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AI FURNISH AR

"Smartly Visualize and Personalize Your Space with AR & AI.

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Abstract: This paper introduces a unique furniture shopping application that combines Augmented Reality (AR) and Artificial Incorporating. AI-driven solutions to refine the overall user experience. sApp enables users to place virtual furniture in their real room environments using AR, helping them check how well the furniture fits and matches with their interior design. AI-based suggestions guide users in choosing furniture that aligns with their style, room aesthetics, and current design trends. The app uses advanced algorithms for smooth real-time AR visualization and smart data analysis to ensure a user-friendly interface. Early testing results show a boost in customer satisfaction and a noticeable drop in return rates. This research also discusses the technical challenges faced, insights from user feedback, and potential areas for future development.

***Index Term*: Android Application, Kotlin, Augmented Reality (AR), Artificial Intelligence (AI)**

1.INTRODUCTION

As technology continues to evolve at an unprecedented pace, Augmented Reality (AR) and Artificial Intelligence (AI) are revolutionizing various industries by delivering more immersive and innovative experiences. In the field of furniture shopping, AR allows users to virtually place and view furniture within their own living spaces, making the selection process more interactive and informed. When paired with AI, this experience becomes even more personalized, since the system recommends furniture tailored to the user's preferences and the layout of their space. This project combines the strengths of both AR and AI to transform the furniture shopping journey, making it more engaging, intuitive, and convenient in real-life settings. The furniture retail sector is undergoing a major transformation toward digital experiences, driven by the increasing need for customization and engaging shopping methods. Despite the growth of online shopping, many platforms still fall short in helping users visualize how furniture will look and fit in their actual homes, or whether it matches the existing decor.

This research presents a furniture application that effectively merges AR and AI technologies to solve these issues. With AR, users can virtually position furniture in their rooms, gaining an accurate view of size, fit, and placement, which greatly aids decision making. At the same time, AI analyzes user behavior, room structure, and design preferences to offer customized recommendations that not only meet user needs but also enhance overall aesthetic appeal. It also provides helpful suggestions for improving visual harmony in the

room. This paper explores the design, functionality, and user experience of the app, emphasizing how it has the potential to influence consumer behavior and reshape the furniture shopping landscape. Additionally, it highlights the key technical challenges and design choices involved in building such a solution.

1.2 PROBLEM STATEMENT

"To develop an Android application that uses Augmented Reality (AR) to let users visualize furniture in their rooms and applies Artificial Intelligence (AI) to recommend suitable furniture based on room aesthetics, improving decision making and user experience.

1.3 OBJECTIVES

1. To develop an intuitive and user-friendly interface for seamless AR furniture interaction.
2. To ensure realistic visualization with high-quality 3D models and accurate environment mapping.
3. To improve environment detection and object interaction for accurate AR placement.
4. To optimize performance across various devices for smooth and responsive experiences.
5. To facilitate easy purchasing through integration with online stores and AR commerce.
6. To integrate AI-driven algorithms for personalized furniture recommendations based on room aesthetics.
7. To continuously improve recommendation accuracy using machine learning models and user feedback.

2 REQUIREMENT ANALYSIS AND SPECIFICATION

2.1 LITERATURE REVIEW

With the rapid progress in technology, Blending AR with AI technologies has reshaped the way people shop for furniture and plan interior designs. Many researchers have explored how these technologies can be used together to provide better visualization, real-time interaction, and customized recommendations. Below are some key contributions in this area:

[1] "Furnish Your Reality" – Intelligent Mobile AR Application for Personalized Furniture

Authors: M. J. Arnold, K. E. Reynolds – SpringerLink, 2023

This study introduces a mobile AR app designed to help users visualize personalized furniture pieces in their actual living spaces. By offering features like proper scaling and placement, it aims to minimize mismatched purchases. The app improves the shopping experience by making it interactive, allowing users to preview how items will fit into their rooms before buying.

[2] "Augmented Reality Based Interior Designing System"

Published in: International Journal of Engineering Research & Technology (IJERT), 2023

This paper presents an AR-powered system that lets users experiment with virtual furniture arrangements in their real environments. The system supports drag-and-drop functionalities and live adjustments, helping users try different layouts with ease. This enhances decision-making and boosts confidence when choosing furniture.

[3] "AI-Driven Furniture Recommendation System Using Deep Learning"

Authors: S. Kumar, R. Gupta – ICAIS, 2022

This research focuses on an AI recommendation engine that applies deep learning to suggest furniture based on user tastes and room types. It studies user behaviour and previous selections to generate personalized suggestions. The system is aimed at making the selection process faster, smarter, and more satisfying.

[4] "Design AR: A Markerless AR Tool for Furniture Placement and Space Visualization"

Authors: L. Tanaka, A. Singh – IEEE Transactions on Visualization and Computer Graphics, 2021

"Design AR" is a tool that allows users to place virtual furniture in their rooms without using physical markers. It leverages spatial mapping to ensure correct size representation and realistic visuals. The research highlights how the tool enhances user interaction and precision in layout planning, making it a helpful resource for interior designers.

2.2 SYSTEM STRUCTURE AND DESIGN

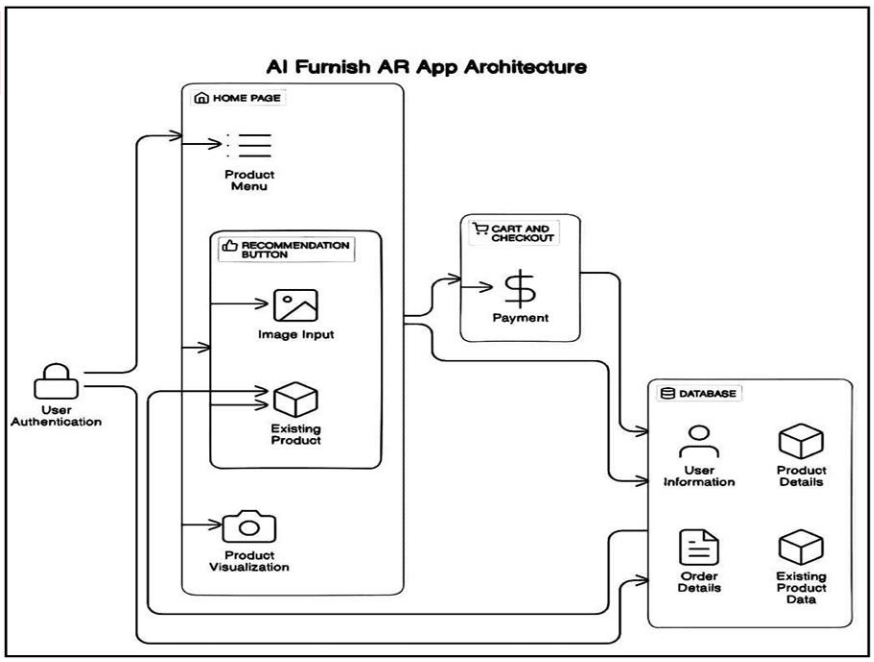

Fig. System Architecture

1. Home Page: This is the first screen users see when they open the app. It offers a quick overview of available products or services and acts as the main starting point for user navigation.

2. AR Mode: This feature allows users to get a preview of how the furniture fits within their actual room using Augmented Reality. It uses the device's camera to capture the surroundings and place a 3D model of the furniture in real-time, helping users make better decisions.

3. Cart and Checkout: This part of the app lets users add chosen items to a shopping cart and proceed with the purchase. It also manages the final checkout process and may connect with online payment systems to complete transactions.

4. User Authentication: This module ensures that users securely access the app by managing account creation, login, and password handling. It helps protect user data and maintains secure access to personal and shopping information.

5. Payment Gateway: This component processes user payments by connecting with various payment options. It ensures that transactions are completed safely and efficiently, using secure channels to protect financial data.

6. Recommendation Service: This part of the system offers product suggestions based on user behavior, past purchases, and preferences. It uses intelligent algorithms, possibly involving machine learning, to personalize the shopping experience and improve product relevance.

7.Databases: These serve as the backend storage for all essential data, including user profiles, product details, order history, and more. They help manage and retrieve data efficiently to support smooth app functionality.

2.3 SYSTEM REQUIREMENTS

Frontend system requirements

1. Device Specifications: Multi-core processor, 8 GB RAM.
2. Operating System: Android. θ Storage Space: 21 MB
3. Permissions: Device's camera access
4. Security: Firebase authentication
5. AR Compatibility.
6. Internet Connection**.**

Backend System Requirements

1. Database: Firebase for user authentication
2. AI Integration: The AI integration uses Python with Flask for backend API.
3. AR Engine Integration: AR Foundation in Unity for backend support of AR functionalities.
4. Version Control: Github for version control and collaboration among developers.

Technologies and Tools Required

1.Android Development-Kotlin, Android Studio.

2. Image Processing- OpenCV, Pillow and scikit-learn for image processing.

3. Machine Learning- Python (for model training), OpenCV for color detection

4. Backend (Optional)- Flask for API-based image processing.

2.4 Module Implemented

Fig.1 Sign up page

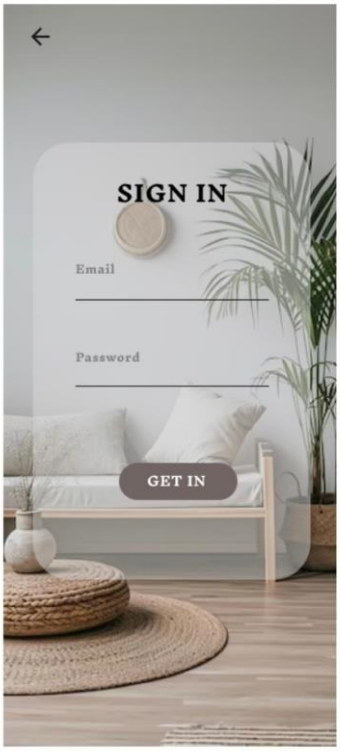

Fig.2 Sign in page

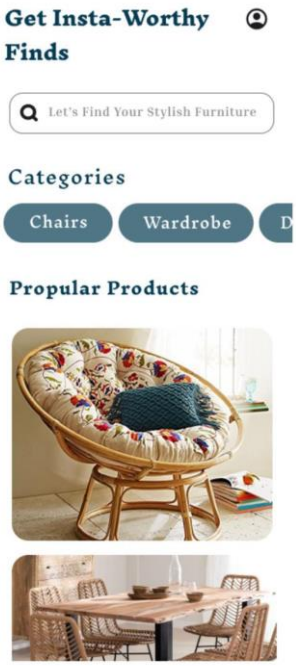

Fig.3 Home Page

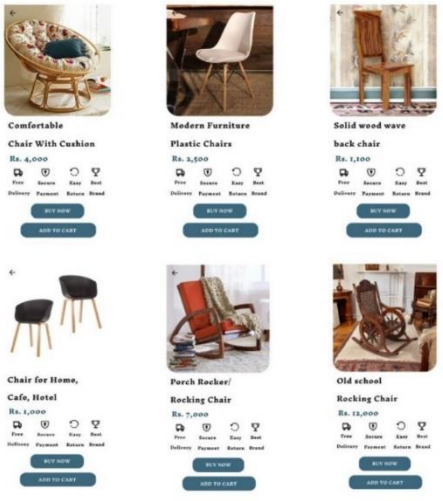

Fig.5 Chair Product detail page

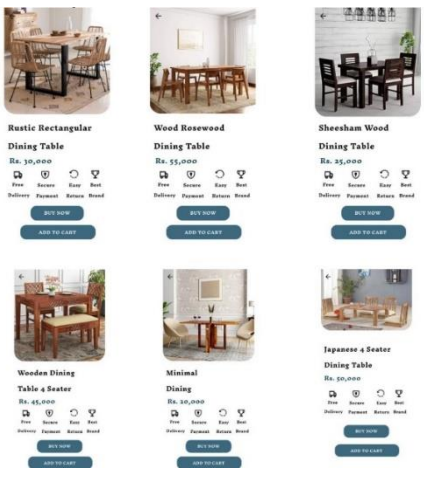

Fig.5 Table Product detail page

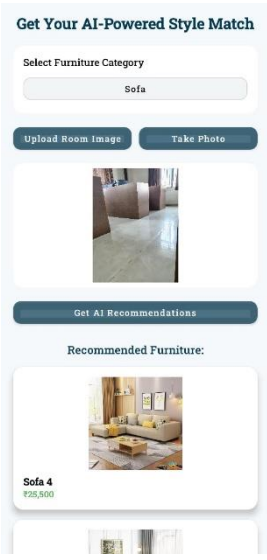

Fig.6 AI Recommendations

3.METHODOLOGY

The development of AiFurnish-AR involves the integration of **Augmented Reality (AR)** for interactive furniture visualization and **Artificial Intelligence (AI)** for intelligent furniture color recommendations. The methodology followed in the development of this Android application is described in the following phases:

1. AR Module Development

Platform Used: Unity with AR Foundation

Purpose: To offer users the ability to place and observe 3D furniture models in their physical space via AR.

Implementation Details:

- Developed 3D furniture models and placed them within Unity.
- Used **AR Foundation** to enable markerless AR capabilities.
- Integrated with the Android app using ARCore support for runtime deployment.
- Enabled object placement, scaling, and orientation control through touch gestures.

2. AI-Based Furniture Recommendation System

Objective: To recommend furniture in a color that contrasts with the wall color in the user's room, enhancing the overall aesthetic appeal.

2.1 Image Capture and Upload

Technology: Android Camera API (Kotlin)

Steps:

- Captured an image of the user's room through the device camera.
- Provided an option to upload an existing image from the gallery.
- Required runtime permissions handled in the Android Manifest and Kotlin code.

1.2 Image Processing and Color Analysis

Technologies Used: Python, OpenCV, Pillow, scikit-learn

Steps:

1. **Color Extraction:**
   - Extracted dominant colors from the wall and furniture regions using OpenCV and K-means clustering.
2. **Color Comparison:**
   - Compared the primary colors of the wall and furniture.
   - Detected if the colors were too similar (low contrast).
3. **Contrast Suggestion:**
   - If colors matched closely, the system recommended a furniture color from a predefined palette that ensures visual contrast with the wall.

3. AI Backend Development

Technology Used: Flask (Python)

Purpose: To handle image processing requests from the Android app via REST API.

Workflow:

- Android app sends a captured/uploaded image to the Flask backend.
- Backend processes the image, performs color detection, and returns the recommended color suggestion.

4. Android App Integration

Technology Used: Kotlin, Android Studio

Steps:

- Integrated RESTful API using Retrofit to communicate with the Flask backend.
- Designed user interface using XML and Kotlin code.
- Enabled dynamic feedback display based on AI recommendations.
- Combined AR visualization with AI-based intelligent suggestions for a seamless user experience.

4.CONCLUSION

By integrating AI and AR, the AiFurnish app offers a modern solution to improve how customers explore and choose furniture. The AI system processes room images to detect the dominant colors and applies image analysis techniques-such as cosine similarity-to suggest furniture items that offer visually appealing contrasts. Meanwhile, the AR feature, built using Unity, allows users to place and preview furniture pieces within their actual surroundings. This combination not only helps users make more informed and aesthetic design choices but also delivers an engaging and tailored interior design experience, making it a smart tool for modern digital consumers.

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