IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 4, April 2021

DOI 10.17148/IJARCCE.2021.10421

Augmented Reality Image Wake-Up Application using Android and Sceneform

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Abstract: Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities , including visual, auditory, haptic, somatosensory
and olfactory. AR can be defined as a system that fulfils three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects. The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment).This experience is seamlessly interwoven with the physical world such that it is perceived as an immersive aspect of the real environment. In this way, augmented reality alters one's ongoing perception of a real-world environment, whereas virtual reality completely replaces the user's real-world environment with a simulated one. Augmented reality is related to two largely synonymous terms: mixed reality and computer-mediated reality. Augmented reality, the technology of overlaying graphical objects on the real world, is radiating everywhere, and all industries are trying to shine by leveraging this sophisticated real-time piece of advancement. One such niche is the automotive sector. This is one of the fastest expanding verticals whose market share falls in the category of trillion dollars.

Keywords: Augmented Reality, Real-time interaction , virtual reality.

I. INTRODUCTION

Augmented reality, the technology of overlaying graphical objects on the real world, is radiating everywhere, and all industries are trying to shine by leveraging this sophisticated real-time piece of advancement. One such niche is the automotive sector. As we are accepting more technologies in our lives, car manufacturing companies are trying to bring traditional vehicles on this digital platform. Nowadays, vehicles are getting so smart that a user doesn't even need search for car's manual to figure out how a particular thing operates. The augmented reality platform is truly driving value for auto companies as well as customers. This tech is a win-win situation for all. Let's dive deeper and have a look at how AR is transforming the complete automotive industry and how it is preparing us for the future. One of the biggest impacts of AR on the automobile industry is the complete shift of the buying persona of a customer. Traditionally, customer must walk into dealerships to check out the cars of their choice. And if a particular model or colour is not available, they would probably settle by checking out some other car or another colour. AR systems are also improving drivers' focus by providing all the necessary navigation and car status information in front of them. So they don't need to look at the central fixed dashboard. Just by using simple eye gestures, a driver can perform various activities without disrupting the concentration.

Advantages of augmented reality

1. Facilitates Object Visualization in the unique way: One application of AR app development is the approach in which it assists to put digital assets in the real world. Integrating the virtual objects with the real world permits developers to interrelate with the digital elements (like 3D objects) they developed as if they were like real objects. In order to understand it, for instance, car designers need to work on approximately thousands of parts in order to let the car design go correctly. By use of immersive AR app development technology as well as computer graphics, they could project the digital layouts of the interior of car essentially on a full size model relating to the car dashboard. It is known that visualizing virtual objects with the help of this app development technology gives comprehensive insights into what a finished product may appear like as related to a flat product image depicted on the screen.
2. Simplify Complex Assembly Processes: Even the average manufacturing and assembly processes can contain hundreds of individual components. Each of these parts has a specific tolerance, and in many cases, they must be assembled or disassembled in a precise order. Augmented reality enters the mix by allowing technicians constant access to diagrams, schematics and work orders, right at the periphery of their field of view. Compared with glancing back and forth between the work piece and, say, a PDF with disassembly instructions, AR glasses are by far a more efficient choice.
3. A total immersion into the architectural project: One of the main benefits of augmented reality for architecture

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is that it is capable of placing a person into a virtual version of a future object. Therefore, using AR technology one can walk through the apartment with nothing but walls and observe the potential interior design from any point of it and at every possible angle. Moreover, the opportunities of real estate augmented reality are not limited to the superimposition of the virtual elements on the real world. Augmented reality in construction can also stage real-life situations for making a certain architectural decision. For instance, engineering an elevator in a building with the help of AR technology, it is possible to check how many people will fit in it with ease.

4. The economy of time and efforts on the architectural object's design engineering: Needless to say, with the help of AR technology the work on the architectural project becomes much easier. First, the constructor has an extremely vivid visualization. Second, one move of a hand is enough in order to make certain changes, instead of inserting the common sets of necessary symbol combinations on the laptop. Third, the client has an opportunity to take part in the augmented reality construction personally, removing, adjusting or adding something into his real estate object.

II. LITERATURE REVIEW

AR combines real and virtual worlds, supplementing the real world with computer-generated virtual objects in real-time. According to one of the most commonly accepted definitions, AR is said to be a technology that has three key requirements: combining of real and virtual objects in a real environment, aligning of real and virtual objects with each other, and real-time interaction.

- The continuum ranges from a completely real environment to a completely virtual environment. Based on this continuum, mixed reality may be defined as a situation in which real and virtual objects are combined
- AR may be considered as a mixed reality technology which contains more reality, as this technology includes virtual objects in the user's real environment, enabling interaction with virtual content.
- In the case of mobile AR, the technology involves the addition of digital elements to the real world through a smartphone camera. Examples of mobile AR applications include Pokémon GO, which is a location-based mobile AR game that enables users to catch various digital Pokémon creatures around their area and AR GPS DRIVE/WALK NAVIGATION which provides an AR-powered navigation system.
- Virtual reality differs from AR, as in virtual reality the real world is shut out and the user steps into a digital world using a virtual reality headset such as the Oculus Rift or Samsung Gear VR .AR no longer requires specialised equipment and may easily be used through computers or mobile devices. A lightly AR supplements the real world with a relatively small amount of virtual information, while a heavily AR contains frequently accessible virtual information. The amount of virtuality within the real world determines the type of technology required to support the AR, as different display and tracking technologies result in different degrees of immersion.
- Immersive technologies such as head-mounted displays are used to support heavily AR and foster more immersion than mobile devices, which can support lightly AR. An example of a lightly AR would be the Pokémon GO mobile application, which can be used through a smartphone. An example of a heavily AR is the Star Wars Jedi Challenges mobile application which requires the user to use a headset .Many people now own mobile devices and therefore have access to AR. The use of AR for learning has been made more feasible due to advances in mobile technology and the increased use of smartphones. Smartphones and tablets are ideal to facilitate AR experiences, due to fast processors, graphics hardware, and various on-board sensors.

III.ARCHITECTURE

Our starting point resembles Sceneform Augmented Images sample but with several notable changes:

- `ArVideoFragment` contains all AR-related code for simplicity's sake. Decomposition is up to you and your business needs. It also extends Sceneform ArFragment thus inheriting most of the boilerplate code that handles Camera permission, ARCore availability checks, etc.

- `AugmentedImageDatabase` instance is created and the sample images are added in the runtime so it's easy to swap the sample image with your own; however, you can generate a database with the arcoreimg tool to save on performance.

- Each sample image has a corresponding sample video. Overall I prepared three image-video pairs to demonstrate all common edge-cases.

If you launch the initial commit code on a device that supports ARCore (or AVD with the Virtual Scene camera… if you're brave enough) and point the device camera to a sample image, you should see a bunch of logs in logcat indicating augmented image tracking state. Now that the app is able to detect sample images, it's time to attach a video surface on top of that image. One needs multiple things to be able to render a video with the Sceneform:

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- 3D model source asset file (*.obj) — represents a surface (in our case, it's just a simple plane)
- Material definitions file (*.mat) — defines the visual appearance of a surface
- Sceneform Asset Definition file (*.sfa) and Sceneform Binary asset (*.sfb) — references the models and textures in your source asset, and also defines materials by providing material parameters for Sceneform's physically-based materials.

For our task, we want to render a video on a simple plane. One can look at the **Sceneform Chromakey video sample repository** to find **chromakey_video.obj** file ready for use. Well, almost ready. In that example, a video is attached perpendicular to the plane, so it looks like the character stands straight on the floor. However, in our case, a video should lay on top of the plane (i.e. augmented image).

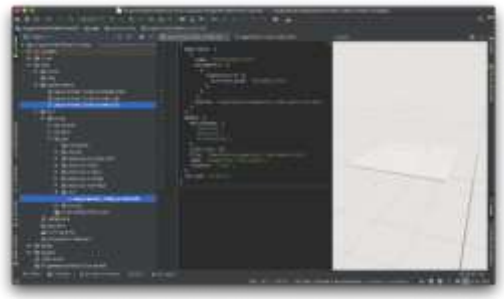

Fig 3.1: Importing 3D models in Android studio

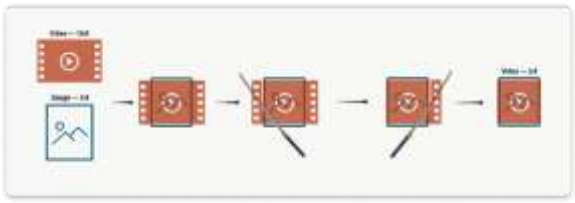

Fig 3.2 Cropping video according to image

The success of automotive companies directly depends on the launching of advanced technologies. In the last years, automotive industry experts agree that the near future of the automotive industry will be closely related to the use of augmented reality technology. AR has been proven to be a very effective sales booster being at the forefront of modern technology its benefits to the furniture industry is astounding. The fact that retailers are able to showcase their products virtually and it allows customers test how an item will look in their homes or offices gives the retailer a competitive advantage over others still using the contemporary methods. Its trials are totally risk free.

Fig 3.3 Image Rendering

fig 3.4 video playing over image

fig 3.5 final AR session

V. 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. 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 doing3D reconstruction to the unknown scene, rendering the virtual objects in real-time. Augmented reality has an extensive practical application in automotive industry serving car manufacturers.
Augmented reality app helps customer to pick cars. AR integration into automobile equipment makes driving safer. The study on Augmented Reality Technique is mainly divided into two directions, one is implementing camera 3D registration

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ACKNOWLEDGMENT

There is always inspiration gained by many in the completion of work. This project is made possible with the guidance of our mentor Professor **Sonia Wadhwa**(Assistant professor, Department of Computer Science & Engineering). We are thankful to our respected Head Of the Department Professor **Santosh Dabadghao** (Department of Computer Science & Engineering) for providing us with all the necessary facilities and also grateful to our Head Of Institute **Dr. B S Chawla** Sir (Principal, Government Engineering College, Bilaspur) for his motivation and encouragement for this research to be successful

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