IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Interioshop: AR Based Interior Design And E-Commerce Application

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ABSTRACT

The AR-based interior designing and shopping app represents a solution that utilizes augmented reality (AR) to revolutionize the world of interior design and home decor. This innovative mobile application provides users with a dynamic and immersive experience, empowering them to effortlessly visualize, customize, and purchase furniture and decor items with ease and confidence. The app's salient features encompass lifelike 3D representations that effortlessly merge digital components with tangible environments, augmented reality instruments guaranteeing exact spatial precision, a vast array of design alternatives, direct interaction with furniture vendors, and cooperative functionalities for exchanging and honing design ideas. This program allows users—from do-it-yourselfers to licensed designers—to convert their living spaces into uniquely functional, aesthetically beautiful, and personalized locations by linking the digital and real worlds. It enhances and broadens the interior design process in addition to making it simpler and more approachable for more people.

Keywords— 3D visualizations, DIY decorators, AR, personalize

INTRODUCTION

In the ever-evolving landscape of technology and design, the emergence of Augmented Reality (AR) has unlocked new dimensions of creativity and convenience. One compelling application of AR is the AR-based interior designing and shopping app, a groundbreaking solution with the potential to reshape the way we approach interior design and home decor. This innovative app bridges the gap between the virtual and physical worlds, offering users an immersive and transformative experience as they envision, customize, and acquire furniture and decor items.

The conventional approach to interior design often involves guesswork, trial and error, and the challenges of visualizing how furniture and decor will fit and look in one's own living space. This AR-powered app addresses these challenges head-on, providing a platform that enables users to bring their design dreams to life with unparalleled precision and confidence. Users can virtually place furniture, experiment with different

products along with the product attributes like colours, sizes and crucially, make informed purchasing decisions — all through the lens of their smartphone or tablet.

A. Problem Statement

Some furniture shopping apps are designed exclusively for specific operating systems (e.g., iOS or Android), limiting accessibility for users who do not own devices on these platforms. The colours of furniture items displayed in the app may not always be true to life due to variations in screen settings, lighting conditions, and the device's screen quality. Some apps may not offer extensive customization options, limiting users' ability to personalize furniture items according to their preferences. Users may find it challenging to match new furniture items with their existing decor and furniture, as they cannot physically compare items in the app to their current space.

B. Objectives

The main objective of the AR InterioShop is to seamlessly integrate augmented reality (AR) technology into the world of online shopping. Users will be able to effortlessly visualize furniture and decor products in their own physical spaces, facilitating informed purchasing decisions.

We provide an intuitive interior design platform, allowing users to experiment with different furniture arrangements and design concepts in a user-friendly manner, enhancing the overall online shopping experience. Personalization plays a central role, as machine learning and recommendation algorithms will offer users simplified decision-making process and making online shopping more convenient.

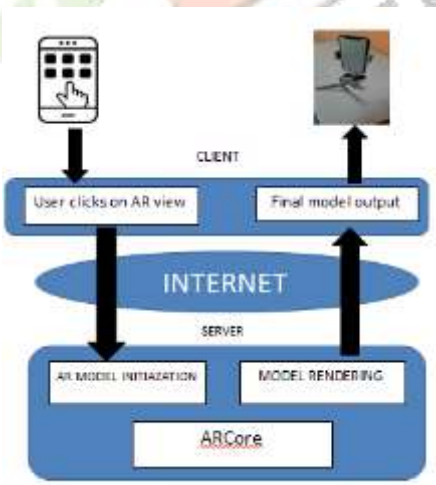
Collaborating with vendors is another objective, making it user-friendly and engaging for users to explore a wide range of products. User engagement and growth are also prioritized through features like design sharing, favourites, and notifications, ensuring that the platform remains user-friendly and engaging.

Data security and privacy are paramount, with a focus on robust encryption, authentication, and compliance with data protection regulations to instil trust and ensure a secure online shopping environment.

Continuous improvement and innovation are integral to the project, with a commitment to user feedback, emerging AR technology advancements, and market dynamics, ensuring that the platform remains user-friendly, innovative, and at the forefront of the industry.

Lastly, user support and training resources will be provided to help users maximize the app's potential and enhance their understanding of AR interactions, design features, and the convenience of online shopping.

SYSTEM ARCHITECTURE



In our InterioShop when a user initiates the AR view feature in the app, it triggers the AR model rendering process using ARCore. In this, Google's AR development platform, utilizes a combination of device sensors and camera data to understand the environment and accurately position the virtual object in the real world. ARCore SDK handles the rendering of 3D model, taking into account factors like lighting, shadows, and perspective to make the virtual object blend seamlessly with the real-world environment. The final output is a realistic and immersive AR experience where the user can interact with the virtual object as if it were physically present in their surroundings. This process enables users to visualize furniture and

decor items in their spaces before making a purchase which in turn enhances the overall shopping experience.

Our AR project system architecture integrates Kotlin, AR Core and Firebase to optimize user experience and robust AR integration. Key components include

A. Kotlin

Modern statically typed programming language Kotlin is fully interoperable with Java and compatible with the Java Virtual Machine (JVM). It's a great choice for Android app development because of its short syntax, null safety, and easy connection with existing Java codebases. Kotlin's features, such as data classes, coroutines, and extension functions, increase developer productivity and make code maintenance easier. Its strong support for functional programming and asynchronous programming simplifies the implementation of complex business logic and UI interactions. Additionally, Kotlin's growing community, comprehensive documentation, and official support from Google make it a reliable and future-proof language for building robust and scalable Android applications like Interioshop.

B. AR Core

For Android devices, ARCore is a platform designed to create augmented reality (AR) experiences. Developers may construct immersive AR applications using its motion tracking, environmental comprehension, and light estimation APIs. ARCore places virtual material in the user's environment with precise spatial tracking by utilizing the camera and sensors of the smartphone to identify flat surfaces and real-world objects.

C. Firebase

Firebase is a comprehensive platform developed for building mobile and web applications. It provides a suite of backend services which includes real-time database, cloud storage, hosting, and more, which help in building high-quality apps without spending much time and efficiently.
For the Interioshop project, Firebase was chosen for its simplicity, scalability, and versatility. By leveraging Firebase's backend services, Interioshop can store product information, user data, and shopping cart details securely in the cloud. Firebase Realtime Database provides real-time synchronization between app instances, ensuring that users always have up-to-date information. Firebase Authentication handles user authentication and authorization, enabling secure access to app features and data. Firebase Cloud Functions allows for serverless execution of backend logic, while Firebase Hosting provides a reliable platform for hosting the web version of Interioshop.

IMPLEMENTATION DETAILS

A. Database Management:

Firebase Realtime Database in Kotlin Android App: Stores product information, user data, and shopping cart details, ensuring real-time synchronization between app instances. Firebase Firestore in Kotlin Android App: Manages transaction history and facilitates data storage and retrieval for enhanced user experience.

B. Transaction Flow:

User Interaction in Kotlin Android App: The user interacts with the app, browsing furniture products and adding items to the shopping cart.

Firebase Realtime Database Update: Upon user interaction, relevant data such as product details and user preferences are updated in Firebase Realtime Database.

Augmented Reality Interaction: If the user activates AR mode to visualize furniture in their space, ARCore processes real-world data and renders virtual objects accordingly.

Firebase Authentication: User authentication and authorization are handled securely by Firebase Authentication, ensuring only authorized users can access and modify app data.

Firebase Cloud Functions: Serverless functions implemented in Kotlin handle backend logic, such as validating user transactions and updating Firestore with transaction details.

Transaction Validation: Firebase Cloud Functions cross-reference transaction data with Firestore and Firebase Realtime Database to validate the authenticity of user transactions.

Order Processing: Valid transactions trigger order processing logic, updating Firestore with order details and deducting the purchased items from inventory.

IPFS Integration: Authorized transactions are uploaded to the InterPlanetary File System (IPFS) for decentralized storage, ensuring data integrity and availability.

RESULTS AND VALIDATION

A. Validation Process

In ensuring the accuracy and integrity of transactions, our Interioshop system implements a meticulous validation process. Initially, transactions undergo comprehensive validation through cross-referencing with the Firebase Realtime Database integrated into our Kotlin Android app. This meticulous step ensures transaction validity by comparing and validating data against the established records stored in the database. Additionally, our system utilizes Firebase Firestore for transaction state management, meticulously tracking transaction progress and maintaining real-time insights into each transaction's validation status. This dynamic approach provides transparency and reliability throughout the transaction lifecycle. Furthermore, our validation framework prioritizes transaction integrity, employing robust measures to prevent unauthorized access and guaranteeing that only legitimate transactions proceed within the system. This ensures the security and authenticity of every transaction, enhancing user trust and confidence in our comprehensive furniture shopping platform.

B. Outcome

Successful transactions within our Interioshop platform leads to a seamlessly integrated, secure, and user-centric approach to furniture shopping. These positive outcomes extend beyond mere transaction completion, contributing to a range of benefits and improvements within the system. Notably, the adoption of Firebase Cloud Storage facilitates enhanced data integrity, where rigorous validation processes and cloud-based storage mechanisms significantly bolster the reliability and accuracy of product information. Moreover, Firebase Cloud Storage improves accessibility, enabling efficient storage and retrieval of product details, which empowers users with independent verification capabilities and fosters a transparent shopping ecosystem. This enhanced accessibility not only enhances user satisfaction but also promotes streamlined collaboration among users, administrators, and vendors. The result is an efficient and cohesive furniture shopping environment that promotes effective communication, collaboration, and ultimately, the delivery of high-quality shopping experiences.

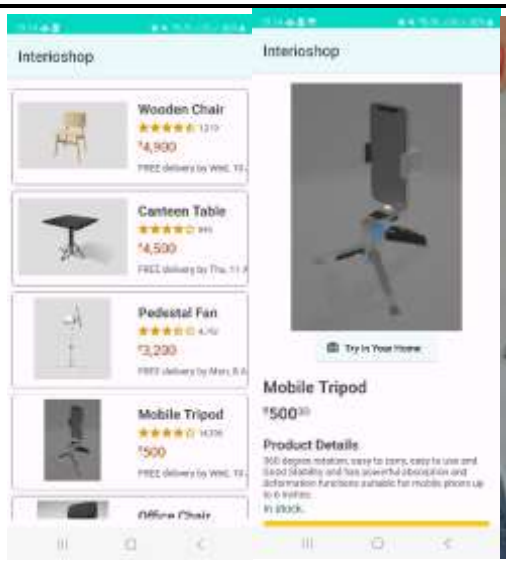


Figure (B): Product Details

Figure (A): Homepage

Figure (C): AR View

Feature	Interioshop Project	Existing System
Augmented Reality Integration	Utilizes cutting-edge AR technology for visualizing furniture in real-world settings, enhancing the shopping experience and enabling more informed purchasing decisions.	Lacks AR integration, limiting users to traditional online product visualization methods.
Immersive Shopping Experience	Offers an immersive and interactive shopping experience, allowing users to virtually place furniture items in their own living spaces to assess how they look and fit before making a purchase.	Provides standard online shopping experience without the ability to visualize products in real-world environments, leading to uncertainty and potential dissatisfaction post-purchase.
Enhanced User Confidence	Boosts user confidence by reducing uncertainties associated with online furniture shopping, as users can accurately gauge the suitability of products for their homes through AR visualization.	Relies on static product images and descriptions, leaving users to imagine how items will look and fit in their homes, often resulting in post-purchase regrets.
Personalization and Creativity	Facilitates personalization and creativity in home furnishing projects by enabling users to experiment with different furniture layouts and styles within their own living spaces.	Offers limited scope for personalization and creativity, as users are confined to selecting products based solely on static images and descriptions provided by the app.
Competitive Advantage	Provides a unique selling proposition with its AR integration, setting it apart from competitors and attracting modern consumers seeking enhanced convenience and engagement in online shopping experiences.	Faces stiff competition from other E-commerce platforms lacking AR integration, potentially losing market share to more innovative platforms offering advanced features.

CONCLUSION

The Interioshop project represents a significant advancement in the world of home furniture E-commerce, propelled by the integration of cutting-edge Augmented Reality (AR) technology. Unlike traditional online shopping experiences, Interioshop offers users the ability to visualize furniture items within their own living spaces through AR, thereby revolutionizing the way customers interact with products. This innovative approach eliminates uncertainties and enhances user confidence by enabling them to accurately assess how the furniture pieces will appear and fit in their homes before purchasing. By leveraging AR, Interioshop not only provides a seamless and immersive shopping experience but also opens up new possibilities for interior design and home decoration. Users can experiment with different furniture layouts and styles, fostering creativity and personalization in their home furnishing projects. Moreover, the app's AR integration sets it apart from competitors, offering a unique selling proposition that resonates with modern consumers seeking enhanced convenience and engagement. As AR technology continues to evolve and become more accessible, Interioshop is poised to remain at the forefront of innovation in the E-commerce industry, shaping the future of online furniture shopping and setting a new standard for user experience and satisfaction.

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