ABSTRACT

Mobilia is a mobile application designed to enhance the shopping experience for furniture consumers. Using augmented reality technology, the app allows users to visualize furniture models in their real-world environment before making a purchase decision. This feature provides a more immersive and interactive experience for users, allowing them to see how a particular piece of furniture will look and fit in their space.The app features a user-friendly interface that makes it easy for users to browse through a wide range of furniture models and select the ones they want to visualize. Once selected, users can use their smartphone camera to scan their surroundings and place a virtual representation of the furniture in their physical space. They can then move the furniture model around and see how it looks from different angles, adjust its position and can take a snap of the furniture model.Those snaps will be saved in their gallery so that they can share it with others or saved it for future use. Mobilia offers a unique and convenient way for furniture shoppers to make informed purchase decisions. By providing a realistic and interactive representation of furniture models, the app allows users to visualize the final look and feel of their space before making a purchase. This not only saves time and money but also helps users make more confident and satisfying choices. Our innovative app introduces an extraordinary AR Measurement feature, which empowers users to measure objects using their smartphones. With a click of the dedicated AR Measurement button, users can access this cutting-edge functionality, leveraging the capabilities of augmented reality technology. Our app enables users to obtain accurate measurements of objects in real-time, both continuously and discretely. Whether it's measuring the dimensions of furniture, assessing the size of a room, or calculating distances for architectural purposes, our app provides a user-friendly and efficient solution. Experience the future of object measurement with our app's AR Measurement feature, revolutionizing the way we gauge and interact with the physical world.

1.INTRODUCTION

Augmented Reality (AR) is one such technology that integrates digital information with the users environment in real time. We are going to develop an android app with augmented reality based system “AR Furniture App” which makes use of AR content onto natural features detected from the surroundings. By using this application the customers can try visualizations of furniture placements in the available space before purchasing them. Augmented reality (AR) is a technology that superimposes virtual objects onto the real world, creating an immersive and interactive experience. With the advancement of AR technology, it is now possible to visualize furniture models using AR, providing a new level of realism and interactivity for furniture shoppers. Furniture visualization using AR allows customers to preview how furniture will look in their own homes before making a purchase. By using a mobile device or AR headset, customers can place virtual furniture models in their actual living spaces and see how they will look and fit in real time. This not only enhances the shopping experience but also provides a more accurate representation of the product, reducing the chances of returns and increasing customer satisfaction. Moreover, Furniture visualization using AR also provides benefits for furniture designers and manufacturers. They can use AR to create and preview furniture designs before producing physical prototypes, which can save time and reduce costs. AR also enables designers to make changes and adjustments to the design on the fly, resulting in a more efficient and streamlined design process. the visualization of furniture models using AR is a powerful tool for both customers and designers. It allows customers to make more informed purchasing decisions and provides designers with a powerful tool for creating and iterating on furniture designs.

2. LITERATURE SURVEY

2.1 3D Furniture Shape with Texture (2021)

In this paper, they have built the large-scale 3D-FUTURE benchmark specific to the household scenario with rich 3D and 2D annotations. The features include but are not limited to the photo-realistic renderings, 2D–3D alignments, and most significantly the industrial 3D furniture shapes with informative textures and different attributes.

2.2 Furnished: An Augmented Reality based Approach Towards Furniture Shopping (2021)

In this paper, they Proposed an e-commerce application with augmented reality support. Using Scene form SDK consisting of a PBR (physically based renderer) to aid in the process of displaying products in the real environment.

2.3 Visualization of Furniture using CNN for Augmented Reality (2021)

In this paper, they have proposed a system that uses Depth-Image unified with Convolutional Neural Network framework to recover 3D shapes from single-view 2D RGB images. This will assist the customers to view the furniture piece virtually in physical space in real-time without buying the object.

2.4 Application Development with Augmented Reality Technique using Unity 3D and Vuforia (2021)

In this paper, they have proposed the three-dimensional model of scene is simulated by the means of Unity 3D. The Vuforia engine can detect and track identification features and fabricate corresponding 3D model in accordance with the relative position and attitude information of sundry identifiers on the visual plane, the corresponding 3D model. The real-time synchronization satisfies the users in the real world to feel the virtual space, thus strengthening the spice and interaction.

2.5 Visualization Of Furniture Model Using Augmented Reality (2022)

In this paper, they have proposed a system that uses Depth-Image unified with Convolutional Neural Network framework to recover 3D shapes from single-view 2D RGB images. This will assist the customers to view the furniture piece virtually in physical space in real-time without buying the object

2.6 AR Measurement Rulers (2023)

This paper provides an overview of AR measurement rules and their applications. There are many benefits to using augmented reality in measurement tools, including the ability to measure objects without physical contact and the ability to view measurements in 3D. The results of this study show that the AR measuring ruler can measure objects of different sizes accurately and reliably. The use of AR measuring rules is expected to increase in various industries and applications in the future.

3 SYSTEM ANALYSIS

3.1 Existing System

IKEA Place, Wayfair are a mobile app that uses AR technology to allow users to preview furniture products in their own homes. Users can select from a wide range of furniture products and see them in their actual living spaces using their mobile device's camera. HoloLens is a standalone AR system developed by Microsoft. It allows users to see virtual objects superimposed onto the real world, creating an immersive AR experience. It can be used for furniture visualization, among other applications.

3.2 Proposed System

The proposed system is a mobile application developed using Unity and AR technology, providing users with an augmented view of furniture items. The application offers an immersive experience where users can overlay virtual furniture onto their real-world environment, visualizing how it will look and fit in their homes. Additionally, an AR measurement feature allows users to accurately measure real-world objects by capturing them with their device's camera. The interactive capabilities of the app enable users to move and rotate virtual furniture, enhancing their exploration and visualization of different arrangements within their space. Overall, the application empowers users to make informed decisions and optimize their interior design choices.

4 SYSTEM SPECIFICATION

4.1 Software Requirements

Language: C#

Unity 3D

Maya 3D

AWS Cloud

5 SOFTWARE DESCRIPTION

5.1 Language:C#

C# (pronounced "C sharp") is a modern, high-level programming language that is designed for building a wide range of applications that run on the .NET Framework or .NET Core platforms. C# was developed by Microsoft in the early 2000s and is now widely used for developing Windows desktop applications, web applications, games, and mobile applications. C# is an object-oriented language, which means that it provides a way to structure programs using objects, classes, and interfaces. It also includes a garbage collector that automatically manages the memory usage of an application, making it easier for developers to write efficient code.

5.2 Unity 3D

Unity 3D is a powerful game engine and development platform that is used to create 2D and 3D games for a variety of platforms, including desktop, mobile, and console. It was first released in 2005 and has since become one of the most popular game engines in the industry. Unity provides a range of features for game development, including a powerful game editor, scripting tools, physics engine, and support for various platforms and devices. It also includes a large library of assets and plugins that developers can use to speed up development and enhance their games.

5.3 Maya 3D

Maya 3D is a powerful 3D computer graphics software developed by Autodesk. It is widely used in the film, television, and video game industries for creating high-quality 3D animations, visual effects, and character models. Maya offers a wide range of features and tools for creating 3D models, including polygon modeling, NURBS modeling, and sculpting. It also has a powerful animation system that allows animators to create complex character animations using keyframe animation, motion capture data, and other techniques.

5.4 AWS Cloud

Amazon Web Services (AWS) is a cloud computing platform offered by Amazon. It provides a range of cloud-based services, including computing power, storage, and databases, that can be used to build and deploy applications and websites. AWS is used by millions of customers around the world, from startups to large enterprises.

6 PROJECT DESCRIPTION

6.1 Problem Definition

The traditional process of furniture shopping and interior design presents various challenges for customers. Firstly, customers often struggle to envision how furniture items will look and fit within their own living spaces. This lack of visualization can lead to uncertainty and dissatisfaction with the final purchase. Secondly, customers face difficulties in accurately measuring their existing furniture or household objects, making it challenging to ensure a proper fit and layout. These limitations hinder the decision-making process and may result in costly mistakes or suboptimal design choices.Additionally, there is a need for a more interactive and personalized shopping experience that goes beyond static images or catalogs. Customers desire a way to explore different furniture arrangements and visualize how they will complement their existing decor. They also seek the convenience of being able to take measurements and make informed decisions while shopping for furniture**.**

6.2 Introduction to proposed system

The proposed system is a mobile application developed using Unity and AR technology, offering users an augmented view of furniture items. With the application, users can overlay virtual furniture onto their real-world environment, providing a visual representation of how the furniture will look and fit in their homes. Furthermore, the application incorporates an AR measurement feature that enables users to accurately measure real-world objects using their device's camera.Through the AR measurement feature, users can capture the dimensions of existing furniture or household objects by simply pointing their device's camera at them. The application uses augmented reality technology to analyze the captured images and provide precise measurements, empowering users to gather accurate information about the size and dimensions of their furniture or other items.Additionally, the interactive capabilities of the application allow users to manipulate and visualize the virtual furniture items within their augmented environment. Users can move and rotate the virtual furniture, exploring different arrangements and perspectives to create an optimal layout within their space.

By combining the augmented view feature with the AR measurement functionality, our application provides users with a comprehensive tool for interior design and decision-making. Users can virtually place and measure furniture items, ensuring a better understanding of how they will fit and complement their existing decor. This empowers users to make informed decisions and optimize their interior design choices based on accurate measurements and visual representations.

6.2.1 System Architecture

1.User Launches the App

The user opens the AR furniture application on their mobile device.

2.Main Screen

The app displays the main screen with two buttons: "AR Furniture" and "AR Measurement."

3.AR Furniture Button

The user taps the "AR Furniture" button to access the augmented reality furniture mode.

4.Select Furniture Item

The user chooses a specific furniture item from the catalog.

5.Visualize Furniture Placement

The user can now see the selected furniture item within their space and assess how it looks and fits.

Interact with Furniture

The user can interact with the virtual furniture, moving and rotating it to explore different placements and angles.

6.Capture Image

If desired, the user can capture a screenshot or image of the augmented furniture view.

7.AR Measurement Button

The user taps the "AR Measurement" button to access the augmented reality measurement mode.

8.AR Measurement Mode

The app switches to the AR measurement mode, utilizing the device's camera for capturing measurements.

9.View Measurements

The app displays the measurements on-screen, allowing the user to view and reference them.

10.Capture Measurement

The user points the camera towards a real-world furniture or object, allowing the app to analyze and provide accurate measurements.

11.Return to Main Screen or Exit

The user can choose to return to the main screen to access either AR furniture or AR measurement mode again, or they can choose to exit the app.

The below chart represents the architecture of the project:

AR FURNITURE

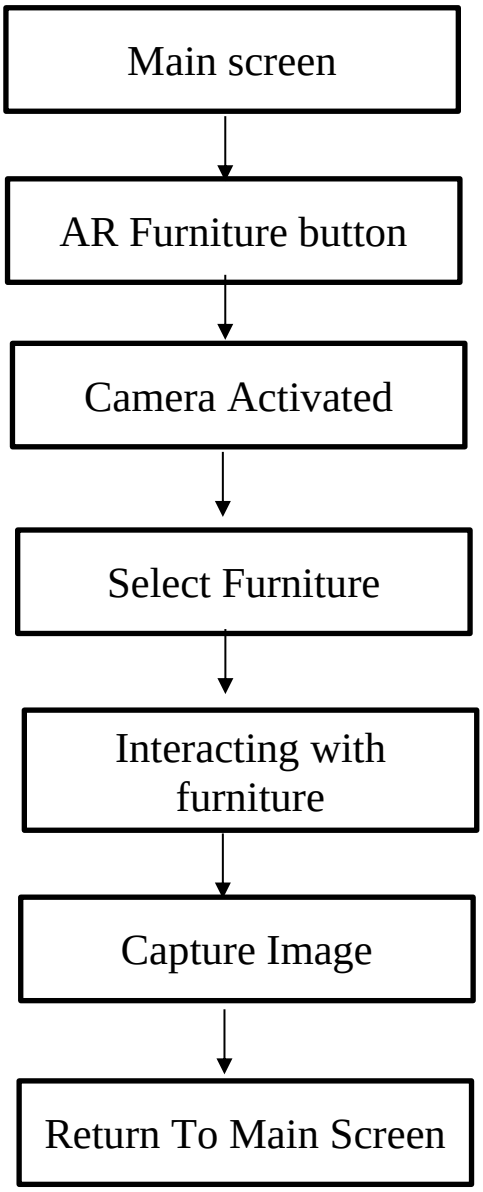

Fig 6.1 AR Furniture flow chart

AR MEASURMENT

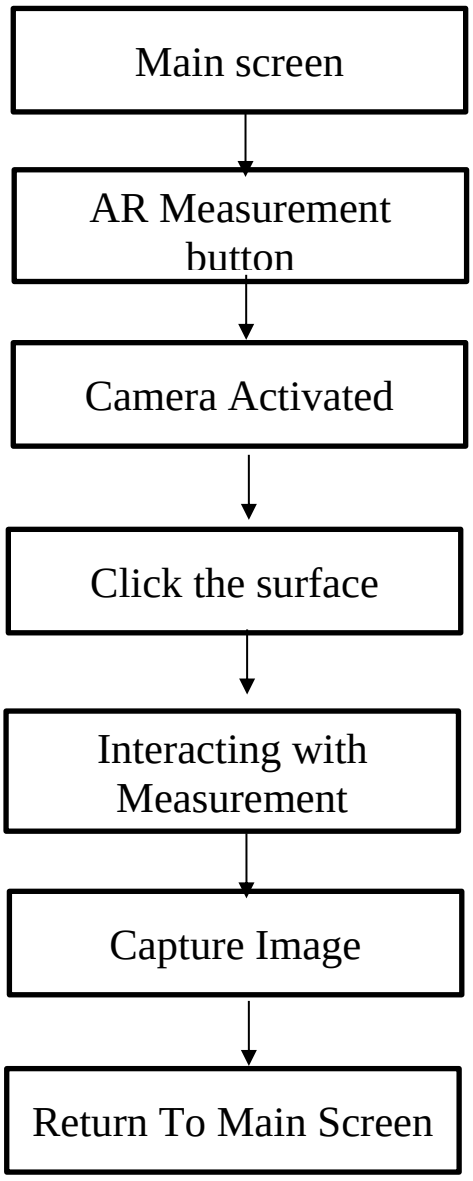

Fig 6.2 AR Measurement flow chart

6.2 MODULE DESCRIPTION

6.2.1 MODULE 1

CREATING AND IMPORTING 3D OBJECTS

In the initial phase of the project, the focus is on creating 3D models using software tools such as Blender and Maya. These tools offer powerful features for designing intricate and detailed furniture items. However, since Unity only supports the FBX file format, the 3D models created in Blender (in the Blend file format) need to be converted to FBX using online conversion tools. Additionally, some 3D models are imported from online sources to enhance the library. Once the 3D models are created and ready, they are imported into Unity for further processing and integration within the AR furniture application.

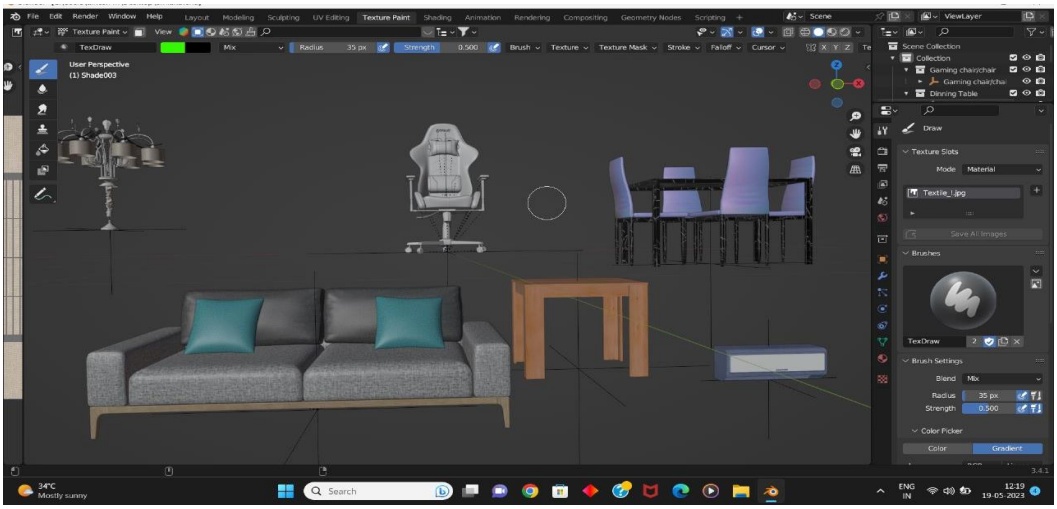

Fig 6.3 Designing 3D models

6.2.2 MODULE 2

DESIGNING UNITY UI

- In the second phase of the project, the focus is on designing the user interface (UI) for the AR furniture application. The UI comprises multiple pages/screens, each serving specific functionalities.
- The main page acts as the central hub and includes two buttons: one for AR furniture and another for AR measurement. Clicking the AR furniture button directs the user to the AR furniture page. This page incorporates a scroll view at the bottom, allowing users to select furniture items based on their preferences.

Additionally, several buttons are available, including a capture button that saves an image of the augmented reality scene to the device's gallery. The reset button clears the page, while the undo button enables users to revert actions. A back button is provided for easy navigation back to the main page.

- Clicking the AR measurement button on the main page takes the user to the AR measurement page. Here, a toggle button enables users to switch between continuous measurement and discrete measurement modes. Continuous measurement mode provides ongoing measurements, while discrete measurement mode captures measurements for specific objects. Similar to the AR furniture page, undo and reset buttons are available for managing measurements.
- Overall, the UI design prioritizes intuitive navigation, clear functionality, and convenient features for users to interact with the AR furniture and measurement capabilities of the application.

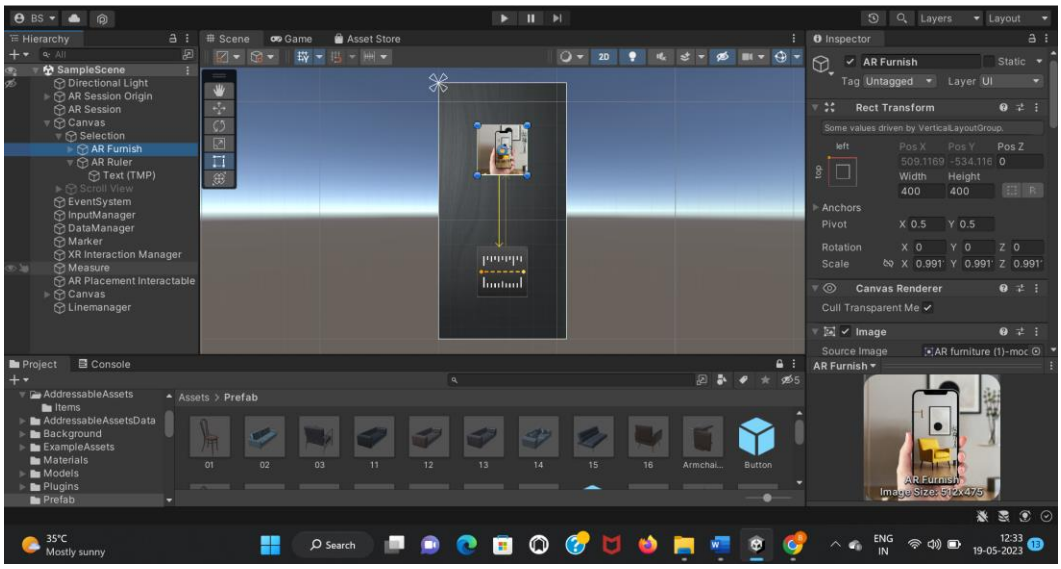

Fig 6.4 Designing Unity UI

6.2.3 MODULE 3:

DISPLAYING THE FURNITURE

The third phase of the project involves displaying furniture in a virtual environment. This process is achieved through the implementation of various scripts:

1. UIManager: This script manages the user interface and handles UI-related functionality. It detects user interactions using the GraphicRaycaster and EventSystem components. The OnEntered method checks if a specific GameObject (button) has been entered by the user.

2. UIContentFitter: Responsible for fitting the content within the UI layout, this script dynamically adjusts the size of the layout based on the number of child elements. It ensures that the furniture buttons are displayed properly within the scroll view.

3. Item Scriptable Object: Represents a furniture item and holds properties such as price, itemPrefab (the 3D model), and itemImage (the sprite).

4. InputManager: Handles user input and furniture placement in the AR environment. It utilizes the ARRaycastManager to perform raycasting and detect surfaces for furniture placement. The script includes functions to handle tap gestures, check if the pointer is over UI elements, and instantiate furniture objects.

5. DataHandler: Manages data related to furniture items. It loads item data from the Addressable Assets system and stores it in a list. The SetFurniture method sets the selected furniture item based on the provided ID, while the GetFurniture method retrieves the selected furniture item for instantiation in the AR environment.

6. ButtonManager: Manages the behavior of furniture buttons. It assigns the button texture (itemImage) and item ID based on the provided data. The script handles button clicks and performs actions when a button is selected.

Collectively, these scripts collaborate to create a user-friendly interface for selecting furniture items, handle user input gestures, manage data storage, and ultimately display the chosen furniture in the AR environment.

Fig 6.5 Displaying Furniture

6.2.4 MODULE 4:

AWS CLOUD CONNECTIVITY WITH UNITY

The fourth phase of the project involves connecting AWS cloud with Unity to enable automatic updates. Firstly, an S3 bucket is created in the AWS cloud, which is set to public access. The Unity project is then built, generating the necessary executable files and assets. These build files are copied and uploaded to the S3 bucket. The path link to the executable file is obtained from the S3 bucket and pasted into the Unity application. This link serves as the location from which users can access and download the application. With this cloud connectivity, any future changes or additions to the application can be directly updated in the S3 bucket. Users will receive automatic updates, eliminating the need for manual application updates. This integration streamlines the process of delivering new content and ensures users always have access to the latest version of the application.

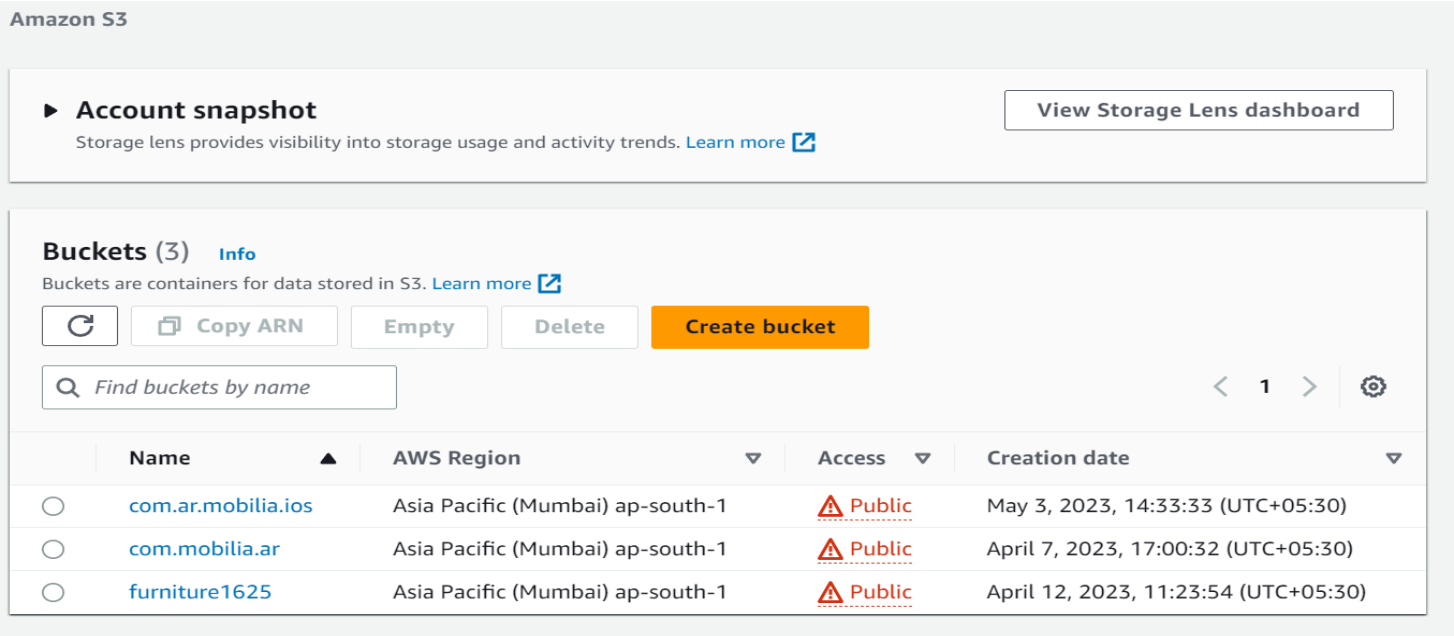

Fig 6.6 AWS Cloud

6.2.5 MODULE 5:

AR MEASUREMENT

The last phase of the project involves adding the AR measurement feature. Here's a brief description of the steps involved:

1. Creating a 3D Object Sphere:

- Creating a 3D sphere object in our Unity project.

-This sphere will act as a measurement point in the AR environment.

2. Adding Line Renderer:

- Attaching a Line Renderer component to the sphere object.

- The Line Renderer will be used to draw the measurement lines between points.

3. Writing the Linemanager Script:

- Creating a new script called "Linemanager" in our Unity project.

- Attaching the Linemanager script to an empty GameObject in the scene.

- The Linemanager script will handle the measurement logic.

4. Implementing Measurement Logic:

- Inside the Linemanager script,the variables are defined to hold references to the Line Renderer component, toggle button, reset button, and undo button.

- Using the Line Renderer to draw lines between measurement points and calculating the distance between points and displaying it.

- Implementing the logic for continuous and discrete measurement modes and then Handling the button events for toggling modes, resetting measurements, and undoing the last measurement.

5. Creating Toggle Button:

- Adding a toggle button to the UI of our application.

- The toggle button allows the user to switch between continuous and discrete measurement modes.

- Implementing the functionality to toggle between the modes when the button is clicked.

6. Creating Reset and Undo Buttons:

- Adding a reset button and an undo button to the UI of our application.

- The reset button allows the user to clear all measurements and start fresh.

- The undo button allows the user to remove the last measurement point.

Now,users will be able to place measurement points, draw lines between them, toggle between continuous and discrete measurement modes, and perform actions such as resetting and undoing measurements.

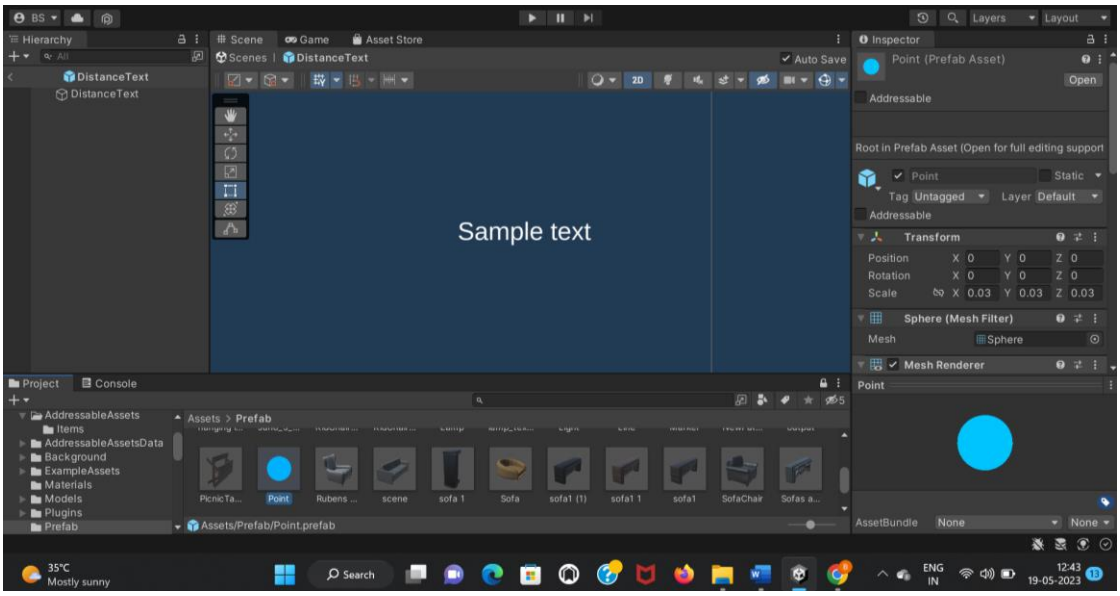

Fig 6.7 Creating w3D object sphere

CHAPTER 7
SYSTEM IMPLEMENTATION

The system implementation for the project involves the integration of various components and technologies to create a functional and user-friendly augmented reality (AR) application. The implementation process can be described in the following steps:

1. Requirement Analysis:

- The project requirements are thoroughly analyzed to understand the desired features and functionalities of the AR application.
- User interface (UI) requirements, AR functionality, furniture selection, and measurement features are identified and documented.

2. Technology Selection:

- The appropriate technologies for AR development are selected, including Unity3D, AR Foundation, and ARCore/ARKit for cross-platform compatibility.
- Additional tools such as Blender and Maya may be utilized for 3D object creation, and AWS cloud services for cloud connectivity.

3. UI Design:

- The UI design phase involves creating wireframes and mockups to define the layout and flow of the application.
- The main page is designed with buttons for AR furniture and AR measurement functionalities.
- The AR furniture page includes a scroll view for furniture selection, capture, reset, undo, and back buttons.
- The AR measurement page consists of toggle buttons for continuous and discrete measurements, as well as undo and reset buttons.

4. AR Furniture Functionality:

- The AR furniture functionality is implemented using Unity3D and AR Foundation.
- The camera is activated, allowing users to view their physical environment through the app.
- The scroll view displays furniture options that users can select based on their preferences.
- Upon selection, the chosen furniture is instantiated in the AR environment using the ARCore/ARKit tracking capabilities.
- Users can capture images of the AR scene, reset the page, or undo previous actions.

5. AR Measurement Functionality:

- The AR measurement functionality is also implemented using Unity3D and AR Foundation.
- Users can switch between continuous and discrete measurement modes using toggle buttons.
- In continuous mode, measurements are continuously updated based on the user's movement in the physical space.
- In discrete mode, measurements are taken at specific points defined by the user's input.
- Undo and reset buttons allow users to manipulate and clear the measurements.

6. Cloud Connectivity:

- AWS cloud services are integrated into the project to enable automatic updates.
- An S3 bucket is created in the AWS cloud and set to public access.
- The built project files are copied and uploaded to the S3 bucket.
- The path link to the executable file is obtained from the S3 bucket and pasted into the Unity application.
- This allows users to automatically receive updates when new items are added to the application.

7. Testing and Deployment:

- The implemented features and functionalities are thoroughly tested to ensure they meet the requirements.
- The application is tested on different devices and platforms to ensure compatibility and optimal performance.
- Once testing is complete, the application is deployed to the intended platforms, such as iOS and Android, for users to download and use.

In conclusion, the system implementation of the project involves the design and development of an AR application with furniture selection and measurement capabilities. The integration of various technologies, UI design, AR functionality, and cloud connectivity allows users to have an immersive and up-to-date experience in their virtual environment.

CHAPTER 8
RESULTS

8.1.1 AR FURNITURE

The app has been created with a main page consisting of two buttons: "AR Furniture" and "AR Measurement." Tapping the "AR Furniture" button opens the camera, revealing a UI design with a scroll view, capture button, and reset button. Once the AR view is opened, the application will detect the plane in the physical environment. Once the plane is detected, a crosshair will be displayed, enabling users to accurately place virtual objects in the correct position within the space. When the user clicks on the furniture item, they will be able to manually adjust its position and rotation within the AR environment. This allows for precise customization and placement of the furniture based on their preferences. Within the scroll view, users can browse different furniture models based on their preferences. The capture button saves an image to the user's mobile gallery, while the reset button restores the page to its original state.

Fig 8.1 Displaying Furniture

8.1.2 AR MEASUREMENT

The main page of the app displays two buttons. Selecting the "AR Measurement" button takes users to the AR measurement window. Within this window, users can utilize augmented reality technology to virtually measure real-world objects. The app offers various tools and features to ensure precise measurements of distances and dimensions within the user's physical environment. These capabilities enhance the user's ability to measure objects accurately within a virtual context.

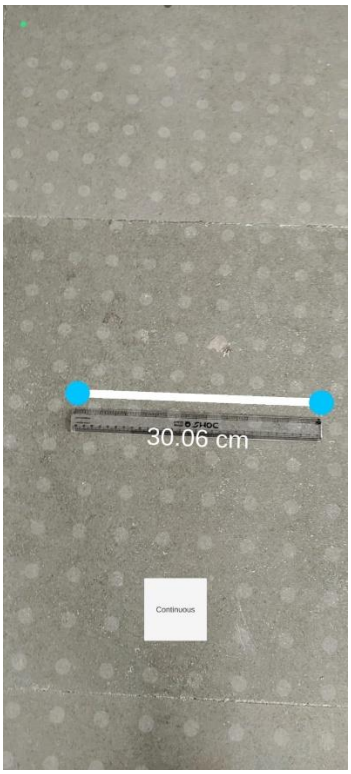

Fig 8.2 AR Measurement

CHAPTER 9
CONCLUSION AND FUTURE ENHANCEMENT

9.1 CONCLUSION

In conclusion, the project successfully implemented an augmented reality (AR) application that offers two main features: furniture placement and measurement. Users can easily select and place virtual furniture in their physical environment, allowing them to visualize and customize their living spaces. Additionally, the application includes a measurement feature that enables accurate distance measurements in the surroundings using AR technology. The integration of these functionalities, along with a user-friendly interface and cloud connectivity for automatic updates, results in an immersive and practical solution for enhancing interior design and measurement experiences. Overall, the project achieves its objectives by providing a comprehensive AR application that combines furniture placement and measurement capabilities, delivering a valuable tool for users in their design and spatial planning endeavors.

9.2 FUTURE ENHANCEMENT

In the future, incorporating buying options can enhance the functionality of the project. This could involve integrating e-commerce capabilities directly into the application, enabling users to purchase furniture they visualize in the virtual environment. By partnering with furniture retailers or establishing a marketplace, users would have access to a wide range of products, pricing information, and secure purchasing options within the app. Integration with payment gateways and order fulfillment systems would ensure a seamless buying experience. Additionally, personalized recommendations based on user preferences and the ability to save and track favorite items can enhance the shopping aspect of the application.

CHAPTER 10
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