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An Augmented Reality Based Product Preview with Hand Gesture Control

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ABSTRACT: In Augmented Reality, the real environment is combined with the artificial environment using Computer Vision technology. Virtual Reality replaces the real environment completely with one created artificially, whereas Augmented Reality adds information to people's reality. The latest handheld devices are capable of entirely rendering an artificial world around us. The major enhancements to Augmented reality algorithms have also contributed to its expansion. This project helps us to get a clear understanding of how a product can fit into our environment without having to picture it blindfolded. Using our Android phone, we simply open the Augmented Reality app to view the products, and then we choose the one we want. This will greatly reduce the return rate of the products because users can try them before making a decision. Thus, it will enhance the shopping experience which will have a significant impact on the decision-making of users.

KEYWORDS: Augmented Reality, Plane Detection, 3D Model, Game Engine, 3D Pose

I. INTRODUCTION

Augmented reality and handheld devices are the technology that plays a major role in the commerce world. The proposed idea of this project is the development and design of an Augmented Reality based product visualization, a technology that provides information about the product which cannot be explained in words, beneficially bringing the dominating trends together. The augmented reality application used in this project is marker-less and uses flat plane detection. First, a plane is detected, then a product is selected from the list of available products by the user and that product's 3D models are downloaded from cloud storage and the 3D pose is calculated, and the product's 3D is rendered live in the augmented reality view.

Customers can preview products or experience services in their own environment and at their own convenience before making a purchase. By previewing products using Augmented Reality, customers are more likely to choose the correct product the first time. Shopping online with AR helps consumers in understanding what they are buying and how it will benefit them. The product preview placement allows customers to see how the product will appear within their own environment in real-time. Engaging customers, reaching new customers, and reducing return rates are all possible with AR.

For two decades, we did all our shopping in offline mode, then we started using e-commerce to buy products, but still, most of us can't trust online products completely, because we don't know how the product exactly looks in our environment. Also, online shopping lacks to provide a shopping experience. This project's aim is to narrow the gap between online and offline shopping experience.

In this project, we created an Augmented reality-based product preview system for android using a game engine (Unity3D), which allows the user to view the product in real time. The application is connected with an FTP server (google drive) to provide the models and other required files, which eliminate the limitation on number of products that can be included and also reduces the application size.

In upcoming sections, we will discuss Section 2 - related work Section 3 - methodology Section 4 - result

II. RELATED WORK

In this section we will discuss about some of the important works related to the area of this project.

[15] In 2014 a group designed a product display system using a 360-degree image and photo AR to simulate a real-world environment where the product is going to be used to give the customer an idea about how the product might look in a real-world environment. But it only uses a 2D image of the product, so the user can only see a single side of the product.



[16] In 2021, a web-based product display system was created using MFC and OpenGL library and uses a camera to capture a real world and an open VRMLP to render the 3D models into that environment. But, because of the web-based nature, it has limitations on processing power and rendering quality.

[17] In 2021, an augmented reality-based product display was created using the unity3D and Arcore plugin to create a high-resolution AR view, with real-time object manipulation. But all the products which are available for AR view should be prepacked into the application. So, this application has limitations on number of products and huge file size.

[14] In 2016, a marker-based augmented reality is created with FLARToolKit library, which is a web-based library, so it is more access to users, but users have to talk a hard copy of marker to use this product and also due to its web-based nature it lacks the performance and some platforms dependent features

[18] In 2020, a comparison between Marker-based and marker-less Augmented Reality was done. They concluded that marker-less augmented reality serves better when it comes to e-commerce

III. PROPOSED WORK

In this project, we created an Augmented reality-based product preview system for android using a game engine (Unity3D). which allows the user to view the product in real time. The application is connected withan FTP server (google drive) to provide the models and other required files, which eliminate the limitation on number of products that can be included and also reduces the application size.

Objective

- a) This project will significantly improve the shopping experience for the customer.
- b) It will fill the gap between online shopping and offline shopping.
- c) This will help the customers to have a better understanding of the product appearance like Size, color, and design.

Novelty:

- a) The existing AR system has a limited number of products that can be viewed because the app runs in offline mode and each time, they have to update the product list and they have to push an update to the application.
- b) But this project connects to a database which removes the product size and number of product limitations in the app

IV. METHODOLOGY

In this section will discuss about methodology of this project

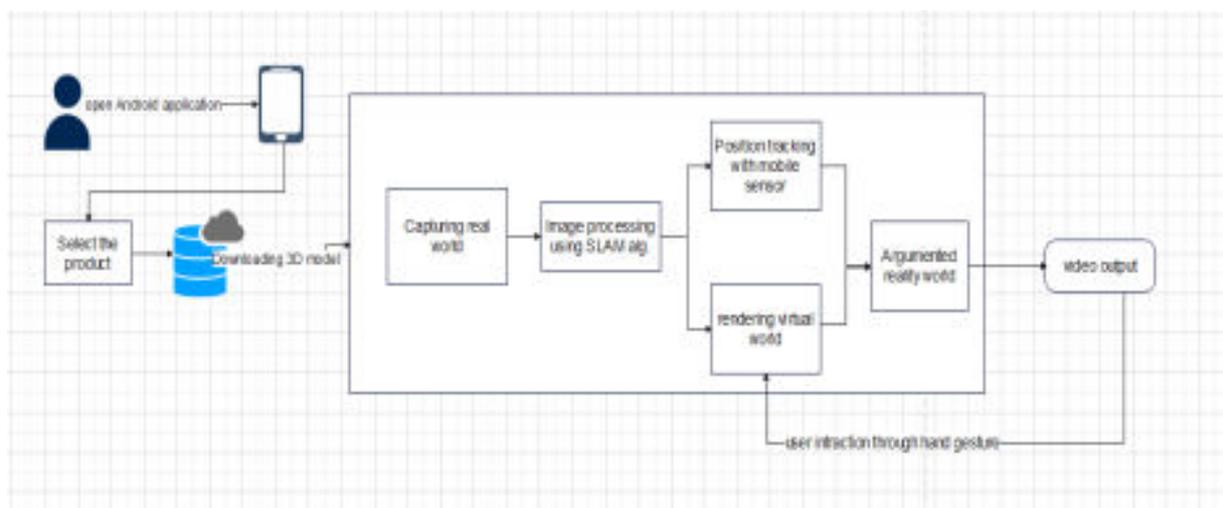


Fig 1 Architecture diagram

V. SYSTEM DESIGN AND ARCHITECTURE

Fig 1 shows the architecture of our proposed system, The user opens the AR preview application by clicking on it, there will a list of products available for AR preview. The users have to select the product which they want to see in the AR preview.

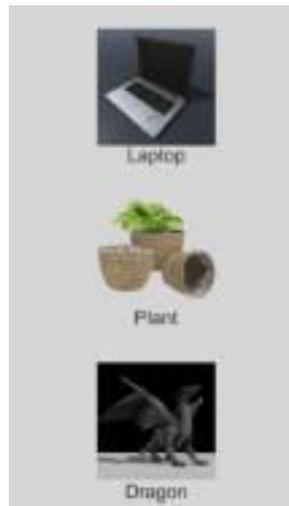


Fig 2 Product selection

In Fig 2, it will show the list of products that can be viewed in AR mode. When the user selects the product which they want to see in AR mode. Then the 3D model will start downloading from the cloud storage.



Fig 3 Download screen

Fig 3 shows how Download screen looks like.

Once the download is completed, the application starts capturing the real world and by using the SLAM algorithm. Augmented Reality mostly uses Simultaneous localization and mapping a CV algorithm that compares multiples frames from the camera to track and map the real-world environment. It also uses data from both the gyroscope and accelerometer, to achieve reliable tracking. this algorithm is based on concepts in computer vision and computational geometry, that are used in robot navigation and odometry for virtual or augmented reality. the application creates a 3D map of the environment by processing the video from the camera and data from the accelerometer and gyroscope. Then it detects the plane where the product can be placed. Then the user has to select a place where they want to place the product. After the input, the application will start rendering the product in the selected place.



Fig 4 AR preview screen

Fig 4 shows how AR preview screen looks like.

The user can interact with the product by using hand gestures like pinch (to resize), swipe (to rotate), and double-tap (to change the position). the interaction is processed and the object will be manipulated respectively.

VI. USE CASE DIAGRAM

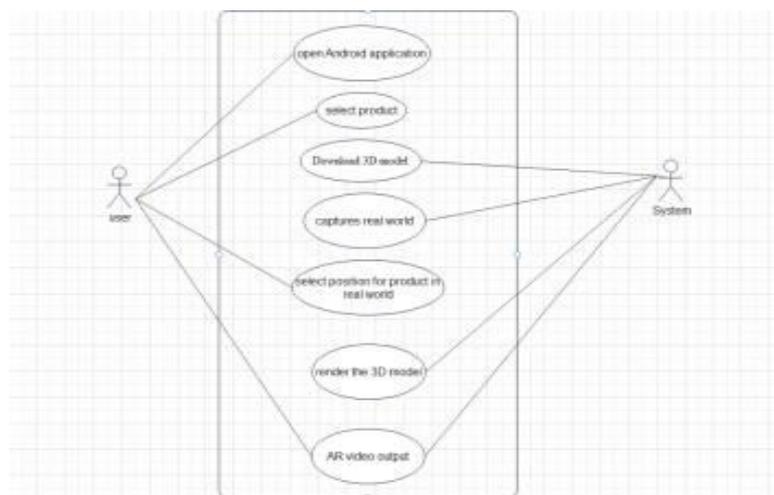


Fig 5 Use Case Diagram

Fig 5 Use Case diagram, initially the user interacts with the android device and launches the argument reality product preview application, then the list of products for AR preview will appear on the screen, the user has to choose a product based on their need. Then the respective model and related files will be downloaded by the system. After the download is complete, system will start capturing the surroundings using devices inbuilt camera, and start tracking the device position using the accelerometer and gyroscope. Then the capture video frames and positions data is processed by SLAM algorithm to create a 3D map of the environment, then the plane are filtered based on the plane size and orientation which are more suitable for product placement. then user have to interact with devices touched input to select the



position where they want to place the object. After the selection system will automatically start render the model in the selected position.

VII. RESULT

This application lets the user preview any e-commerce products in an Augmented reality view. Once the user selects a product, the application downloads the respective 3D model from the FTP server. Users can manipulate the 3D model using a hand gesture to rescale, rotate, and move the product to get a better view and idea of the product.



Fig 6 Google 3D animal

In Fig 6 Google 3D animal is a web-based AR application that is used to project the animals into a device's screen to create an AR experience, because of the hardware usage constraints for the web browser-based AR application have less quality and lacks to provide some platform-dependent features.



Fig 7 flower pot screenshot



Fig 8 laptop screenshot

Fig 7 and Fig 8 are taken from the application created for this project, an android application created using a game engine(unity3D), native Android application can access the device GPU directly to render the models which result in higher rendering quality and reduced internal latency.

In a survey of 100 people 82% of the people voted that they had a better overall shopping experience when using Augmented Reality based product preview rather than traditional online shopping.

As a result, using a native Android application connected with FTP server will improve the product preview quality and overall shopping experience.

VIII. CONCLUSION

Rapid growth in mobile technology and its significant increase in processing power opens a new possibility to support augmented reality applications. This takes us to next-generation e commerce shopping using augmented reality. By providing a better view and perspective, this application helps users to make a better decision on whether they should buy the product or not. So, it will significantly reduce the return rate of the product. Augmented Reality applications require higher performance power, but Web-based AR applications have less quality and poor performance because of limited memory and limited computing capabilities. Hence by creating an android application using a game engine like unity3D the quality of the rendered 3D model and performance issignificantly higher.

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