Augmented Reality Furniture Visualization

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***Abstract*—This research paper explores the implementation of an augmented reality (AR) project designed to seamlessly integrate furniture models into real-world environments. The project utilizes .GLB model files created using Blender, a popular open-source 3D computer graphics software, and employs Meta Spark Studio for development, with a focus on user interface (UI) interaction for selecting furniture models. Challenges encountered in accurate plane tracking within Meta Spark Studio led to the exploration of an alternative implementation using Lens Studio, albeit with modified interaction functionality. This paper delves into the methodology, technical implementation details, challenges faced, and solutions devised during the development process.**

***Index Terms*—Augmented Reality, Furniture Placement, Meta Spark Studio, Lens Studio, .GLB Model Files, Blender**

I. Introduction

Augmented Reality (AR) technology has witnessed significant advancements in recent years, enabling immersive and interactive experiences in various domains, including gaming, education, and interior design. One promising application of AR is in furniture placement, where users can visualize how furniture items would look and fit in their real-world environment before making a purchase. This capability can enhance the furniture shopping experience and reduce the risk of buyer's remorse, ultimately leading to increased customer satisfaction and reduced return rates.

The ability to visualize furniture in a real-world context is particularly valuable for online furniture retailers, as it allows customers to overcome the limitations of traditional 2D product images. By integrating AR technology, customers can place virtual furniture models in their living spaces, evaluate their size, color, and style compatibility, and make more informed purchasing decisions.

This paper presents an augmented reality project aimed at enhancing the furniture shopping experience by seamlessly integrating virtual furniture models into the real world. The project utilizes .GLB model files, a widely-used format for 3D assets in AR and virtual reality (VR) applications, created using Blender, an open-source 3D computer graphics software. The development process employs popular platforms such as Meta Spark Studio and Lens Studio.

II. Literature Review

The literature review explores existing research and development efforts in the field of augmented reality furniture placement. Several studies have investigated the use of AR technology to visualize furniture in real-world settings, with platforms like Meta Spark Studio and Lens Studio emerging as popular choices for development.

One of the key challenges identified in previous research is the accurate tracking of planes and surfaces in the real-world environment. Precise plane tracking is crucial for ensuring that virtual furniture models are accurately placed and scaled within the user's space. Various techniques, such as simultaneous localization and mapping (SLAM) and planar surface detection, have been explored to address this challenge.

User interface design is another critical aspect that has been studied in AR furniture placement applications. Intuitive and user-friendly interfaces are essential for enabling seamless interaction with virtual furniture models, including selection, placement, rotation, and scaling. Previous research has investigated different interaction modalities, such as gesture-based controls, voice commands, and traditional input methods like touchscreens and controllers.

These insights from existing literature provide valuable guidance for the implementation of our augmented reality furniture placement project, highlighting the importance of accurate plane tracking and user-friendly interaction design.

III. Methodology

A. Implementation Details

The implementation involved utilizing .GLB model files created using Blender, an open-source 3D computer graphics software. Meta Spark Studio and Lens Studio were employed for development, with a focus on user interface (UI) interaction for selecting furniture models.

1. .GLB Model Files from Blender: Blender, a popular open-source 3D computer graphics software, was used to create .GLB model files. These files contain 3D representations of the furniture items that users would visualize in the AR environment. Blender offers a wide range of tools for modeling, texturing, and animating 3D objects, making it suitable for creating realistic furniture models.

2. Development Platforms: Two main development platforms were utilized: Meta Spark Studio and Lens Studio. Meta Spark Studio is known for its intuitive interface and is widely used for developing AR experiences, particularly for devices like the Meta Quest. Lens Studio, on the other hand, is developed by Snap Inc. and is primarily used for creating AR experiences for the Snapchat platform.

B. Tools and Software Used

The project utilized Blender for 3D modeling, Meta Spark Studio for initial development, and Lens Studio for an alternative implementation.

1.Blender: Blender is a versatile open-source 3D computer graphics software used for modeling, texturing, rigging, animation, simulation, rendering, compositing, and motion tracking. It was utilized for creating detailed and realistic furniture models in .GLB format.

2.Meta Spark Studio: Meta Spark Studio provides a user-friendly interface for developing AR experiences. It was initially used for development, focusing on UI interaction and functionality.

3.Lens Studio: Lens Studio, developed by Snap Inc., was explored as an alternative due to challenges encountered with Meta Spark Studio. It provided improved plane tracking capabilities, albeit with constraints in interaction design and UI customization.

C. Challenges Faced

Accurate plane tracking within Meta Spark Studio posed a significant challenge, leading to the exploration of an alternative implementation using Lens Studio.

1. Accurate Plane Tracking: Achieving accurate plane tracking within Meta Spark Studio was challenging. Inaccurate tracking can lead to virtual objects appearing misaligned or floating, detracting from the immersive experience.

2. Surface Detection: Surface detection, closely related to plane tracking, refers to the ability to identify and analyze surfaces in the real-world environment accurately. Challenges in surface detection can arise from factors such as environmental complexity, lighting conditions, and reflective surfaces.

3. Interaction Design: Developing intuitive user interfaces for selecting, placing, and interacting with virtual furniture models presented challenges. Balancing functionality with simplicity was crucial to creating a user-friendly AR experience.

4. Compatibility and Optimization: Ensuring compatibility and optimization across different devices and platforms posed additional challenges. AR applications must run smoothly on a variety of hardware configurations, from smartphones to dedicated AR headsets.

IV. Results

The results section presents the outcomes of the augmented reality project implementation. We evaluated the performance of both Meta Spark Studio and Lens Studio in accurately placing furniture models in various real-world environments.

In the case of Meta Spark Studio, despite its powerful features and intuitive UI design, the accurate placement of furniture models proved challenging due to limitations in plane tracking and surface detection. While the application was functional and allowed users to select and place furniture models, the alignment and scaling of the virtual objects within the real-world environment were often inconsistent or inaccurate.

On the other hand, Lens Studio demonstrated improved performance in terms of accurate plane tracking and surface detection. The alternative approach employed by Lens Studio enabled more precise alignment and scaling of virtual furniture models within the user's physical space. However, we encountered limitations in terms of interaction design and UI customization within Lens Studio, as it was primarily designed for creating AR experiences for the Snapchat platform.

User feedback and usability testing were conducted to assess the effectiveness and user satisfaction of the AR applications developed in both platforms. While users appreciated the overall concept and functionality of visualizing furniture in their real-world environments, they highlighted the importance of accurate placement and alignment for making informed purchasing decisions.

The results demonstrate the potential of augmented reality technology in enhancing the furniture shopping experience and provide insights for future development. They highlight the need for robust plane tracking and surface detection algorithms, as well as user-friendly interaction design, to ensure a seamless and intuitive experience for users.

V. Discussion

The discussion section analyzes the findings from the results and discusses their implications for augmented reality furniture placement applications. We compare the strengths and limitations of Meta Spark Studio and Lens Studio, highlighting the importance of accurate plane tracking and user-friendly interaction design.

Meta Spark Studio offered a powerful and intuitive development environment, with a wide range of tools and features for creating immersive AR experiences. Its visual scripting interface and robust community support made it a compelling choice for our project. However, the challenges we encountered with accurate plane tracking and surface detection within Meta Spark Studio proved to be a significant limitation, hindering the precise placement of virtual furniture models in real-world environments.

Lens Studio, on the other hand, demonstrated improved performance in terms of accurate plane tracking and surface detection. The alternative approach employed by Lens Studio enabled more precise alignment and scaling of virtual furniture models within the user's physical space. This accuracy is crucial for providing a realistic and reliable visualization experience to users, enabling them to make informed decisions about furniture purchases.

However, Lens Studio's primary focus on creating AR experiences for the Snapchat platform posed limitations in terms of interaction design and UI customization. While we were able to adapt the UI and interaction methods to accommodate the furniture placement functionality, the constraints of the platform restricted our ability to create a fully tailored and optimized user experience.

Considering the creation of virtual furniture models using Blender, an open-source 3D computer graphics software, our project benefited from the flexibility and control offered by this

powerful tool. Blender allowed us to design and model highly detailed and realistic furniture models, accurately representing their real-world counterparts in terms of shape, proportions, and textures.

Additionally, Blender's optimization features enabled us to prepare the models for efficient real-time rendering in AR applications. By reducing polygon counts and utilizing texture compression techniques, we ensured smooth performance and minimal resource consumption, enhancing the overall user experience.

The use of Blender also facilitated the seamless integration of the furniture models into the AR development workflow. The ability to export the models directly into the widely supported .GLB format streamlined the process, eliminating the need for complex file conversions or compatibility issues.

Based on these findings, it is evident that accurate plane tracking and surface detection are critical factors for successful augmented reality furniture placement applications. Developers should prioritize the integration of robust tracking algorithms and continue to explore advanced techniques, such as simultaneous localization and mapping (SLAM) and machine learning-based approaches, to improve accuracy and reliability.

Additionally, user-friendly interaction design is paramount for ensuring a seamless and intuitive experience for users. Intuitive UI elements, gesture-based controls, and voice commands can enhance the usability of AR furniture placement applications, allowing users to effortlessly interact with virtual furniture models and explore different placement options.

Furthermore, the choice of 3D modeling software plays a crucial role in the overall quality and performance of the virtual furniture models. Blender, as an open-source and versatile tool, proved to be an excellent choice for our project, enabling precise modeling, texturing, and optimization for AR applications.

Looking ahead, potential improvements and future directions for the project could include integrating advanced features like real-time furniture customization and online shopping integration. Real-time customization would allow users to modify the appearance, materials, and colors of virtual furniture models, providing a more personalized and engaging experience. Online shopping integration could enable users to seamlessly purchase the furniture items they have visualized in their real-world environments, streamlining the buying process and reducing friction.

VI. Conclusion

In conclusion, this paper presents an augmented reality project aimed at enhancing the furniture shopping experience by seamlessly integrating virtual furniture models into the real world. The implementation involved utilizing .GLB model files created using Blender, an open-source 3D computer graphics software, and developing interactive user interfaces using Meta Spark Studio and Lens Studio.

Throughout the project, we encountered challenges with accurate plane tracking and surface detection, which are critical for ensuring precise placement and alignment of virtual furniture models within real-world environments. While Meta Spark Studio offered a powerful development environment, the limitations in plane tracking hindered the accuracy of furniture placement. Lens Studio demonstrated improved performance in this regard but faced constraints in interaction design and UI customization.

Despite these challenges, the project demonstrates the potential of augmented reality technology in revolutionizing the way furniture is visualized and purchased. By providing users with an immersive and realistic visualization experience, AR furniture placement applications can enhance customer satisfaction, reduce return rates, and ultimately drive sales for furniture retailers.

The use of Blender as the 3D modeling software proved to be an effective choice, enabling the creation of high-quality and optimized furniture models for AR applications. The ability to export models directly into the .GLB format streamlined the development workflow and ensured compatibility with various AR platforms.

Future research should focus on addressing the remaining challenges and further improving the user experience of AR furniture placement applications. This may involve exploring advanced plane tracking algorithms, integrating machine learning techniques, and developing innovative interaction methods tailored for AR experiences. Additionally, incorporating features like real-time furniture customization and online shopping integration could further enhance the value proposition of these applications, providing users with a seamless and engaging journey from visualization to purchase.

As augmented reality technology continues to evolve and gain widespread adoption, its applications in the furniture industry and beyond hold immense potential for transforming consumer experiences and driving innovation in various sectors.