

**A  
PROJECT REPORT  
ON  
INTERIOR DESIGN APPLICATION**

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## CERTIFICATE

This is to certify that the report entitled “**Interior designing using AR**” is a bonafied work carried out by **Om bhesania(D21DCS158)**, **Bhaktesh Patel(D21DCS159)**, **Neel Patel(D21DCS167)** under the guidance and supervision of **Prof. Chintal Raval** for the subject (CE255)-**Software Group Project-II** (CSE) of 4<sup>th</sup> Semester of Bachelor of Technology in **DEPSTAR** at Faculty of Technology & Engineering – CHARUSAT, Gujarat.

To the best of my knowledge and belief, this work embodies the work of candidate himself, has duly been completed, and fulfills the requirement of the ordinance relating to the B.Tech. Degree of the University and is up to the standard in respect of content, presentation and language for being referred to the examiner.

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## **ACKNOWLEDGEMENT**

We, the developer of the Project “INTERIOR DESIGNING USING AR”, with immense pleasure and commitment would like to present the project assignment. The development of this project has given us wide opportunity to think, implement and interact with various aspects of management skills as well as the new emerging technologies.

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## **ABSTRACT**

It is an application which the furniture and furnishings will develop in three dimensional surface of object and present by using augmented reality. It is the application that can be use in the mobile phones, tab and etc. especially using Android platform to choose furniture that suitable for their house. Nowadays, people usually will go to the shop for samples to decorate house and room. But majority of the people are busy with work. People are no time to go to various stores to buy furniture for their home, shop or office. It is also difficult to let alone taking it out and trying it at home. If found out that the furniture is not suitable to the house, then the furniture needs to return to the furniture shop. Even if have time to go to the furniture shop, after visit to the shop, people may found out that there is none of the furniture that fulfils requirement. Hence there should have a way to let people use their mobile to view a 3D interior design in anyway and anytime before it populate with the real items.

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# Chapter 1

## Introduction

### 1.1 Project Definition

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one's current perception of reality. Augmented reality basically brings out the components of the Digital world into our perceived Real world. This project on Augmented Reality for home furniture has potential to be a boon as an end user application (a customer who wishes to buy furniture). It provides 3-D animated models (furniture models) and instructions integrated with the work domain in real

### 1.2 Description

Augmented Reality in simple terms can be stated as:

**Computer/mobile generated data (Augment) + Physical/Real-world Environment (Reality)**

Augmented Reality (AR) is a computer technique to harmonize the virtual world with the real world, and is a hot topic of many researchers in recent years. Based on computer graphics and related image processing techniques, AR places virtual objects into the real scene and enables users a realistic immersion. Different from Virtual Reality (VR), AR emphasizes the application of the real scene to the virtual world. It picks a real world scene and adds virtual object to it thus the viewer sees the digital image as if it's real.

There are two methods to match the virtual objects and real objects in AR technology: marker systems tack and marker less systems. The former takes LED, identification plate etc. as the Camera tracking target; the later takes edge, plane, and feature invariants etc. complicated natural features as the camera tracking target. The greatest challenges in the implementation of MAR are tracking and registration.

Because of the limited computing capability of mobile device, implementation of lightweight tracking and registration is especially important. To those marker less tracking system, applicability in the mobile devices should be noticed.

The purpose of this project is that stores can be replaced by smaller, cheaper, simpler spaces whose expensive physical inventory is replaced by virtual designs that can be projected onto just a few floor models.

While it allows companies to open smaller stores, it also lets customers get a better idea of how a pattern or color looks across a piece of furniture or the walls of a room.

### **1.3 Problem Formulation**

Today's trend is cheap and better aesthetics furniture. The key factors in this decision making is price, quality, durability and functionality. There is also rising demand on online purchased goods. Manufacturers and interior designers become more creditable. As well as the impact on personal information sources are greater on furniture purchase decisions. So taking all this into consideration we've built an application integrating Augmented Reality to match the current trend of users.

### **1.4 Proposed solution**

This application augments a 3D model of the desired furniture on the current live camera stream in real time. Thus, it helps the customer who wishes to buy that particular piece of furniture can virtually see that furniture model in real time and can interact with the system to fit perfectly. The user gets to decide whether he/she wishes to buy that particular piece or to choose a piece which is more suitable to his/her requirements. The proposed solution helps the user to get an approximate view of the furniture in the desired position.

## 1.5 Scope of the Project

- To convert the live frame (camera stream) into a binary image and perform image segmentation to extract out the edges and thereby detect the marker in real time.
- To augment the 3-D model onto the detected marker and also adjust the 3-D model as per the orientation of the detected marker such that augmentations are generated and are visible in real time.
- The user interacts with the system by obscuring designated spots on the marker and can choose which the position and the orientation of the selected augmented model.
- To augment multiple 3-D models at the same time and interact with them individually.
- Letting the user to choose his/her desired marker by first capturing an image using the camera and then setting that captured image as the marker for augmentation



## Chapter 2

# System Analysis

### 2.1 Functional Requirements:

Functional requirement defines function of a system and its component. A function describes as a set of inputs, the behavior and output. These are the following requirements:

- Provide an Augmented Reality view, with display of furniture
- Connect directly to database for markers, images, etc.
- Manage database and displaying alerts when passing critical thresholds
- Operate in 2 modes: Developer and user

### 2.2 Non-Functional Requirements:

The non-functional requirements define how a system is supposed to be.

- Run on newer versions of OS
- Make use of best practices to avoid data leakage over Wi-Fi
- Do not reveal information to anyone not an authenticated user

### 2.3 Specific Requirements:

#### 2.3.1 Hardware Requirements:

- Android Smartphone
- Processor: Qualcomm® Snapdragon
- 2D markers to be placed in real world
- Camera 3.5MP or higher

### 2.3.2 Software Requirements:

- Operation Platform: Android 5 or later
- Unity3D integrated with Vuforia SDK
- Android Studio

## Unity 3D

Unity3D is a powerful cross-platform 3D engine and a user friendly development environment. Easy enough for the beginner and powerful enough for the expert; Unity should interest anybody who wants to easily create 3D games and applications for mobile, desktop, the web, and consoles.

The Unity application is a complete 3D environment, suitable for laying out levels, creating menus, doing animation, writing scripts, and organizing projects. The user interface is well organized and the panels can be fully customized by dragging and dropping.

Scripts, known in Unity as behaviors, let you take assets in your scene and make them interactive. Multiple scripts can be attached to a single object, allowing for easy code reuse. Unity supports three different programming languages: UnityScript, C#, and Boo. UnityScript is similar to JavaScript and ActionScript, C# is similar to Java, and Boo is similar to Python. Depending on your background you may feel more comfortable with one or the other.

## Marker

In a marker-based AR application where image recognition is involved, a marker can be an image, or the corresponding descriptors (features + key points). Usually an AR marker is a black & white (square) image.

Markers have to be selected in such a way that not a lot of processing power on the end-user device is needed to perform the recognition.

Matching techniques require a database of all possible markers and the system tests the marker under identification against all of them.

## Chapter 3

### 3.1 Objectives of Project: -

To create an interior design application using augmented reality technology, To provide users a new interactive technology to be practiced in interior design, To develop an augmented reality mobile application in 3D interior design that more convenience to the user, To produce realistic virtual furniture model in interior design similar to the real furniture.

### 3.2 ARcore

ARcore uses three key technologies to integrate virtual content with the real environment:

1. **Motion Tracking:** it allows the phone to understand its position relative to the world.
2. **Environmental understanding:** This allows the phone to detect the size and location of all type of surfaces, vertical, horizontal and angled.
3. **Light Estimation:** it allows the phone to estimate the environment's current lighting conditions.

### 3.3 Scope of the Project: -

1. **User** — Everybody that has mobile gadget to use the augmented reality application to design their room or house with virtual 3D objects.
2. **Furnishing companies** — Implement augmented reality application with virtual 3D representation furniture and furnishings for their customer.
3. **Interaction technique** — Three types of gestures have been provided in this application such as drag, pinch and rotation gesture. User can drag, rotate, enlarge and minimize the furniture model in order to fit in their house. At the same time, user can view different dimension of the 3D virtual object such as the front view, side view and back view of the model by rotate the model with fingers.

**4. Content application** — The application is an interactive AR application. The model focus is the furniture of the living room. So, the 3D models that develop will be the furniture of the living room. In order to use this application, user needs to have camera on their device. After that, user just needs to install the application, turn on the application and point the camera to the living room. User can take a picture of the design space and set the image as tracking pattern. Then, user can choose the furniture from the list and the sofa's image will be overlaid on the room. The whole process can then be reset by reactivating the camera.

### 3.4 Advantages: -

1. **Better Visualization** – AR in Interior Design help the client visualize the project before it is developed. Using AR in interior design gives an ability to the user to design the space the way they want. Be it a rustic, beach or boho style home, AR will let the user visualize that all in a go. A mobile phone or a tablet loaded with samples is all needed to transform the userspace.
2. **Design editing abilities** – User will also get an ability to edit the designs and make changes even if the design is at the final stage. So, now users need not worry about the tedious corrections that are done in actual décor and furniture.
3. **Better guidance** – AR in interior design will let a user guide the designer in the best possible manner. Even the minute details related to the designing process can be communicated interactively using AR.

### 3.5 Limitations: -

AR Technology is not widely supported in all android devices, so to overcome the issue 8th wall was used, as 8th wall is still a developing arsdk tool, hence the lack of accuracy in the application is faced. The furniture object which are seen in the option are imported from the backend and stored locally and hence no existence of photogrammetry which will enable the application to convert the picture image into 3D object. The application unable the user to place two or more instances of object on a single surface due to limited features provided by the sdk tool.

## Chapter 4

### Testing

#### 4.1 Test Cases

Test ID	Test Name	Test Description	Test Step	Expected Result	Actual Result	Result
01	Unity Installation	Install all package from official unity website	Select appropriate download depending on 32bit or 64bit	Should Install correctly once necessary steps are considered	Install successful with all packages loaded	OK
02	Install Android SDK	Install latest Android SDK for Android Build	Select all recent packages	All packages should be downloaded	Downloaded all packages	OK
03	Download FBX models	Check for FBX objects matching the application use	Select furniture, tables, chair, etc.	All should b downloaded without any viruses or malware	Download successful without harm	OK
04	Is the loading time of virtual objects in the scene satisfactory?	To see if all objects are loaded	Open application and start placing objects in scene	The furniture should be displayed on the screen immediately on touch	Objects get displayed on being selected	OK
05	Are the virtual objects merged correctly with real world?	Object should not match with the environment	Place objects in the scene	On moving the objects it should be visible easily	Objects are merged well	OK

06	Is the user instructed about what to do during the interaction?	The user must be guided throughout the process	Hints has to be shown to guide user	User is notified at each step of process	The application has provided instructions at the start	NO
07	Is it easy to stand the marker in an appropriate position and orientation to be detected by the camera/sensor?	The user should be able to place the marker wherever desired	Placement of marker through the device	Once marker placed it should be detected always	Marker is detected even if camera scope is changed	OK
08	Are there specific requirements ? (camera, marker mobile, GPS, user position, lighting, calibration)	To get perfect augmented reality features	Check clarity of camera , surrounding lights and also phone memory and RAM	A phone with top features and proper surrounding and lights gives good results	Not achieved always because of lack of proper lights and mobile features may differ	NO
09	Is the tracker system stable?	Object placement	Select object to display furniture	Objects should be track able once augmented	Objects are track able once augmented	OK
10	If the tracker system detects more than one object in the scene, does the application continue to function correctly?	Multiple objects on screen	Application is able to function with multiple objects in display	No crashes should occur with any number of furniture displayed	No crashes occurred and all furniture displayed with ease	OK

Table 4.1 Test Cases

## Chapter 5

### Snapshots Of our Application



**Fig.1(Demonstration of chair)**



**Fig.1.2(Demonstration of chair and Television)**





**Fig.1.3(Demonstration of Objects Using AR)**



**Fig.1.4(Demonstration of objects)**



**Fig.1.5(Made a TV show case using AR)**



**Fig.1.6(Demonstration of Cupboard )**



**Fig.1.7(Implementation of objects)**

## **Chapter 6**

### **Conclusion and Future work**

#### **6.1 Conclusion**

The application is designed for Android smartphones and is implemented in Unity which is integrated with Vuforia. The application makes the use of markers which helps to track and augment a virtual model by the android smartphone.

The camera stream of the device is used and the augmented model is created and displayed in real-time. The UI of the application is developed on Android studio and Unity3D.

The UI for the selection of the particular furniture object from the list of available models is developed on Android Studio and the UI for the Camera stream on which the augmented model which is shown is developed on Unity3D.

The application contains both user-defined markers and pre-defined markers. The application has 3D model furniture's built in so that the user has options to choose what they wish along with options to change textures.

The application UI is simplest compared to other AR applications of this type making sure user has the best experience.

#### **6.2 Future Scope**

Augmented Reality is the future. This application can be made market ready and can be sold to online furniture selling websites like pepperfry.com. This website displays the images of the furniture and the user has to buy first and return it if not satisfied by the purchase. By displaying the augmented view of the furniture it will help these online websites to increase sales. Customer satisfaction is a must and if the customer is able to feel how the furniture will look in their room without imagining it themselves, then it fast forwards the process of buying furniture with complete customer satisfaction.

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