commerce due to its ability to enhance user interaction by allowing users to visualize virtual products in their real-world environment before making a purchase. Previous research has extensively explored AR's potential in improving online shopping experiences by making the process more interactive, engaging, and personalized. AR helps bridge the gap between physical and digital shopping by offering a more immersive experience, which is particularly beneficial for industries such as furniture, where seeing how a product fits in the customer's physical space can be crucial.

This study focuses on the comparison between AR-based shopping and traditional web-based shopping, examining six key AR attributes: interactivity, information, enjoyment, novelty, vividness, and intrusiveness. Prior literature indicates that AR enhances consumer engagement and increases purchase intention by offering more vivid and novel experiences compared to standard online shopping methods. However, intrusiveness, such as technical issues or complex interfaces, has been found to negatively affect user experience.

By applying structured equation modeling and multi-group analysis techniques, the authors contribute to the growing body of work on AR by comparing the user experience and purchase intention of individuals who used AR (via IKEA Place app) versus a web-based mode (via the IKEA website). The study's results confirm the hypothesis that AR's interactivity and novelty significantly improve user experience and online purchase intention, while intrusiveness can detract from these positive effects.

The research is particularly valuable because it was conducted in a developing country, where consumer behavior and technology adoption may differ from more developed markets. This context provides fresh insights into how AR can be practically implemented by retailers to improve user experience and drive purchase intentions in such regions.

### Does the Article Talk About Furniture AR?

Yes, the article does mention AR in the context of furniture, as it evaluates participants using IKEA’s AR app (IKEA Place) to visualize furniture in their physical spaces. This suggests a focus on furniture-related AR technology to enhance online shopping experiences.

Reference:

Zare Ebrahimabad, F., Yazdani, H., Hakim, A., & Asarian, M. (2024). Augmented Reality versus web-based shopping: How does AR improve user experience and online purchase intention? Telematics and Informatics Reports, 15, 100152. <https://doi.org/10.1016/j.telinf.2024.100152>

7: Furnished: An Augmented Reality based Approach Towards Furniture Shopping

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**Publication Date:**

* May 2021 (Vol. 10, Issue 05, IJERT)

**Literature Review:**

The integration of Augmented Reality (AR) in the e-commerce industry has lagged behind other sectors, despite its potential to transform user experiences. Historically, AR has been leveraged primarily in the entertainment industry through applications like Snapchat and Pokémon Go, providing users with immersive experiences. However, AR's commercial applications—especially in business sectors like retail—have remained largely untapped. This is a missed opportunity, particularly in the furniture industry, where consumers would greatly benefit from the ability to visualize products in their physical spaces before making a purchase.

Previous studies have indicated that AR in retail can bridge the gap between physical and online shopping by offering users a more tangible and interactive shopping experience. Users can visualize products in their real environments, reducing uncertainty and increasing confidence in their purchases. However, the technology's underutilization may be due to a lack of user-friendly platforms and tools tailored to everyday consumers, especially in traditional shopping experiences.

The **"Furnished"** application discussed in this study seeks to address this gap by creating an AR-based furniture shopping platform. The goal is to provide a comfortable, easy-to-use AR experience for consumers, encouraging the adoption of AR as a utility in daily life, particularly in traditional sectors like furniture shopping. By utilizing Google's ARCore and Android technology, the application enables users to virtually place furniture items in their home environment, helping them make better-informed decisions regarding color, size, and overall fit before purchasing.

The literature also suggests that AR in furniture shopping can significantly reduce the gap between consumer expectations and product reality, thereby improving customer satisfaction and reducing return rates. Future research could focus on enhancing the accessibility and affordability of AR technologies in the retail sector to ensure a wider adoption.

In conclusion, AR has the potential to revolutionize e-commerce, particularly in the furniture industry, by offering an interactive, immersive, and visually enriched shopping experience.

Reference:

Dhavle, S. N., Qais, C. M., Arora, B., & Tabarakallah, K. M. S. (2021). Furnished: An augmented reality-based approach towards furniture shopping. International Journal of Engineering Research & Technology (IJERT), 10(05), 253. <http://www.ijert.org/papers/ijertv10is050253.pdf>

8: Augmented Reality based Furniture Application

### Author Names:

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* S. Pothumani

### Publication Date:

* May 2023

### Literature Review:

Augmented Reality (AR) has emerged as a powerful tool to enhance online furniture shopping, particularly by addressing the challenges associated with visualizing products in real-world environments. One of the main issues in the online furniture sector is that customers often struggle to ensure the furniture's model, size, and color fit well in the space where it will be placed. This challenge significantly affects consumer confidence and increases return rates.

Past research emphasizes that AR can bridge this gap by allowing customers to virtually place 3D models of furniture in their actual environments, offering a more realistic view of how the items would look and fit. Applications leveraging AR in the furniture industry focus on user interaction, enabling customers to explore product customization in terms of size, style, and material before purchase. This technology improves customer satisfaction, as it provides an accurate preview of the product's suitability within their home or office setting.

The study presented by Gubbala et al. builds on this foundation by proposing an AR-based furniture application using **Google AR** technology. This application aims to solve the core problems of online furniture sales by incorporating features such as 3D product visualization, dynamic pricing tools, and enhanced rendering techniques. The application development process utilizes **Android Studio** and Google's AR services to deliver an interactive platform that addresses the specific needs of online furniture consumers.

Existing literature in the field suggests that AR has the potential to significantly transform the e-commerce furniture landscape by providing users with a richer, more interactive shopping experience. Similar applications have been shown to increase customer engagement and reduce decision-making time by providing more accurate, real-time previews of furniture products in their intended spaces.

The study also highlights potential areas for improvement in AR-based furniture applications, such as better surface detection (for ceilings and walls), integration of barcode or QR code scanning, and optimization of 3D models to ensure they fit the space accurately. These advancements would further refine the user experience and performance of the AR application, making it an indispensable tool in the future of online furniture shopping.

In conclusion, the adoption of AR in online furniture retail enhances product visualization and customization, making it easier for customers to make informed purchase decisions. The research by Gubbala et al. builds on this premise and proposes future developments that could make AR technology more versatile and accurate in furniture shopping applications.

Reference:

Gubbala, S., Alti, D. N., Srividhya, S., & Pothumani, S. (2023). Augmented reality based furniture application. In 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC) (pp. 1-5). IEEE. <https://doi.org/10.1109/ICAAIC56838.2023.10140655>

9: How AR Technology is Changing Consumer Shopping Habits: from Traditional Retail to Virtual Fitting

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### Publication Date:

* 2024

### Literature Review:

The rise of **Augmented Reality (AR)** technology has significantly influenced the retail landscape, driving a transformation in consumer shopping habits from traditional in-store experiences to virtual environments. The literature on **AR** in retail emphasizes its potential to bridge the gap between the tangible and intangible aspects of online shopping, offering users an immersive and interactive experience similar to what they would encounter in physical stores.

In the broader context of **e-commerce**, one of the main drawbacks for consumers is the inability to physically examine and try on products before making a purchase, which has led to customer hesitation and higher product return rates. Researchers have explored how **AR** mitigates this issue by enabling virtual try-on features, where customers can visualize how a product—such as furniture or clothing—would look in their own space or on themselves before making a decision. Studies have consistently shown that **AR** increases consumer engagement, enhances decision-making, and boosts overall satisfaction with online shopping.

**AR** is particularly impactful in sectors like **custom furniture**, where customers need precise visualizations of products within their homes or offices. **Virtual reality (VR)** shopping experiences, such as PaRUS, further extend this engagement, allowing for a more holistic interaction by immersing customers in a fully virtual store setting. These technologies provide not only visualization but also customization options, which are crucial for personalized shopping experiences. Such advancements have been embraced by tech-forward retailers looking to innovate customer interaction.

Additionally, AR is being explored for its potential to improve **accessibility**, particularly for individuals with visual impairments. Research highlights how **AR** technologies, in conjunction with recommender systems, can support individuals in making informed purchase decisions through features like enhanced product descriptions, tactile feedback, and visual overlays.

Several studies in this field point out the positive effects of **AR** on consumer behavior, noting improvements in user engagement, trust, and purchase intention. The interactive nature of AR can create more informed consumers by providing comprehensive product information in an intuitive, visually rich manner. These findings suggest that **AR** can play a pivotal role in transforming the future of online retail.

The paper by **Ran Liu, Balamuralithara Balakrishnan, and Erni Marlina Saari** builds upon these established insights, analyzing case studies that demonstrate **AR's** effectiveness in improving the online shopping experience. It also identifies gaps in the current research, proposing future studies that explore advanced **recommender agents**, further **accessibility improvements**, and deeper integration of **VR shopping** with **AR capabilities**.

Overall, the literature underscores **AR** as a tool that not only enhances the online retail environment but also serves as a critical innovation for the future of **consumer behavior** and **e-commerce** development.

Reference: Liu, R., Balakrishnan, B., & Erni Marlina Saari. (2024). How AR Technology is Changing Consumer Shopping Habits: from Traditional Retail to Virtual Fitting. *Academic Journal of Science and Technology*, *9*(2), 140-144. <https://doi.org/10.54097/n5fk7m44>

10: Augmented Reality System in Furniture Sales Management Simulation in Vietnam.

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### Publication Date:

* July 26, 2024

### Literature Review:

The application of **Augmented Reality (AR)** in furniture sales has gained attention for enhancing customer engagement by allowing users to visualize products in their own space. **AR** helps bridge the gap between traditional shopping challenges, such as determining a product’s fit, and offers "try-before-you-buy" solutions. This reduces uncertainty and product return rates, providing a more informed purchase experience.

In **sales management simulations**, **AR** aids both customers and businesses, facilitating inventory management and product customization. The integration of advanced technologies like **NeRF (Neural Radiance Fields)** allows for realistic, dynamic 3D models, enhancing user interaction and product visualization. This research, focusing on Vietnam, highlights the potential of **AR** and **NeRF** in improving customer satisfaction and sales processes. It aligns with existing literature and pushes the boundaries of virtual furniture shopping experiences, setting a foundation for future research.

Reference:

Le, T. D., Tran, K. T., Nguyen, D. P., Quach, K. V., Le, L. T. T., & Quach, L.-D. (2024). Augmented reality system in furniture sales management simulation in Vietnam. In ICIIT '24: Proceedings of the 2024 9th International Conference on Intelligent Information Technology (pp. 460-466). <https://doi.org/10.1145/3654522.3654591>

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