

FURNITURE ORGANIZER APPLICATION USING AUGMENTED REALITY

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Abstract — The rapid increase in technologies like Virtual Reality (VR) and Augmented Reality (AR) demand for smart house planning, especially in mobile phones. The user is the main component who is responsible for managing the environment. Mobile based Augmented Reality is steadily being introduced in the market. It is helping in achieving a reduction of the associated workforce, economic costs and time intervals. This improves the overall control of the system. We aim to replace the conventional method of moving furniture from house to house and provide virtual view of the furniture in the new house. This also creates a scope for realtors and buyers during house hunting as well as for house planning. We will be using UNITY 3D, Android Studio, cloud-based software called Firebase, Wikitude, ARCore in the development of the Augmented Reality application. We propose a system where customers can simply tap into their phones and open the application. Once they open the application, they will be presented with three options: New Environment, Virtual Tour and Load Environment. The main idea is to scan the room with mobile camera and select different types of furnitures for the room. The users will be able to choose from a variety of furniture models and place them wherever they want. These furniture models can be resized according to the users will. The Virtual Tour option helps in creating a 3D blueprint of a room. This is useful for realtors and buyers during house hunting. The environment created will be saved on a secure cloud-based database called Firebase. Thus, a hassle-free house planning can be done with no additional cost for user.

Index Terms - Furniture, Vuforia, UNITY3D, Augmented Reality, ARCore, Wikitude, Mobile application.

1. INTRODUCTION

Moving from one house to another is quite common nowadays. The problem of moving or simply buying a new house is not a hassle. The main hassle is moving the furniture from the old homes to the new ones. Lot of times, people find out that certain old furniture does not fit well in the new home. So, they have to sell it and buy some new furniture. There is also no certainty whether the new furniture bought online will look good or fit well.

However, with the evolution of Augmented Reality, new approaches have been developed in some parts of the world. One such example is marker-based furniture placement - where a marker (which can be any 2D object) is detected by the camera and the furniture will pop out where the marker is placed [2][3]. The other primitive method is the measurement of the furniture, the room and then placing the furniture accordingly. However, the primitive method is tiresome and creates wastage of resources, time and money. The marker-based system is a very small-scale process and cannot be implemented on a large scale.

The number of mobile devices supporting accelerometer and gyroscope are increasing nowadays. The camera is also powerful. Therefore, Augmented Reality can be leveraged for the purpose of house planning. We aim to put mobile devices to use for house planning and apply the concept of Augmented Reality, Virtual Reality [5]. This will help to overcome the drawbacks of conventional system.

2. RELATED WORKS

2.1 Physical Method: This is a traditional approach which has always been used and is still in use. This method requires the user to manually lift and place the furniture every time the user wishes to change the arrangement of the furniture. Even if the user wishes to buy a new piece of furniture, the user has to visit a lot of shops. First, the user has to decide what sort of furniture they wish to buy. After deciding the type of furniture, the user then must roam around to find a suitable piece of furniture. This is a tedious task since the user invests a lot of time and energy to find a perfect piece of furniture for their home.

In the case of property dealers, the dealers have to visit each and every home with the buyers to see the house space. This goes on until the buyers find the perfect place. The buyer and the dealer both, spend a lot of time travelling to various locations which is tiresome and a time-consuming task.

2.2 Marker-Based Augmented Reality: In a marker-based Augmented Reality application, the images (or the corresponding image descriptors) to be recognized are provided beforehand [2][3]. In this case the user knows exactly what the application will search for while acquiring camera data (camera frames). Nowadays most of the Augmented Reality applications dealing with image recognition are marker-based. The marker-based Augmented Reality needs a marker or a specific image for the application to work. The furniture or any other model is spawned only when a marker is detected by the application. If the marker is not there, the application cannot spawn the model and hence the user gets limited scope. Marker-based Augmented Reality also does not have the functionality to create a virtual world, where the user can store the previous configurations. The marker-based Augmented Reality is much simpler and is used in a lot of upcoming applications.

2.3 Planar Object Tracking: Planar Object tracking is a relatively new approach for the Augmented Reality system for the furniture layout based on a planar object tracking [1]. The planar object tracking methods using natural features are effective methods to estimate the object's pose and position. This is because we are able to use the natural images. However, most of the feature descriptors have a lot of matching procedure. Therefore, by using an efficient feature point descriptor which is very fast both to build and to match, planar objects are tracked. Floor plans as used as the planar objects, and then furniture CG models are overlaid on the floor plans [1]. This is because the floor plans are presented in the selection of rooms for rent or buy. Therefore, this system helps borrowers and buyers to select some mansion or apartment rooms. In order to show the effectiveness of the proposed system, planar object tracking experiments when we applied the proposed system to some floor plans. Also for realistic results we refer the content-based image retrieval system. It retrieves the stored images from the database by comparing the features of the uncertain image against the images in the group [7]. The system first extracts and stores the features of the uncertain image then it go through all images in the database and extract the features of each image. The results are the images that its features are most similar to the uncertain image.

3. SYSTEM ARCHITECTURE AND METHODS USED

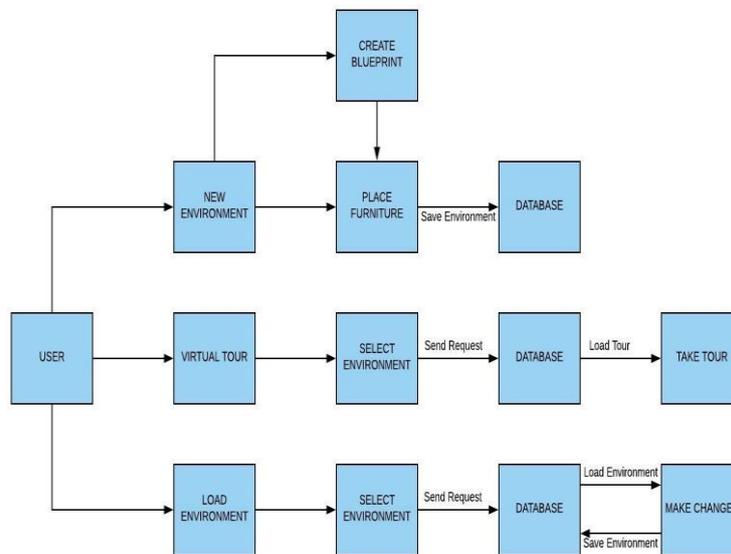


Fig 3.1 Block Diagram of the application

Figure 3.1 describes the proposed system architecture. The system architecture helps defines how the users can use the application and what input will produce what output. The user can login to create a new environment or load a previous environment. The user can also choose to take a virtual tour of a home. The application is interfaced with Firebase using Unity and Android Studio SDK which helps in the backend connectivity for storing and retrieving the virtual world. The user is basically provided with three options: a) Create new environment b) Virtual Tour and c) Load Environment.

When the user chooses to create a new environment, the application opens the phone camera that is linked with the application. The user will be presented something similar to Fig 3.2(a) and Fig 3.2(b). The user can also create a blueprint by selecting to create a new environment. The place furniture module is divided into two phases; Plane detection phase and object placement phase wherein the plane is detected and made static. Then objects are then placed on the plane using ARCore.

ARCore is constantly improving its understanding of the real-world environment by detecting feature points and planes. ARCore looks for clusters of feature points that appear to lie on common horizontal surfaces, like tables and desks, and makes these surfaces available



Fig 3.2(a) Plane detection using ARCore

The module detects the X-Z plane using ARCore and the plane shows red color if the plane is not detected.

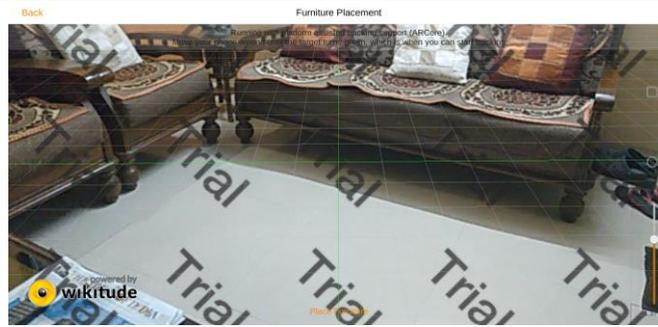


Fig 3.2(b) Plane detection using ARCore

Once the plane is detected by ARCore, the grid (where the furniture is placed as reference) becomes green in color which indicated that a plane has been detected and the furniture can be placed. If the user wishes to place furniture, they can click on the 'Place Furniture' button. This will make the grid static which will allow the user to place furniture. The user can also move around and view it from different angles.

4. RESULT



Fig 4.1 Placing furniture in the actual environment

The objects are AutoCAD fbx models as a result of which a 360-degree view of the object can be seen. Since the plane is fixed multiple objects can be placed around and in accordance to each other. The object follows all the rules of physics such as gravity, shadows, overlapping and distance auto resizing i.e. the farther the object is placed, the smaller the object will be in size. The overlapping of objects ensures that the models blend in with the environment to make the simulation as real as possible. The object placed in the environment also follows all the rules of physics such as shadow, gravity, overlapping, distance automatic sizing and different angle view.



Fig 4.2 Placing multiple furniture together

The user can mix and match from the variety of options. This helps the user to get a better insight to how the overall house would look once it is furnished. This is possible with as ARCore keeps track of each object in the environment individually. This helps to make a multiple object environment as each object is tracked and is not lost in the environment.



Fig 4.3(a) Furniture can be viewed from different angles



Fig 4.3(b) Furniture can be viewed from different angles

Before the user fixes the plane to start placing the environment, the grid is dynamic in nature. But, once the plane has been fixed, the grid becomes static. This allows the user to view the furniture from difference angles. This also gives an insight as to how it will look from different parts of the house.



Fig 4.4(a) The furniture can be placed at different distance

Since the grid has been fixed, the user can place the furniture at different distance. The user can drag and drop the furniture anywhere on the grid. The furniture object follows the laws of physics and changes its size dynamically. This means that if the object is dragged far away, it will appear small automatically and vice versa.



Fig 4.4(b) The furniture can be placed at different distance

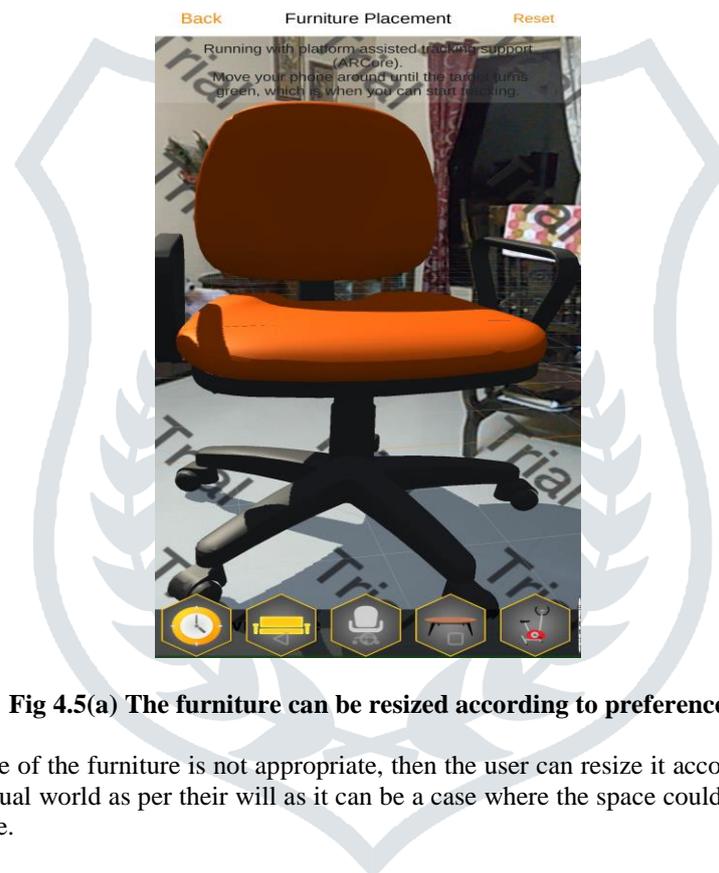


Fig 4.5(a) The furniture can be resized according to preference

If the user feels that the size of the furniture is not appropriate, then the user can resize it according to their will. Resizing will help the users to set up the virtual world as per their will as it can be a case where the space could be small or even big. Therefore resizing plays an important role.

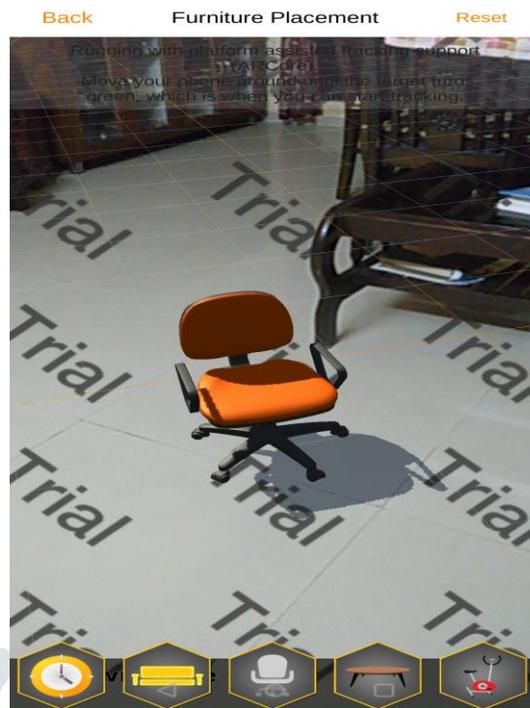


Fig 4.5(b) The furniture can be resized according to preference

5. CONCLUSION

As technology progresses, it makes some of our tasks easier. Augmented Reality and Immersive Media as a whole are some of the upcoming technologies. It helps the user to have an immersive experience and simulate a virtual world in a real world. In a similar way, this Furniture Placement application simulates the furniture virtually by showing it as a part of the real world. It is meant to reduce the physical work and help in better organization of a house. The users can take advantage of the features provided by the application to reduce the amount of time and effort spent in buying furniture significantly. Customers can use the application and take an accurate decision about the type of furniture they want. They can place the furniture and check whether it suits their home. The realtors can load the virtual world anytime and anywhere. Customer does not have to visit every house and can take a tour from where he feels comfortable.

6. REFERENCES

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