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'Abode Alchemy'- An Augmented Reality based Flutter Application

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Abstract - The e-commerce sector grapples with substantial losses stemming from frequent product returns, primarily caused by customers' struggles to envision how items will fit into their environment. Furthermore, industries such as surgery and construction lag behind in adopting Metaverse technology, which holds immense potential for enhancing their operations. Addressing these challenges, the solution lies in augmented reality applications that empower users to preview products and settings within their actual surroundings, thereby enabling more informed purchasing and operational choices. Introducing our solution Abode Alchemy, an AR furniture application built on the Flutter platform, compatible with both iOS and Android devices. Sporting a sleek and intuitive interface, Abode Alchemy facilitates virtual previews of furniture and décor items in real-world spaces using the device's camera. With its extensive object library and automated scaling functionality, the app ensures a seamless user experience with minimal power consumption. In the event of scaling discrepancies, users can effortlessly adjust object dimensions manually within the app.

***Key Words*:** Augmented Reality, E-Commerce, Flutter Application, Metaverse Technology, Facilitating more informed purchasing and operational decisions.

1.INTRODUCTION

In today's world of online shopping, consumers often face a common challenge: how to ensure they're making the right purchase without physically seeing the product first. This is where Abode Alchemy comes in: an innovative Augmented Reality (AR) solution designed to simplify the furniture shopping experience. By allowing users to visualize furniture items in their own living spaces through their smartphone, Abode Alchemy aims to bridge the gap between digital browsing and real-world application. With its user-friendly interface and extensive library of 3D furniture models, Abode Alchemy has the potential to revolutionize online furniture shopping, reduce return rates, and enhance customer satisfaction. This paper explores the development journey of Abode Alchemy and its transformative impact on the way we shop for furniture online.

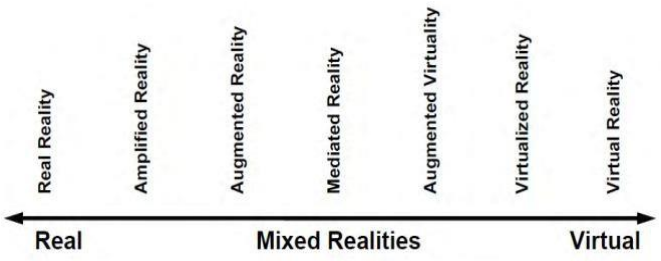

Fig. 1: Reality and Virtual Reality Chart

2. LITERATURE SURVEY

Several applications, such as IKEA's AR app, Houzz, and Roomy, have introduced AR technology to the field of interior design, enabling users to visualize furniture and decor items in their living spaces before making a purchase. However, these apps often face limitations such as restricted object libraries, inaccurate size representation, and lack of cross-platform compatibility. IKEA's AR app allows users to preview furniture items in their homes using their smartphone cameras, but its object library is limited to IKEA products. Similarly, Houzz and Roomy offer AR features for interior design, but they suffer from similar limitations, hindering the user experience. Despite their contributions to AR interior design, these applications fail to deliver a fully captivating and comprehensive experience for users. Abode Alchemy aims to address these shortcomings by providing a seamless and efficient solution for users to preview products and environments in their real-world context. Abode Alchemy offers a solution with its large library of object templates, automatic sizing and resizing features, cross-platform compatibility, and low power consumption, giving best user experience.

Abode Alchemy aims to overcome these limitations by providing a more extensive library of object templates, ensuring accurate sizing and resizing, and offering cross-platform compatibility. By addressing these challenges, Abode Alchemy seeks to enhance the user experience and revolutionize the way people shop for furniture online.

3.ANALYSIS

The analysis phase of the development process for Abode Alchemy, an Augmented Reality (AR) furniture application, was crucial in understanding project requirements and selecting an appropriate process model. Abode Alchemy comprises three main modules: browsing the environment, adjusting objects, and user interface. Under the guidance of our mentor, Professor Bhanu Tekwani, our team opted for an

iterative approach, guided by the Agile Model, for its adaptability to change and focus on team empowerment.

The development of the AbodeAlchemy follows an iterative and user-centric process model that focuses on innovation, user feedback, and continuous improvement. The chosen process model is a approach that uses elements of the Agile methodologies to ensure the efficient creation of an immersive and feature-rich application.

The Agile Model, with its emphasis on delivering working software, value-driven development, continuous planning, testing, and improvement, aligned well with our project goals. Each iteration followed a structured process. Initially, we identified the tasks for the iteration through thorough planning and research, consulting research papers and similar applications for insights. Subsequently, we devised a blueprint, utilizing various tools to establish the project's basic structure. Following this, we transitioned to building the design into a functional product, rigorously testing it to ensure it met design specifications.

The final phase focuses on user-centric enhancement and deployment. The hybrid process model encourages ongoing user engagement, ensuring that AbodeAlchemy aligns with user expectations. Post-deployment, the application continues to evolve based on user feedback and usage data. The development team actively monitors the application's performance, and machine learning-driven design recommendations are explored for future enhancements. The process remains dynamic, with a commitment to delivering an application that revolutionizes the interior design industry.

A.*Tech Specs and Hardware Requirement*

Abode Alchemy, an Augmented Reality (AR) furniture application, harnesses the synergies of Flutter/Dart, Unity, and Firebase to deliver an unparalleled user experience. Flutter/Dart, renowned for its cross-platform development capabilities, ensures Abode Alchemy's compatibility with both iOS and Android devices while providing a smooth and responsive interface. Unity, a powerful game development engine, forms the backbone of the AR functionality, offering robust 3D rendering, physics, and interactive features essential for creating realistic virtual furniture placements within users' living spaces. Firebase, a comprehensive backend platform, complements the application by facilitating real-time data synchronization, user authentication, and cloud storage, thereby ensuring seamless user interactions and efficient data management. For hardware we made use of, a powerful ASUS Rog Strix laptop with an Intel Core i7-9750H CPU, Nvidia GeForce GTX 1650 4Gigs DDR5 GPU, and 16GB DDR4 RAM, as well as a Huawei Media pad T5 phone with 4GB RAM and Android operating system, and an iPhone 7 with 2GB RAM and iOS 15.x. We're delighted to announce that Abode Alchemy performed seamlessly on all these devices, including any virtualization of the Android operating system. Therefore, regardless of the device you're using, you can rely on Abode Alchemy to provide an exceptional AR experience!

B. Security Analysis

Safety is paramount in any application, and Abode Alchemy prioritizes the protection of users' personal data. To safeguard user information during transmission and storage, the app employs secure encryption methods. Additionally, robust measures are in place to prevent unauthorized access and mitigate against potential security threats, including malware. While Abode Alchemy does not currently utilize two-factor authentication (2FA), precautions have been taken to secure user data, such as encrypting passwords stored in the database to prevent unauthorized access. Continuous monitoring and updates of security logs are conducted to uphold the integrity of user data. Furthermore, the app employs strict access controls and regularly undergoes security audits to identify and address any vulnerabilities promptly. Although the implementation of 2FA is under consideration for future updates, regular security assessments and updates are performed to uphold the app's security standards and align with best practices. By prioritizing safety, Abode Alchemy offers users a secure and trustworthy experience, ensuring peace of mind while using the application.

4.TECHNOLOGY USED

A. Flutter

Abode Alchemy leverages Flutter, a comprehensive software development kit (SDK) for mobile applications, enabling developers to create robust and high-fidelity apps for both Android and iOS platforms from a unified code base. Utilizing the Dart programming language, which is known for its simplicity and efficiency, Abode Alchemy streamlines app development processes. In our project, the front end of the Abode Alchemy application, encompassing tasks such as user interface design, user input management, and 3D object presentation, was developed using Flutter. Moreover, we incorporated additional functionality using Flutter plugins, including augmented reality features and integration with the Firebase backend. Leveraging Flutter's "Hot Reload" feature allowed us to swiftly implement changes and observe their impact in real-time, significantly enhancing productivity and expediting the development process for Abode Alchemy.

B. Dart

Originally developed by Google, Dart is a versatile programming language designed for creating high-performance applications that operate seamlessly across various platforms, including desktop, mobile, and web environments. Within the Abode Alchemy project, Dart plays a central role in crafting the application's user interface. With its modern syntax, reactive programming features, and extensive library support, Dart proves particularly adept at building UI-rich applications. Leveraging Dart has enabled the development of a fluid and responsive user interface essential for delivering an immersive augmented reality experience through Abode Alchemy.

C. Swift

Developed by Apple, Swift is a versatile and compiled programming language designed specifically for crafting applications for iOS, iPadOS, macOS, watchOS, and tvOS platforms. Swift stands as the primary language for building native iOS applications due to its seamless integration with Apple's Cocoa and Cocoa Touch frameworks. In the Abode Alchemy project, Swift was employed to develop the iOS version of the app, ensuring compatibility with iPhones and iPads. Known for its robust safety measures that mitigate

errors and crashes, Swift is widely acclaimed for its efficiency and capability in handling complex tasks, making it a preferred choice for mobile app development.

D. C

While C programming, a versatile language widely employed in developing operating systems, system software, and embedded systems, wasn't directly utilized in this project, several tools and technologies utilized, such as Unity, were programmed in C. Recognized for its efficiency, portability, and ability to control low-level hardware, C remains a popular choice for creating system-level applications, contributing indirectly to the functionality and performance of the Abode Alchemy app.

E. C++

C++ stands out as a widely-used high-level programming language renowned for its effectiveness in developing software applications. While it wasn't directly utilized in this project, C++ often finds application in crafting high-performance programs such as video games and other graphically intensive applications. Within the Abode Alchemy project, Unity's engine utilizes C++ to construct 3D objects, ensuring optimized graphics rendering and overall performance. Thus, proficiency in C++ programming can enhance the optimization of 3D objects and the entire application in Abode Alchemy.

F. JavaScript

JavaScript, a commonly used programming language, is primarily employed for building interactive features within web browsers. In our project's web application, JavaScript is essential for front-end development, enabling the creation of dynamic and interactive UI components like buttons, forms, and other interface elements. Additionally, JavaScript handles event management, facilitates asynchronous HTTP connections to the server, and conducts client-side validation of user inputs. To simplify the development of intricate user interfaces, we utilize JavaScript frameworks such as ReactJS.

G. CMake

Software projects are developed, tested, and packaged using the cross-platform build system generator CMake. CMake was used in this project to create the Makefiles for the C++ code as well as to build the Unity project.

H. Firebase

Firebase, a mobile and online development platform, offers authentication, real-time databases, cloud storage, hosting, and various other tools and services. In this project, hashing algorithms are employed to securely store user information and passwords on Firebase. Furthermore, Firebase is utilized to manage user authentication and regulate access to specific application functionalities. The real-time database capability of Firebase is utilized to store and retrieve 3D object data from the cloud. Additionally, Firebase provides comprehensive analytics and crash reports, which can be utilized to monitor the application's performance and implement necessary adjustments.

I. Unity

Developers commonly utilize the Unity game engine to craft 2D and 3D games, simulations, and interactive experiences. In this project, Unity was utilized to create and generate 3D models of furniture and various objects. These models were subsequently incorporated into the application's database, allowing users to access and view them through augmented reality. Additionally, Unity's cross-platform development features were leveraged to build and deploy the app across both iOS and Android operating systems. Moreover, certain backend functionalities of the project were implemented using C#, the scripting language of the Unity engine.

J. VSCode

Visual Studio Code (VS Code), developed by Microsoft, is a versatile source-code editor compatible with multiple programming languages. Notable features include debugging support, syntax highlighting, intelligent code completion, snippets, and code refactoring. In this project, VS Code served as the integrated development environment (IDE) for Flutter and Dart, facilitating rapid code writing and debugging. To enhance the development workflow, various extensions were incorporated. Among these extensions was the Flutter plugin for VS Code, which provided additional functionalities for creating Flutter applications.

5.DESIGN AND WORKING

A.Flow Diagram of Working

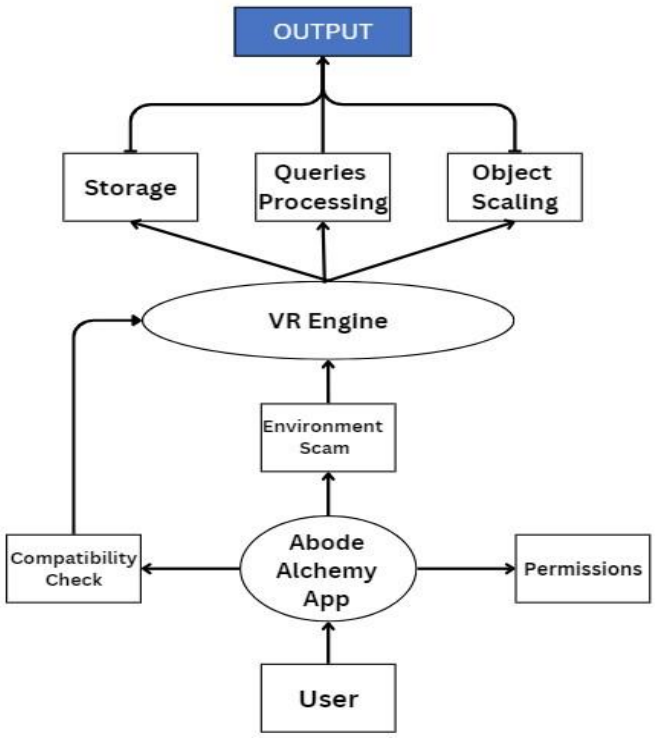

Fig. 2: Data Flow Diagram

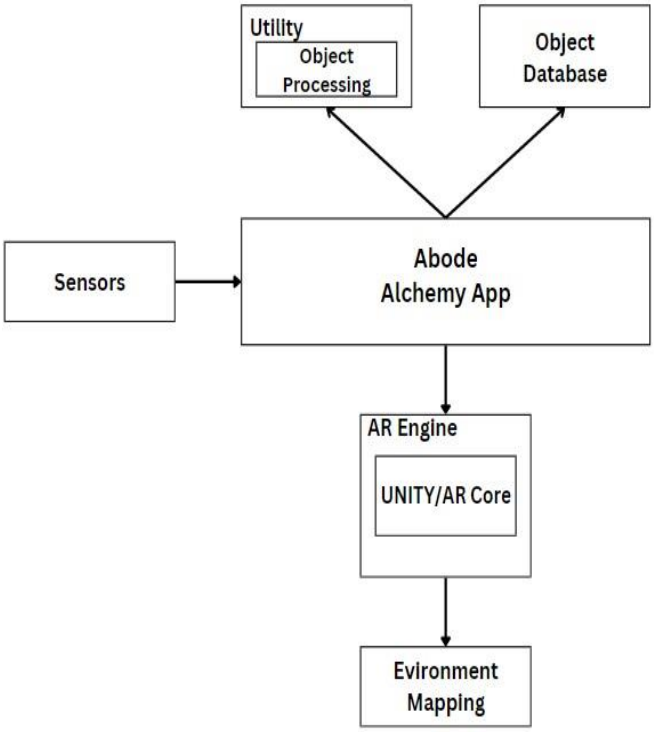

Fig. 3: Component Diagram

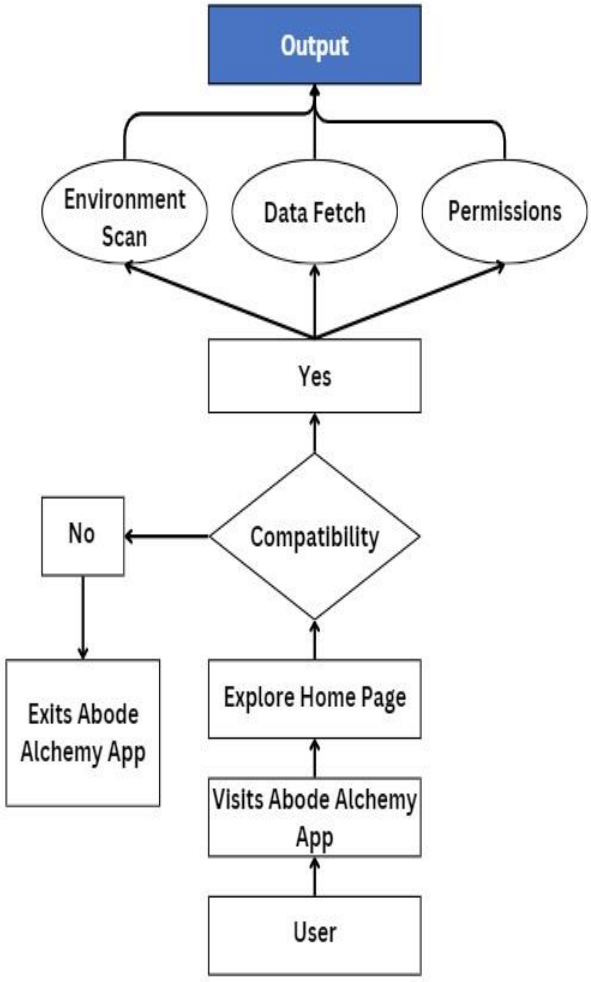

Fig. 4: Activity Diagram

B.Actual Interface

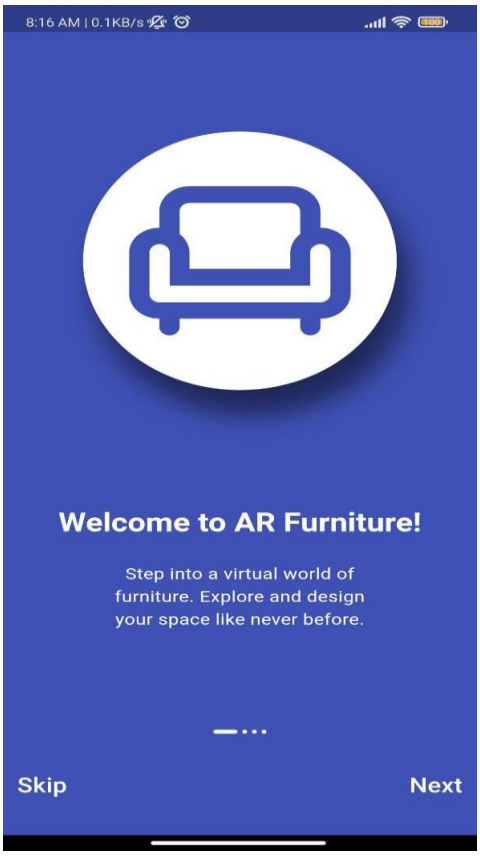

Fig. 5: Onboard Interface

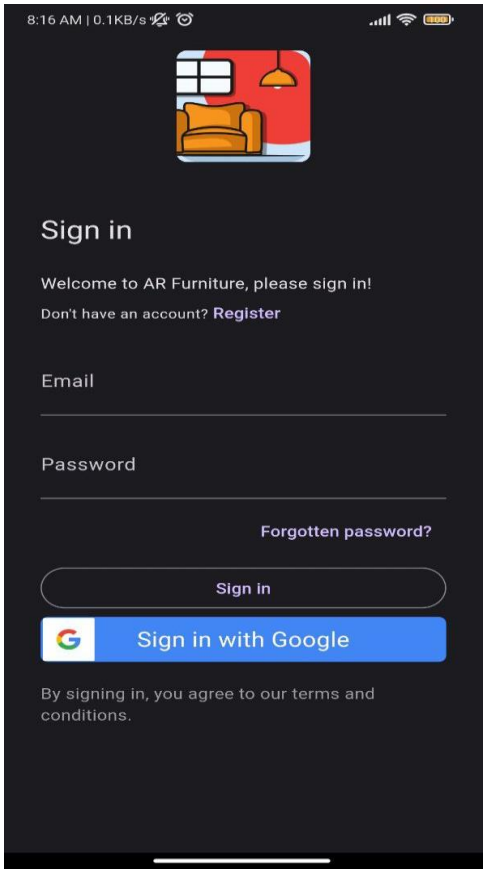

Fig. 6: Sign Up Interface

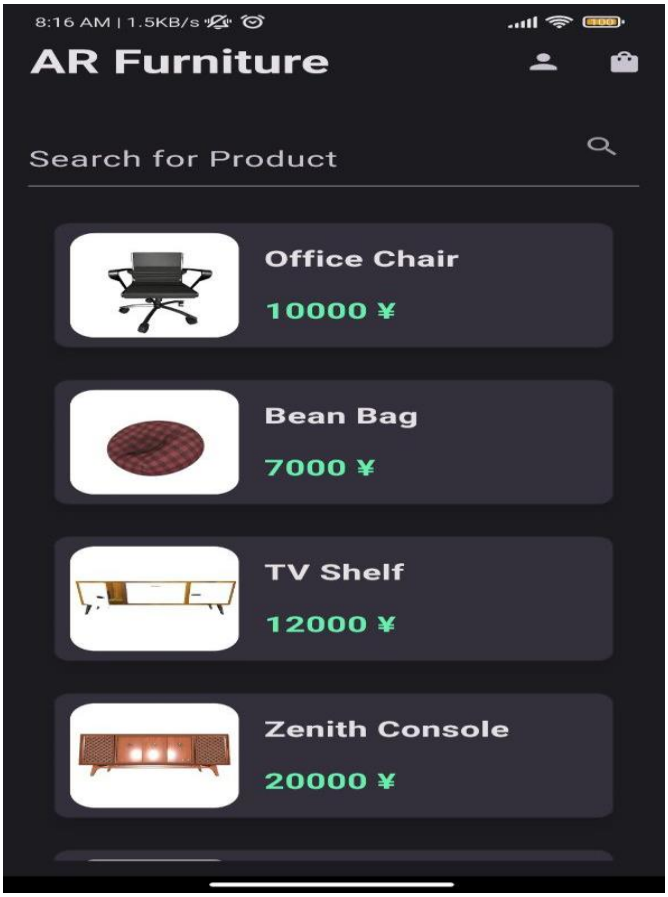

Fig. 7: Product Interface

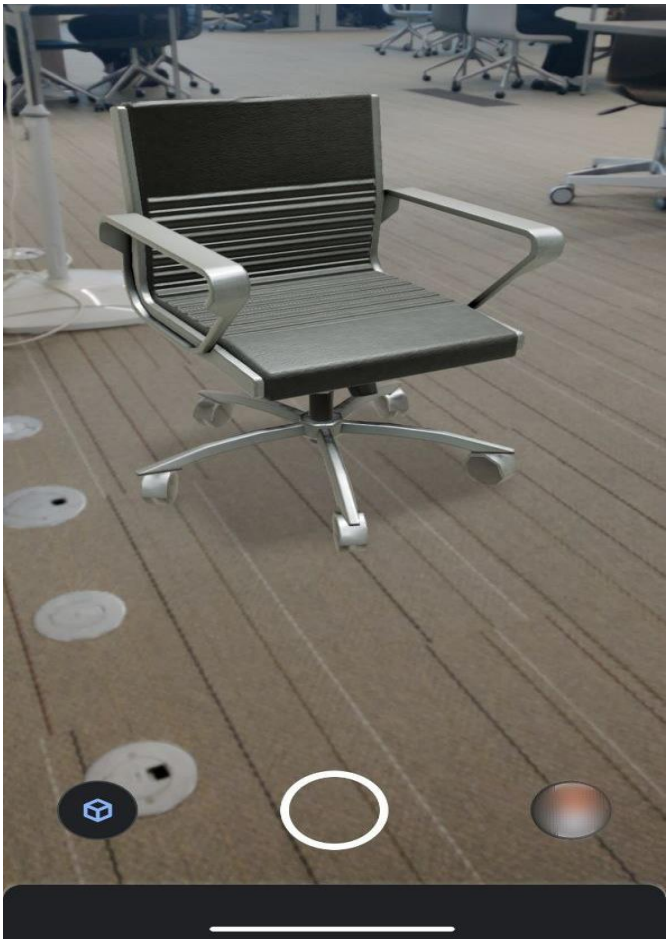

Fig. 8: Augmented Object into Real World

6.CONCLUSIONS

The Abode Alchemy App project aimed to develop a cutting-edge augmented reality platform for purchasing home furnishings. Utilizing advanced tools such as Flutter, Dart, Swift, C, C++, JavaScript, CMake, Firebase, Unity, and VS Code, a reliable and effective platform was constructed, offering users a distinctive and captivating shopping experience. Feasibility assessments affirmed the technical and economic viability of the idea, supported by readily available resources and hardware. A robust security system was implemented to safeguard user data, ensuring privacy and protection, as confirmed by a security analysis.

An intuitive and user-friendly interface was crafted through the project's iterative development process, which involved market research, user testing, and feedback. The seamless data management and synchronization between devices, enabled by Firebase integration, allow users quick access to their saved preferences and purchase history. The Abode Alchemy App presents a promising addition to the mobile app industry, offering consumers a more convenient and engaging buying experience with the potential to revolutionize the interior design sector.

With further development and improvements, the Abode Alchemy App has the potential to dominate the interior design app market. The project's success highlights the importance of leveraging cutting-edge technologies to enhance user experiences and develop innovative solutions, setting a high standard for future endeavors in the mobile app sector. Overall, the Abode Alchemy App project is a noteworthy success that raises the bar for upcoming ventures in the industry.

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REFERENCES

1.Design and assessment of a graphical iPad application for arranging adaptable furniture by S. Bonardi, J. Blatter, J. Fink, R. Moeckel, P. Jermann, P. Dillenbourg, and A. Ijspeert was published in RO-MAN, 2012 IEEE, September 2012, pp. 290-297.

2.Spatial Augmented Reality: Merging the Real and Virtual Worlds, O. Bimber and R. Raskar. 2005, A. K. Peters.

3.IKEA, "3d kitchen planner," http://www.ikea.com/, accessed: 2014-09-15.

4.TryLive, "Use trylive home to completely immerse yourself in augmented reality to visualise furniture," accessed: 2014-09-15. Available: http://www.youtube.com/watch?v=q5kJvjFcYVk.

5.In the 2010 Proceedings of the First Annual Scandinavian Workshop on Augmented Reality (ScandAR), held at Aalto University in Espoo, Finland, C. Slynge and R. Olesen published "ifurn: An Augmented Reality Application for iOS."

6.Van Reveled, D.W.F., and Poelman, R. The report, "A Survey of Augmented Reality Technologies, Applications, and Limitations," International Journal of Virtual Reality, 2010;9(2):1–20M. The Technical Writer's Handbook by Young. University Science, Mill Valley, California, 1989.

7.Ronald Azuma, Blair MacIntyre, Yohan Baillot, Reinhold Behringer, Steven Feiner, Simon Julier, Computers & Graphics, November 2001, "Recent Advances in Augmented Reality"Title of paper, if known, by K. Elissa, unpublished.

8.Kinectfusion: Real-time 3d reconstruction and interaction using a moving depth camera is described by S. Izadi, D. Kim, O. Hilliges, D. Molyneaux, R. Newcombe, P. Kohli, J. Shotton, S. Hodges, D. Freeman, A. Davison, and A. Fitzgibbon in Proceedings of the 24th Annual ACM Symposium on User Interface Software and Technology, series UIST '11. New York.

9.Android App & Training: https://developer.android.com/training/basics/firs
//flutter at https://flutter.dev.

10.AR interior designer: Automatic furniture arrangement using spatial and functional relationships Jeff K. T. Tang; WanMan Lau; Kwun-Kit Chan; Kwok-Ho To2014 International Conference on Virtual Systems & Multimedia (VSMM).