

INTERIOR DESIGN USING AUGMENTED REALITY

Ms. Tanmayi Samant¹, Ms. Shreya Vartak²

^{1,2}Student, Department of Computer Engineering DJ Sanghvi College of Engineering, Vile Parle, Mumbai-400056
Maharashtra- India.

Abstract - AR technology is often used in applications that simulate an arrangement of furniture. We here will discuss a system based on Augmented Reality for Home Exhibition, which supports real-time tracking without Identification Markers, the system uses FAST corner detection. To solve this problem, this paper proposes a method that can add virtual object to the real environment (Augmented Reality) using camera. Augmented Reality furniture arrangement systems are useful for viewing room or building layouts without having to buy or move real furniture. However, such systems often require users to physically and frequently change their viewpoint of the physical space, which requires manual manipulation of the scene, and are often limited to 2D tablet or phone interfaces. To help address this problem, we have developed a system that automatically calculates the most suitable viewpoint to improve understanding of the room layout as a whole, and allows the user to easily transition to that viewpoint.

Keywords: - Augmented Reality, Identifications Markers.

1. INTRODUCTION

Recently augmented reality (AR) furniture arrangement systems help users overlay virtual furniture onto the real world. Such systems allow people to see how the room will look with new furniture without actually buying or moving real furniture. Augmented Reality (AR) is a kind of Computer Vision Technology which can add the virtual information to the real environment, which makes the virtual and the real as a whole. It is a popular research area in recent years, more and more researchers studied on it. The research is mainly divided into two directions: In the aspect of theory, the scholars innovated constantly on the key algorithms of the core part, from based on the artificial markers to the natural markers, and then based on the visual no marker system, they made the Augmented Reality Technique's implementation more and more natural; On the other hand, in business applications, the Augmented Reality Technique has expanded into every field, appeared many applied innovative developments combined with traditional industry.

We will combine the theory and business application, applied the Augmented Reality Technique to the household decoration. The research based on the Virtual Home Augmented Reality System of Android operating system, consists of the researches and the developments for the key algorithms of every module of the system. The system can stack the virtual 3D furniture models on the user's real room, place the furniture through human computer interaction, simulate the home decoration process, create home space in dream, make selecting furniture and the decoration more convenient, which has commercial value. This system supports real-time tracing with Identification markers

2. SYSTEM ANALYSIS

This system is a Home Exhibition developed by Vuforia SDK Augmented Reality technique based on Unity platform for android devices (jelly bean and above.), it can realistically display the virtual models on the user's real scene, realizing the user's operation to home and the real-time photo to AR scene.

A. System General Design

The system uses mobile phone build-in camera to collect image as the real scene image observed by human eye and stacks the 3D furniture models on the screen display image. First of all, we need to do the feature detection description to the images collected by the camera, choose tracing image and do 3D registration, establish initial 3D map and obtain the camera pose. Next, in the software development period, we build 3D furniture models by using unity3d. Through identifying and tracing marker images, the camera obtains external parameters matrix and establishes projection models, at last stacks the imported 3D virtual models on the tracing image. Because Android smart phone has touch-screen interface function, we can place the furniture by sliding screen. The system framework is as shown in Figure 1.

B. Analysis and Design of Tracking Module

As the start of the whole AR scene, tracking mode plays a vital role in the entire display module. This Augmented Reality system we hope to establish only need the user interact with the mobile phone without any other auxiliary operations, which can experiences the virtual interior augmented reality in any unknown indoor scene. at first the environment is created using the VuforiaSDK. That is the augmented reality camera is set that will be used to display the 3d models in real world. An image that can be easily found by any user will be set as an image target. Image target will be created from VuforiaSite.(<https://developer.vuforia.com/targetmanager/licenseManager/licenseListingDetails>) i.e. Database of image targets that will be used will be created.

This images will be set as image target in the image target prefab of the VuforiaSDK. This image targets are then attached to AR Camera as tracking module.

C. Analysis and Design of Exhibition Module

The exhibition effect this system wants to realize is that stacking the virtual furniture models on the real room, and can place and observe the virtual furniture in real time. The display module contains the construction of 3D furniture models, the making of 3D display animation and the establishment of the virtual furniture projection models, which can make it stack on the real environment. After initializing the system, we can determine the projection model from the real scene to the camera image through placing the image targets at the desired location. According to the projection model, it then uses AR camera to locate the position and place the virtual furniture models real-time display on the camera image.

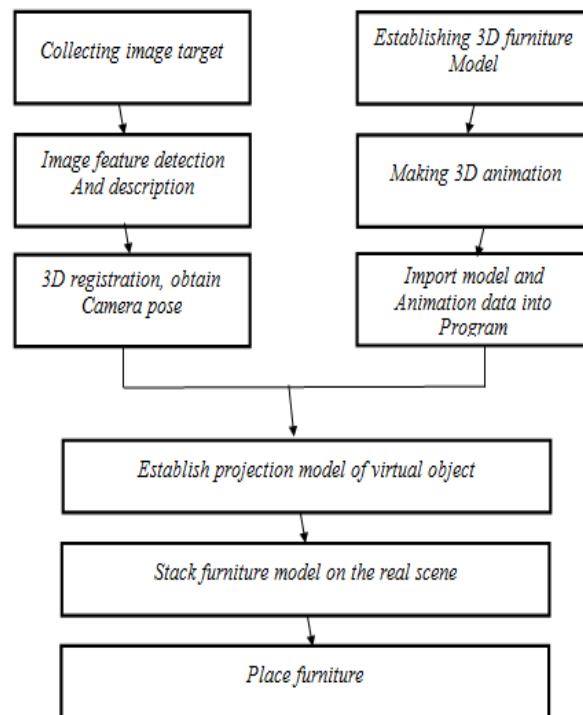


Fig 1.System Frame Diagram

D. Analysis and Design of Interactive Module

There are many reference factors for the determination of the interactive mode of home selection functions, such as this kind of selection mode should let the user understand how to operate at a glance, in addition, based on the large quantity of the home service, home sort selection also should be considered. Therefore, the home selection can firstly enter into home species selection by clicking a plus sign on the screen, after selecting the kind the home service belongs to, there will be a pulled column which contains all of the home service's circle thumbnail belongs to this kind jump out from the left of the screen, users can browse the content of the column by pulling up and down, select the home service you want by clicking the circle thumbnail. After fulfilling the primary need that can select model to display, interacting with the home

service appeared in the AR scene became the new requirement for user. The operation which user needs to do to the home is no more than

3. USE-CASE DIAGRAM:

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses.

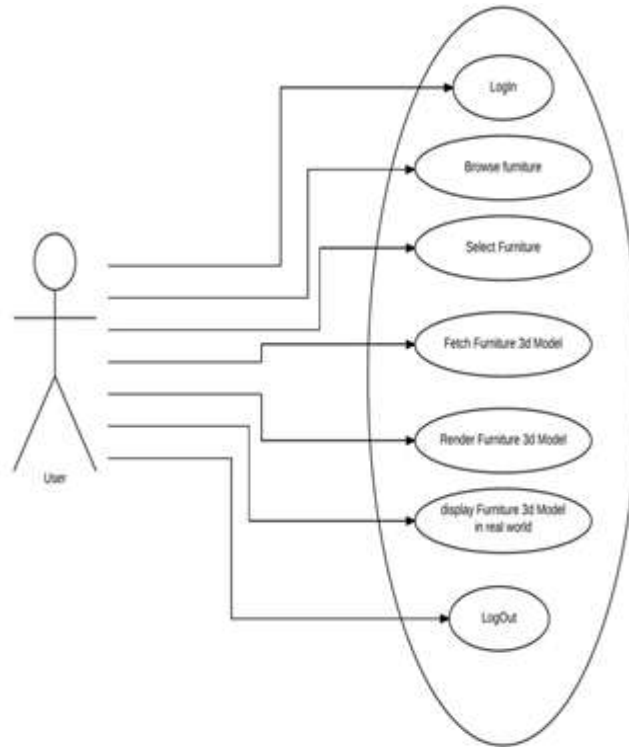


Fig2. Use case diagram of Interior designing using augmented reality

4. Advantages of augmented reality:

1. Facilitates Object Visualization in the Unique way:

One application of AR app development is the approach in which it assists to put digital assets in the real world. Integrating the virtual objects with the real world permits developers to interrelate with the digital elements (like 3D objects) they developed as if they were like real objects. In order to understand it, for instance, car designers need to work on approximately thousands of parts in order to let the car design go correctly. By use of immersive AR app development technology as well as computer graphics, they could project the digital layouts of the interior of car essentially on a full-size model relating to the car dashboard. It is known that visualizing virtual objects with the help of this app development technology gives comprehensive insights into what a finished product may appear like as related to a flat product image depicted on the screen.

2. Simplify Complex Assembly Processes:

Even the average manufacturing and assembly processes can contain hundreds of individual components. Each of these parts has a specific tolerance, and in many cases, they must be assembled or disassembled in a precise order. Augmented reality enters the mix by allowing technicians constant access to diagrams, schematics and work orders, right at the periphery of their field of view. Compared with glancing back and forth between the work piece and, say, a PDF with disassembly instructions, AR glasses are by far a more efficient choice.

3. A total immersion into the architectural project:

One of the main benefits of augmented reality for architecture is that it is capable of placing a person into a virtual version of a future object. Therefore, using AR technology one can walk through the apartment with nothing but walls and observe the potential interior design from any point of it and at every possible angle. Moreover, the opportunities of real estate augmented reality are not limited to the superimposition of the virtual elements on the real world. Augmented reality in construction can also stage real-life situations for making a certain architectural decision. For instance, engineering an elevator in a building with the help of AR technology, it is possible to check how many people will fit in it with ease.

4. The economy of time and efforts on the architectural object's design engineering:

Needless to say, with the help of AR technology the work on the architectural project becomes much easier. First, the constructor has an extremely vivid visualization. Second, one move of a hand is enough in order to make certain changes, instead of inserting the common sets of necessary symbol combinations on the laptop. Third, the client has an opportunity to take part in the augmented reality construction personally, removing, adjusting or adding something into his real estate object.

As for the time required for the development of an architectural project, it is also considerably reduced, as all stages of the engineering process are much simplified.

5. Conclusions:

The Augmented Reality Technique has become a hot issue in the field of computer vision technology, with its different user experience, slowly and deeply changing people's life, which includes many different fields such as education, medical, advertising and so on. The study on Augmented Reality Technique is mainly divided into two directions, one is implementing camera 3D registration by identifying the markers in scene, the other is updating camera pose by doing 3D reconstruction to the unknown scene, rendering the virtual objects in real-time. This research mainly used the second method to research, realized the Virtual Home Augmented Reality System, which can support auxiliary information to people when decorating and selecting furniture, help users feel the placement of furniture in the room in advance before putting them in.

This research achieved virtual home software by using the method of 3D reconstruction to unknown scene to implement camera 3D registration, did an integral analysis to this kind of Augmented Reality System based on no markers. First, calculate the feature points matching pair of two key frame images, in this process the author used the method of combining FAST corner and ShiTomasi corner to make the matching and tracking process more stable according to the advantages and disadvantages of feature points detection operator discussed before. Next, evaluate the essential matrix according to five-point algorithm, calculate the camera's external parameter matrix, determine the camera's initial pose and triangulate according to the pose of camera to calculate the 3D map points. Add the map points by searching polar line, register significant plane according to the obtained map points, adjust the map points and camera pose to the significant plane, complete initialization stage of the system. Next according to the map points initially generated, match and track it, update the camera's pose, and then update the map through the pose and added key frame image to realize the real-time pose updating of the camera. At last, we use Unity3d Vuforia to model and to render, making the virtual and reality integrate.

REFERENCES

- [1] Indoor Marker-based Localization Using Coded Seamless Pattern for Interior Decoration Shigeru Saito; Atsushi Hiyama; Tomohiro Tanikawa; Michitaka Hirose 2007 IEEE Virtual Reality Conference
- [2]. The Design and Realization of Real-Time Texture Mapping and Collage in Virtual Home Decoration Xixi Huang; Mingmin Zhang; Ling Lin; Zhigeng Pan; Rongzhao Li 2012 Fourth International Conference on Digital Home
- [3]. Research on the augmented reality system without identification markers for home exhibition Liyan Chen; Xiaoyuan Peng; Junfeng Yao; Hong Qiguan; Chen; Yihan Ma 2016 11th International Conference on Computer Science & Education (ICCSE)
- [4]. A Transitional AR Furniture Arrangement System with Automatic View Recommendation Mami Mori; Jason Orlosky; Kiyoshi Kiyokawa; Haruo Takemura 2016 IEEE Internal

[5]. Energy-Efficient Resource Allocation for Mobile Edge Computing-Based Augmented Reality Applications Ali Al-Shuwaili; Osvaldo Simeone IEEE Wireless Communications Letter

[6]. Approach to the Interior Design Using Augmented Reality Technology Jiang Hui 2015 Sixth International Conference on Intelligent Systems Design and Engineering Applications (ISDEA)

[7] <https://evreyeye.com/en/blog/dopolnennaya-realnost/the-main-advantages-of-augmented-reality-and-its-appliance-in-architecture>

[8] AR interior designer: Automatic furniture arrangement using spatial and functional relationships Jeff K. T. Tang; Wan-Man Lau; Kwun-Kit Chan; Kwok-Ho To 2014 International Conference on Virtual Systems & Multimedia (VSMM)