DÉCOR : Augmented Reality Based Application To Enhance Interior Designing Using Marker-less Tracking

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***Abstract*—Today information and communication technology support the development of the interaction of humans with the virtual environment such as medical, science, education, etc. The field of computer science innovation known as augmented reality deals with combining the real world with computer-related data. Earlier, if customers wanted to buy furniture without visiting the showrooms it was not possible because it is very important to check how the object actually looks in their home structure. Now in our proposed system, it is possible for the users to purchase the furniture objects while staying in the home without having to visit the furniture showrooms. The main purpose of the "DÉCOR : Augmented Reality Based Application To Enhance Interior Designing Using Marker-less Tracking" is to develop an android application for trying different furniture in a virtual way using a mobile which has a camera that supports AR. The application will eradicate the human efforts of physically visiting the furniture stores which is a very time-consuming activity. Besides this, it might be easier to use this technology in online shopping such that the user gets to try the variety of furniture items in their room or house that they wish to purchase and allowing the user to visualize the room as to how it will look after placing the desired furniture in it. The user can try different types of furniture virtually, without any physical movement of the furniture items. By developing an augmented reality application that allows us to imagine the furniture in the appropriate arena, we hope to improve time efficiency and increase accessibility to the furniture that can be tried on. Before purchasing furniture equipment, the buyer will be able to digitally visualize it in a real-world environment. The consumer will be able to see how his home will look after buying the appropriate furniture equipment as a result of this method. This system would let the user to try out the various set of combinations of the furniture objects virtually without any actual movement of the furniture objects. This will help the customer to determine how to decorate the furniture in his/her home structure.**

***Index Terms*–Augmented reality, marker detection, rendering.**

I. INTRODUCTION

Augmented reality and virtual reality have been interesting topics in the tech industry for many years, but with the advent of devices like Google Glass, they are gaining new attention and visibility. Augmented reality is a technology that uses vision-based algorithms to enhance environmental senses like sound, video, audio, and other inputs using sensors on real-world objects and our devices' cameras. It's a more efficient way of making real-world data and communicating it, allowing virtual elements to be superimposed on the real-world environment. Augmented reality superimposes data on top of our immediate surroundings, transporting us to a digital universe in which the physical and virtual worlds are inextricably linked.

The idea behind Augmented Reality is that when a user takes a picture of a real-world object, the underlying software senses a target and triggers it, causing it to overlay a virtual object (a 3D image) on top of the real-world image and display it on our camera screen.

Our application allows the users to view a 3D model - a virtual similitude of the physical piece of furniture without any disruption of the markers - which can be viewed and configured in real time by making use of our Augmented reality application.

With the aid of a dynamic and interactive GUI, a user can imagine the image of virtual furniture presented in the real world, which is a modern technique for applying Augmented Reality technology to the furniture industry.

II. RELATED WORKS

1. Mami Mori et al proposed a system called "A Transitional AR Furniture Arrangement System with Automatic View Recommend ation" in 2016. It is a transitional AR furniture arrangement system that recommends a secondary view that can improve a user's understanding of a room layout and contains two scenes high occlusion and low occlusion.
2. Snehal Mangale, et al proposed a technique named "Virtual Furniture Using Augmented Reality" in 2016 which is a web based application where the user, have to place the marker in a room where they want to try out the

furniture items.

3. Elizabeth Carvalho et al proposed a system for "Use of Augmented Reality in furniture industry" which uses Simultaneous Localization and Mapping (SLAM) that helps in fixing to rigid body and makes use of markers to reference object to the rigid image.
4. Khushal Khairnar et al proposed a technique named "Furniture Layout Application Based on Marker Detection and Using Augmented Reality" to develop an application where user have to place the marker in a room where he want to try out furniture items. The user's webcam will be on and through the webcam he will capture the live feed of the room. Then application search the marker using fiducial marker detection algorithm. To identify the position of marker using direct linear transformation algorithm. Whichever furniture object the user want to try out he will select that object from the database. Then the application will superimpose 3D object. In three dimensional objects are overlaid on to the two dimensional image frame acquire from webcam.
5. Santosh Sharma et al proposed technique named "Marker less Augmented Reality based Interior Designing system", which uses Markerless Augmented Reality as a basis for enhancing user experience and for a better perception of things. It has advantage of no need of markers in the surface area and disadvantage is Object is aligned with camera so that it moves as we move a camera.

III. PROPOSED WORK

Using an augmented reality program, this is simple to achieve. The promise of augmented reality in the field of interior design has yet to be fully realized. People nowadays are technologically savvy and use smartphones with augmented reality cameras. As a result, the idea of designing a furniture layout-based application takes the designer one step closer to being technologically advanced.

With the recent emergence of better quality cameras and more accurate sensors in about to be mainstream devices. In our current implementations of application, we use Vuforia to accurately determine the real-world environment, allowing users to place virtual 3D objects into a real world context.

The proposed framework relies on marker-less Augmented Reality to improve user experience and perception. Marker-less tracking is a spatial tracking technique that allows us to determine an object's location and orientation within a given context. Since this framework does not use labels, it is a dynamic and versatile GUI.

The basic idea of the proposed system is to place the digital 3D models the on top of real things using a camera.

- This Application will use the mobile phone which is AR supported to scan the living area and display the augmented 3D image of furniture to check whether it fits in the environment or not and thus helps with better choice of furniture for our home.
- Augmented objects are the virtual objects (3D Models) that are modelled to look like the furniture objects that we will us in our app.
- The next step is to use the Unity 3D platform's various components to set up light, shadow, and camera positioning for these models.
- The next step is to choose the suitable furniture model, which is then manufactured and processed before Vuforia packages are loaded onto the scanned surface.
- A 3D model is mapped onto the mobile device, which determines the model's dimensions, which are then rendered and projected on the screen.

IV. MODULES

The proposed system consists of:

- Creation of Augmented Reality Objects.
- Developing Scenes for User Interface.
- Placement of the 3D Object on the Surface Area.
- Verification of placed objects

A. Creation of Augmented Reality Objects

The Unity 3D project must first be opened. Then, from the menu bar, choose the GameObject menu. There are several items in the GameObject. Menu that can be used to create a game. From there, we can choose a 3D object and the form choices that best fit our needs. We can choose the rotation tool to aid in the rotation of our plane object. It also assists us in rotating the items in our scene. We can create the assets by using the hierarchy view which helps us to combine various shapes within the unity. There is a pro builder in Unity which allows us to edit our shapes helping us to obtain our 3D furniture objects.

B. Developing Scenes For User Interface

In this module, we create the scenes necessary for every slide of our application using the Unity 3D platform. The main interface contains furniture model, buttons that helps to move to next model, to scan the surface area of living room, description of model such as length, width, height. In order to implement these functions, we make the scene display to ratio of Android display and add the buttons to the scene that helps in moving to the next scene. Later we use the 3D model developed in Unity 3D and functionalities like rotating the chair will be displayed using C# code for that object and add functionalities to move to next scene.

C. Placement of the 3D Object on the Surface Area

For this project Android studio is used with the Vuforia package. Vuforia packages is used because it offers 3D model demonstrations, to create applications for customers to personalize their products and gives a robust AR experience with the vision technology. We upload our target image in the Vuforia cloud, it renders the features of the target image and stores it such that when we scan the environment it identifies the target image. After the identification, our 3D object gets

placed over the target image. Target image acts as a position indicator such that the 3D furniture image gets fixed wherever we place our target image.

D. Verification of Placed Objects

Once the user thinks that the object is well suited to his need, he can check the description by selecting the information button that helps in describing the width, height and length of object. In order to view this description, we create another scene that helps in displaying all the required information. We add one more button that helps in rotating object by an angle of 30°. For this rotation and link redirection we use two classes which are programmed with C#.

V. System Architecture

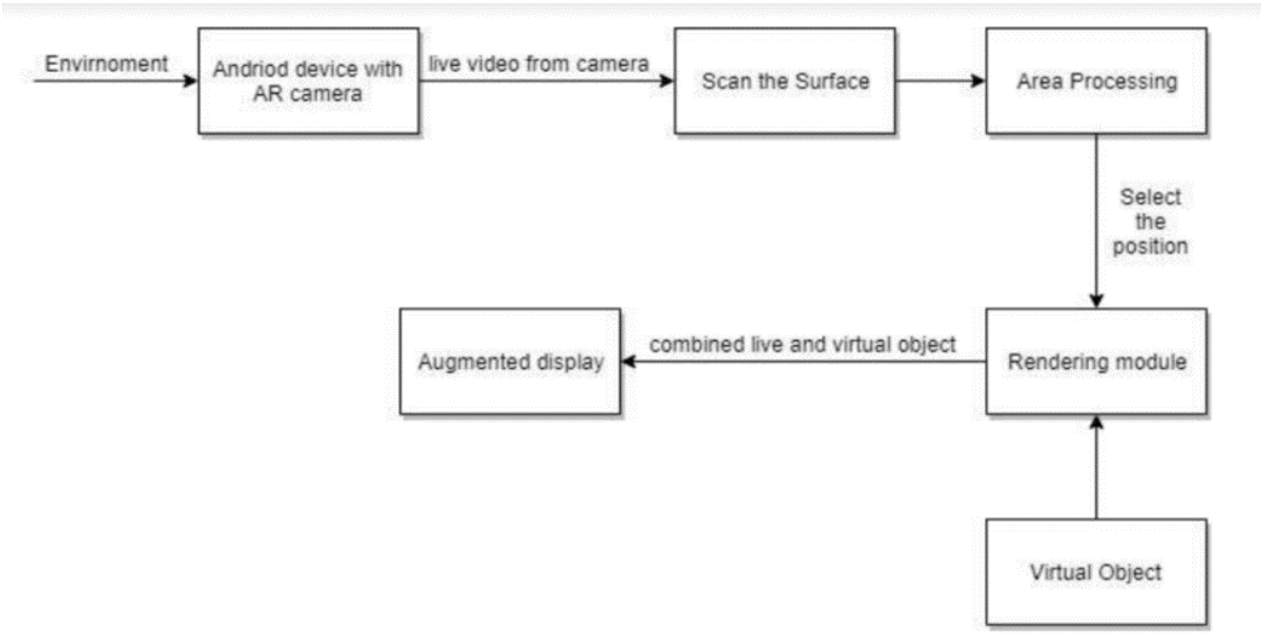

Fig. 1. System architecture.

VI. Advantages

- In interior design industry, AR will help the designers to visualize their project even before actually building it. Thus, making the design process ten times easier.
- Using AR in interior design the user can also participate in the designing process by instructing the designer the changes he requires which thereby increases the creativity of both the parties.
- A good AR visualization for the customers will help in quickening the purchase along with designing process and thus increasing the profit.
- The best of all, it saves time. Heard of the popular saying? "TIME IS MONEY" thus, save time, save money and be completely satisfied with the choices you visualize.

VII. Experimental Results

Our project was created using Unity 3D, Vuforia, and Android Studio.

- Unity 3D is game creation software that provides a development environment for interactive 2D and 3D content, as well as a rendering and physics engine, a scripting interface for programming interactive content, and a content exporter for a variety of platforms (web, mobile, etc). It is used to create our software's scenarios.
- Vuforia is a mobile-based augmented reality software development kit that allows developers to construct augmented reality apps. Using computer vision technology, it recognizes and tracks planar images and simple 3D objects like boxes in real time. The target image is scanned and stored using Vuforia so that when the camera is put over it, it identifies it and inserts our 3D item on top of it.
- The android studio aids in the creation of the .apk file.

A. Home Page

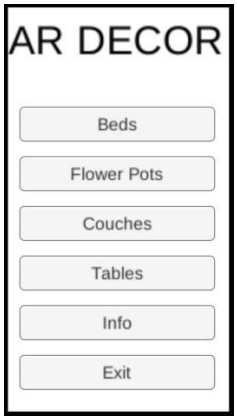

Fig. 2. Home page.

This is the home page of our app and it consists of five sections of varied furniture pieces: Beds, Flower Pots, Couches, Tables and Information.

B. Ouput 1(Bed 3D Image)

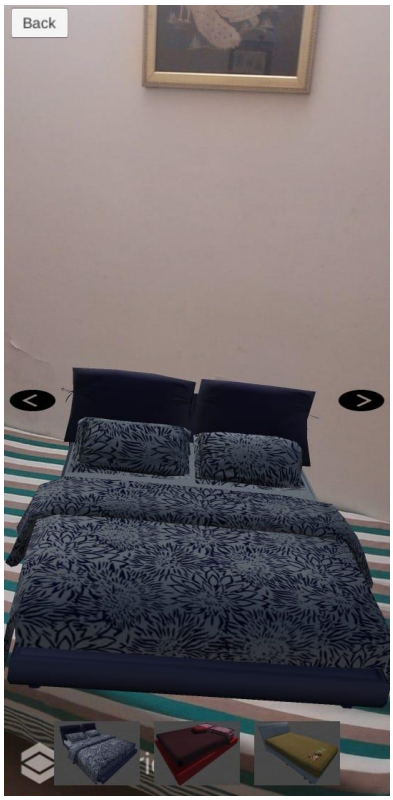

Fig. 3. Bed 3D image.

The 3D image of the L shaped sofa has been successfully positioned on the target image and now we can check if it fits in our home set up. We can rotate the sofa using the arrows provided and there are 3 options of beds where we can choose from.

C. Output 2(L Shaped Sofa)

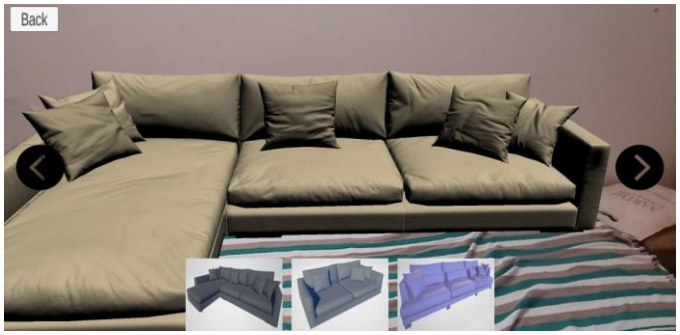

Fig. 4. L-shaped sofa 3D image.

The 3D image of the L shaped sofa has been successfully positioned on the target image and now we can check if it fits in our home set up. We can rotate the sofa using the arrows provided and there are 3 options of sofas where we can choose from.

VIII. CONCLUSION

This system is used to analyze the use of augmented reality to render the furniture model in real world. Augmented reality is a technology that allows the customers to decide the furniture to buy by allowing interaction between the 3D images and the real world, offering new possibilities for furniture online shopping. It helps the customer to view and understand the furniture for his/her requirements. Due to this customer will know how the furniture be setup in his house. Augmented reality's support for furniture helps in creating many new opportunities for future research to anticipate new ideas in the field of online shopping as customer will get benefit with these types of applications and gives a better understanding and decision making for purchasing a furniture in an efficient way. Augmented reality is new evolving technology in the field of computer science and will make us much more helpful than the traditional technologies .

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