

DecARate: Home Decor App using Augmented Reality Technology

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ABSTRACT

This paper revolves around the usage of augmented reality in a home décor system through which a user can preview life-sized dimension products using native camera of their smartphones in their surrounding environment by which they can understand what size products they should purchase and how a product will look like in reality in a particular space and lightning. This paper will include the implementation of Augmented Reality and Three-Dimensional models imported into the application of all home decor products. Augmented Reality has proven to be helpful in businesses which hike the number of customers that buy the products with clarity of what exactly they are purchasing. while also providing a natural experience for users. This idea will span the usage through both the platforms i.e., android application and website in which users can see the products from both the platforms but can use the AR feature from the app. Therefore, this paper analyses the research that has been conducted on Augmented Reality.

Keywords— Augmented Reality, Interior Design, Marker-less AR, Marker-based AR, 3D Model

Date of Submission: 03-05-2023

Date of acceptance: 14-05-2023

I. INTRODUCTION

It is a technology that works with your computer's image-based recognition algorithms and uses your device's camera to enhance sound, video, graphics, and other sensor-based input to real-world objects. Augmented reality technology is applicable to all conceivable disciplines and knowledge levels, and it will affects every aspect of our lives and change the way we live and interact with the world.

This paper introduces an augmented reality system to develop future tech that emerge by superimposing virtual furniture in a physical

environment which can be used by everyday modern user.

II. AUGMENTED REALITY

Human eye have an aptitude of seeing objects within 3 dimension however, imagining ones future house how will it going to look by just simply seeing an image is a tricky for several folks. Thus the use of Augmented Reality help to save the scene. AR revolves around the overlay of virtual/imaginary objects within the actual atmosphere. At the same time, this will allow users to interact with virtual objects and adjust them to their liking. Ideally, virtual objects should obey all the laws of physics and react consequently.

In a more general way, Augmented reality may be a part of a broader general term known as Mixed Reality. MR includes numerous sub-areas such as Increased Reality, computer game & telepresence. This technology has applications in numerous fields together with medication, engineering, style and military.

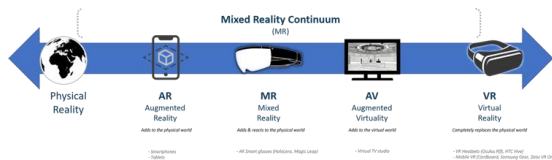


Fig. 1. Mixed reality

Augmented reality can be experienced in many ways. AR types are:

Projection-Based AR: As its name suggests, it is primarily based on projecting objects onto the surface. For example, you can project a virtual keyword onto a wall and use laptop vision to track your finger movements when you press something. If set up properly it will produce a extremely realistic AR area. one in every of the examples may be a place known as electrical toy in Albuquerque, Land of Enchantment created a projection-based area.

Recognition-Based AR: Location-based augmented reality is based on device location, orientation, sensing element knowledge to seek out wherever the user is trying and provides purposeful info. Famous example is Pokémon Go (where the Pokémon' spawn in keeping with your location).

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Superimposition-Based AR: Superimposition-based AR allows users to blend the real and virtual worlds. This allows the user to request element substitution by converting Touch or Full Browsing. Interior style is best achievable to this sort of Superimposition-Based AR. it's typically has 2 categories:

- 1) With the use of a HMD
- 2) With the use of a mobile

III. AUGMENTED REALITY TECHNIQUE

A. Marker-based AR

Marker-based AR applications typically involve image recognition. When it detects a marker, it uses the AR marker area unit as the location to render the virtual object. AR markers contain various images, but usually these areas contain small two- dimensional barcodes called Data Matrix codes or his second

written on some kind of poster. It's an image. The augmented reality application device recognizes the target through the camera, processes the image, converts the barcode into an Internet address, and calls relevant web content containing arbitrary information from the browser. The good thing about using this next method is that the camera can easily recognize the mark or target, which is very convenient. Additionally, the use of markers yields many stable and accurate objective-specific images. It is currently the most popular choice due to its ease of implementation.

B. Marker-less AR

Marker-less AR applications do not recognize predefined objects. Since the app doesn't have a predefined image target, the application sees completely different options, patterns, colours, etc. At runtime, the app needs to parse various variables in the private frame to trigger AR actions. The following methodologies work by utilizing scanning algorithms and have detection systems. Let's say we want to examine the data of an object. Just point your phone at an object and the Silent Feature Recognition or Pattern Recognition system will try to find it. A specific scanning algorithm is used to determine that. Create or attach a virtual grid to the image captured by the camera. To pinpoint the precise location, auto-scan finds a number of anchor points and binds the virtual model to them. Marker less technology has several advantages, such as the vital organism itself acting as the mark and no overhead construction or marks needing to be created on the object. There is usually no need to create a unique visual identifier. Digital images are projected directly onto physical objects. This is often called projection mapping and can be used to create some very cool effects.

IV. LITERATURE REVIEW

Geeta, Sangnale, Priyanka, Nilam and Wade in [1] demonstrates a Marker Based AR approach for a better AR experience. Their findings were limited to AR experience disappearing when camera focuses on something else or away from the marker. Trigger marker scanning becomes difficult if it is tampered with and results in poor AR experience.

Rohit, Renukdas, Vishal and Harshvardhan in [2] describes Markerless based AR approach Utilizing Metaio SDK (4.1) which provided high level abstraction, advanced tracking, and support for a wide range of formats and direct loading of the 3D models. They made use of AWS S3 file storage. Their limitations were the use of local storage to store 3D models. Also, resolution of 3d models and texture used were of low quality.

Priya, Sapna, Preeti and Sachin in [3] describe Markerless based AR Approach providing different 3D models. They used Viro Media which

provides AR toolkit to make live possible and file storage such as AWS S3. The limitations of the solution were 3D Model rendering in live feed and use of local storage to store 3D models.

Xu and Qiang in [4] demonstrate Marker Detection with less complexity and high reliability. They made use of 2D arrays eliminating 3D array complexities. The solution was limited by distortion and low resolution.

V. WHAT ARE WE BUILDING

An attempt to build an android application that will allow its users to interact with augmented furniture and visualize it using the camera of their android phone in real time. This will allow the user to use their android phone camera and sensors to place directly on the live stream from camera. We are using markerless technology to place an object in a visual 3D space without the need for markers. Using this technology, we are developing an interior design application that allows you to virtually view furniture in your home.

VI. GOAL OF READING PAPERS

Our purpose of reading papers is to know various methods available to render completely a 3D furniture models and to create an app that is able to handle various gestures.

We found that our system will do these following tasks:-

- Select furniture from the menu
- Tap the screen to place the furniture
- Delete rendered furniture
- Change material of rendered furniture
- Move furniture position
- Take a picture of the current environment and save it to local storage
- From local storage Load the 3D model

VII. METHODOLOGY

Reading existing research papers on Augmented Reality and identifying gaps and features that have not been implemented yet and developing an android and web application to implement Augmented Reality with Open CV.

VIII. RESOURCE REQUIREMENTS

- ❖ Android Studio
 - ❖ React.js
 - ❖ Firebase
 - ❖ A smartphone with specifications: 5 android version, 2 GB RAM, 720p camera
 - ❖ 3D Design Software:
- 3D design are often thought-about because the start to creating AN AR app. A virtual model may be a should for bridging the gap between real and virtual world. Development of those models are often done through

several apps however here area unit many apps that the majority of the inside designers and 3D designers prefer:

- Blender
- Autodesk Maya
- Autodesk AutoCAD
- Sketchup
- ❖ AR Functionality

AR functions like feature detection, marker detection, rendering etc. area unit obtainable in numerous kinds of

frameworks and plug-ins that integrate terribly simply with the computer code that's being employed to develop

the AR experiences. Here are a unit a number of the few common platforms within the market obtainable presently for development of an AR system:

- AR Toolkit
- Wikitude
- AR Core
- AR Kit

IX. ADVANTAGES OF AR IN INTERIOR DESIGN

A. *Make your content more authentic*

Augmented Reality's approach to blending the real and virtual worlds makes your content look much more authentic than CAD images rendered in 2D. This creates a virtual object and becomes its world object. For example, interior designers can use the app to transfer their own models and prepare them much easier as the app uses interaction modules for drum sander gesture management compared to CAD software. This fashion-inspired interior development provides a lot of comprehensive insight into what the finished interior will look like.

B. *Greater Immersion and Depth*

Traditional interior design methods are used to create sets heavily relies on his second rendered image. This limits depth perception, makes it less immersive. This suggests that it's easier to visualize the internals. Users can also move with the virtual objects, greatly increasing user satisfaction.

C. *Optimized workflow*

Augmented reality has the ability of optimizing the workflow of the inside style by simplifying the coming up with method which supplies them the flexibility to urge a lot of artistic in their work so making a a lot of aware design method. This provides the user with a lot of improved prospects of presentation which might cause higher consumer satisfaction. A stronger workflow conjointly suggests lesser trouble of engaged on advanced software.

X. CHALLENGES FOR AR IN INTERIOR DESIGN

A. *AR systems are not ready for market:*
Augmented reality is still a growing field with a huge variety of applications, however not a great deal of individuals realizes it outside the core technical school business. it's still thought-about as a diversion technology by the common public. the inside style business hasn't fully shifted to AR as a result of there's a scarcity of a high-end AR CAD computer code that provides all the functionalities of a standard CAD computer code.

B. *User Interface:*
UI/ UX researchers and developers area unit still making an attempt to work out the doable computer program for an AR application. AR systems area unit a full new challenge for them as they must work out how to display the functionality of the system as a result of, they're at home with the computer program.

C. *Hardware Limitations:*
Even though the hardware for making a mature AR system has improved drastically within the recent decade, it still isn't adequate for mass implementation. This generation hardware, though quick, is much too advanced and troublesome to integrate into one high-end operating system. for instance, HMDs like Microsoft's HoloLens and Magic Leap area unit revolutionary AR Head Mounted Displays however they still aren't compact enough for public uses. They're conjointly quite advanced to control which ends up during a harder learning curve that destroys the aim of transferring from traditional CAD to AR primarily based CAD computer code.

XI. UX CASE STUDY

A. *Overview*
decARate is an Ecommerce platform which sells home decor products and aims at creating a smooth online experience for users. decARate is powered with Augmented Reality and helps users to view the products in a virtually simulated environment to help them make better buying decisions that affects the size of the product, the contrast between the color of product and its surroundings, etc.

Goals:

- To improve the user shopping experience.
- To design an accessible and usable product.
- To design user friendly and aesthetically appealing intuitive interfaces.
- To create an app that drives profitable growth by expanding customers' reach and creating a good user experience.
- To create a smooth user experience and path to purchase which reduces cart abandonment.

B. *Context*

Physical shopping comes with certain kinds of difficulties that make customers frustrated with going to stores all the time. It can also be depressing to be busy with official duties while having to go shopping at a store or mall at a certain time. In addition, some people just want to window shop for products. So physical shopping he going to the mall can be very stressful. Therefore, this paper aimed to improve the overall user interaction with the online shopping website and provide a good user experience. Yet to better understand their values, purpose, and goals. WE have adapted the five stages of the design thinking process to work. This will give you a clear understanding of the problem and how to implement strategic.

solutions to solve it.



Fig. 2. 5 Stages of my design

Empathize: The online shopping industry is booming and all offline brands are rushing to launch online stores. The market is huge and the market is becoming saturated with selling to more and more potential customers. what are his strengths? What makes it better than offline stores?

User Research

Target Audience:

Who: Millennials and Middle-aged people

Age: 25-50

Market Share: South Asia

Primary Research- User Interviews:

Five users from target audience were interviewed, discussed and asked some open ended questions under three main topics:

- Offline Shopping Behavior.
- Online Shopping Behavior.
- User Needs and Pain Points.

C. *Empathy Map:*

To gain a deeper understanding of user behavior and decision making, we used empathy map techniques. It is a collaborative visualization used to represent what we know about a particular type of user.

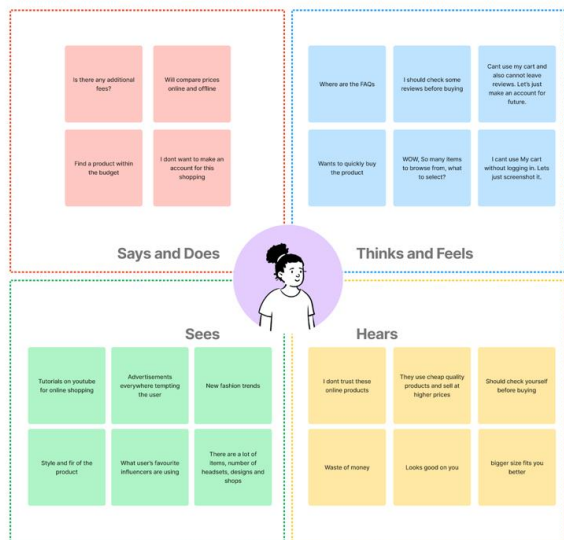


Fig. 3. Empathy Map

D. User personas:

Based on the target demographics of wedding dresses customers and our research participants, we crafted 2 User Personas to represent the different user types that might use the website to shop.

Vikram Goel

Age: 27
 Education: M.B.A.
 Status: Unmarried
 Occupation: Product Manager
 Location: New Delhi

"I wish I could get a feel of how a brown poster look on my gray wall"

Personality
 Extrovert
 Warm

Bio
 Vikram is a Product Manager at a MNC based in New Delhi, India. He loves to shop for home decor items and organize his house the better way. He wants to shop online because it saves time and is more convenient.

Habits

- Browses E-commerce stores online when free.
- Enjoy watching interior design related content online.
- Subscribes to newsletters of brands and likes to keep up with discounts.

Core Needs

- Needs to find best and valuable products easily.
- Find big discounts and good offers from top brands.
- Wants to get a feel of the product before buying it.

Pain points

- Difficulty in searching products.
- Slow delivery and delivery charges.
- Cannot decide if a product would look good at his home or not.
- Complicated return and exchange process.

Fig. 4. User Personas

E. Define

Problem Statements: Vikram is a Product Manager at a MNC based in New Delhi, India. He loves to shop for home decor items and organize his house the better way. He wants to shop online because it saves time and is more convenient.

Manisha is a housewife based in Kolkata, India. She manages the house and is interested in shopping online for new furniture. She is not very tech-savvy and gets stuck a lot performing user flows. She tries to be up to

date with new technology but worries if things will go well.

Data collection and Analysis: Affinity diagrams are tools for analyzing large amounts of data and discovering relationships, allowing you to orient your design based on relationships.

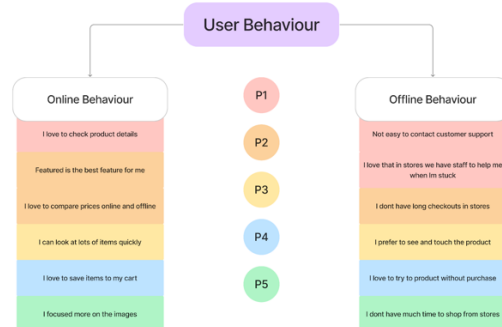


Fig. 5. User Behaviour

Fig. 6.

Prototype & Design

The design screens show a mobile app interface for 'decARate' with the following elements:

- Home Screen:** Welcome back, Harry. Featured Products: Dining room Sofa (₹14,599), Elegance Brown Sofa (₹14,599), Magnolia Chairs (₹2,499), Do More Wall Poster (₹899), Royal Chandelier (₹39,999).
- Search Screen:** Search bar with filters: Sofas sets, Chairs, Posters, Chandeliers, Tables.
- Product Detail Screen:** Focuses on the 'Elegance Brown Sofa' with price ₹14,599 and 'Add to Cart' button.
- AR Feature Screen:** 'Learn to explore products with AR' with a video player.
- Promotional Screen:** 'Holiday Season sale' with 'Get upto 35% discount on new arrivals!' and 'Start Shopping' button.
- Checkout Screen:** 'We got something to buy!' showing 'Elegance Brown Sofa (x1) ₹14,599', Shipping Free, Total ₹14,599, and 'Checkout' button.
- Review Order Screen:** 'Review order' showing 'Elegance Brown Sofa 6ft x 3ft ₹14,599' and 'Add to Cart' button.

Fig. 7. Design

Fig. 8.

F. Testing

After building a high-fidelity prototype, we ran a usability run to see if the design solution met users' needs. Tests were conducted by real online shoppers. Her three measures of usability testing are:

- Satisfaction

- Efficiency
- Effectiveness

Therefore, Here are the main results of usability testing:

- Users can easily navigate between categories to find products.
- Users feel that product pages are clear enough.
- Users find checkout convenient.
- Users find the checkout process easy enough and the checkout time sufficient.
- Users can now create accounts.
- The website interface is clean and meets user needs.

G. Final words

decARate reduces the stress of shopping in stores and allows users to shop from the comfort of their own home.

But we had fun working on this paper and enjoyed the whole process. We learned the importance of designing with the user to make the user experience of the product more satisfying. We also learned about the

processes required to create a viable, accessible, and easy-to-use product and improved my problem-solving skills.

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