

AR FURNITURE APP

Submitted in partial fulfilment of the requirements of the degree of

BACHELOR OF COMPUTER ENGINEERING

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(2022-2023)



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CERTIFICATE

This is to certify that the Mini Project 2B entitled “AR Furniture App” is a bona fide work of “**Sahil Chordia (20102094), Sara Chaudhari (20102002), Rubin Gala (20102019), Venus Bias (20102028)**” submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **Bachelor of Engineering in Computer Engineering.**

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ABSTRACT

Furniture shopping has traditionally been a frustrating and difficult process for many customers. One of the main problems with traditional furniture shopping experiences is that customers often have difficulty visualizing how furniture will look in their own homes before making a purchase. This lack of visualization can lead to high rates of returns and customer dissatisfaction, which can have a negative impact on the business's bottom line and brand perception. To address this problem, we propose to develop a furniture app with AR functionality that enables customers to virtually place and visualize furniture within their own homes. By leveraging the power of AR technology, the app will allow customers to see how furniture will look in their space before making a purchase, reducing the rate of returns and improving customer satisfaction. The app will use advanced computer vision algorithms to recognize and map the user's room and place the furniture in a realistic manner, providing a seamless and immersive experience. Additionally, the app will offer a more personalized and engaging shopping experience that allows customers to explore different design options and customize their purchases according to their preferences. Customers will be able to visualize how different furniture pieces and designs will look in their space, experiment with different colors and finishes, and receive recommendations based on their previous purchases and browsing history. By offering a more interactive and innovative shopping experience, the furniture app with AR will differentiate our brand from competitors and drive sales for the business. The app will also reduce the cost associated with returns, showrooms, and sales personnel, providing a more cost-effective and efficient sales channel for the business. In summary, our furniture app with AR aims to solve the lack of visualization and interactivity in traditional furniture shopping experiences, providing customers with a more engaging, personalized, and innovative shopping experience that meets their needs and preferences. By leveraging the power of AR technology, our app will provide a unique and immersive shopping experience that drives business growth and improves customer satisfaction.

Keywords: AR functionality, Virtual visualization, User preferences, Personalized shopping experience.

CONTENTS

Sr. No.	Chapter Name	Page No.
1	Introduction	8
2	Literature Survey	9
3	Problem Statement, Objective & Scope	13
4	Proposed System	16
5	Project Plan	21
6	Experimental Setup	22
7	Implementation Details	23
8	Results	27
9	Conclusion	31
10	References	32

LIST OF FIGURES

Sr. No.	Figure Name	Page No.
1	Architecture Diagram	17
2	Use Case Diagram	18
3	Sequence Flow Diagram	19
4	Activity Diagram	29
5	Gantt Chart	21
6	Plane Detection	27
7	Sofa Model	27
8	Rotating Sofa Model	28
9	Measurements	28
10	Product Page	29
11	Cart Page	29
12	Payment portal	30

Chapter 1

Introduction

Furniture Augmented Reality (AR) is a technology that allows users to view and place virtual furniture objects in real-world environments using their mobile devices or AR headsets. With furniture AR, users can visualize how a particular piece of furniture would look in their home or office before making a purchase, which can help to reduce the risk of buyer's remorse and make the buying process more efficient. Furniture AR typically works by using the device's camera and sensors to create a 3D model of the environment, and then overlaying virtual furniture objects on top of the camera feed. Users can then move and adjust the virtual objects to fit the space and get a sense of how they would look in the real world. Some furniture AR apps also offer features such as 360-degree views, real-time shadows, and the ability to change colors and materials of the virtual objects. Furniture AR can be used by both consumers and retailers. For consumers, it allows them to visualize how furniture will look in their homes or offices, and to make more informed purchasing decisions. For retailers, it can help to increase sales by allowing customers to try out products before making a purchase, and can also reduce the cost and hassle of setting up physical showrooms. Some popular furniture AR apps include IKEA Place, Wayfair, and Houzz. These apps offer a wide range of virtual furniture objects and styles, and can be used on both iOS and Android devices. Furniture AR is expected to continue to grow in popularity as the technology becomes more advanced and more retailers and furniture companies adopt the technology.

Chapter 2

Literature Review

[1]Viyanon, Waraporn & Songsuittipong, Thanadon & Piyapaisarn, Phattarika & Sudchid, Suwanun. (2017). AR Furniture: Integrating Augmented Reality Technology to Enhance Interior Design using Marker and Markerless tracking. 1-7. 10.1145/3144789.3144825.

This paper presents AR Furniture, an application that integrates augmented reality technology for interior design, using both marker-based and markerless tracking. The application allows users to visualize furniture and design elements in their own living spaces and customize them to their liking. A user study showed that the application was effective in improving user satisfaction and providing a more realistic and interactive interior design experience.

[2] Pooja S, 2Praveen B, 3Raghul Prasath S, 4Krishnnammal M, Furniture Try-On Application using Augmented Reality. JETIR2204409:

This paper presents a furniture try-on application that uses augmented reality technology to provide customers with a personalized shopping experience. The application allows users to virtually place furniture in their living spaces, customize the color and size of the furniture, and make informed purchasing decisions. A user study demonstrated the effectiveness of the application in improving customer satisfaction and reducing the time and effort required for furniture shopping.

[3] Syamantak N. Dhavle , Chaudhary Mohammed Qais , Khan Mohd Saif Tabarakallah , Prof. Bhavna Arora. An Augmented Reality based Approach Towards Furniture Shopping. Furnished ISSN: 2278-0181 IJERTV10IS050253 Published by : www.ijert.org Vol. 10 Issue 05, May-2021:

This paper introduces Furnished, an augmented reality-based application for furniture shopping that allows users to virtually place furniture in their living spaces and visualize how it would look. The application also provides a personalized shopping experience by allowing

users to customize the furniture to their liking and purchase it directly from the application. A user study demonstrated the effectiveness of Furnished in improving customer satisfaction and reducing the time and effort required for furniture shopping.

[4] Moares, Rohan and Jadhav, Vaishnavi and Bagul, Rushikesh and Jacob, Reji and Rajguru, Shagufta and K, Rakhi, Inter AR: Interior Decor App Using Augmented Reality Technology (January 3, 2020). Proceedings of the 5th International Conference on Cyber Security & Privacy in Communication Networks (ICCS) 2019 | National Institute of Technology, Kurukshetra, India, Available at SSRN: <https://ssrn.com/abstract=3513248> or <http://dx.doi.org/10.2139/ssrn.3513248>:

This paper presents Inter AR, an interior decor application that uses augmented reality technology to provide users with an interactive and personalized design experience. The application allows users to virtually place furniture and design elements in their own living spaces, customize them to their liking, and preview how they would look. A user study showed that Inter AR was effective in improving user satisfaction and providing a more realistic and immersive interior design experience.

[5] ALHARBI, Basma & Aljojo, Nahla & Alshutayri, Areej & Banjar, Ameen & ZAINOL, Azida & ALHARBI, Asmaa & ALGHANMI, Sanaa & MANSOUR, Shaza & ALSHEHRI, Mram. (2021). The design and implementation of an interactive mobile Augmented Reality application for an improved furniture shopping experience. *Revista Română de Informatică și Automatică*. 31. 69-80. 10.33436/v31i3y202106.:

This paper presents an interactive mobile augmented reality application for furniture shopping, aimed at improving the shopping experience of customers. The application allows users to virtually place furniture in their living spaces, customize it, and purchase it directly from the application.

Research Paper	ANALYSIS
1. Viyanon, Waraporn & Songsuittipong, Thanadon & Suwanun. (2017). AR Furniture: Integrating Augmented Reality Technology to Enhance Interior Design using Marker and Markerless tracking	The paper "AR Furniture" presents an augmented reality application for interior design that uses marker and markerless tracking. It allows users to visualize and customize furniture in their living spaces, enhancing the design process. The paper highlights the potential of AR in improving user satisfaction and revolutionizing interior design.
2. Pooja S, 2Praveen B, 3Raghul Prasath S, 4Krishnnammal M, Furniture Try-On Application using Augmented Reality.	The paper "Furniture Try-On Application using Augmented Reality" introduces an AR-based application for personalized furniture shopping. Users can virtually place furniture in their living spaces, customize it, and make informed purchasing decisions. The paper highlights the effectiveness of the application in improving customer satisfaction and reducing shopping time and effort, as evidenced by a user study.

Research Paper	ANALYSIS
3.. Syamantak N. Dhavle , Chaudhary Mohammed Qais Prof. Bhavna Arora. An Augmented Reality based Approach Towards Furniture Shopping.	The paper "An Augmented Reality based Approach Towards Furniture Shopping" presents Furnished, an AR-based application for virtual furniture shopping. Users can place furniture in their living spaces, customize it, and make purchases directly from the application. The paper highlights the effectiveness of Furnished in improving customer satisfaction and reducing shopping time and effort, as evidenced by a user study.
4. Moares, Rohan and Jadhav, Vaishnavi and Bagul, Rushikesh Inter AR: Interior Decor App Using Augmented Reality Technology	The paper "Inter AR: Interior Decor App Using Augmented Reality Technology" introduces an AR-based application called Inter AR for interior decor. Users can virtually place furniture and design elements in their living spaces, customize them, and preview the results. A user study demonstrated the effectiveness of Inter AR in enhancing user satisfaction and providing a realistic interior design experience.
5. ALHARBI, Basma & Aljojo, Nahla & Alshutayri, Areej & Banjar, Ameen Mram. (2021).The design and implementation of an interactive mobile Augmented Reality application for an improved furniture shopping experience	The paper presents a mobile augmented reality application for furniture shopping that enhances the overall shopping experience. Users can virtually place furniture in their living spaces, customize it, and make purchases directly from the application. The implementation of this interactive AR application has the potential to improve customer satisfaction and streamline the furniture shopping process.

Chapter 3

PROBLEM STATEMENT

The problem addressed is the lack of visualization and interactivity in traditional furniture shopping experiences, leading to high rates of returns, customer dissatisfaction, and lost revenue.

Often, customers are unable to visualize how furniture will look in their own homes before making a purchase. This lack of visualization can lead to high rates of returns and customer dissatisfaction, which can have a negative impact on the business's bottom line and brand perception.

Additionally, traditional furniture shopping experiences often lack personalization and interactivity, making it difficult for customers to explore different design options and make informed purchasing decisions. This can result in missed sales opportunities and lost revenue for the business.

To address these problems, we aim to develop a furniture app with AR functionality that enables customers to virtually place and visualize furniture within their own homes. The app will allow customers to see how furniture will look in their space before making a purchase, reducing the rate of returns and improving customer satisfaction.

Moreover, the app will offer a more personalized and engaging shopping experience that allows customers to explore different design options and customize their purchases according to their preferences. By offering a more interactive and innovative shopping experience, the furniture app with AR will differentiate our brand from competitors and drive sales for the business.

Overall, the problem that we aim to solve with our furniture app with AR is the lack of visualization and interactivity in traditional furniture shopping experiences, which can lead to high rates of returns, customer dissatisfaction, and lost revenue. By providing a more engaging, personalized, and innovative shopping experience, our furniture app with AR will meet customers' needs and drive business growth.

OBJECTIVE

- The objective of the furniture app with AR is to provide a more personalized, engaging, and innovative shopping experience that addresses the problems associated with traditional furniture shopping. By leveraging the power of AR technology, the app aims to:
- Improve customer satisfaction providing a more interactive and immersive shopping experience. Drive sales by providing a more personalized and engaging shopping experience.
- By offering personalized recommendations, special offers, and social media integration, the app will attract and retain customers, driving sales and revenue for the business, reduce costs associated with traditional furniture shopping.
- By reducing the rate of returns and the need for physical showrooms and sales personnel, the app provides a more cost-effective and efficient sales channel for the business, provide a competitive advantage: for the business by offering a more innovative and efficient sales channel.
- By offering a more personalized and engaging shopping experience, the app will attract and retain customers, driving sales and revenue for the business.

SCOPE

The app is built on AR technologies using Unity to create a realistic and immersive shopping experience. The app is a mobile application making it easier for users to use compared to web based application. The application provides a variety of features that help in giving a unique and customized experience to our users. Some of these features are as follows:

- The application will have a user-friendly interface that will allow the users to browse through the available furniture models and select the ones they want to place. An intuitive interface that allows users to easily navigate the app and select and place furniture items.
- The application will have a library of 3D models of furniture that the users can choose from. The models will be of high quality and will have accurate dimensions.
- The application will allow the users to choose models and place them in the detected plane according to their needs. It will provide users with accurate dimensions of the furniture giving a more detailed idea about the product to the user. It will provide the user the ability to rotate and resize furniture items to fit within the physical space.
- The application will be developed for both iOS and Android platforms, and will be compatible with AR-enabled devices.
- Vast catalog of furniture items like table, chair, sofa from where the users can choose different furnitures.

Chapter 4

Proposed system

The proposed system for an augmented reality (AR) furniture app would consist of several key components. Firstly, the app would have a user-friendly interface that allows users to easily navigate through different furniture options, customize furniture features, and view furniture in their own living spaces through AR technology.

The app would also include a comprehensive database of furniture items with detailed information such as dimensions, and prices, which would be constantly updated with new furniture options and pricing information. Users would have the ability to customize furniture items according to their preferences, such as changing colors, sizes, and finishes, allowing them to visualize how different customization options would look in their own living spaces.

Furthermore, the app would integrate with an e-commerce platform to enable users to make purchases directly from the app, providing valuable insights for improving the app and enhancing the overall user experience.

Diagrams:

1.ARCHITECTURE DIAGRAM

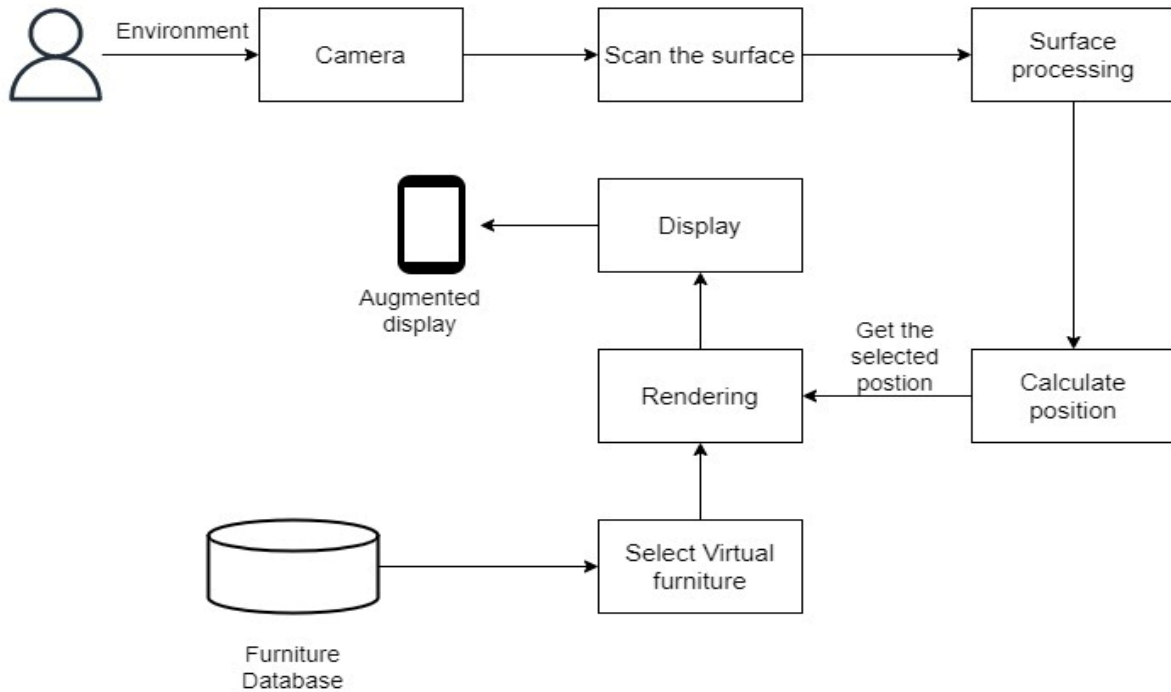


Fig.1 Architecture Diagram

The above architecture diagram shows the entire implementation of the project. It shows the components required like AR camera, plane surface and the modules of the project like plane detection, object manipulation and database. It illustrates the general structure of how the project is broken down into the modules and the flow of modules throughout the project.

2.USECASE:



Fig.2 Use Case Diagram

Use cases specify the expected behavior (what), and not the exact method of making it happen (how). The use case diagram specifies how the user will act with the application, what all actions can the user perform. This use case diagram shows the expected behavior of the user with the application.

3. SEQUENCE DIAGRAM

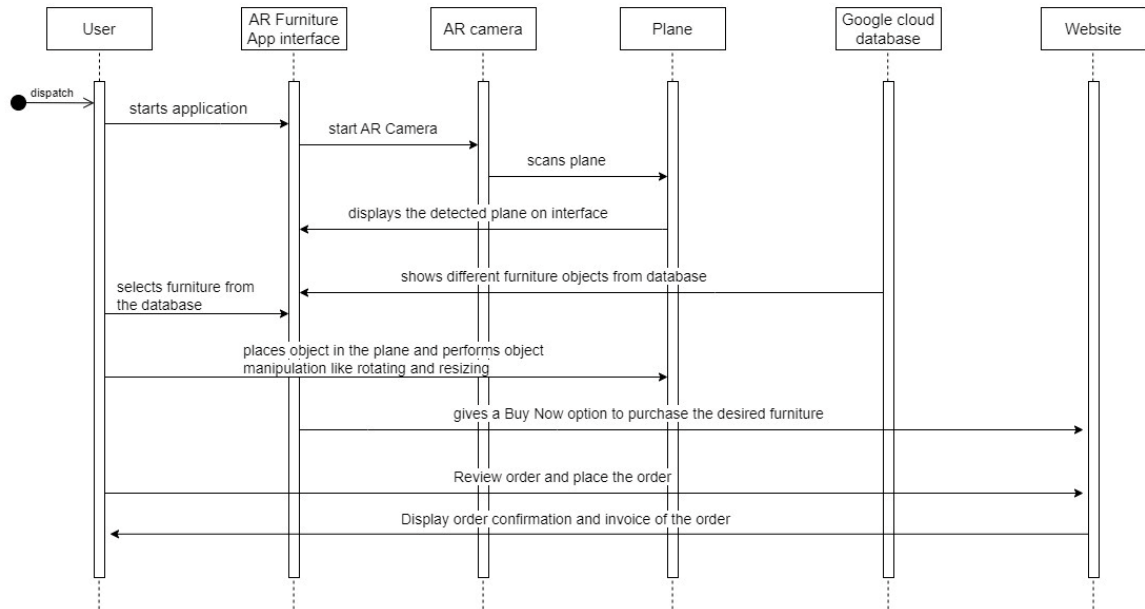


Fig.3 Sequence Diagram

The above sequence diagram shows detailed sequence of how operations are carried out. Here the user will start the application and can access the AR camera. The AR camera is used for plane detection. The cloud database stores variety of furniture objects from which the user can select the desired furniture and place in the detected plane as per his needs. The user can later buy the placed furniture from the website.

4. ACTIVITY DIAGRAM

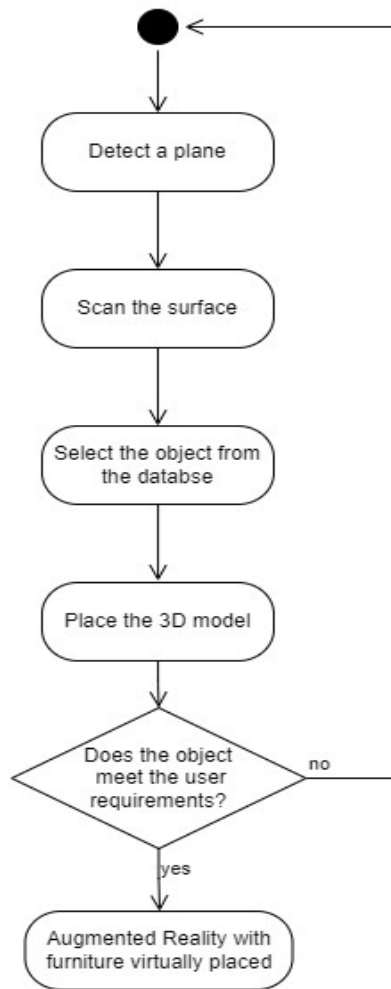
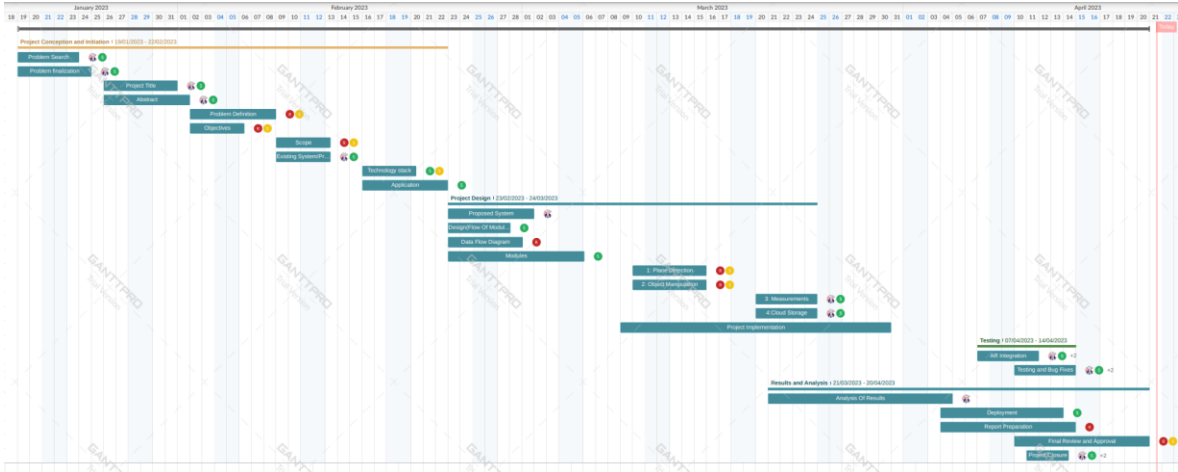









































Fig.4 Activity Diagram

Activity diagram describes dynamic aspects of the system. An activity diagram is essentially an advanced version of a flowchart that models the flow from one activity to another activity. The activity diagram illustrates the following:

1. Start the AR app and detect plane where you want to place furniture
2. Select the furniture of your choice and place in the plane as per desired using object manipulation
3. Make a purchase of the furniture if the user wants from the website.

GANTT CHART



College AR FURNITURE APP			
	Task name	Assigned	Status
1	 Project C...		
1.1	Proble...	 	 Done
1.2	Proble...	 	 Done
1.3	Projec...	 	 Done
1.4	Abstract	 	 Done
1.5	Proble...	 	 Done
1.6	Objec...	 	 Done
1.7	Scope	 	 Done
1.8	Existin...	 	 Done
1.9	Techn...	 	 Done
1.10	Applic...	 saracha...	 Done
2	 Project D...		
2.1	Propo...	 Venus ...	 Done
2.2	Desig...	  saracha...	 Done
2.3	Data F...	  rubingala	 Done
2.4	Modül...	  saracha...	 Done
2.5	1: Pla...	  	 Done
2.6	2: Obj...	  	 Done
2.7	3: Me...	 	 Done
2.8	4:Clou...	 	 Done
3	Project L...	unassigned	 Done



















4	Testing		
4.1	AR Int...	  +2	 Done
4.2	Testin...	  +2	 Done
5	Results a...		
5.1	Analys...	 Venus ...	 Done
5.2	Deplo...	 saracha...	 Done
5.3	Repor...	 rubingala	 Done
5.4	Final ...	 	 Done
5.5	Projec...	  +2	 Done

Fig.5 Gantt Chart

Chapter 6

Experimental Setup

Software Requirements

Working framework: Android 8.0 or more

Tools

- Unity 3D

Unity 3D is a popular cross-platform game development engine that allows developers to create 2D and 3D interactive experiences for various platforms, including desktop, mobile, and virtual reality (VR) devices. It provides a wide range of tools and features, such as a powerful physics engine, a flexible scripting language (C#), an extensive asset store, and a visual editor for creating scenes and game objects. Unity 3D also supports a large community of developers, with an active community forum and abundant documentation, making it accessible for both beginners and experienced developers. Its versatility and flexibility make it a popular choice for creating a wide range of applications, from games to simulations, training programs, and more.

- React JS

React is a popular JavaScript library for building user interfaces, known for its component-based architecture, virtual DOM, and efficient performance. Developed by Facebook, it allows developers to create reusable UI components and is widely adopted for building modern web applications.

Hardware Requirements

- RAM Capacity: 4GB
- Memory: 120 MB
- Graphics Card: 1 GB
- Accessories: Smart phone with AR support

Chapter 7

Implementation

Module 1: Plane Detection

AR plane detection places a digital 3D model on a real-world flat surface, like a tabletop or floor. Plane detection is an important aspect of augmented reality (AR) applications as it enables virtual objects to be placed and anchored to real-world surfaces. In order to detect planes in AR, a combination of computer vision and machine learning techniques are used.

One commonly used approach for plane detection in AR is to use a technique called visual odometry. This involves analyzing the motion of a camera in real-time to determine its relative position and orientation with respect to the environment. By analyzing the changes in the images captured by the camera, it is possible to identify features in the scene and determine the location of planes.

Another approach is to use depth sensing techniques, such as time-of-flight or structured light, to capture 3D data of the environment. This data can be used to create a 3D model of the environment, which can then be used to detect planes and other surfaces.

Once a plane has been detected, virtual objects can be anchored to it using techniques such as surface tracking or markerless tracking. This enables the virtual objects to remain anchored to the real-world surface, even as the camera moves around.

Plane detection is a crucial aspect of AR applications, enabling virtual objects to be placed and anchored to real-world surfaces and creating more realistic and immersive AR experiences for users.

Module 2: Object Manipulation

Object manipulation in augmented reality (AR) involves interacting with virtual objects in the real world using various input modalities, such as gestures or voice commands. There are several techniques for object manipulation in AR, including:

Gesture recognition: This involves recognizing and interpreting hand gestures and movements to manipulate virtual objects in the AR environment. For example, pinching and dragging motions can be used to resize and move objects.

Touch input: Users can use touch input to interact with virtual objects in AR, such as tapping to select an object or dragging to move it.

Motion tracking: This involves tracking the user's movement and using it to manipulate objects in the AR environment. For example, users can use their head movements to control the position and orientation of objects.

Once the user has selected an object, they can manipulate it in various ways, such as rotating, scaling, or moving it around in the AR environment. The virtual object can also interact with the real world, such as bouncing off real-world surfaces or casting shadows on them.

Object manipulation in AR opens up new possibilities for interactive experiences and can be used in a variety of applications, such as gaming, education, and training.

Module 3: Measurements

Measurements in augmented reality (AR) involve using the AR environment to measure distances, sizes, and other physical attributes of real-world objects. There are several techniques for taking measurements in AR, including:

Marker-based measurement: This involves placing markers of known size in the AR environment and using them as a reference point to measure other objects. For example, placing a marker of known size next to an object and then measuring the distance between the marker and the object.

Plane detection: Plane detection can also be used to take measurements in AR. By detecting and measuring the size of real-world surfaces, such as walls or floors, users can determine the size and distance of objects in the environment.

Depth sensing: Depth sensing techniques, such as time-of-flight or structured light, can be used to capture 3D data of the environment. This data can be used to measure distances and sizes of objects in the AR environment.

Visual odometry: This technique involves analyzing the motion of a camera in real-time to determine the distance and size of objects in the AR environment. By analyzing the changes in the images captured by the camera, it is possible to determine the size and distance of objects in the environment.

Once the measurement has been taken, the results can be displayed in the AR environment, such as on top of the measured object or on a virtual ruler. This enables users to easily visualize and understand the measurements they have taken.

Measurement in AR can be used in a variety of applications, such as architecture, interior design, and engineering. It can also be used for educational purposes, such as teaching children about measurement and geometry in a fun and interactive way.

Module 4:Cloud Based

Cloud storage is a type of data storage that involves storing files and data on remote servers that can be accessed over the internet. Cloud storage allows users to access their data from anywhere, at any time, as long as they have an internet connection. Some benefits of cloud storage include:

Scalability: Cloud storage can be easily scaled up or down depending on the needs of the user. This means that users can store as much or as little data as they need, and only pay for what they use

Accessibility: Cloud storage can be accessed from anywhere, at any time, as long as there is an internet connection. This makes it easy for users to access their data from multiple devices and locations.

Reliability: Cloud storage providers typically have multiple servers in different locations, ensuring that data is always available even if one server goes down

Security: Cloud storage providers typically use advanced security measures to protect user data, such as encryption and multi-factor authentication.

Collaboration: Cloud storage makes it easy for multiple users to collaborate on documents and files in real-time, without the need for physical file transfers.

Some popular cloud storage providers include Dropbox, Google Drive, OneDrive, and iCloud. These services typically offer both free and paid plans, with the paid plans offering additional storage space and features. Cloud storage can be used for a variety of purposes, such as backing up important files and documents, sharing files with others, and syncing data across multiple devices.

Chapter 8

Result



Fig.6 Plane Detection

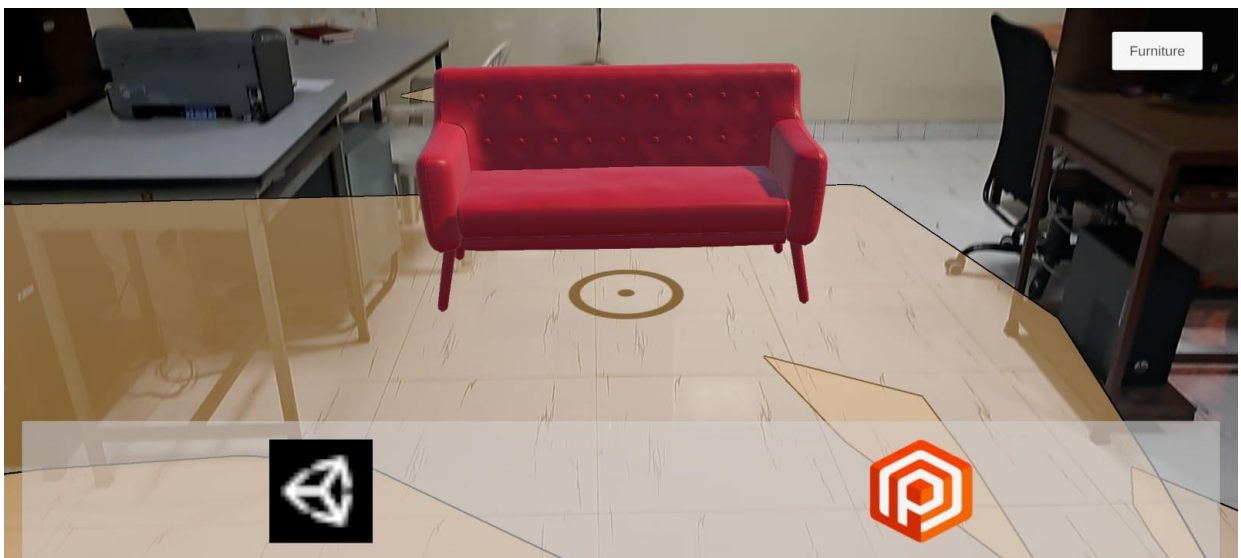


Fig.7 Sofa Model



Fig.8 Rotating Sofa Model

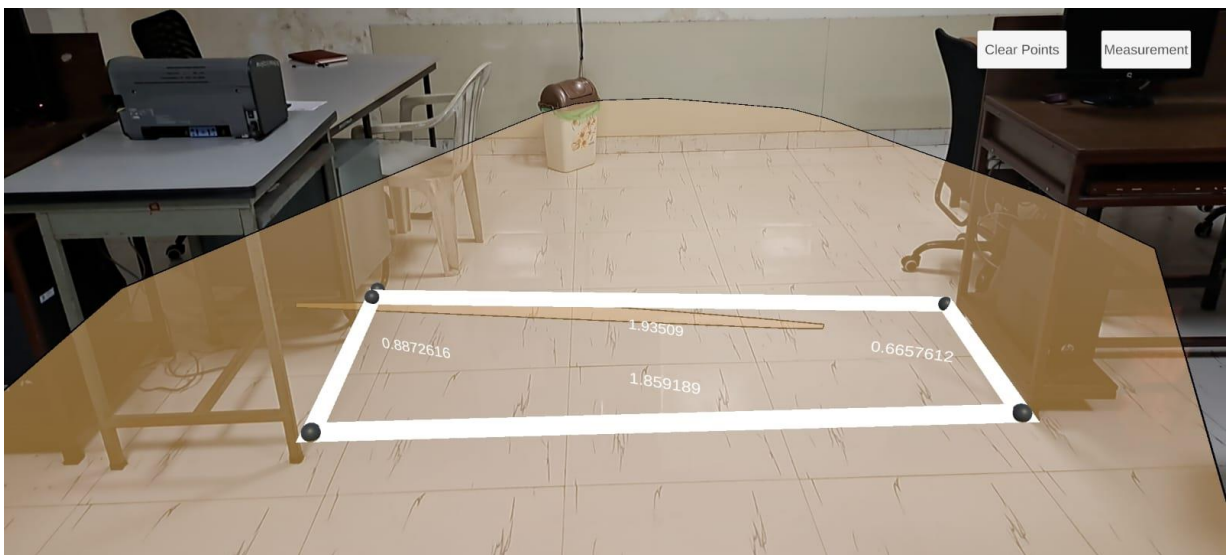


Fig.9 Measurements

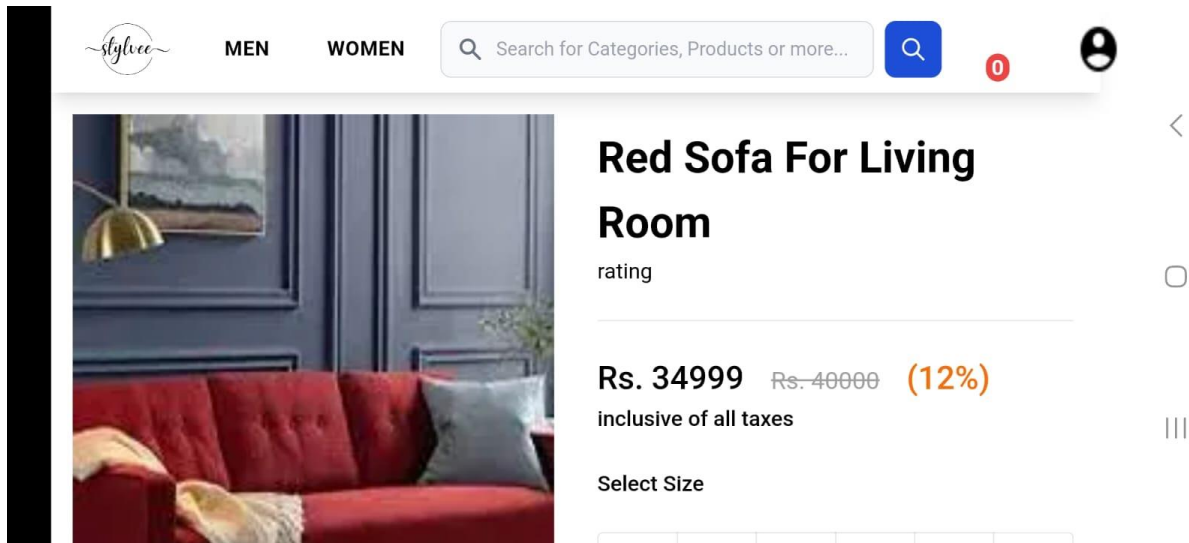


Fig.10 Product Page

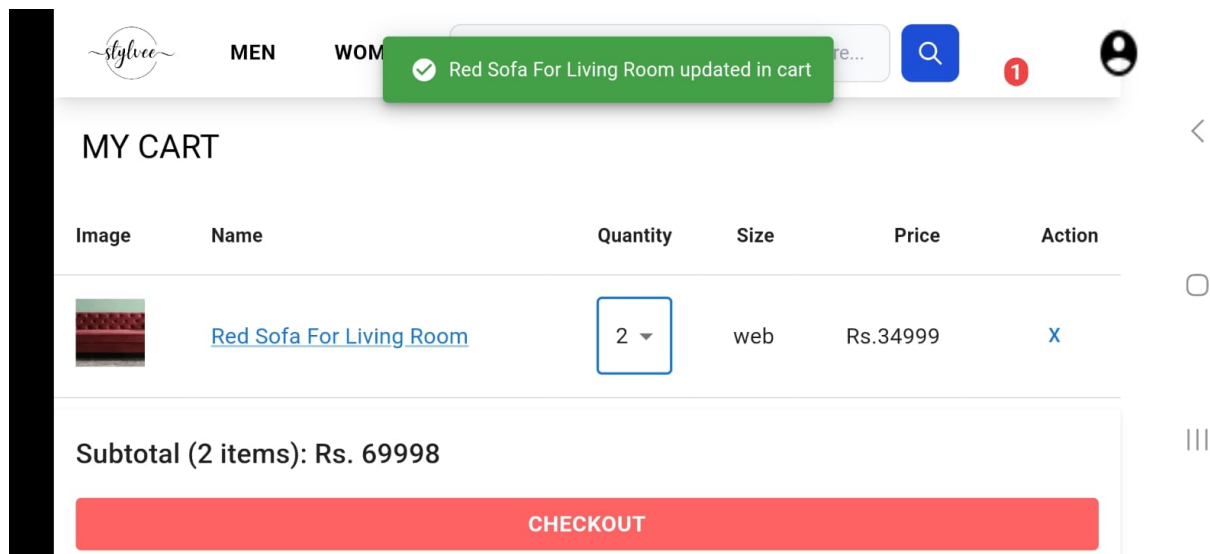


Fig.11 Cart Page


Status: not delivered

Payment Method

PayPal


Status: not paid


Order Items

Image	Name	Quantity	Size	P
	Red Sofa For Living Room	2	web	349

Order Summary

Items:	Rs.69998
Tax:	Rs.6999.8
Shipping:	Rs.0
Total:	Rs.76997.8



 Debit or Credit Card


Powered by 

Fig.12 Payment portal

Chapter 9

Conclusion

9.1 Conclusion

In conclusion, furniture augmented reality (AR) is a technology that has revolutionized the way consumers shop for furniture. With furniture AR apps, users can now visualize how a particular piece of furniture would look in their home or office before making a purchase, which can help to reduce the risk of buyer's remorse and make the buying process more efficient. Additionally, for retailers, furniture AR can help to increase sales by allowing customers to try out products before making a purchase, and can also reduce the cost and hassle of setting up physical showrooms.

Popular furniture AR apps such as IKEA Place, Wayfair, and Houzz offer a wide range of virtual furniture objects and styles, and can be used on both iOS and Android devices. These apps have transformed the way consumers shop for furniture, offering a more immersive and personalized shopping experience. As the technology continues to advance, furniture AR is expected to become even more popular, and more retailers and furniture companies are likely to adopt the technology to offer a more innovative and interactive shopping experience.

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