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MARKER-LESS AUGMENTED REALITY SYSTEM FOR HOME INTERIOR AND DESIGNING

A Project Report of Capstone Project - 2

Submitted by

HIMANSHU SINGH

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Under the Supervision of

Dr. PRASHANT JOHRI

Professor,Ph.D

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SCHOOL OF COMPUTING AND SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that this project report **"MARKER-LESS AUGMENTED REALITY SYSTEM FOR HOME INTERIOR AND DESIGNING"** is the bonafide work of "**HIMANSHU SINGH**" who carried out the project work under my supervision.

SIGNATURE OF HEAD

Dr. MUNISH SHABARWAL, BB
PhD (Management), PhD (CS)
Professor & Dean,
School of Computing Science & Engineering

SIGNATURE OF SUPERVISOR

Dr. PRASHANT JOHRI
Ph.D.,
Professor
School of Computing Science & Engineering

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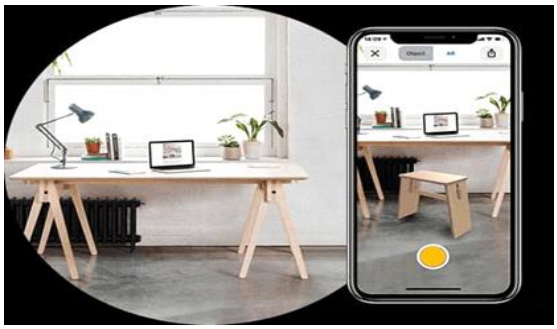
Abstract

This article analyzes the use of augmented reality technology and augmented reality 3D interior models for interior design. We are introducing augmented reality technology for interior design. And exterior design. Architectural projects also require virtual information. This document presents the use of augmented reality technology for interior and exterior design. Augmented reality provides many benefits for digital architecture design and construction. Finally, this study proposes a new way of applying AR technology in interior design work, where the user can view virtual design and create a three-dimensional virtual environment using data, with a dynamic and flexible user interface can interact easily. To help solve this problem, we have developed a system that automatically calculates the most appropriate point to improve understanding of the layout of the location and allow the user to easily navigate to this approach she gives. To improve and evaluate the design project, a complex decoration modelling structure is created to ensure that the user can coordinate every aspect of the design project to achieve a balance between structure and Function. A virtual model of real environment can be designed before its physical implementation, it will allow interior designers to implement their idea in the given workspace virtually and then view it in real environment, it will also allow architects to view their 3D visualizations on their 2D drawings.

This study proposes a new method for applying Augmented Reality [1] technology to furniture, where a user can view virtual furniture and communicate with 3D virtual furniture data using a dynamic and flexible user interface.

1.INTRODUCTION

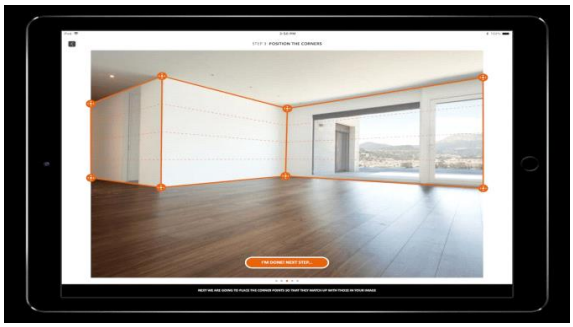
Augmented Reality (AR) furniture placement systems help users in laying virtual furniture in the real world. Such systems allow people to see what a new commodity room will look like without actually buying or moving an actual item. Such systems allow people to see what a room with new furniture will look like without actually buying or moving actual furniture. Until now, traditional AR systems have shown an extended view from only one point of view (for the camera only), which is not always ideal for understanding what this location will actually look like.



Thus, the user must physically walk into the room each time he or she wishes to inspect the room from a different angle. Several systems have been proposed to switch between AR and virtual reality (VR) modes and allow you to move around the approach in VR mode.

Augmented reality technology is divided into two types: AR based on marker and AR without marker. The project is based on marker-free AR. Project is a mobile application for Android, which will be compatible with all current and future versions of Android phones. The user has to install the application and run it on Android phone or tablet. Then place markers on the floor in the required locations. Launch an application that will launch the camera. Project the camera on the marker. The marker will be detected, the coordinates of the marker will be calculated, and three-dimensional objects will be dynamically generated above the marker. Envisioning how a specific object will look in a room before it is decorated is a difficult challenge for anyone. Augmented reality is a new technology that includes the placing of some of the virtual

objects on the real environment. As an outcome, the end-user can see the real environment augmented with physical object where you can interact with them. In General-context, this reality was also termed as mixed reality which discusses multiple fields that covers Virtual Reality (VR), Augmented Reality (AR), telepresence, and other related technology. This technology has been used in various fields like in repairing, medicine, telerobotic, manufacturing, robotics, maintenance, engineering design, education and military application. Augmented reality applications typically are either marker-based or marker-less. A marker is an image that the device camera can detect, and once detected, a virtual scene is shown on top of it. Marker-less applications, instead of detecting a pre-defined image, detects real-world objects, such as trees. We combine theory and business application by applying augmented reality methodology to interior or exterior design. The study, based on the virtual home augmented reality system of the Android operating system, consists of research and development of key algorithms for each module of the system



We combine theory and business application by applying augmented reality methodology to interior or exterior design. The study, based on the virtual home augmented reality system of the Android operating system, consists of research and development of key algorithms for each module of the system They typically require detection algorithms in order to be able to identify objects and show the virtual scene. A marker-less application has the advantage of being more universal and generic. The downside, however, is that, compared to a marker-based application, it is much more difficult to implement because the application does not know exactly what to expect when using the camera to

analyze the scene, and it requires more advanced algorithmic techniques and, potentially, increased processing power.

1.1 Problem Definition

Since the customer buys a wide variety of furniture on the Internet, but on the Internet he only shows pictures and cannot be determined by the size of the room. Despite the fact that there are some applications based on augmented reality, they are not suitable for real-time processing and require more time to process an area, and some are fixed on a specific image plane. Thus, to overcome this, he can use this application to check whether the furniture is adjustable, which can be placed in the customer's living area, such as home or office, of augmented reality images. By using Our application is a step in this direction, allowing users to view 3D-visualized models - a virtual analogy for physical furniture without any interruption of markers - that are realized using our augmented reality application Can be viewed and configured in time.

This study proposes a new method to apply augmented reality technology to furniture, where the user can view virtual furniture and exchange data with three-dimensional virtual furniture using a dynamic and flexible user interface.

1.2 Existing System

Traditional design methods include advising and assisting customers who relied on a combination of verbal explanations and 2D drawings via an online shopping app. However, this approach is clearly limited to the range of explanations provided to the customer for the specific location of the furniture, and makes it less effective and confusing when purchasing furniture.

The main disadvantages of current system carriers are:

• A static type design that cannot convey

• I cannot determine if the furniture will meet our needs.

• Must have height and width information.

1.3 Proposed System

With the augmented reality approach, this is easily achievable. Interior design is an area in which augmented reality cannot fully master. Today people are well aware of this technology and use Smartphone's with AR support. Thus, the concept of building an application based on a furniture layout brings the design step closer to technological excellence.

With the recent advent of more advanced cameras and more accurate sensors in future major devices. In our current implementation of the application, we use Google AR Core to correctly determine the real environment, such as the location of walls and intersection points, allowing users to place virtual objects in a real context gives. The proposed system uses augmented reality without markers, as a basis for improving user interaction and better perception of things. A marker without tracking is a position tracking method - determining the position and orientation of an object in its environment. This is a very important function in augmented reality (AR), allowing you to know the user's view and perspective - allowing the environment to react accordingly or to place augmented reality content according to the real world. Although marker-based motion tracking methods use special optical markers, positional tracking without markers is not required, making it a more flexible method. It also eliminates the need for a ready environment in which fiduciary markers are placed.

The mainstay of the proposed system is the imposition of digital 3D-models on top of real things using a camera.

• This application will use an AR-enabled mobile phone to scan the living area and display items of augmented furniture to see if it is adjustable or not, and it is the best selection of the right furniture for our needs. helps to.

• Augmented objects are virtual objects (3D models) that look like a furniture tool developed using Auto Desk Maya [8] and Substrate Painter.

• Autodesk Maya software that provides a complete set of creative features for 3D computer animation, modelling, simulation, rendering, and compositing.

• The next step involves adjusting the lighting, shadows and camera position of these models using various Unity 3D components.

• Then, the furniture model is selected, and the selected model is processed and loaded on a scanned surface using Google AR core.

• A 3D model is displayed on the Smartphone screen, which determines the size of the model, which is then displayed and displayed on the screen.

1.4 Requirements Specification

1.4.1 Software Requirement

Language : C#

Operating system : Android 8.0 or more

Tools

- Unity 3D
- Autodesk Maya
- Vuforia
- Substance Painter

1.4.2 Hardware Requirements

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

INTRODUCTION OF RELATED TECHNOLOGY

1. AR Technology: Augmented Reality (AR) adds digital elements to the Smartphone's camera, creating the illusion that holographic content is part of the physical world around you . Unlike virtual reality (VR), you are not immersed in the entire artificial environment. AR changes the atmosphere a bit by adding 3D objects, sounds, video, and graphics to it.

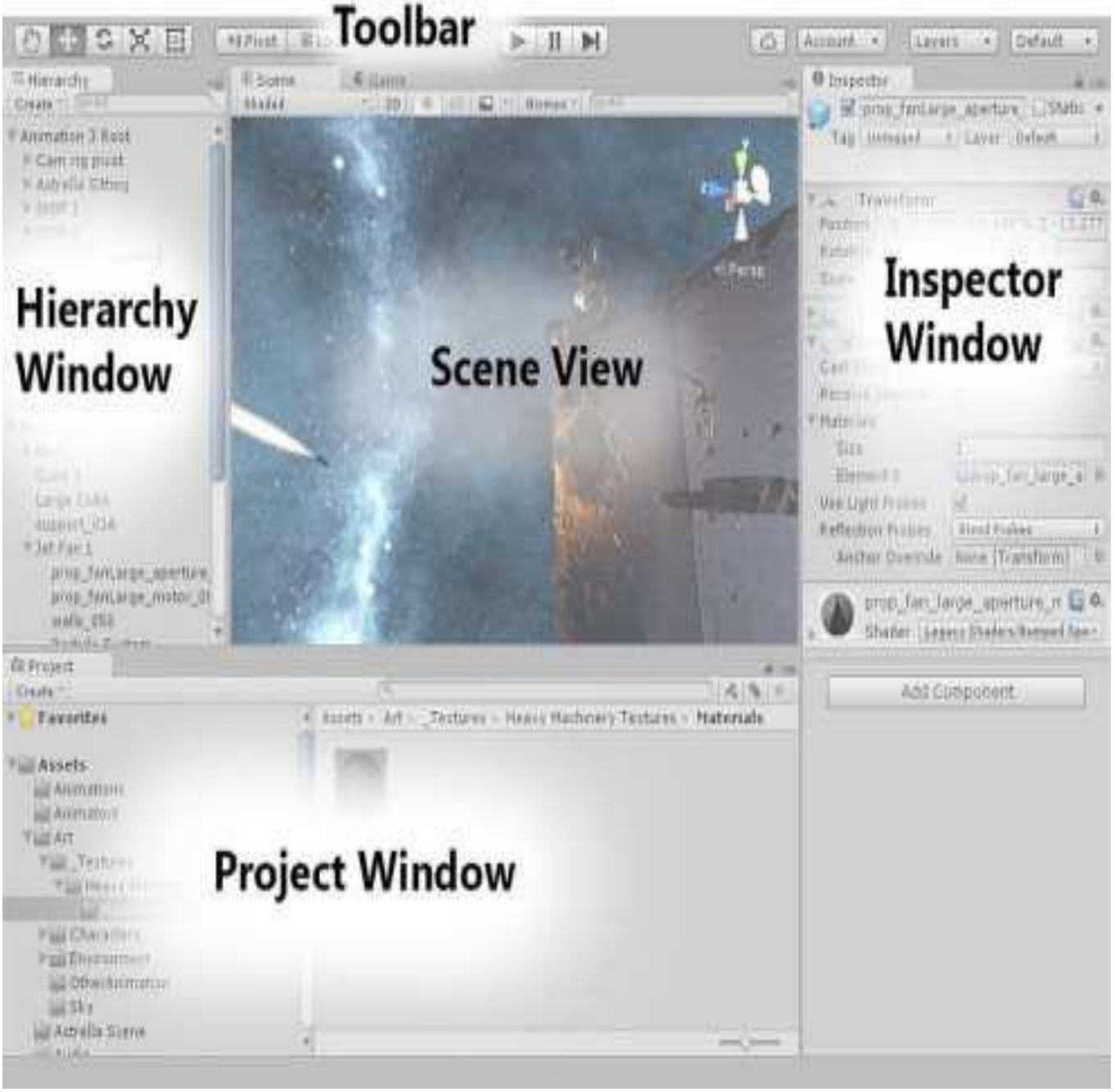
2. AR Toolkit: AR Toolkit is an open source computer library for creating augmented reality applications that overlay virtual images on the real world. The AR toolkit library is used to determine the relationship between the real and virtual worlds. The AR Toolkit uses a computer vision technique to define the position and orientation of the real camera viewpoint relative to a real world marker.

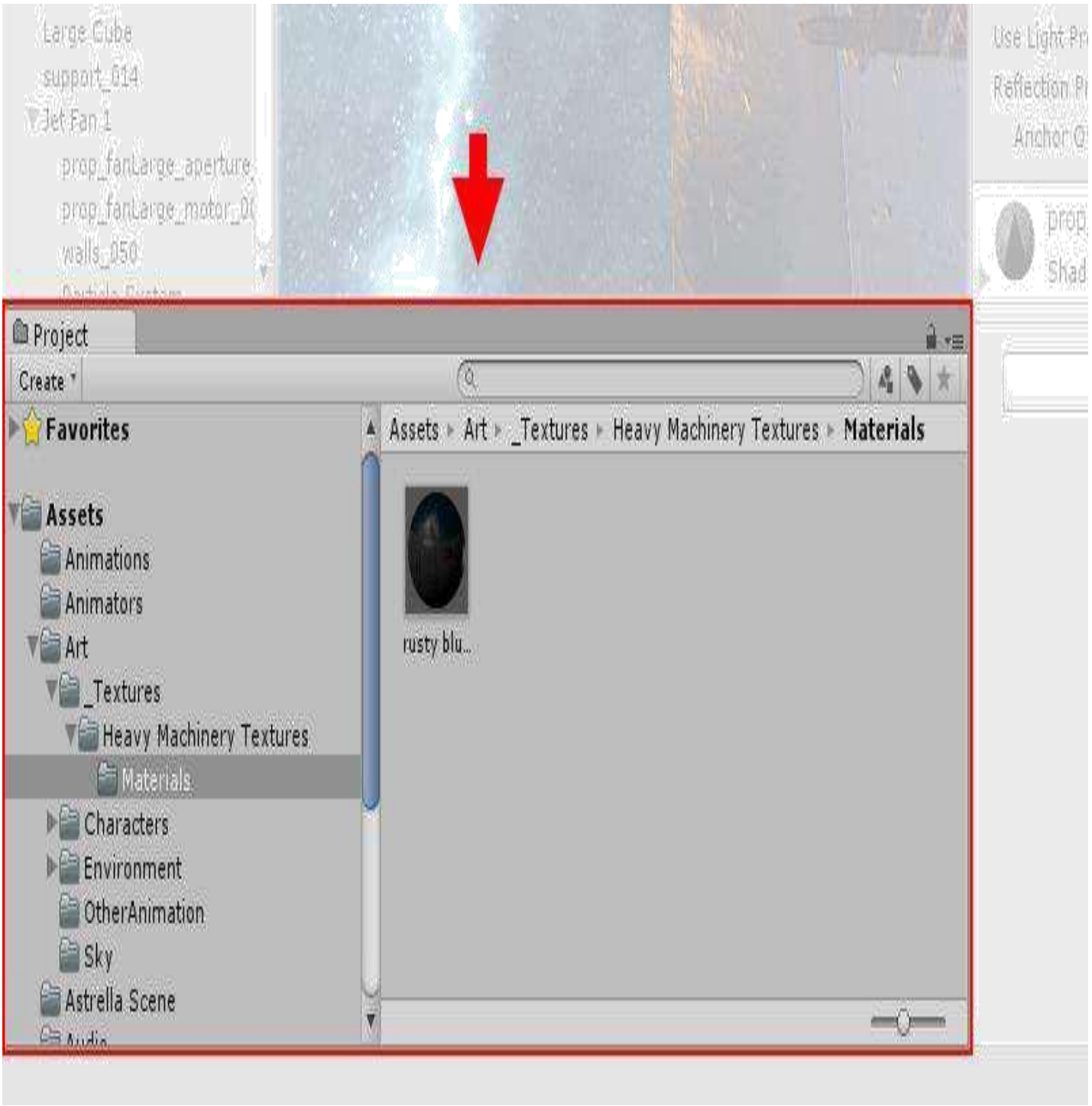
3. **Vuforia Augmented Reality SDK**: Vuforia is an augmented reality (AR) software development kit (SDK) for mobile devices that allows you to create augmented reality apps. It uses computer vision technology to identify and track flat images and simple three-dimensional objects .The Vuforia SDK supports a variety of 2D and 3D targets, including marker less image targets and 3D configurations with multiple targets.

Vuforia is a cross-platform augmented reality (AR) and mixed reality (MR) application development platform that incorporates mobile devices and mixed reality head-mounted displays (HMDs) such as Microsoft HoloLens with reliable tracking and variety of hardware. It uses Computer Vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time. This ability to register images allows developers to position and orient virtual objects, such as 3D models, relative to real-world images when they are viewed using a mobile device's camera. The virtual object then monitors the position and orientation of the image in real time so that the viewer's view of the object matches their view of the "image" object, so that the virtual object appears to be part of

the real world view.

4. **UNITY:** Unity 3D is a powerful cross-platform 3D engine and a convenient development environment. Simple enough for beginners and powerful enough for experts. Unity uses its own C # compiler to compile your script. It automatically creates and maintains a Visual Studio file. Whenever someone adds / moves / transfers / deletes a file from Unity. You can also add your files from Visual Studio to your solution. He then imports these new files, and the next time Unity creates the project files again, he will create them with this new file including image tracking**.**





5. Image Tracking: In visual tracking, the system determines the position based on the camera On the comments of what he sees. In an unknown environment, it Facing up;[25] It takes some time to collect enough data to be able Get a currency, and then the calculated currency estimate flows easily After some time. Since the environment is unknown to the system randomly selects the orientation of the coordinate axis, which can to be inconvenient for the user. Also impossible to cut the correct scale is based entirely on visual annotations.

2. LITERATURE SURVEY

The study of augmented reality technologies has led to the development of various applications in the field of computer science. This literature review shows how reality is applied in various fields using 3D Unity.

Santosh Sharma, Yash Kayakini, Part Walking In, Sonali Vaidya proposed a technique called "marker-free internal design system with augmented reality" without markers as the basis for improving user experience and better perception of things. Uses augmented reality. The advantage is that surface markers are not needed, and the disadvantage is that the object is aligned with the camera, so it moves when the camera moves.

Snehal Mangale, Nabil Fansopkar, Safwan Mujawar, Neeraj Singh proposed a technique called "virtual furniture using augmented reality", [2], which is a web application where the user should place a marker in the room where he Wants to try out furniture items. , The user's webcam will be turned on, and through the webcam they will record the live broadcast of the room. The application captures the image and goes through a predefined marker detection algorithm. The algorithm is based on image processing methods that use color and other properties as input to detect markers. The user initially selects furniture for placement from this database. The application places the furniture on the original image with the center coincident with the center of the markers in both directions. Furniture items are superimposed on a two-dimensional image obtained from a webcam. It will feel as if it is actually in the real world. And finally, the user can see what the area looks like with the furniture present.

Khushal Khairnar, Kamleshwar Khairnar, Sanket Kumar Mane, Rahul Chaudhary proposed "an application to identify furniture based on the identification of markers and use augmented reality" to develop an application in which the user is in that room. Put a marker where he wants to try the furniture item. The user's webcam will be turned on, and through the webcam, he will record a live broadcast from the room. The application then searches for the marker using the Fiduciary Marker Detection algorithm. To determine the

position of the marker, a straightforward linear transformation algorithm is used. The user will select this object from the database of any furniture they want to test. The application will then overlay the 3D object. Three dimensional objects are superimposed on a two dimensional image of a frame from a webcam

It will feel as if it is in the real world. And finally, the user can see the room and object from different angles.

Table 2.1: Literature survey for the application

S.No	Year	Author	Title	Techniques	Advantages	Disadvantages
1.	2018	Santosh Sharma, Yash Kaikini, Parth Bhodia, Sonali Vaidya	Marker less Augmented Reality based Interior Designing System	It uses Marker-less Augmented Reality as a basis for enhancing user experience and for a better perception of things	No need of markers in the surface area.	Object is aligned with camera so that it moves as we move a camera.
2.	2016	Snehal Magale, Nabil Phansopkar, Safwaan Mujawar, Neeraj Singh	Virtual Furniture Using Augmented Reality	A web-based application where user have to place the marker in a room where they want to try out furniture items.	It is faster in image capturing and provide high resolution for furniture 3D model	It is based on personal computer webcam and every time the captured image is to be loaded into web application for processing
3.	2016	Mami Mori, Jason Orlosky, Kiyoshi Kiyokawa, Haruo Takemura	A Transitional AR Furniture Arrangement System with Automatic View Recommend ation	Subjects were first asked to memorize a furniture layout presented on a desktop monitor. They were allowed to examine and manipulate the 3D model using a mouse for as long as they wished.	a transitional AR furniture arrangement system that recommends a secondary view that can improve a user's understanding of a room	It is desktop-based application ands needs stereo camera and should be placed at minimal and marker based.

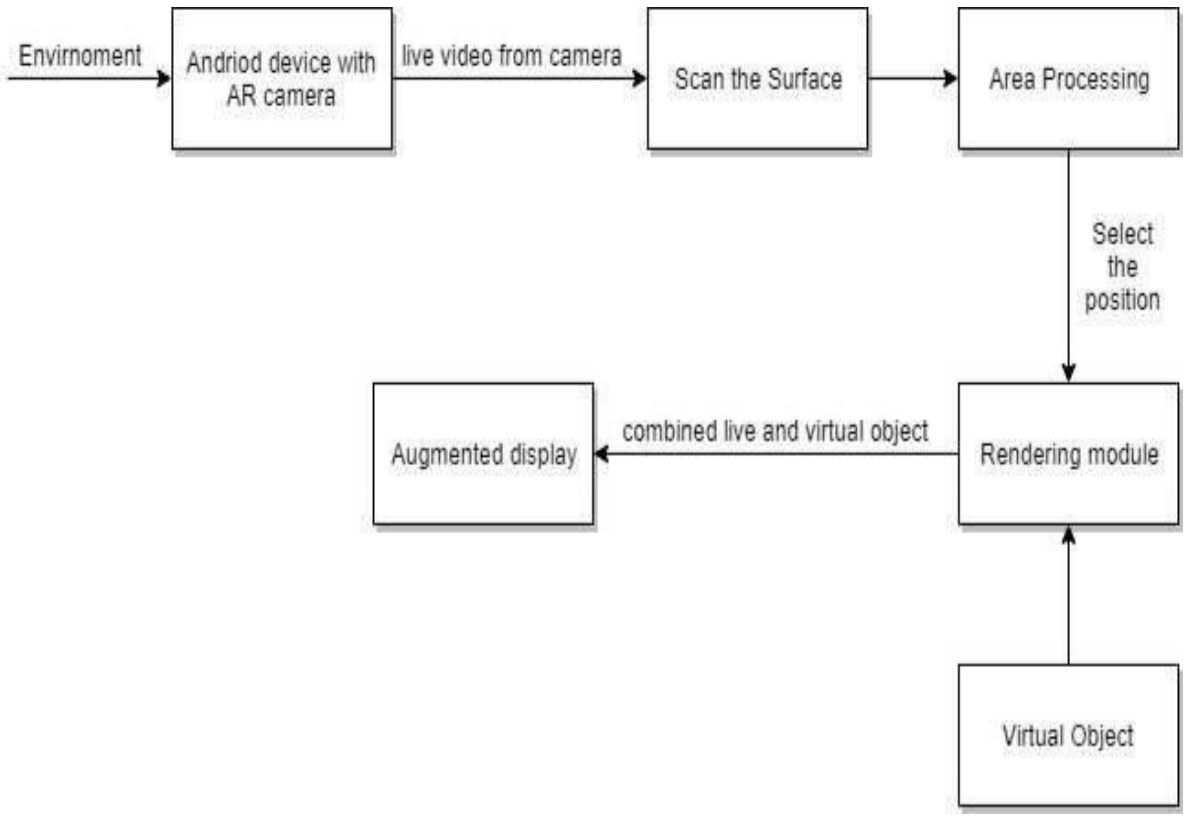
				Once satisfied, they wore the	layout and	
				video see-through headset and used a game pad to place the furniture objects based on their memory of the scene	contains two scenes high occlusion and low occlusion.	
4.	2015	Jiang Hui	Approach to The Interior Design using Augmented Reality Technology	to design the structure and function of the space, and to decorate the interior space based on the customers	interior design can reduce the cost and provide the multimedia augmentation of high vivid simulations for user in real time	Requires huge amount of information and quality of object is low.
5.	2015	Elizabeth Carvalho, Gustaava Macaes, Isabel Varajao, Nuno Sousa, Paulo Brito	Use of Augmented Reality in furniture industry	Template matching technique to reference image to rigid object	Use Simultaneous Localization and Mapping (SLAM) that helps in fixing to rigid body	Marker based and can be placed only on the predefined images.

3. METHODOLOGY IN AUGMENTED REALITY FOR FURNITURE INDUSTRY

3.1 Architecture

The system primarily uses a mobile phone's built-in camera, which supports augmented reality, to collect images as a real image of the scene seen by the human eye, and three-dimensional models of furniture on the display screen It puts First, we need to configure views in Unity 3D [6] for the selection of the user interface of the application, such as buttons, text fields, background image, and virtual objects. We later create 3D models from Autodesk Maya and import them into Unity 3D. By identifying and tracking surface area, the camera retrieves pointers using the Google AR core and sets the projection model, eventually putting the imported three-dimensional virtual model into a real-world view. Since Android smart phones have a touch screen interface function, we can place the furniture on the sliding screen.

Figure 3.1: System Architecture of Application



AR tracking can be divided into 4 types:

1. Token-Based Fiduciary Tracking: A Solution Overcomes difficulties to preset easily detectable Enter the environment and use computer vision methods Find it A marker is a sign or image such as a computer.[25] The system can detect videos using image processing, Methods of pattern recognition and computer vision. The typical Markers used in AR are black and white squares. Geometric shapes [4]. Use of black and white gives high May be contrasted against background quickly found out. An obvious flaw in the investigation. The technique of markers is that they need to be seen and cannot be hidden by another object while zooming.

2. Hybrid Tracking: This type of tracking combines two or more data sources like GPS, compass, accelerometer. Calculate the actual position and orientation. Information can be used to calculate what needs to be supplemented in field of view without actual processing of real image but the actual image is used to hold the layer developed.

3. Simulated Tracking: Model Approach Uses Initial knowledge of three-dimensional objects in the environment along with them, Attendance. Using geometric representations of three-dimensional objects according to them can manipulate their position and orientation. For his colleagues in sight. Model approach works using edge detection to create 3D models, in some cases, the model is designed to track similarities relevant to your topic in an environment like tracking traffic on the road, although this approach requires more processing power.

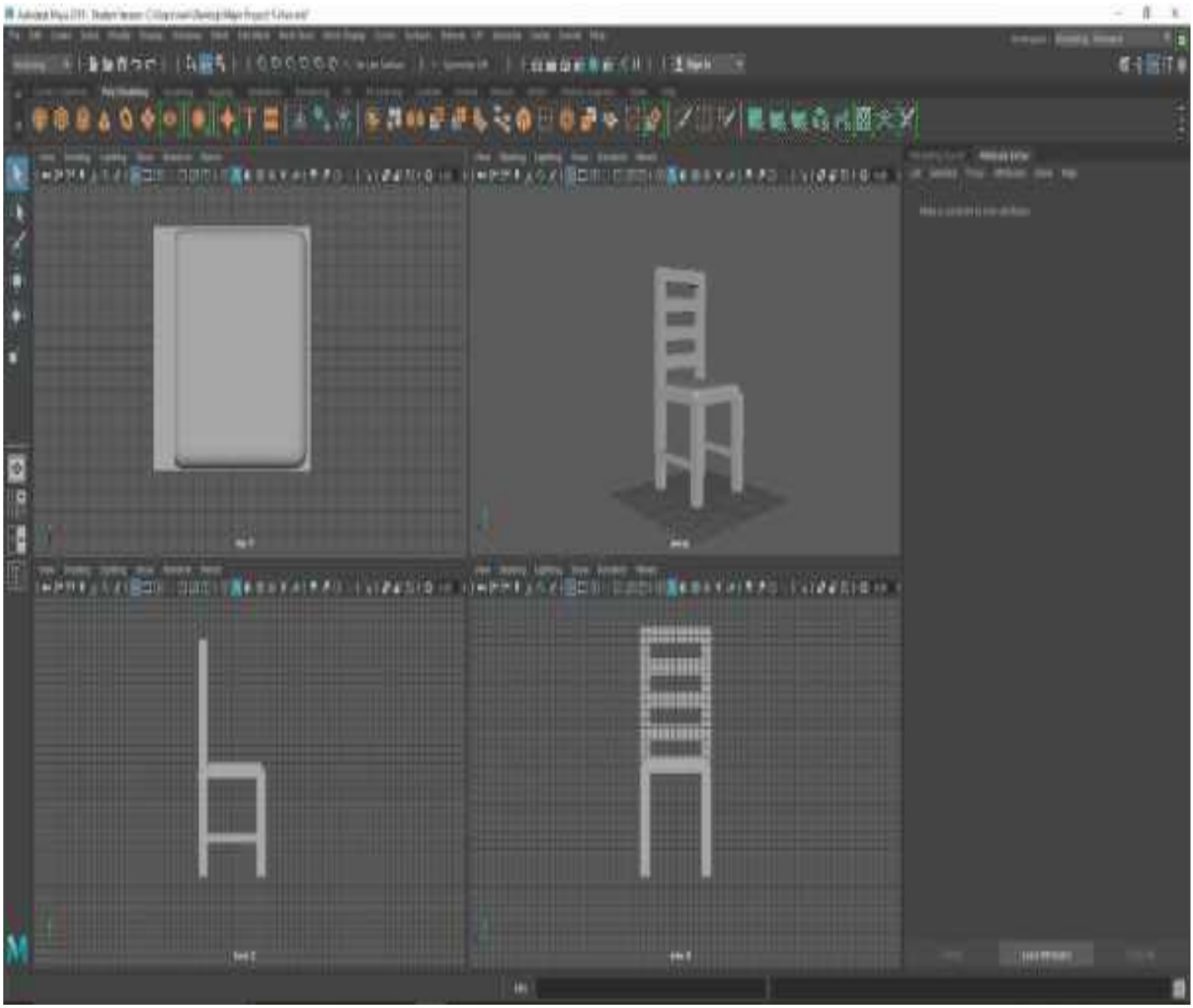
4. Natural Tracking: This technique has used objects in real the world as markers, recognizing their characteristics. this is the approach can be called tracking based on attributes or without markers. Which uses the features already

available in the scene? View marker-free currency trackers rely heavily on natural feature points (Often referred to as point of interest or major point) user environment

Modules

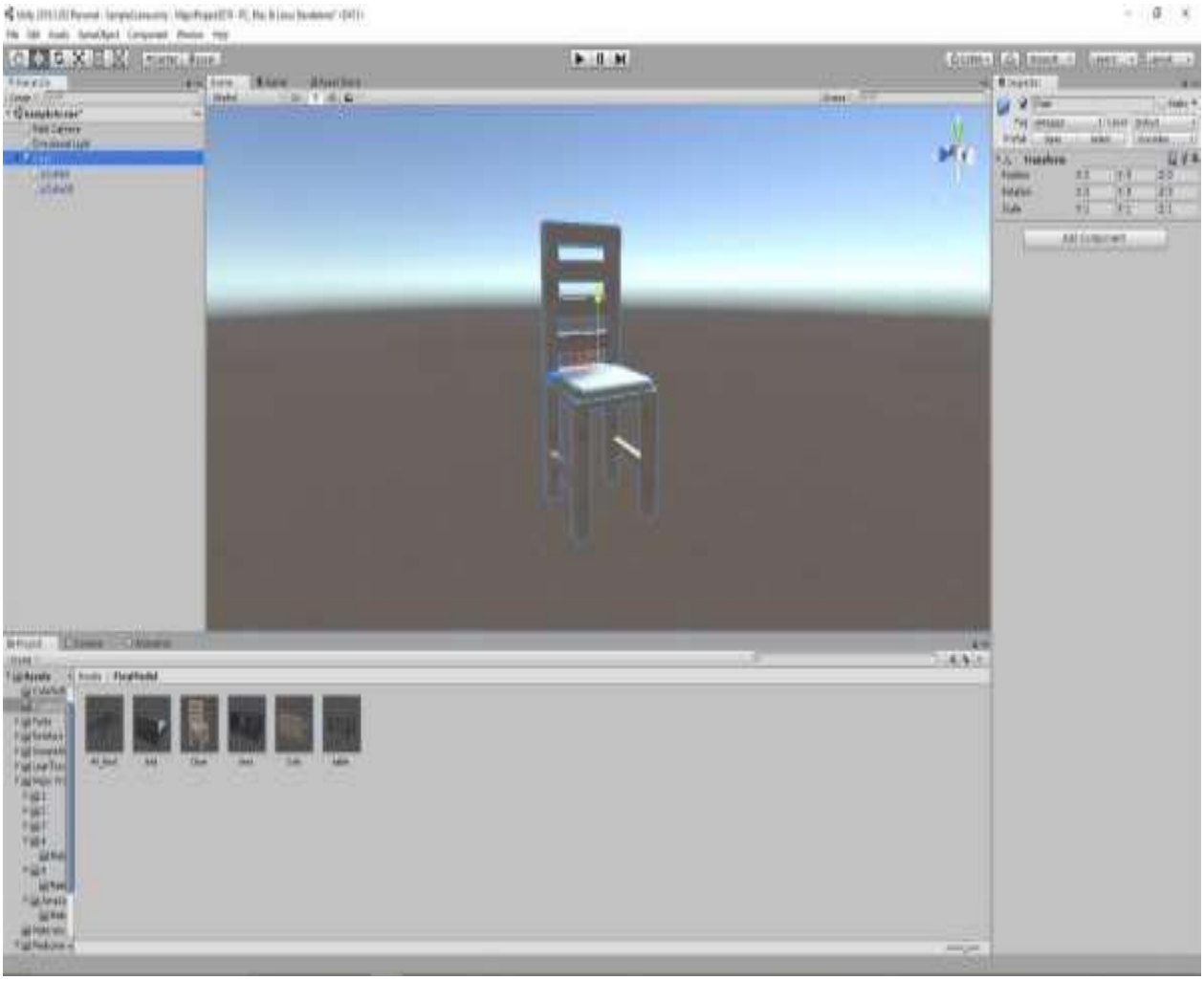
The application implementation consists of four modules.

- Creating Augmented Reality Objects.
- Designing Views for the User Interface.
- Place the Object on the Surface Area.
- Verification of placed objects.
- **Creating Augmented Reality Object:** First of all, we need to create virtual models using Autodesk Maya software [8] to create three-dimensional furniture models, models mainly use polygons and NURBS modelling methods, animation mainly. Uses key frame and expression animation techniques from. After the model is implemented in Autodesk Maya, four important information about the model will be stored in each model's file: coordinate top of the model, coordinate texture, normal coordinate, and the total number of polygons.[25] These data are the main ones when rendering. Model. The application will store them in memory and read them to render the model when the render function is called. The data volume of the model is very large, so we need the loading module of the model so that it is convenient to load it into the program. Later we export the model data, the file exported by Autodesk Maya is an .obj file that stores the above information, then we convert the information into a file that is available in the program by the model loader, and we The models obtain the data by calling the header file. After loading the model data, we can present and display them on the scene via Unity 3D [6].



As shown from the above figure it shows how the 3D objects are developed for this application using the Autodesk Maya. In the figure it shows the front view, side view, top view, 3D view of the object that is been created.

- **Designing Views for the User Interface**: In this module, we create views for each slide of the application using Unity 3D. The main interface interacts by rolling and viewing the key. The main interface consists of a furniture model, buttons that help you move to the next model, living room surface area, model details, for example, scanning length, width, height, and the possibility of buying a model in an online store Huh. A furniture column stores the keys of all furniture, displays one furniture at a time, and also supports sliding viewing. To implement these functions, we display the view in relation to the Android display and add buttons to the view that help us move to the next view. Later, we import a 3D model developed using Autodesk Maya [8] and perform the task of moving a chair while using C # code for this object, and the function to move to the next view.

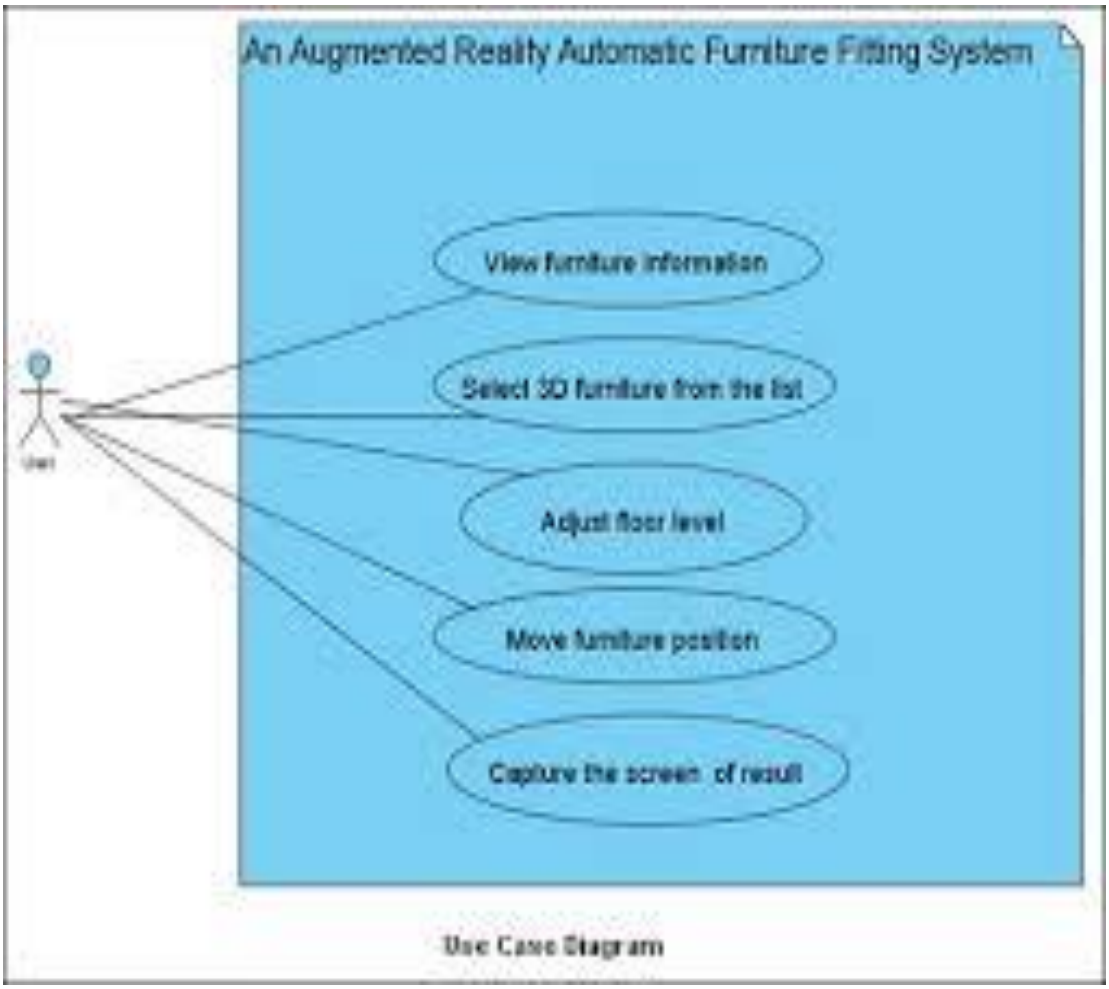


- **Place the Object on the Surface Area**: In this scenario, we use the Google AR kernel package [7], which will be imported into Unity 3D, and by modifying the package to help us scan the surface of the living area where we need to in the real world Need to have a virtual object. After making changes to the core of Google AR, we will create a view in such a way that after scanning the surface and pressing the touch screen, the virtual 3D model is displayed or integrated with the living area, so that the user can meet our needs Check the model of matching furniture. The user can drag the virtual furniture model as he wants in the actual view through the user interface provided at this stage.

- **Verification of placed object:** When the user believes that the object suits his needs, he can examine the description by selecting an information button that helps to describe the width, height, and length of the object. To view this description, we create another view that helps display all the necessary information. Add another button that helps to redirect to the online store where furniture can be purchased. Add another button that helps rotate the object at an angle of 30 °. For this rotation and redirection of links, we use two classes that are programmed in C #.

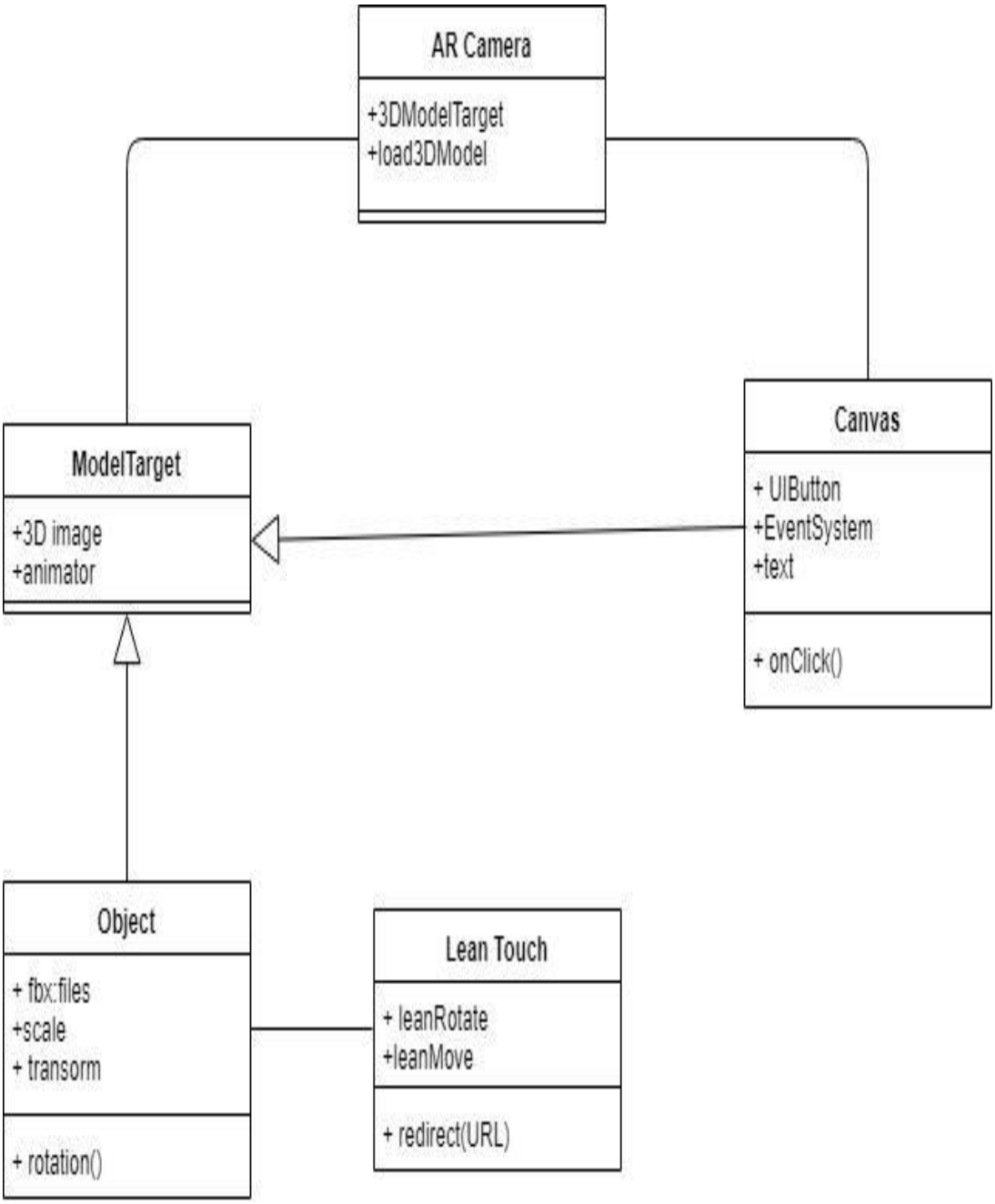
3.3 UML Diagrams

3.3.1 Use case Diagram

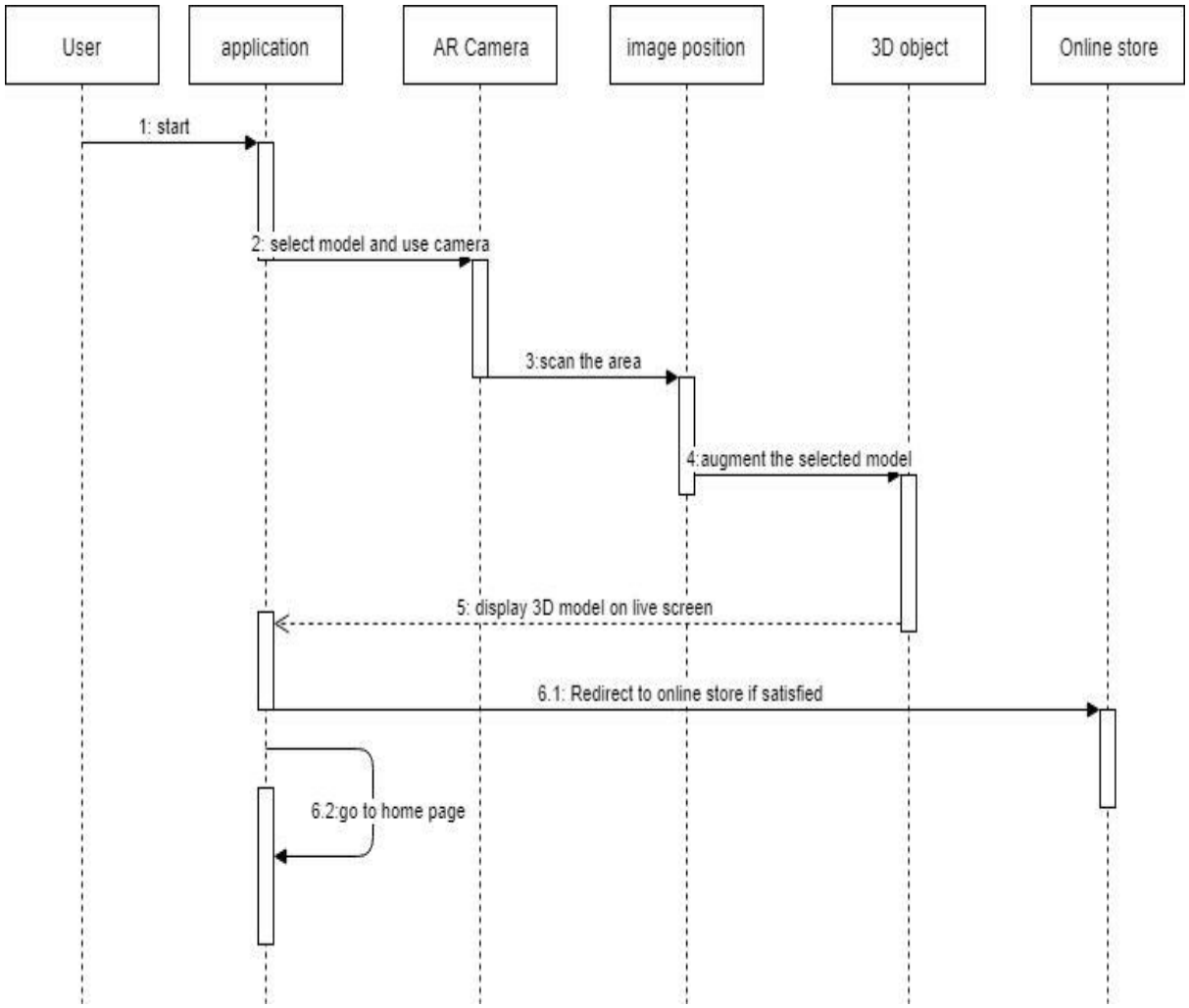


As shown in Figure 3.4 above, this application describes a diagram of use cases in which a user interacts with an application using an Android device that supports an AR camera. First, we select the model of interest to us, then scan the neighbourhood using the camera of the device and keep the model to check if it satisfies our needs, if it is satisfied, We can go to the online store. The actor is a user here and uses cases, selects 3D furniture, scans the surface, holds 3D furniture, if all is done, redirects to information and online stores

3.3.2 Class Diagram

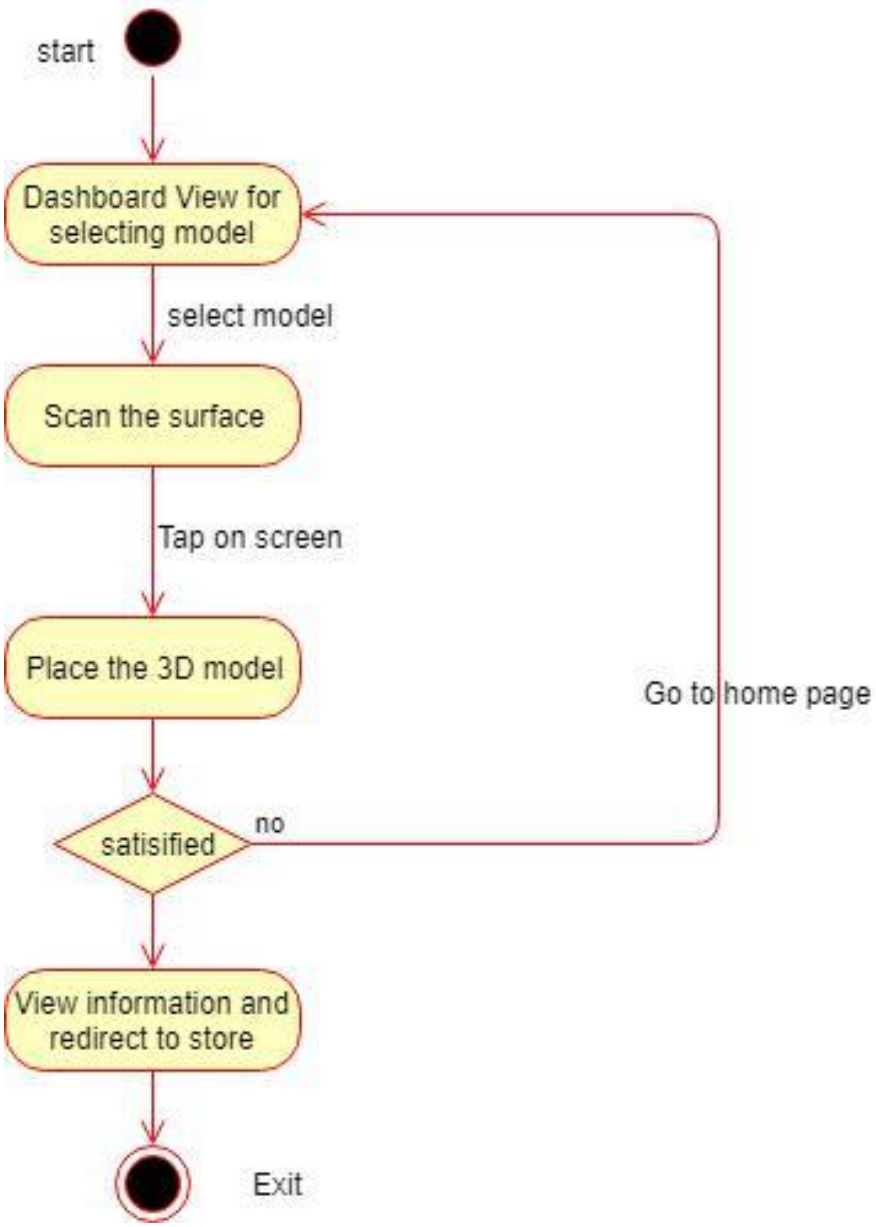


3.3.3 Sequence Diagram



As shown in Figure above, it describes an application sequence diagram, ie. An extended demonstration is found in the order of how the application is started and finally negotiated. Users, applications, AR cameras, image positions, 3D objects, online stores are the main objects of this diagram. First, the user launches the application and scans the surface and holds the living area. As soon as the area is scanned, the selected 3D model is placed above the field. After that, if the user is satisfied, he can visit the online store or return to the home page of this application.

3.3.4 Activity Diagram



As shown in Figure above, it describes an application activity diagram, which consists of an application flow that contains a dashboard view of tasks to select a model, ie. The homepage then scans the surface, holds the 3D model, and finally, if it suits you, go to the online store.

4. TESTING AND RESULTS

4.1 Test Cases

Testing is debugging program which is one of the critical aspects of the computer programming triggers. It is process of evaluating a system or its component(s) with the intent to find that whether it satisfies the specified requirements or not. It is executing a system in order to identify any gaps, errors or missing requirements in country to the actual desire or requirements.

Table 4.1: Unit Testing

ACTION	RESULT	REMARKS
Add image target in the Hierarchy	Camera not set to AR camera	Added AR camera in the hierarchy window
Press play button to see the animation	Animation cannot be added to the game object as the animator is not set to the inspector window	Added animator scene in the inspector window

Table 4.2: Specification Testing

ACTION	RESULT	REMARKS
Opening software to make a new AR scene	Launch error	Download patch file from online and executed to launch software and clear previous error
Changing scene from one level to another level	Missing Scene Manager Package	Added Scene Manager package in the scene changing script

Press the button to play the object	AR object is missing in play scene mode	Import the 3D model from Auto desk Maya

Table 4.3: Code Testing

ACTION	RESULT	REMARKS
Tap to place the 3D object	3D object is not placed	Add Google AR package to 3D model and modify package.
Rotating the 3D object in clock wise direction	3D object doesn't rotate	Added transformation. position class in the script
Touch the screen to adjust the 3D object	Touch doesn't work when focused on the image target	Added Lean touch script to the 3D object
Changing the scene from one mode to another mode	UI button doesn't work as the function to go forward to another mode	Added function to UI button

Table 4.4: Integration Testing

ACTION	RESULT	REMARKS
Building app	Failed to build	Add Android SDK in the builds

Application failed to open	Google AR core is missing	Download Google AR core from play store

Table 4.5: Validation Testing

ACTION	RESULT	REMARKS
Open the application and target the 3D model	3D object is projected in real world environment using the image target	Application runs successfully

4.2 Output Screens

4.2.1 Home page

When the application is launched the home page appears where we can able to select the furniture model that is needed to buy and verify whether it suits our living area.

As shown in the above figure 4.1 it shows the home page that displays the chair object, if we need to choose another object we can move to other object by pressing arrow buttons

4.2.2 Scanning page

After the furniture objected is selected by tapping on the object that we choose. Next we move to the scanning scene where we need to scan the plane where the furniture object is to be placed. Scanning the surface will create the points on the floor using Google AR core.

As shown in the above figure , it shows how the living area is scanned to find the plane in order to place the selected object.

4.2.3 Placing the object scene

Once the surface plan is scanned and obtained the points of the place we can tap on the screen to place the furniture object where ever we need over the plane. Along with the object placed, we get UI buttons that helps in moving to Home page, Information page, Online store, rotating the object.

As shown in the above figure, it shows the furniture virtual 3D object that has been placed in the real world i.e., augmented display.

OBJECTIVES

Augmented reality is a new technology that includes the placing of some of the virtual objects on the real environment. This proposed research most likely acts as an effective tool which can decrease the gap between industrial company and customer in addition to other applicable business communities. It will help in visualizing architect plans and interior designs. A virtual model of real environment can be designed before its physical implementation, it will allow interior designers to implement their idea in the given workspace virtually and then view it in real environment. In General-context, this reality was also termed as mixed reality which discusses multiple fields that covers Virtual Reality (VR), Augmented Reality (AR), telepresence, and other related technology. This technology has been used in various fields like in repairing, medicine, tele robotic, manufacturing, robotics, maintenance, engineering design, education and military application.

Implementation or architecture diagrams

Methodology

Augmented Reality uses computer graphics technology and visualization technology to generate the virtual objects which don't exist in real environment and accurately "place" the virtual objects in the real environment through sensing technology. It has virtual objects integrated with the real environment

through the display device and presents to the user a new environment with true sensory effects. Therefore, the Augmented Reality system has new features of combination of virtual and reality, real-time interactive and three-dimensional registration.. The application should convert 2D maps into 3D by scanning (specifically for architects) and end users can maintain their schedules and set the reminder, share their work among the community (blog) and will also have accessibility of understanding other designers work which will provide them with new motivation. The user can interact with virtual 3D models of the furniture using an Augmented Reality in real time, and altering the colour of walls and furniture, style, or covering of furniture in a real environment. Therefore, this permits complex and innovative designs to be explored and envisioned, making AR technology for interior designer and Architects accessible to both pros and amateurs.

Keywords—3D visualizer, workspace, interior designers, architects, augmented reality, Marker based AR, Marker less AR

Application works as follows:

1. The camera captures video of the real world and sends it to the application.

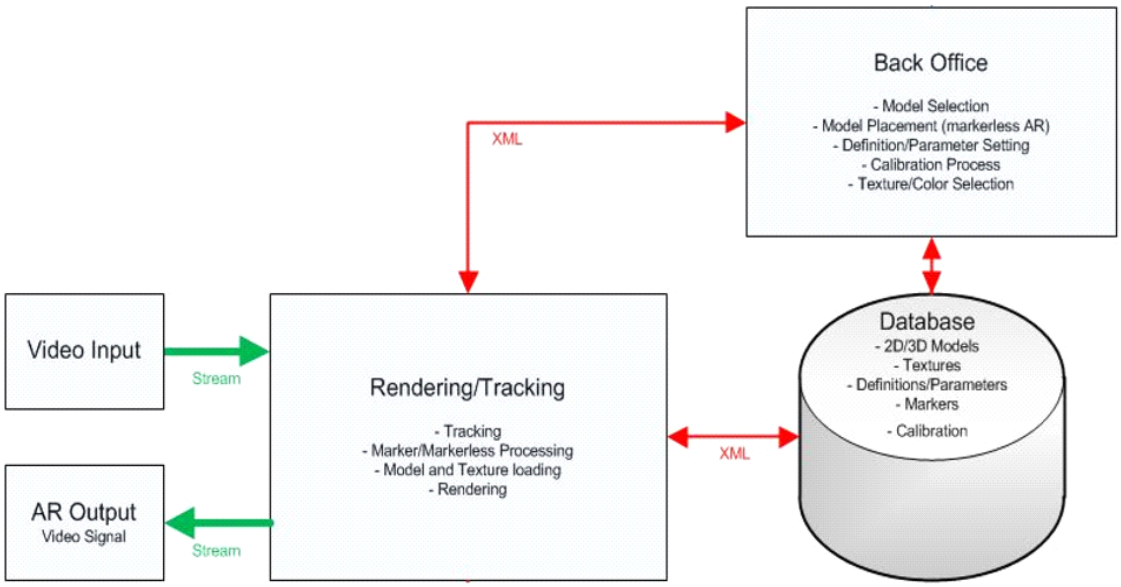
2. Application searches through each video frame for any square shapes.

3. If a square is found, the application calculates the position of the camera relative to the black square.

4. Once the position of the camera is known a computer graphics model is drawn from that same position.

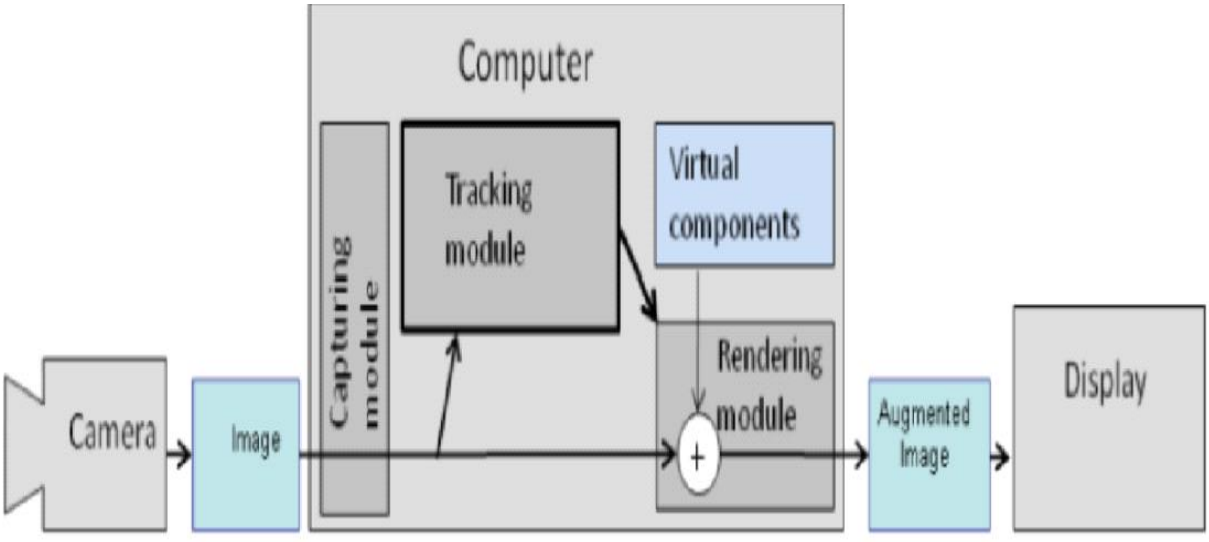
5. This model is drawn on top of the video of the real world and so appears stuck on the square marker.

6. The final output is shown back in the handheld display, so when the user looks through the display they see graphics overlaid on the real world.



Functional and non-functional requirement

- Module for Architecture
- Module for Interior Designing
- **Camera Tracking Module**
- Algorithm Image Tracking:
- Create class (Image Tracking) Create variables (Set the below variables = 0)
- Camera Position
- Camera Angle



Process Description including DF++

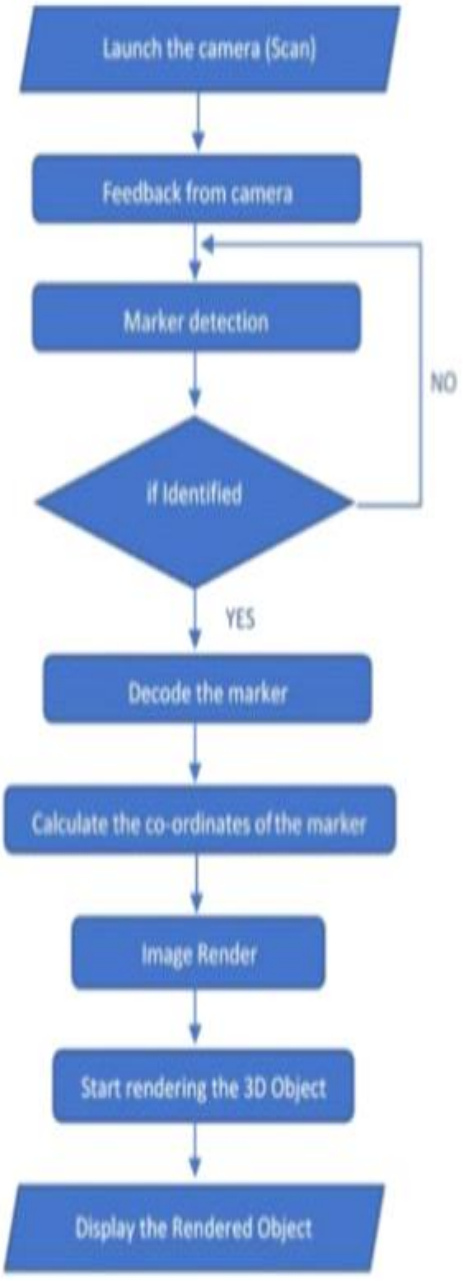
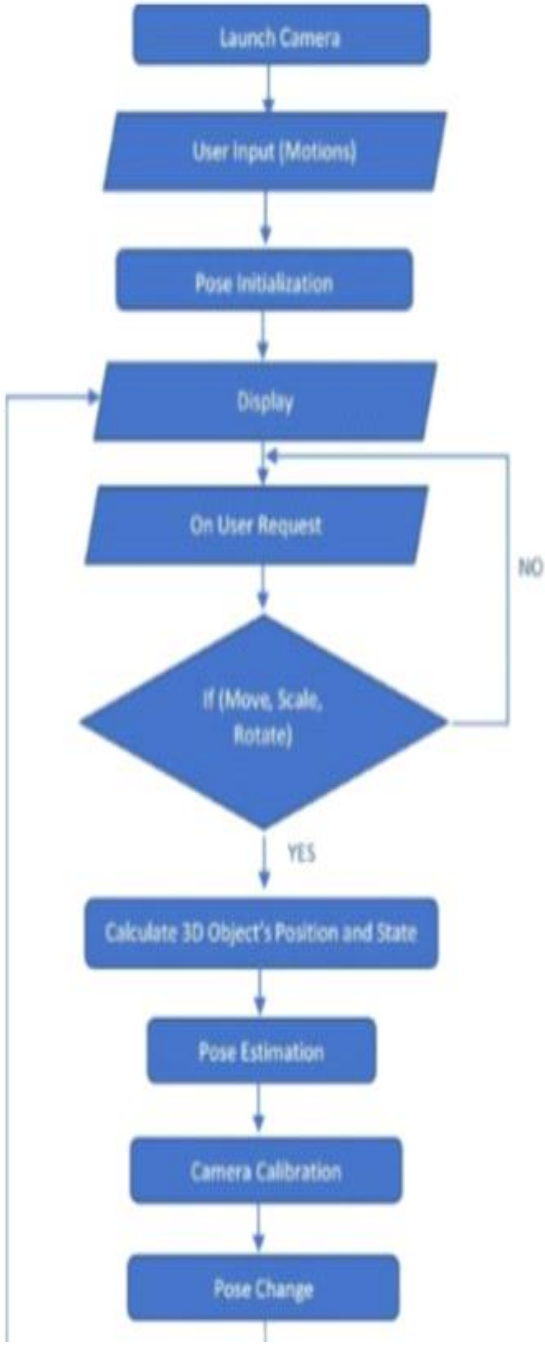


Fig. 2. Image Tracking/Rendering Module

Else make no Change



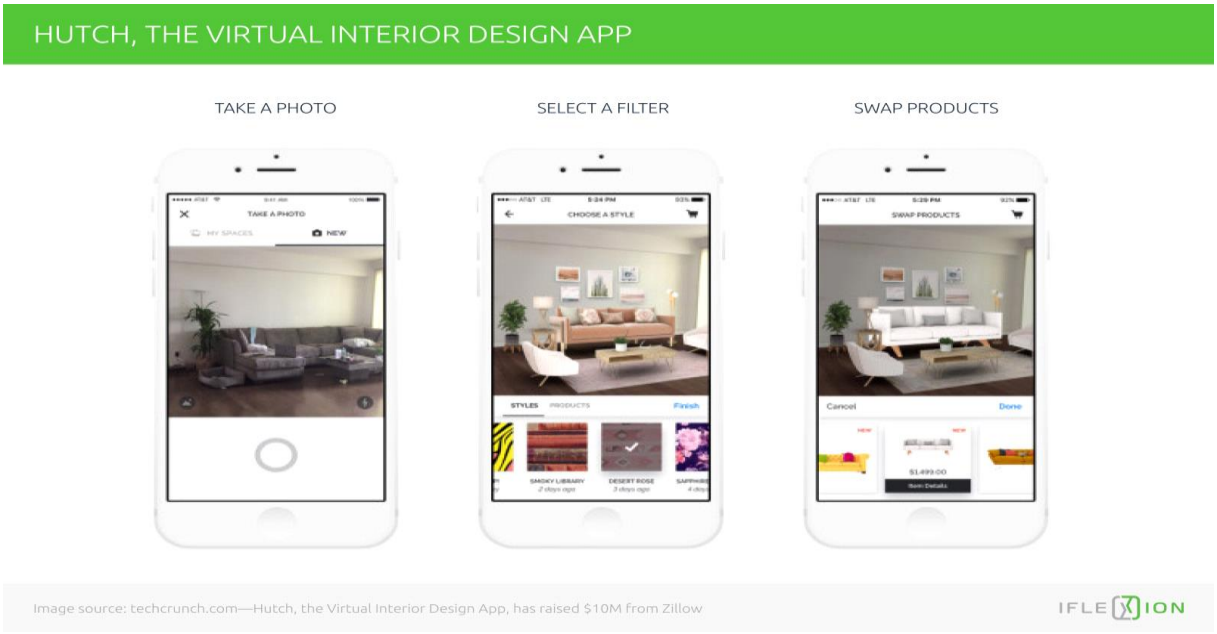
Pose and Proximity Detection:

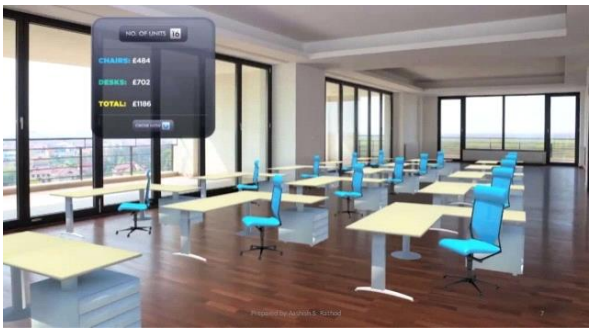
Figure shows a flowchart for a simple augmented reality system. The capturing module captures the image from the camera. The tracking module calculates the correct location and orientation for virtual overlay. The rendering module combines the original image and the virtual components using the calculated pose and then renders the augmented image on the display.

Output / Result / Screenshot

How it works?

- Initialize the video capture and camera parameters and acquire device position information from the magnetic compass and accelerometer.
- Main Loop: Freeze video input frame.
- Get device position and orientation from the magnetic compass.
- Calculate the camera transformation relative to the device position.
- Draw the virtual objects in the center of the screen. Shutdown and Close the video capture.

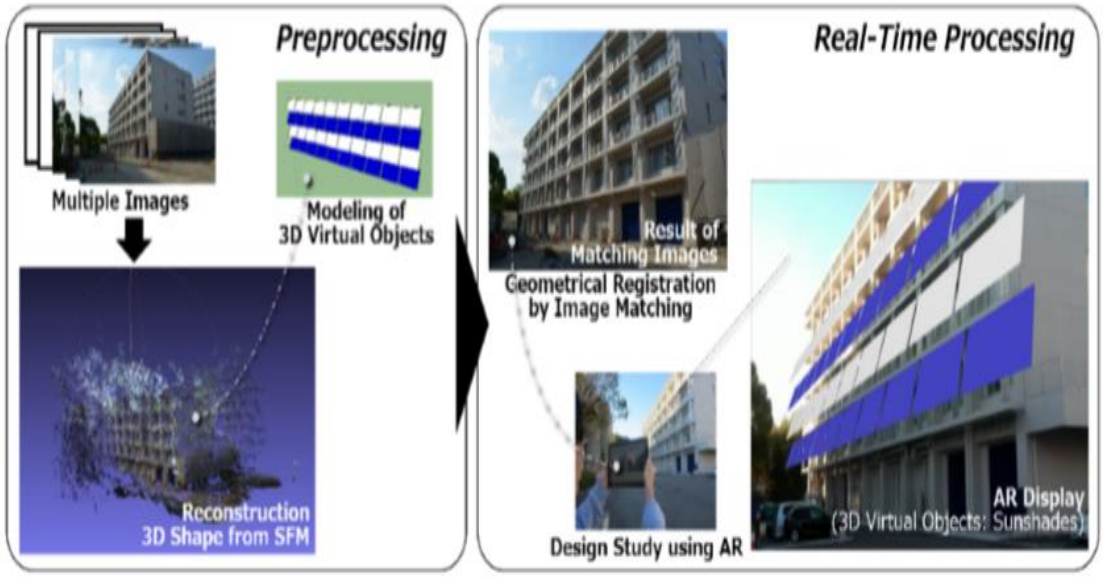




3. SYSTEM ARCHITECTURE

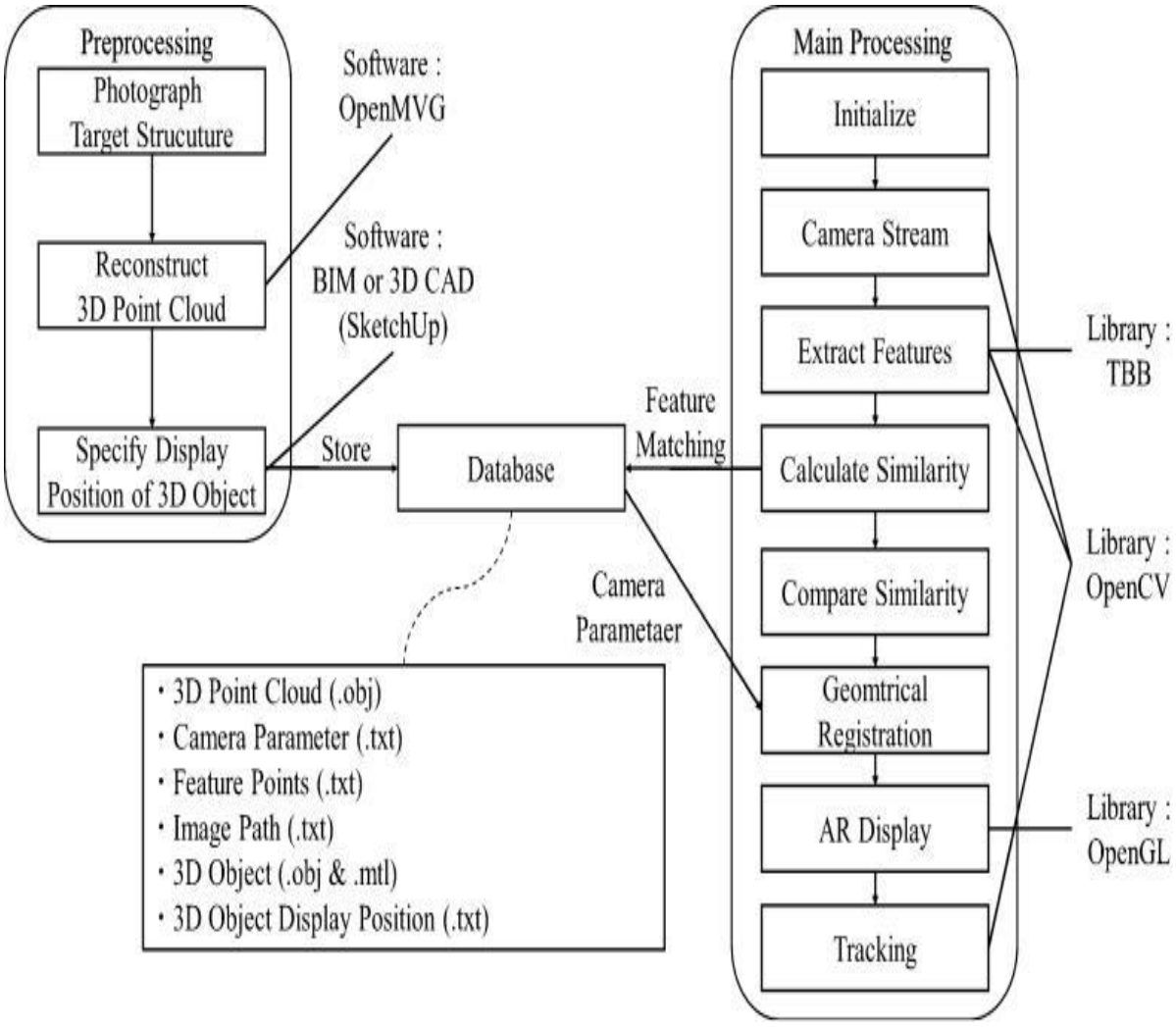
The proposed method has two main steps; Pre-processing and real-time processing. During pre-processing, the 3D model of the medium has previously been re-created using the SfM method using photographs taken from several perspectives. Data on the position and orientation of all approaches are stored in a database. The coordinates of the second, three-dimensional virtual objects that need to be extended are determined relative to the coordinates of the 3DCG model of the environment reconstructed by SfM and stored in a database.

Finally, the main points and attributes of each photo used for SfM are extracted and saved in a text file. In addition, the file paths of all photos are saved in a separate text file. This study uses an advanced local object detector and descriptor, namely scale-invariant object transformation (SIFT), which is used to detect points of interest.



In the real-time processing step; first, the files created in the pre-processing3 step are imported. Second, features of the live video images are extracted using SURF in real time, and extracted features of the live video images are compared with features of stored images in the database. Finally, 3D virtual objects are precisely rendered in an AR display using position and orientation data of the

camera and by finding the most similar image in the database. For tracking, motion vectors are calculated using optical flow.



PROTOTYPE EXPERIMENTATION

For the renovation case study, the design of awning (sunshades) for a part of M3 building is chosen. In the AR scene, the prototype system allows users to change the material of to-be-installed awnings (sunshades). As for design alternatives, blue and white colour

materials and different angles (10, 20 and 30 degrees) for shades were prepared.

The procedure for the verification study is presented in the following steps:

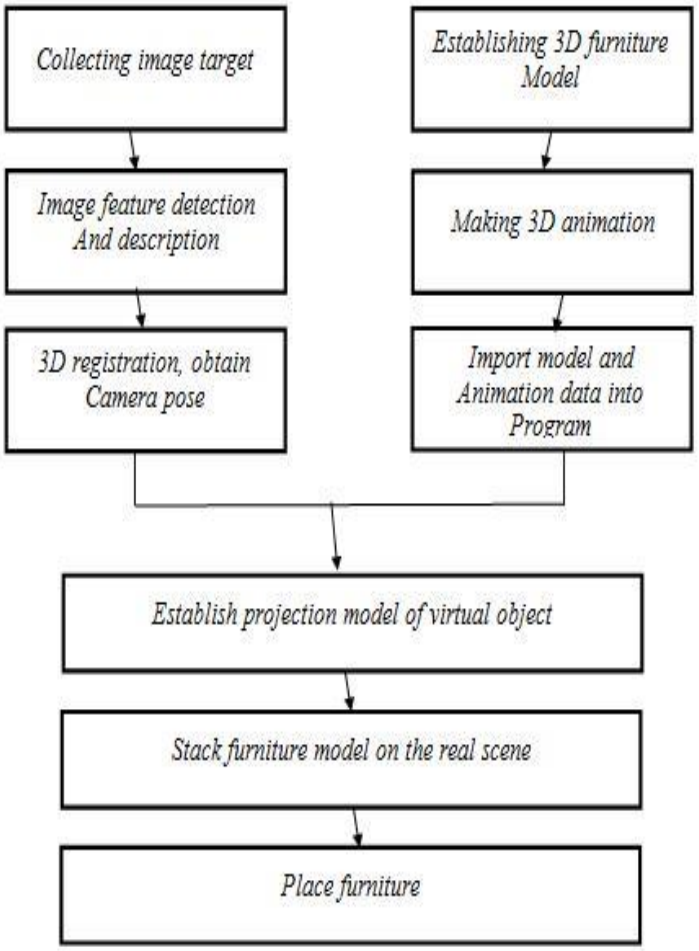
1. 3D shape of M3 building was reconstructed by SfM. In this study, SfM pro-cessing was carried out using images captured by a digital camera. One hun-dred images (resolution 900×600) of M3 building were used for SfM. More-over, drawing position of the awning was assigned to the reconstructed 3D shape. The photography route for SfM is presented in Figure 3. Examples of images used for SfM is presented in Figure 4 and 3D shape of M3 building reconstructed from SfM are presented in Figure 5. Drawing position of awn-ings is presented in Figure 6.

2. Initializing marker-less AR system including M3 building contents was con-firmed.
3. The display of AR models on the same route where the images are captured for SFM was confirmed.

4. Changing colour of awning material, and changing the angle of awnings were confirmed.

5. Tracking 3DCG model on the same route where the images are captured was confirmed.

6 The application of the developed marker-less AR system for building renovation was verified.



.MARKER-LESS AR SYSTEM DESIGN

This system design will show you how the marker less augmented reality system works in case of rendering the object and it will define various factors off using and android application for interior design..

- Augmented reality technology without markers allows you to use any and all parts of the physical environment as the goal or basis for placing superimposed virtual objects. AR without markers depends on the natural features of the environment, not on fiducial identification markers. The system retrieves and stores environmental information and attributes. Kudan supports marker less tracking, also known as ArbiTrack, which can hold objects.

- This tracking method works using scanning algorithms and feature detection systems. Suppose we want to get information about an object,

we can simply point our phone at it, and some feature detection or pattern recognition systems try to identify it. For its identification, special scanning algorithms are used. It creates or projects a virtual grid on the image captured by our camera. And to determine the exact location, automatic scanning locates several reference points and binds them a virtual model. Technology without markers has many advantages, including the fact that an actual object can serve as a marker in itself, and there is no overhead for creating or creating markers on objects.

- We need to create specific optical identifiers. Digital images of physical objects are projected directly onto them. This is known as projection mapping and can be used for highly noticeable effects.

This system design will show you how the marker less augmented reality system works in case of rendering the object and it will define various factors off using and android application for interior design.[9]

Algorithm:

1.Initialization:Initialize the video captureand camera parameters and acquire device position information from the magnetic compass and accelerometer.

2.Main Loop:Freezevideo input frame.

3. Getdevice position and orientation from the magnetic compass.

4. Calculate the camera transformation relative to the device position.

5. Draw the virtual objects in the center of the screen. Shutdown 6. Close the video capture

5.RESTRICTIONS ON MOBILE DEVICES

Smartphone’s with RAM as low as 64 MB won’t support this app. Android system will force close the app if it won’t respond within stipulated time (3 to 5 sec). The CPUs on the embedded processors mostly don’t allow parallel processing. Even then AR can make use of multithreading which speeds up certain marking and detection algorithms. Many of the phones don’t have a separate FPU. Hence the app which runs on the phone will work 3 to 4 times slower than that of the average PC and will consume the battery more than other apps due to more computations required.

6.SYSTEM IMPLEMENTATION

1. Implementation of Tracking Module: The system uses a three-dimensional registration method, based on a marker, which requires matching it with a marker image or identifying and tracking markers in real-time , The only thing we need to do is to compare and track. The two principal frames of the image, taken at different angles, determine the camera's initial position using a five-point algorithm.

2. Implementation of exhibition ceremony. The effect of the exhibition, which this system intends to implement, is that it puts the model of virtual furniture in a real room and can place and inspect virtual furniture in real time. Display modules include the creation of a three-dimensional model of furniture, the creation of a three-dimensional animation of a display, and the creation of a virtual projection model of furniture that can make it fit the real environment.

After initializing the system, we can determine the projection model from the actual view to the camera image by placing the target images at the correct location. According to the projection model, this camera uses an AR camera to determine the location and placement of a virtual furniture model in real-time on the image.

3. Interactive Module Design: There are several helpful factors for determining the interactive mode of home selection functions, for example, this type of selection mode may allow the user to understand how to work at a glance, In addition, depending on the maintenance of a large number of houses, the selection of a home may also occur. To be considered. Thus, the home option can first enter the choice of pet species by clicking on the plus sign on the screen, after selecting the species to which the home service belongs, a long column Home service related to that species A circle containing all the thumbnails will appear. Jumping in from the left side of the screen, users can see the contents of the column by dragging up and down**,** clicking on the thumbnail of the circle and selecting the desired home service.

7.RESULT AND EVALUATION

AR app for Architect and interior designers brings conventional 2D blueprints to real life. This is done by overlaying the normal pictures with accurate-scale 3D models to analyze construction after a certain period of time.[13] Thereby, it can also be used to see the impact of different types of building material or to demonstrate engineering around a structure.[17]

3.1 Goals of the Project

The main goals of this research is to build an app that is able to render different furniture models and be able to interact with them using different gestures. We determined that the system will perform the following tasks:

1. Select a furniture from a menu
2. Place a furniture by tapping on the screen
3. Remove rendered furniture
4. Change material of rendered furniture
5. Move the location of furniture
6. Take a picture of the current environment and store in the local storage
7. Load 3d models from local storage

While there have been number of attempts in creating AR app in interior design space using different platforms, tools and techniques. We are trying to find an elegant and simple solution to this problem.

3.2 Outcomes of the project

The main outcomes of this project are as follows:

1. A GUI that allows user to use select, place, remove and modify 3d models in an interactive way by using different touch gestures, at any time, more than 90% of the screen is filled by camera stream and rendered models. We have adopted “more is less” approach to design this GUI.
2. A solid backend that handles app’s core functionality such as detecting the gestures, modifying rendered 3d models, loading 3d models from local storage.

Conclusion/Future Enhancement

This application is relatively new, this application allows the user to add multiple object to the screen in real-time. The user can manipulate the object like, move, rotate, resize and change the color or texture of the object on selection. Thus, allowing the interior designer to implement their design and evaluate them in real- environment. In this application one module is endowed to Architectures where over their 2D image a 3d object is rendered to let them consider and assess their idea This is known as the Create Room Panel and one part of the application. This panel enables the user to implement their design by dragging the object on to the Screen. This Panel shows all the functionalities of Augmented reality (Marker-less). It also exhibits the Categories that is provided to the user to use. The Augmented Reality Technique has become a hot issue in the field of computer vision technology, with its different user experience, slowly and deeply changing people's life, which includes many different fields such as education, medical, advertising and so on. The study on Augmented Reality Technique is mainly divided into two directions, one is implementing camera 3D registration by identifying the markers in scene, the other is updating camera pose by doing 3D reconstruction to the unknown scene[9], rendering the virtual objects in real-time. This paper mainly used the second method to research, realized the Virtual Home Augmented Reality System, which can support auxiliary information to people when decorating and selecting furniture, help users feel the placement of furniture in the room in advance before putting them in virtual environment.

8. FUTURE WORK

- Models can be stored on file hosting and downloaded on request. Although this will increase productivity, reduce memory consumption and increase reliability, the user will need a high-speed Internet connection.[23]

- This application can be improved and expanded for architecture, civil engineering, advertising and other purposes.

- We are trying to integrate photogrammetry into our existing platforms, which will allow us to recreate 3D models of furniture from images. At the moment, the user can only imagine 3D-models that are in local storage, we want to extend this functionality. We intend to connect the application to cloud storage, allowing the user to view the furniture and import it at runtime. In addition, we plan to revolutionize how we share using the principles of photogrammetric

9. CONCLUSION

The Augmented Reality Technique has become a hot issue in the field of computer vision technology, with its different user experience, slowly and deeply changing people's life, which includes many different fields such as education, medical, advertising and so on.[14] The study on Augmented Reality Technique is mainly divided into two directions, one is implementing camera 3D registration by identifying the markers in scene, the other is updating camera pose by doing 3D reconstruction to the unknown scene[9], rendering the virtual objects in real-time[19]. This paper mainly used the second method to research, realized the Virtual Home Augmented Reality System, which can support auxiliary information to people when decorating and selecting furniture, help users feel the placement of furniture in the room in advance before putting them in virtual environment [7].

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.

APPENDIX

/* Load Application scenes - MenuStart.cs */

```
using System.Collections;

using System.Collections.Generic;

using UnityEngine;



public class MenuStart : MonoBehaviour {

    public void changemenuscene(string scenename)

    {

        Application.LoadLevel(scenename);

    }

}
```

/* Rotate.cs */

```
using UnityEngine;

using System.Collections;



public class Rotate : MonoBehaviour

{
```

```
    public float speed = 10f;

    void Update()

    {

        transform.Rotate(Vector3.up, speed * Time.deltaTime);

    }

}
```

/* Google AR core package modification – HelloARController.cs */

```
//-----------------------------------------------------------------------

// <copyright file="HelloARController.cs" company="Google">

//

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//

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// See the License for the specific language governing permissions and

// limitations under the License.

//

// </copyright>

//-----------------------------------------------------------------------

namespace GoogleARCore.Examples.HelloAR

{
```

```
    using System.Collections.Generic;
    using GoogleARCore;
    using GoogleARCore.Examples.Common;
    using UnityEngine;
    using UnityEngine.UI;

#if UNITY_EDITOR
    // Set up touch input propagation while using Instant Preview in the editor.
    using Input = InstantPreviewInput;
#endif

    /// <summary>
```

```
    /// Controls the HelloAR example.
    /// </summary>
    public class HelloARController : MonoBehaviour
    {
        /// <summary>
        /// The first-
person camera being used to render the passthrough camera image (i.e. AR background).
        /// </summary>
        public Camera FirstPersonCamera;

        /// <summary>
        /// A prefab for tracking and visualizing detected planes.
        /// </summary>
        public GameObject DetectedPlanePrefab;

        /// <summary>
        /// A model to place when a raycast from a user touch hits a plane.
        /// </summary>
        public GameObject AndyAndroidPrefab;

        /// <summary>
        /// A gameobject parenting UI for displaying the "searching for planes" snackbar.
        /// </summary>
```

```
    public GameObject SearchingForPlaneUI;


    /// <summary>
    /// The rotation in degrees need to apply to model when the Andy model is placed.
    /// </summary>
    private const float k_ModelRotation = 180.0f;


    /// <summary>
    /// A list to hold all planes ARCore is tracking in the current frame. This object is used a
cross
    /// the application to avoid per-frame allocations.
    /// </summary>
```

```
    private List<DetectedPlane> m_AllPlanes = new List<DetectedPlane>();


    /// <summary>
    /// True if the app is in the process of quitting due to an ARCore connection error, other wise false.
    /// </summary>
    private bool m_IsQuitting = false;


    /// To check the instance has been placed once
    public bool is_placed = false;
    //public Text display_dist;


    private GameObject andyObject;


    public GameObject button1;
    public GameObject button2;
    public GameObject button3;
    public GameObject button4;
    public GameObject button5;
    public GameObject button6;
    public GameObject shw_text;
```

```
private bool display_text = false;

private bool display_btn=false;




/// <summary>

/// The Unity Update() method.

/// </summary>

///

// Use this for initialization
```

```
public void Update()

{

    _UpdateApplicationLifecycle();



    // Hide snackbar when currently tracking at least one plane.
    Session.GetTrackables<DetectedPlane>(m_AllPlanes); bool
    showSearchingUI = true;
    for (int i = 0; i < m_AllPlanes.Count; i++)
    {
        if (m_AllPlanes[i].TrackingState == TrackingState.Tracking)
        {
            showSearchingUI = false;
            if(is_placed == false)
            {
                display_text = true;
            }

            break;
        }
    }
```

```
shw_text.SetActive(display_text);


SearchingForPlaneUI.SetActive(showSearchingUI);


// If the player has not touched the screen, we are done with this update.
Touch touch;
if (Input.touchCount < 1 || (touch = Input.GetTouch(0)).phase != TouchPhase.Began)
{
    return;
}


// Raycast against the location the player touched to search for planes.
TrackableHit hit;
TrackableHitFlags raycastFilter = TrackableHitFlags.PlaneWithinPolygon |
```

```
    TrackableHitFlags.FeaturePointWithSurfaceNormal;


if ((Frame.Raycast(touch.position.x, touch.position.y, raycastFilter, out hit)))

{




    // Use hit pose and camera pose to check if hittest is from the

    // back of the plane, if it is, no need to create the anchor.

    if ((hit.Trackable is DetectedPlane) &&
        Vector3.Dot(FirstPersonCamera.transform.position - hit.Pose.position,

            hit.Pose.rotation * Vector3.up) < 0)

    {



        Debug.Log("Hit at back of the current DetectedPlane");

    }

    else if(is_placed == false)

    {

        /// It wont come to this method again.

        is_placed = true;

       // Vector3 a = FirstPersonCamera.transform.position - hit.Pose.position;

        //TextAlignment.text = a.x + " " + a.y + " " + a.z;
```

```
// Instantiate Andy model at the hit pose.

andyObject = Instantiate(AndyAndroidPrefab, hit.Pose.position,
hit.Pose.rotation); display_text = false;

shw_text.SetActive(display_text);

//display_dist.text = "Display : "+a.x + " " + a.y + " " + a.z;


// Compensate for the hitPose rotation facing away from the raycast (i.e. camera)
.

andyObject.transform.Rotate(0, k_ModelRotation, 0, Space.Self);


// Create an anchor to allow ARCore to track the hitpoint as understanding of the
physical

// world evolves.
```

```
            var anchor = hit.Trackable.CreateAnchor(hit.Pose);


            // Make Andy model a child of the anchor.
            andyObject.transform.parent =
            anchor.transform; display_btn = true;


        }

        button1.SetActive(display_btn);

        button2.SetActive(display_btn);

        button3.SetActive(display_btn);

        button4.SetActive(display_btn);

        button5.SetActive(display_btn);

        button6.SetActive(display_btn);

    }

}

public void Button_Click()

{

    //if (Input.GetKey(KeyCode.RightArrow))
    //transform.Rotate(Vector3.up, rotSpeed * Time.deltaTime);
    andyObject.transform.Rotate(0, 30, 0, Space.Self);


}
```

```
/// <summary>
/// Check and update the application lifecycle.
/// </summary>
private void _UpdateApplicationLifecycle()
{
    // Exit the app when the 'back' button is pressed.
    if (Input.GetKey(KeyCode.Escape))
    {
        Application.Quit();
    }

    // Only allow the screen to sleep when not tracking.
```

```
        if (Session.Status != SessionStatus.Tracking)

        {

            const int lostTrackingSleepTimeout = 15;
            Screen.sleepTimeout = lostTrackingSleepTimeout;

        }

        else

        {

            Screen.sleepTimeout = SleepTimeout.NeverSleep;

        }



        if (m_IsQuitting)

        {

            return;

        }

    // Quit if ARCore was unable to connect and give Unity some time for the toast to app ear.
        if (Session.Status == SessionStatus.ErrorPermissionNotGranted)

        {

        _ShowAndroidToastMessage("Camera permission is needed to run this
            application."); m_IsQuitting = true;

            Invoke("_DoQuit", 0.5f);

        }
```

```
    else if (Session.Status.IsError())

    {

        _ShowAndroidToastMessage("ARCore encountered a problem connecting. Please
        start the app again.");

        m_IsQuitting = true;
        Invoke("_DoQuit", 0.5f);

    }

}



/// <summary>

/// Actually quit the application.

/// </summary>

private void _DoQuit()

{
```

```
Application.Quit();
        }

        /// <summary>
        /// Show an Android toast message.
        /// </summary>
        /// <param name="message">Message string to show in the toast.</param>
        private void _ShowAndroidToastMessage(string message)
        {
            AndroidJavaClass unityPlayer = new AndroidJavaClass("com.unity3d.player.UnityPl
ayer");
            AndroidJavaObject unityActivity =
unityPlayer.GetStatic<AndroidJavaObject>("curr entActivity");

            if (unityActivity != null)
            {
                AndroidJavaClass toastClass = new
                AndroidJavaClass("android.widget.Toast");
                unityActivity.Call("runOnUiThread", new AndroidJavaRunnable(() => {
                    AndroidJavaObject toastObject = toastClass.CallStatic<AndroidJavaObject>("m
akeText", unityActivity,
                        message, 0);
                    toastObject.Call("show");
```

```
            }));

        }

    }



}
}
```

/* Redirection to online shopping application – buy.cs */

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;


public class buy : MonoBehaviour
{
    // Start is called before the first frame update
    public void buybed()
    {
        Application.OpenURL("https://www.amazon.in/Spacewood-Queen-Woodpore-Finish-
Natural/dp/B076D7QK9B/ref=sr_1_7?s=kitchen&ie=UTF8&qid=1551717939&sr=1-7");
    }
    public void buysofa()
    {
        Application.OpenURL("https://www.amazon.in/Uberlyfe-Premium-Centerville-Pillows-
SCB-001735-HDRL-LTBR/dp/B07NTM6X28/ref=pd_sbs_196_1/258-4899201-
3823227?_encoding=UTF8&pd_rd_i=B07NTM6X28&pd_rd_r=61e0ad63-3e9e-11e9-9b9f-
e50f1baa143f&pd_rd_w=YpSQp&pd_rd_wg=2bu9P&pf_rd_p=87667aae-831c-4952-ab47-
```

```
0ae2a4d747da&pf_rd_r=MGHJQEB10WFEK0P83726&psc=1&refRID=MGHJQEB10WFE
K0P83726");
    }
    public void buychair()
    {
        Application.OpenURL("https://www.amazon.in/RK-Furniture-Sheesham-Cushion-
Chestnut/dp/B07PBJN5ZL/ref=sr_1_1?s=kitchen&ie=UTF8&qid=1551718137&sr=1-1");
    }
    public void buydesk()
    {
        Application.OpenURL("https://www.amazon.in/Forzza-Odessa-Rack-Wheels-
Wenge/dp/B074ZFMRZW/ref=sr_1_61?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }
     public void buydinning()
    {
        Application.OpenURL("https://www.flipkart.com/cello-proline-plastic-4-seater-dining-
```

```
table/p/itmf46hymz7wngge?pid=DNTF46HYYRBZYMZU&lid=LSTDNTF46HYYRBZYM
ZU6SUW4P&marketplace=FLIPKART&srno=b_1_1&otracker=CLP_lhs&fm=neo%2Fmerc
handising&iid=355f785f-9ee6-408e-8f2b-
96d4ca1d97f8.DNTF46HYYRBZYMZU.SEARCH&ppt=StoreBrowse&ppn=Store&ssid=ms
1t7fcz1s00000015558433783l5");
    }
    public void buytvtable()
    {
        Application.OpenURL("https://www.flipkart.com/home-full-engineered-wood-tv-
entertainment-
unit/p/itmf73xgxpmvs8qm?pid=TVUF72XZPR9VJAZD&lid=LSTTVUF72XZPR9VJAZDG
ZSTNL&marketplace=FLIPKART&srno=b_1_9&otracker=nmenu_sub_Home%20%26%20
Furniture_0_TV%20Units%20%26%20Cabinets&fm=neo%2Fmerchandising&iid=50f8bc0e
-94ab-4c27-ad0b-
f8ea80ced0e6.TVUF72XZPR9VJAZD.SEARCH&ppt=StoreBrowse&ppn=Store&ssid=ssut
wci45s00000015558436086O1");
    }
    public void shoestand()
    {
```

```
        Application.OpenURL("https://www.flipkart.com/bonita-metal-shoe-
stand/p/itmezb4urgbtnzs4?pid=SHKEZB3PFFKWU9FZ&lid=LSTSHKEZB3PFFKWU9FZ
XXUSBY&marketplace=FLIPKART&srno=b_1_3&otracker=clp_banner_1_6.bannerX3.BA
NNER_shoerackclp-store_1J583U13QF&fm=neo%2Fmerchandising&iid=e654c60c-3c49-
4a11-8881-
0b01ee7186cf.SHKEZB3PFFKWU9FZ.SEARCH&ppt=StoreBrowse&ppn=Store&ssid=jm
mflqvi1s00000015558438248 41");
    }
    public void buydesk()
    {
        Application.OpenURL("https://www.amazon.in/Forzza-Odessa-Rack-Wheels-
Wenge/dp/B074ZFMRZW/ref=sr_1_61?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }
```

```
    public void buychair3()
    {
        Application.OpenURL("https://www.amazon.com/Great-Deal-Furniture-295398-Clarice/dp/B00P2ZPKKS?ref_=fsclp_pl_dp_1");
    }

    public void buyBed24()
    {
        Application.OpenURL("https://www.snapdeal.com/Heritage-Mandos-Rack-Wheels-Wenge/dp/MF5GJGJIRY94/ref=sr_1_61?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }

    public void buydesk5()
    {
        Application.OpenURL("https://www.amazon.in/Forzza-Odessa-Rack-Wheels-Wenge/dp/BDKFUNF696/ref=sr_1_65?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }

   public void buydesk6()
    {
```

```
        Application.OpenURL("https://www.amazon.in/Forzza-Odessa-Rack-Wheels-
Wenge/dp/B07KDFBUEF/ref=sr_1_68?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }

    public void buydes7k()
    {
        Application.OpenURL("https://www.amazon.in/Heritage-Mandos-Rack-Wheels-
Wenge/dp/B074ZFMRZW/ref=sr_1_69?s=kitchen&ie=UTF8&qid=1551718899&sr=1-61");
    }
```

```
    public void buychair2()

    {

        Application.OpenURL("https://www.flipkart.com/hometown-stella-solid-wood-dining-chair/p/itmer6ynawjzqpgy?pid=DNCER6YFCCYHESTC&lid=LSTDNCER6YFCCYHESTCCTSEFP&marketplace=FLIPKART&srno=b_1_24&otracker=nmenu_sub_Home%20%26%20Furniture_0_Chairs&fm=neo%2Fmerchandising&iid=en_63tuYXJjuRRc4uunrPb5PAcaj69J5CQLSffQykuC4JtDidde7eIl76St5J%2FyM8TFmSFp%2BWWQYx08MBHlgDhr7g%3D%3D&ppt=StoreBrowse&ppn=Store&ssid=zxruks9r7k000001555843983627");

    }


    public void buytable()

    {

        Application.OpenURL("https://www.amazon.in/Bluewud-Osnale-Coffee-Table-Rectangular/dp/B07D7W1RQX/ref=sr_1_13?s=kitchen&ie=UTF8&qid=1551718331&sr=1-13");

    }


// Update is called once per frame
    void Update () {


    }


}
```

/* Colour picker for changing colour of furniture – colorpicker,cs */

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;



public class colorpicker : MonoBehaviour
{

    public Material[] material;
    public Renderer[] rend;



    // Use this for initialization
    void Start () {
        for (int i = 0; i < rend.Length; i++)
        {
            rend[i].enabled = true;
            rend[i].sharedMaterial = material[0];
```

```
    }
}
public void OnButtonPressed()
{
    //Debug.Log("Hello");

    for (int i = 0; i < rend.Length; i++)
    {
        rend[i].sharedMaterial = material[1];
    }

}
```

```
    public void OnButtonReleased()
    {
        //Debug.Log("button not pressed");
        for (int i = 0; i < rend.Length; i++)
        {
            rend[i].sharedMaterial = material[0];
        }
    }
// Update is called once per frame
    void Update () {

    }

}
```

/* rotatescript.cs */

```
using System.Collections;

using System.Collections.Generic;

using UnityEngine;


public class rotatescript : MonoBehaviour {

    public float rotSpeed = 20f;

    // Use this for initialization

    public void Button_Click()

    {

        //if (Input.GetKey(KeyCode.RightArrow))
        //transform.Rotate(Vector3.up, rotSpeed * Time.deltaTime);
        transform.Rotate(0, 45, 0);

    }


    // Update is called once per frame

    void Update () {
```