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AUGMENTED REALITY BASED FURNITURE PLACEMENT APPLICATION

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Abstract: *This work presents the design and development of an Augmented Reality (AR) Furniture Placement Application with real-time visualization and interactive object manipulation. The system uses Google ARCore to detect surfaces and accurately place 3D furniture models in the user's physical environment. An Android application developed using Kotlin serves as the main platform, enabling users to select, position, and adjust furniture models using intuitive touch interactions. The system also integrates Firebase Authentication for secure user access and a local database for managing furniture models efficiently.*

Keywords: **Augmented Reality, ARCore, Furniture Placement, Android, Firebase**

1. INTRODUCTION

Interior design and furniture arrangement often require visualization before making decisions, which can be difficult using traditional methods. Augmented Reality provides an effective solution by allowing users to visualize virtual objects in real-world environments through mobile devices. This project focuses on developing an AR-based application that enables users to place and interact with furniture models in real time.The application uses ARCore to detect surfaces and accurately position 3D models within the environment. Users can move, rotate, and scale objects according to their requirements. The system also manages furniture data and user authentication, ensuring a smooth and interactive experience. It operates as a real-time system where object placement, rendering, and user interaction occur simultaneously, improving usability and decision-making in interior design.

2. Literature Survey

The development of Augmented Reality (AR) applications has gained significant attention in recent years due to the rapid growth of mobile computing, e-commerce, and interactive technologies. Researchers have focused on improving user experience by integrating AR into applications such as interior design, gaming, and real-time visualization. This section reviews existing approaches related to AR-based furniture placement systems, focusing on visualization, interaction, and system performance.
From the reviewed literature, the following key observations can be made:
• Visualization of furniture in real environments improves user decision-making and reduces uncertainty.
• AR-based systems provide more interactive and realistic experiences compared to traditional 2D design methods.

• Efficient surface detection and object placement are critical for accurate AR visualization.
• User interaction features such as scaling, rotation, and movement enhance usability.
• Many existing systems lack optimized performance on mobile devices and real-time responsiveness, limiting practical usage.

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3. Proposed System

The proposed system is an Augmented Reality Furniture Placement Application designed to provide real-time visualization and interactive placement of virtual furniture in a real-world environment. The system uses an Android device as the main platform to perform both visualization and user interaction operations.

In this system, Google ARCore is used to detect real-world surfaces and enable accurate placement of 3D furniture models. The application captures the environment through the device camera and identifies flat surfaces where virtual objects can be placed. The system continuously tracks the environment to maintain stable positioning of the objects. Firebase Authentication is integrated to manage secure user login and access.

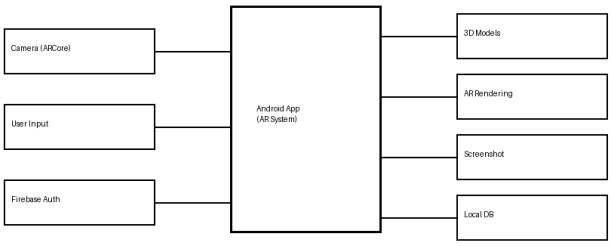


Fig 1: Proposed System

The application provides an interactive interface that allows users to view and control different functionalities such as:

- Selection of furniture models
- Real-time AR object placement
- Object movement, rotation, and scaling
- Screenshot capture of the AR scene

The system also ensures smooth performance by efficiently loading 3D models and maintaining real-time rendering. It provides a user-friendly and cost-effective solution for interior visualization using widely available mobile devices.

4. Methodology

The methodology of the system is organized into the following steps:

1. Environment Detection:

The application uses ARCore to detect real-world surfaces through the device camera. It identifies flat planes suitable for placing virtual objects.

2. Data Acquisition:

The camera continuously captures real-time frames of the environment. ARCore processes these frames to understand motion tracking and spatial positioning.

3. Model Selection:

Users select furniture models from the available catalog. The selected model is prepared for placement in the AR scene.

4. Surface Interaction:

When the user taps on the detected surface, the system creates an anchor point. The selected 3D model is placed at this position.

5. Object Manipulation:

Users can interact with the placed object by:

- Moving the object
- Rotating the object
- Scaling the object

These interactions help adjust the furniture according to the room layout.

6. Real-Time Rendering:

The system continuously renders the placed objects, ensuring stable positioning and realistic visualization in the environment.

7. Screenshot and Storage:
Users can capture screenshots of the AR scene. The images are saved to the device gallery for future reference.

8. System Management:
The application manages user authentication using Firebase and handles model data through a local database for smooth operation.

5. Proposed System Results

The proposed Augmented Reality Furniture Placement Application was successfully developed and tested under different usage scenarios. The system effectively enabled real-time visualization, object placement, and user interaction within the AR environment.

• The application accurately detected real-world surfaces using ARCore. Surface detection was stable and responsive under normal lighting conditions.

• The user interface successfully allowed users to select and place furniture models in the real environment. The placement of objects was precise and visually aligned with detected surfaces.

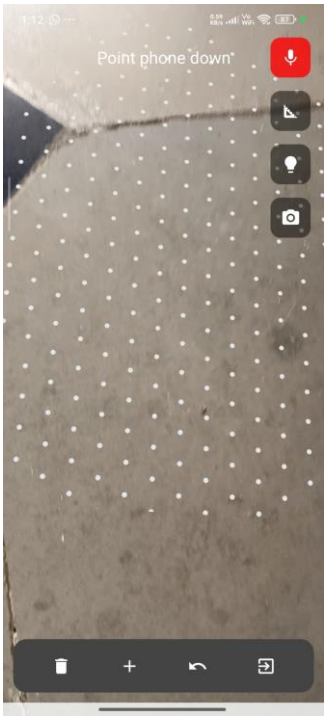
• The system supported smooth interaction features such as moving, rotating, and scaling of objects, providing a flexible and user-friendly experience.

• The application was able to load and render 3D models efficiently without noticeable lag during operation.

• The screenshot feature worked effectively, allowing users to capture and store AR scenes in the device gallery.

Fig 2: AR Furniture Placement View

The response time of the system was fast, and object placement and rendering occurred in real time without delays.



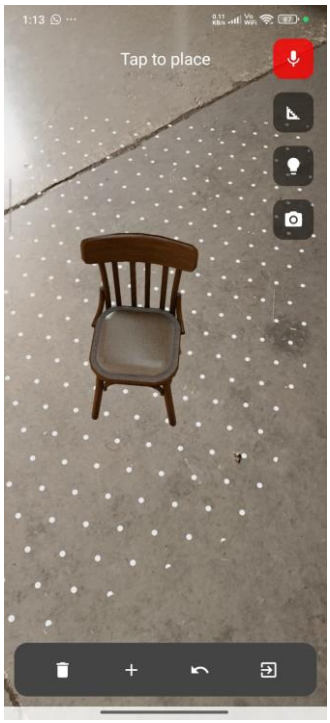


Fig 3: Surface Detection **Fig 4: Object Placement and Interaction**

Overall, the system demonstrated reliable performance in real-time visualization, user interaction, and AR-based interior design assistance.

6. CONCLUSION

This work successfully developed an efficient and user-friendly Augmented Reality Furniture Placement Application using Android and ARCore. The system effectively enabled real-time visualization of furniture models within a physical environment, allowing users to interact with virtual objects accurately. The application successfully handled key functionalities such as surface detection, object placement, and object manipulation, ensuring a smooth user experience.

The use of AR technology improved visualization compared to traditional methods by allowing users to place and adjust furniture directly in their surroundings. Features such as real-time rendering, interactive controls, and screenshot capture enhanced usability and practical application. The integration of Firebase Authentication and local database management ensured secure access and efficient handling of model data.

Overall, the system demonstrated reliable performance in real-time AR visualization and interaction, providing an effective solution for interior design and furniture planning.

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