A Synopsis on

AR in Furniture Placement

Submitted in partial fulfillment of the requirements
of the degree of

Bachelor of Engineering

in

Information Technology

by

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CERTIFICATE

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Abstract

Purchasing products for interior design always has a problem that the purchased product may not satisfy customers because they cannot put them into their own place before buying. The purpose of this project is to study and develop an android application with the use of Augmented Reality technology will help customers visualize how furniture pieces will look and fit in their homes and can also provide details of the product to support customer decision along with additional facilities like space management .The principle of the application is started with analysing images from the rear camera of a smartphone or tablet using ground plane detection technique for displaying products detail and displaying 3D model and calculation of position to display a 3d model over real world image.

Introduction

Augmented reality is a technology within which we can see the objects in physical world virtually, thus providing a composite view. It gathers a wide variety of user experiences. We are going to develop a system with augmented reality that lets user to try on virtual furniture in user's real home structure before buying. From this user will be able to choose furniture objects a lot easier. It will not be necessary to go shopping and long searching for the large user need, or use a measure tape to find out whether or not the furniture would fit in customer's room or not.

The main purpose of this project is to develop an application for various furniture items in furniture stores virtually without using the actual means that is incredibly exhaustive and time consuming activity. By using this application, it will be convenient for the user to do online shopping of furniture items. This will additionally help the user to try out the furniture items in their room and they will be able to see how it will look after placing furniture in it. User can attempt multiple combination of furniture objects virtually without physically moving the furniture items. Our motivation here is to increase the time efficiency and additionally improve the accessibility of furniture try on by making this layout in augmented reality.

The main use of AR application is to allow visualization without any physical effort. However, during visualization, objects located at the place where the virtual object will settle are a problem for AR processing. Therefore, it is necessary to solve this problem with a software. One possible technique that can be used to solve this problem is the "diminished reality" technique. The capabilities of the diminished reality technique in terms of use in interior design are particularly valuable.

Objectives

The main objectives of Augmented reality in furniture placement are:

- To create a mobile based application for furniture placement using augmented reality technology.
- To make user to visualize furniture at they are own spaces and it will help them to buy the best furniture.
- To make user Friendly Interface design.
- To create range of furniture models with variety of texture and dimensions to choose form.

Literature Review

Augmented Reality is a combination of a real and a computer-generated or virtual world. It is achieved by augmenting computer-generated images on real world. It is of four types namely marker based, marker less, projection based and superimposition based augmented reality. It has many applications in the real world. AR is used in various fields such as medical, education, manufacturing, robotics and entertainment.

From IEEE paper Augmented Reality and its effect on our life (2019) it gives all detail of evolution of augmented reality and its application, uses and advantages disadvantages. From this we have founded to use Superimposition Based Augmented Reality. In this type of reality, the original view of an object is either partially or fully replaced with a newly augmented view of that same object. Here, object recognition plays an important role. E.g. IKEA - Augmented Reality Furniture catalogue. It is a virtual furniture app that augments furniture onto real floor. As Other option are not suitable of our project.

From IEEE paper AR Development for Room Design (2018) In this paper, Room Designed using multiple marker. Using Technology like Vuforia but in this problem is that every model require QR marker but distributing QR to every user is not possible. Due to this drawback we are using ground plane detection of ARCore. From this research paper, we founded to included feature to user that user will able to customize its own furniture by changing color. So that user can visualize that furniture that can suits the best in his/her home environment.

From IEEE paper Performance Evaluation of Augmented Reality based 3D Modelling Furniture Application (2018)

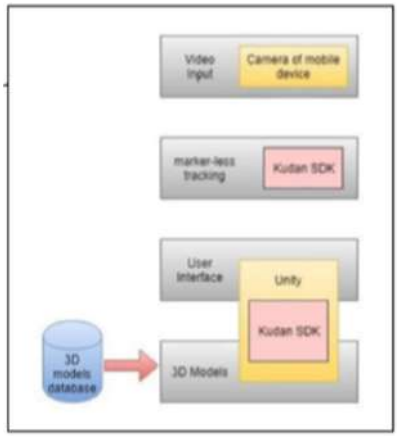


Fig. Overview of Implemented System

Video Input– The video input provided by the camera of the mobile device. It sends our 30 frames per second to the application. Some devices have camera with better resolution; therefore, they send a greater number of pixels to the processing unit than it is expected. To overcome this scenario, video is compressed and sent to the processing unit.

Markerless tracking- In Augmented reality applications-based marker-less tracking, the camera doesn't have any information about what it should look for in the camera frames. It detects all the natural features from the camera data using Simultaneous Localization and Mapping algorithms. We make use of Kudan SDK, to perform this operation.

Existing Interior Architecture AR Application Examples The use of AR technology in interior design is still very new. For this reason, the applications developed for interior design are mostly for entertainment purposes and do not concern any commercial concern. In addition to this, there are also some interior architectural AR applications developed for end users today that are not fully mature. Many of these applications promise users that they can buy branded furniture and decoration products that they test internally with AR technology, by seeing features such as material, size, color and texture. All of these applications share some commonalities with different characteristics, advantages and disadvantages.

Decolabs
Decolabs was developed in 2012 and is an interior architecture AR application where users can experience virtual furniture with an online catalog. This application not only allows the virtual furniture to be experienced in the real space, but also provides the opportunity to access the drawings of various residential spaces created with Decolabs products. Besides, users can test the virtual furniture on the visuals by uploading the photograph of the places they live. Virtually added furniture can be adorned with the help of a standard marker provided by the program. The program does not provide any flexibility in setting the size of the furniture to the user. In addition to this, the online brands include limited and concept design products. Users also have the opportunity to share their AR designs online. It is also foreseen that the space is relatively empty for flexible use of the program and that there is no obstacle in the field where the marking is placed for the AR technology to work properly. The application only supports the IOS platform for mobile devices.

"**Decolabs**" AR application
1. Real-time interface of the program.
2. Program product interface.
3. The marker provided by the program.

Ikea AR

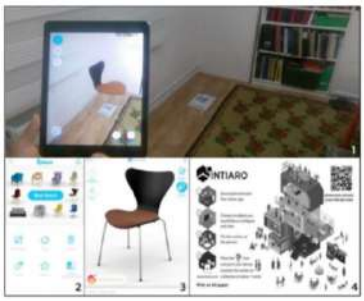
Ikea AR is a software application starting in 2014 that is distributed to the users in an integrated manner to the company's mobile application. Users can visually test the decorative products and furniture's in their catalogs published by the company during the period with the help of AR technology. The application is only for the products of Ikea, so there is no connection with the product catalog of any other brand. The user can see the products he wants to test with all the features and can change the options such as the color and texture provided by the company. Because Ikea has a widespread store network on a global scale, the speed and possibilities of obtaining a product that the user tests in the application of AR are relatively higher. In this application, it is also necessary that the relevant part of the space where the user is to test the products is empty or there is not a visual obstacle to obstruct the marking. The app, which has mobile app options for Android and IOS platforms, uses turnkey publishing catalogs as a marker.

"**IkeaAR**" AR application
1. Real-time interface of the program.
2. The catalog used as a program marker.
3. The program's content interface.

Intiaro

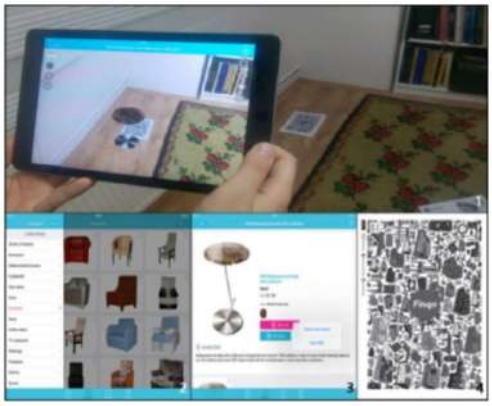
The Intiaro AR application has also been developed as an application where users can buy and sell reinforcements and decoration products with many brands support. In addition to grouping products such as seats, cabinets, and chairs in the application, there are many products within general spatial classifications such as hotel, living area, dining room. The user can carry out the desired product characteristics to the extent determined by the retail company and at the same time get information about the product's price, material, style and where to buy it. The fact that the product catalog has a simple use and it is important to be able to connect with social media so that users can share their designs in the social media environment. In addition, many of the products are also represented by real-world appearances. In application, virtual products added to the space come in a standard size depending on the category. However, the fact that some products are normally large and that there is no means of adjusting the size of the products in application can be a problem for the health of the AR experience. On the other hand, the presence of retail companies in different countries constitutes an obstacle to the user's easy access to the product. This also indicates

that additional shipping charges may be added to the price of the product. The application uses a standard visual marker with black and white contrasting colors. This interior AR application also predicts that the area in which the virtual soil will be placed is empty. Any real object found in the camera view angle collides with the virtual object, causing the occlusion problem. Users of both Android and IOS platforms are able to access the app.



"**Intiaro**" AR application
1. Real-time interface of the program.
2. Product catalog interface.
3. Visualization of the virtual image in the program.
4. The marker used by the application.

Fingo
Fingo AR application is also user-oriented applications developed for commercial purposes such as other internal architecture AR applications. The products included in the application are classified according to their intended use as they are in other applications. In this application, users can view properties such as product's material and price. Although a wide variety of brand names appear in the program interface, many of the furniture that the user views in front of the AR experience do not reach the 3D model. Moreover, there are some problems related to the size of the product when it is displayed indoors. There is no intervention tool to adjust the size of the virtual product that is transferred to the actual space in a standard size. The program only uses two basic options such as displacement and rotation. The AR application uses a standard pointer to follow. However, the integration of the virtual object and the product is lost when the screen is moved, and the product deviates towards other directions. The same situation can also arise in the form of sticking virtual object to real objects during imaging. These adverse events affect the success of the AR process and severely limit its effectiveness.



"**Fingo**" AR application
1. Real-time interface of the program.
2. Product catalog interface.
3. Visualization of the virtual image in the program.
4. The marker used by the application.

Problem Definition

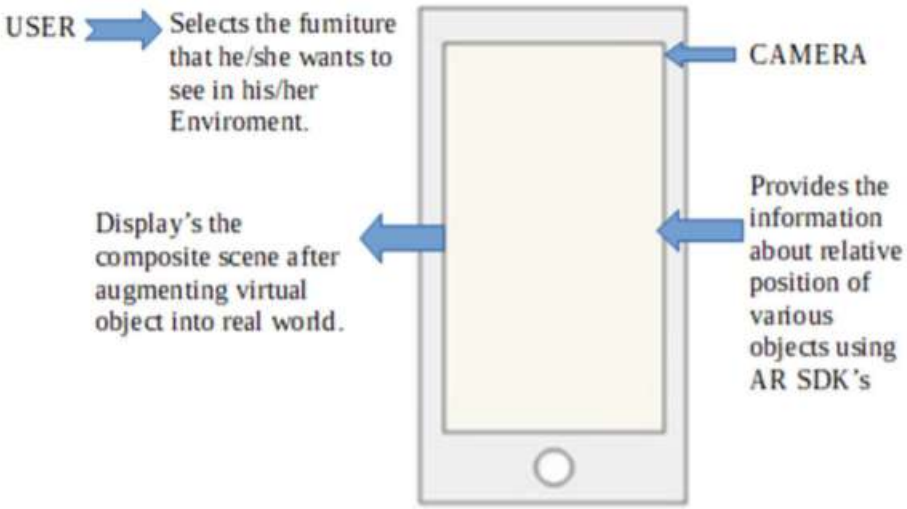
As more and more purchases move online, new categories of products start gaining e-commerce traction. Using AR people can visualize the required furniture and make a perfect choice in between them so, making it easier rather than actually taking a note of dimensions, look and colour or physically bringing of the furniture for making choice. The biggest problem with buying furniture is that you have almost no idea how it will actually look into your interior. This is why people hire visual designers who can show the whole picture. With an AR app you'll be able to place any piece of furniture into your apartment without needing to bring it there physically. As augmented reality application that allows you to do that. It can even scale the so you can choose that perfect sofa for your living room.

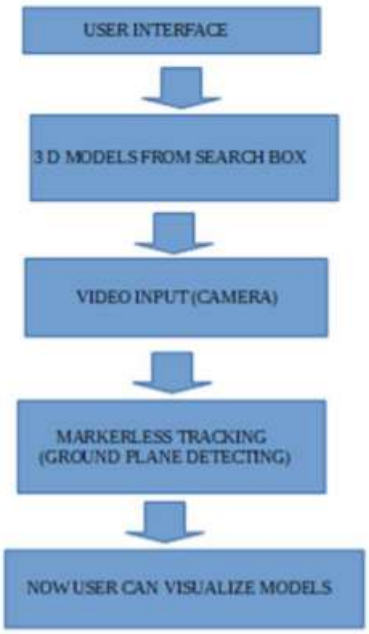
Proposed System Architecture/Working

Product Functions

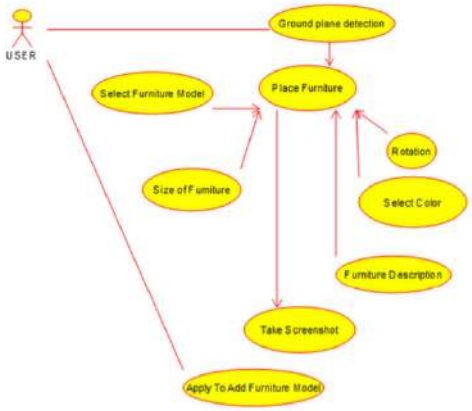
1. User can use search box for selecting objects for virtual placements
2. Markerless object placement
3. Multiple textures for single object
4. Furniture description
5. Furniture can be Rotated, Resized
6. Can import your own model
7. Multiple Color for Furniture

Operating Environment: The AR system is a mobile based application which can be used on mobile operating system like iOS, Android.





Use Case Diagram:



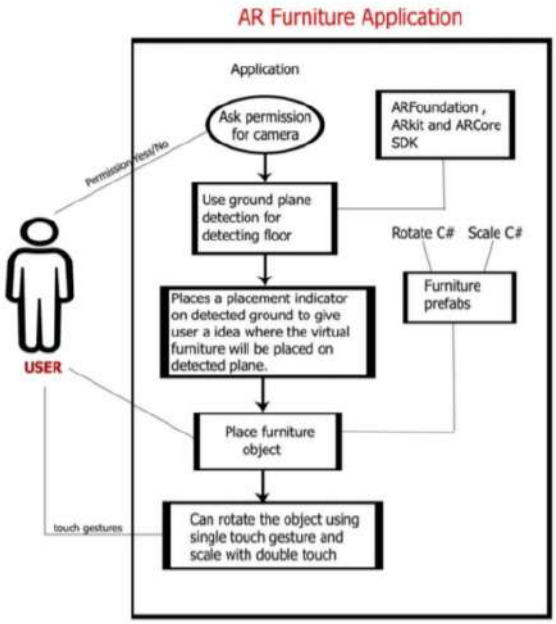
Working:

- **Markerless**: Markerless Augmented Reality is used to denote an AR application that doesn't need prior knowledge of a user's environment to overlay 3D content into a scene and hold it to a fixed point in space. Augmented Reality has completed the transition from image- or QR code-based activations to markerless Augmented Reality experiences.
- **Search Box**: User will able to find variety of furniture in app and can visualize in AR

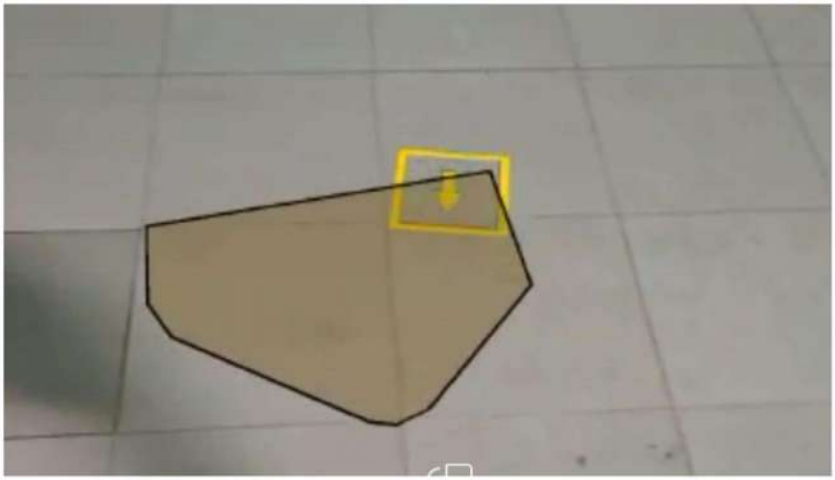
system.

- **Multiple texture for furniture**: User will able to visualize variety of texture and color. So that user can find perfect texture.
- **Importing your own Models**: User will able to import they are own model in AR app and can visualize.
- **Furniture Description**: Virtually user can find out description of furniture as price, size, material used, texture, color.
- **Can import your own model**: User will able to import they are own furniture model.
- **o save Visual Screen**: User can save the visual screen by taking the screenshot option.
- **Rotation**, resizing: User can rotation, resizing the furniture on screen to that visual the furniture according to their need.

Design and Implementation



Detecting Ground Plane:



Rotating Object:

Resizing Object:

Summary

In this AR environment, the user is able to adjust the properties of virtual furniture and create its own arrangements in the real world. Through the mobile camera the user can detect the plan surface and select the furniture through the application and place it on the screen. As a design solution, this application can help cut the prototyping costs and help simulate a better experience for the customer. It also enables the customer to be the designer themselves and make their home as they want it to be. It also helps them to set a theme in the house and get a feel of it before placing an order. This application will also prove beneficial to the companies for advertisement purpose.

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1 Publication

Paper entitled **"Paper Title"** is presented at **"International Conference/Journal Name"** by **"Author Name".**