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Shape Your Home: Interior Designing Application

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ABSTRACT

This project offers a comprehensive solution for modernizing interior design methods by combining augmented reality (AR) technology with user-centric design concepts. The system has four major modules targeted at improving user experience and productivity in interior design projects. For starters, the AR-based object visualization and placement capability allows users to put virtual decor and furniture objects in their living areas in real time. Allowing customers to experiment with various layouts and combinations improves design decisions. Second, the AR-based measuring module gives users precise measurements of room dimensions and furniture sizes, which helps with proper space planning and layout. Furthermore, the wall paint selection module includes a large number of colour palettes, allowing customers to try different paint colours on their walls before they are applied. Users may utilize this function to see the aesthetic impact of various colour schemes, allowing them to make more confident selections about wall colour. Finally, the application makes it easier for customers to communicate with interior designers and decorators, offering them a quick method to acquire expert advice and collaborate on projects. The project's goal in combining these modules is to allow users to release their creativity, streamline design procedures, and efficiently accomplish their ideal interior environments.

Keywords— *AR Technology, Interior design, visualization, wall paint, Color palettes, Precise measurements, Interior designers.*

I. INTRODUCTION

The first aim of the project is to use AR technology so that a user can introduce virtual objects into their homes. This is feasible because this feature allows users to experiment with alternative ideas and see how they appear before making a selection, making decision-making easier and providing a unique design experience.

In addition, the second objective involves the creation of AR measurement applications so that consumers will be able to take measurements of dimensions of premises and furniture in a reliable manner. This ensures more accuracy and effectiveness in designing layouts for an office or a house based on an arrangement of pieces of furniture, leading to maximum use of available space.

Moreover, the paper explores the implementation of the wall paint selection module that enables people to select colour palettes and view a wide range of paint colours on their walls before implementing them. Moreover, this feature allows one to make easy decisions on what colour the wall should be by easily visualizing how different combinations would look, thus not only making the decision-making process streamlined but also giving power to the users about the aesthetic view of a room. Finally, connecting with interior designers is explored, since it simplifies the process for users seeking expert advice or cooperation on their projects. This technology goes above and above by ensuring that all of its users may seek professional assistance from registered interior designers and decorators, increasing access to expert guidance and ensuring easy cooperation on design projects.

In general, this study intends to provide understanding regarding the impact of AR technology and OpenCV on changing interior design processes. Consumers are enabled to express their creativity and, at the same time, facilitate the design processes by simplifying them, thus achieving their desired indoor spaces more effortlessly.

2. LITERATURE REVIEW

A mobile sensor, an AR gadget, a coordinate measuring device, and a computer make up an Augmented Reality (AR)-based system. The AR gadget has a camera to record the surroundings and a display to show overlays and the environment. The coordinate measuring device establishes the location of the AR gadget and the mobile sensor. In order to establish a referenced status for the AR device, the computer does the following: It controls the camera, establishes a reciprocal data connection, and provides the AR-data as well as at least one corresponding identification feature. It then establishes a pose for the AR device in relation to the respective identification feature and generates the overlays in the referenced status based on the AR device's pose [1].

The development of interactive Augmented Reality (AR) apps still requires a high level of technical expertise; the complexity of the application increases with the need for programming abilities. This paper presents a node-based visual editor that is both versatile and scalable. It is based on the entity system architecture, and it is demonstrated how to use the tool by creating a straightforward but interactive water cycle educational application. Six participants are split into two opposing groups (developers and non-developers) for a usability test. A questionnaire is utilized to get information about the users' experiences, and the findings are shown to indicate that both groups thought the tool was interesting and helpful[2].

In this paper, the application is predicated on a common planar (Pattern) that is brought into the frame. First, the last can be used to extract the camera's parameters and calibrate it thanks to the detection and follow up of the pattern. This enables us to measure things that are already present in the obtained scene and permits transitions between the various references (scene, camera, and image). Lastly, a few tests are shown to validate the theory and assess our approach [3].

A paint palette designed so that a painter or muralist may paint a ceiling or other structure while standing on a ladder or scaffolding. The paint palette is designed to hold paint while employed upside down [4].

Paint can be transferred and stored more effectively, enabling painters to work more quickly and efficiently. The paint palette system allows painter to pour paint into a low-profile container for later removal with a paintbrush or similar tool. A removable and disposed of paint retaining cloth holds the paint in an orderly and drip-free manner [5].

Users can visually paint on a wall or other display with the help of a painting simulator that is offered. Near the display are one or more sensors that can be activated by the user with one or more objects; each sensor is connected to a virtual paint color. A controller detects the user's object using the sensors, and when the object approaches the display, the controller directs a camera to follow it visually. When the item moves in relation to the display, the controller responds by projecting an image or other visual representation of the virtual paint color onto the display [6].

A wall painting tool is disclosed in the invention. A height-adjustable painting assembly is arranged at the upper end of the supporting base, a moving block is positioned at the upper ends of the linear guide rails, a supporting base is positioned on the moving block, a paint bucket is positioned on the supporting base, and a pump body is connected between the paint bucket and the pipeline. The device is made up of two parallel linear guide rails that are connected by a support [7].

The invention is connected to the method, tool, and technique for painting walls. Getting a rolling positive pressure threshold range of a roller rolling on a wall as a reference; getting a rolling positive pressure value of the roller rolling on a wall in real-time; matching the obtained rolling positive pressure value with the reference rolling

positive pressure threshold range; and emitting different voice prompts based on the outcome that the obtained rolling positive pressure value is matched with the reference rolling positive pressure threshold range are the steps that make up the method used to remind employees to perform various functions [8].

As of late, chat apps have become among the most important and popular ones on smartphones. They can send and receive documents, photos, and messages to any location in the world for free. Every message needs to be safeguarded. Today's chat apps are all utilized for sending messages fast and safely. Actually, things are not as secure as they seem when it comes to the sent messages. Therefore, in order to close this gap, homomorphic encryption is employed in this research to more protect the messages without slowing down the transaction. The purpose of this work is to create a homomorphic encryption chat application, which provides an extra layer of security on top of end-to-end encryption [9].

There are a lot of apps available nowadays in the social media realm that let us share info with others who live far away. These social media apps are available on multiple platforms. Our idea is a desktop social networking tool that allows us to communicate and exchange data with others around the globe. For this project, the Python programming language and associated modules were utilized. In our project, we employ TCP protocol for communication and a client-server architecture. It is equipped with a basic GUI interface. Keywords: TCP protocol, multithreading, social media app, chat application, and client-server model [10].

Chats are proving to be a useful and user-friendly method for retrieving information, and they are being used successfully in a variety of industries, including banking, healthcare, and customer service. However, the use of conversations for image retrieval has been largely disregarded, and existing systems to image retrieval mainly handle the issue of a single query-to-image round [11].

3. EXISTING SYSTEM

Traditionally we were following these methodologies to achieve the desired result (Interior designing process):

Positioning of items:

Traditionally, interior designers have planned the positioning of things within a room using physical models, drawings, or floor plans. To experiment with various designs and layouts, they might actually move furniture or decor objects around the space.

Additionally, designers frequently use their skills and knowledge of design principles to influence the positioning of objects in a way that improves usability and looks.

Wall Paint:

Initially choosing wall paint has required going to paint stores to see actual paint samples or palettes.
In order to see how paints appear in various lighting situations, designers may gather several paint samples to bring back to the place they are designing. Once a few possibilities have been chosen, designers could paint the walls in small quantities to see how the colors look in the particular setting.

The ultimate choice is usually determined depending on the created attractive, lighting factors, and overall design plan.

Measurement of Object:

Usually tape measures, rulers, and other hand instruments have been used to measure things and the size of rooms. Interior designers physically measure room size and existing furnishings to guarantee appropriate space planning. After that, these measurements are converted into digital or paper floor plans to help with the planning and placement of furniture in the room.

Connect with Interior designers:

Traditionally, clients seeking professional interior design assistance relied on word-of-mouth recommendations, referrals from friends and family, or in-person visits to design organizations.

During first in-person meetings, clients discuss their design choices, objectives, and budget with interior designers. Designers may express their design concepts to the client through sketches, vision boards, or proposals after the initial session.

The customer and designer usually communicate with each other via phone conversations, email exchanges, and in-person meetings during the design process.

4. PROPOSED SYSTEM

This application will provide following objective for interior designing using different technologies:

Object Placement using AR:

The "Object Placement" capability allows users to virtually arrange furniture and home decorations in their surroundings using augmented reality (AR). After turning on the AR camera, users may browse a list of available things and choose one to place in real time.

Wall Paint using color palette:

The "Wall Color Change" option enables customers to change the color of the walls. Take a picture of the room, making sure to include the wall that has to be edited. After that, the software recognizes the wall using object detection and OpenCV. Users choose a color for the wall, and the application applies it in real-time. Before viewing the completed image with the new wall color, users are able to explore many color possibilities and make their selection.

Connecting with Interior designers:

With the help of this module, customers may get in touch with interior designers for help. Interior designers get messages and images of the room from users.

AR-Based Measurement of different objects using nodes:

The "Object Measurement" feature measures objects precisely by using the AR camera on the phone. For a two-point measurement, users place anchor nodes and choose two spots on the object and they can mark multiple points on the item to determine its dimensions. This tool makes interior design project duties like space planning and furniture sizing easier.

5. METHODOLOGY FOR IMPLEMENTATION

This application uses various technologies and libraries for implementation:

5.1. AUGMENTED REALITY IN OBJECT VISUALIZATION:

Object Visualization in the Real Environment:

AR technology enables users to see virtual items layered on their real-world environment via the device's camera. This allows customers to preview how certain decor items or furniture will appear in their actual living areas before making a purchase or making design adjustments.

Selection and placement are interactive:

With augmented reality, users may peruse a list of available goods or home accessories within the app and choose things of interest. They may then use augmented reality to put these things in their environment, altering their location and orientation in real time to obtain the appropriate pattern or arrangement.

Precise proportions and sizing:

With the use of AR technology, users may see virtual items exact dimensions in relation to their real-world surroundings.

5.2 OPENCV IN WALL PAINT

Identification and Detection of Objects:

The wall is detected from the rest of the scene by using image processing techniques such as edge detection, contour detection, and feature extraction. OpenCV is utilized to evaluate the user-captured image and detect wall in space.

Color Selection and Application:

After the wall is identified, OpenCV helps to extract relevant color information from the user's chosen color or theme. To achieve proper color representation, color space transformations such as converting RGB to HSV or LAB may be necessary.

A real-time preview:

OpenCV allows the application to display a real-time preview of the selected color on the wall. As the user changes their color preferences, OpenCV automatically updates the virtual wall color in the preview image.

Processing and Rendering of Images:

Finally, OpenCV helps to produce the completed image with the modified wall color. It may be used in post-processing operations such as mixing the virtual wall color with the original image, changing lighting, and improving visual quality for a more realistic portrayal

5.3 AUGMENTED REALITY FOR MEASURING OBJECT:

Visualization in real time:

AR allows for real-time display of measurements as users interact with their surroundings. As users set anchor nodes and mark measurement sites, they can see the virtual markers directly in their surroundings, allowing them to properly assess distances and dimensions.

Depth Perception:

AR technology can include depth perception capabilities, allowing users to precisely calculate distances from the camera to objects in the environment. This helps to overcome perspective distortion issues and provides more precise measurements.

5.4 FIREBASE FOR USER AUTHENCATION:

Real-time Communication:

The Firebase Realtime Database may be used to provide real-time communication between users (customers) and interior designers. Instant chat, and image sharing are made possible by this.

User Authentication:

Only authorized interior designers will be able to access specific features or data inside the application thanks to Firebase Authentication's handling of user authentication and permission. It offers safe login options including Google Sign-in, email and password, and others.

Storage:

Multimedia files including photos, videos, and documents that are exchanged between users and designers can be kept in Firebase Storage.

6. WORKFLOW ANALYSIS

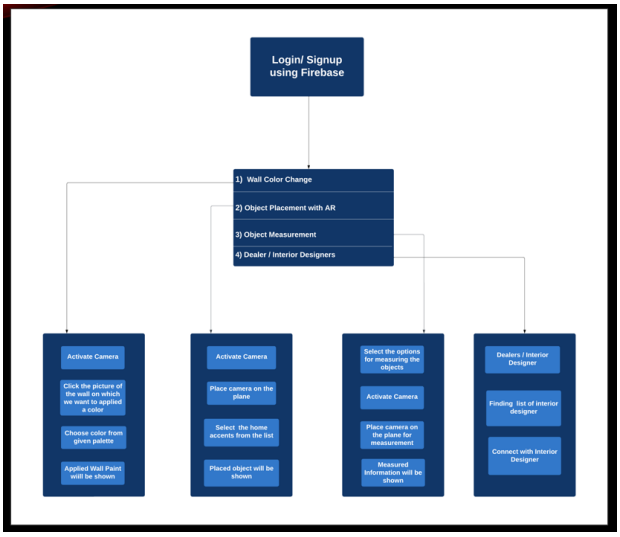

Fig. 1. Block Diagram showing the flow of work

This application's workflow consists of four key actions: user login/signup via Firebase, wall colour change, object placement using AR, object measurement, and dealer/interior designer interaction.

Initially, users interact with the application via a login/signup screen provided by Firebase authentication. Following authentication, the pipeline divides into four separate activities. First, with the "Wall Color Change" function, users use their device's camera to take a photo of the wall they want to change. They then choose a color from a palette and impose it in real time onto the captured image or show it directly.

Second, with the "Object Placement with AR" feature, users utilize their device's camera to create a reference plane in which they want to put virtual things. They are shown a catalog of home accents to pick from, and once selected, the chosen object is seamlessly combined into the user's surroundings via augmented reality depiction on the device's screen.

Third, the "Object Measurement" function allows users to utilize their device's camera for measuring. Users can initiate the processing of acquired data by putting the camera on a certain plane, which results in the display of relevant measurement information on the screen.

Finally, the program has a "Dealer/Interior Designers" component that allows users to view a selected list of interior designers. They have the option of directly connecting with these designers for advice and services, which will help them with their design projects.

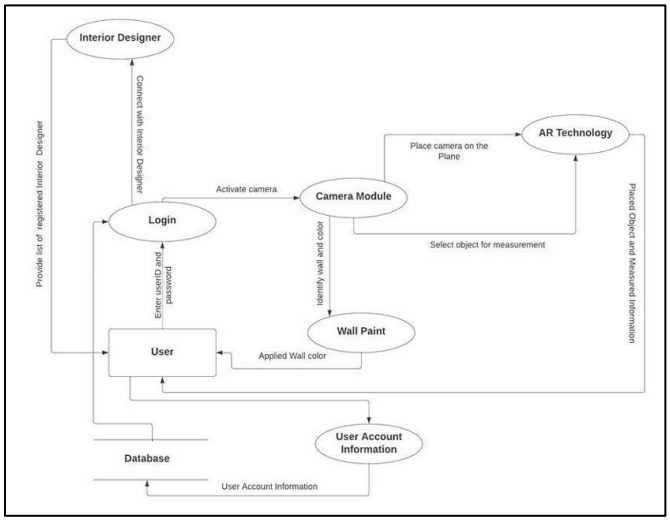

Fig. 2. DFD Level 1 describing the Workflow

7. SYSTEM REQUIREMENT

7.1 SOFTWARE REQUIREMENTS:

Developer End:

1. Frontend: XML
2. Android SDK
3. Java Development Kit (JDK)
4. Android Studio
5. AR Development Tools
6. Firebase
7. Operating system: Windows 11

User End:

1. Android 7.0 (Nougat) and later.

7.2 HARDWARE REQUIREMENT

Developer End:

1. 8 GB RAM
2. 256 GB Storage
3. Intel i5+ Processor
4. Architecture: 32-bit or 6t.
5. OS: Windows
1. 6.Mobile Camera

User End:

1. Mobile
2. Tablet

8. LIMITATIONS

1. Items with uneven shapes pose challenges too. Several factors influence AR measurement accuracy such as negatively - lighting conditions and objects obstructing view.

2. Some devices may lack AR support. Older devices may behave differently. It might be hard for people to use these functions without AR or with old devices.
3. The wall color feature lets you pick hues, but screens don't show exact shades. Factors like screen settings, light, and display quality change how colors appear.
4. Internet access is essential to utilize design services and connect with experts. However, areas with unreliable or limited connectivity may hinder your ability to use this feature seamlessly.
5. Many people worry about their privacy. Sharing images and messages with interior designers means sharing personal stuff. Some users might not want to share private photos or info. That makes this feature less useful.

9. FUTURE SCOPE

1. Integration with e-commerce sites for the purpose of buying decor.
2. Working together with real estate applications for advertising properties virtually.
3. Increased measurement and identification of objects precision.
4. Social media integration for the exchange of designs and experiences.
5. Implementing in place an effective rating and feedback system for both consumers and experts to ensure flexibility and quality.
6. Integrating with smart home appliances to manage lighting, temperature, and other features inside the planned area.

10. CONCLUSION

To summarize, combining augmented reality (AR) technology with user-centric design principles provides a breakthrough option for upgrading interior design processes. This project aims to empower users by providing four key modules: Firstly, the augmented reality (AR) lets you try out virtual furniture and decorations in your real space. This helps you make design choices and be creative. The AR measuring tool also gives precise room and item sizes. It helps you plan out the space and layout effectively.

Secondly, the wall paint module gives many color choices for walls. People see how walls look with color before painting. This helps them pick wall color they really like. Moreover, a key aspect enables collaboration with interior designers and decorators. This feature simplifies the process while enhancing results through communication and garnering expert insights. This initiative marks an important advancement in interior design approach by providing easy tools for experimentation, thoughtful choices, and collaboration, with the potential to improve user experience and productivity in the field.

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