3-D Rendering of objects using Augmented Reality

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Abstract

With the expeditious evolution of 3-D Rendering and Processing capacities, Augmented Reality experiences by the use of advanced technology have seen a swift elevation along with the Real-world experiences. Augmented Reality Core permits one to have interaction with the virtual as well as the real-time applications and gives a natural experience to the user. Firstly, the introduction which includes the past, present trends and advancement about the technology is summarized. Then, the process of creating a mobile application in Android Studio which provides the user with several day-to-day use furniture items that can be visualized in a 3-D environment by the user. ARCore can't be considered as SDK because it doesn't directly develop AR experiences, instead it can be considered as an engine which helps SDK's in rendering the objects. To use this capability of ARCore, Google launched the Sceneform SDK so that the developers could use this functionality to develop AR enabled applications. Our application would make it facile for the user to choose design, color combination and size of the furniture based upon his preference and also the user of the application can visualize how well the selected furniture fits with present space. The application has been designed in such a manner that the user won't need to visit and measure the furniture articles at a store. Through this application, we will be anchoring virtual images to real world surfaces in augmented reality spaces. The key techniques involved in the development of the application have been discussed in detail. Finally, the future scope of the Augmented reality technology experiences have been discussed.

Keywords: Augmented Reality - AR Core - SceneForm - Android Studio.

Introduction

Augmented reality can be termed as "the technology which is able to expand the physical world, by performing the layers addition of digital information onto it". Unlike Virtual Reality (VR), AR does not believe in creating whole artificial environments to substitute real with a virtual one. This term was first defined in the 1990's but was never considered of great significance due to lack of advancement of technology which created an obstacle in its implementation. But the expeditious advancement of mobile phones and web, Augmented Reality saw a wave and 3-D models were now being directly projected into things that are physical and also were being fused together in a real-time.

ARCORE

ARCore is a Google's SDK (software development kit) which helps us to develop AUGMENTED REALITY applications and experiences. By the use of several API's, it enables a mobile phone to sense its surroundings so that it could gather the indispensable information for interacting with the real world. It supports Android as well as IOS for the development of 3-D environments and experiences.

To integrate the virtual elements with the real world around the mobile phone, it uses some key characteristics:

1.   Motion tracking

2.   Light estimation

3.   Environment understanding

SCENEFORM

ARCore can't be considered as SDK because it doesn't directly develop AR experiences, instead it can be considered as an engine which helps SDK's in rendering the objects. To use this capability of ARCore, Google launched the Sceneform SDK so that the developers could use this functionality to develop AR enabled applications. It carries many features which includes an automatic mandatory compatibility check, camera permissions from the user, an API to tackle all the complexities and plugin for the manipulation of 3-D assets.

SKETCHUP

Sketchup is an application for 3-D display that uses the push and pull strategy for the alteration and construction of 2-D and 3-D models. In this, one can simply click on an object and pull it until the required size and structure of the object is obtained. It has 3 different forms i.e. Sketchup Make, Sketchup Pro and Sketchup Free.

PICASSO

Picasso is a famous library which is used in android. It is an image library. It is demandable and utilized because it is a very practical and simple library. The maintenance of Picasso is done by SQUARE. For android projects it's great for image loading and transformation. Image loading with Picasso is very simple. For loading of image Picasso class is used and the URL of the image which is to be loaded is pasted inside the class. Some other support from Picasso are decoding, fetching and display of images. A user can plug in to any stack of a network by the use of a compatible API that is provided by Picasso.

ADOBE XD

ADOBE XD is a software freely available in the market by ADOBE. It is utilized for the design phase of any application or website. In the Software development life cycle (SDLC), while creating the design before the implementation. Its key features include consoling of different routes which includes resizing of objects, permits to oversee segments inside a feature and presence of configuration that utilizes voice model.

FIREBASE

A web application development platform which was initially launched by FIREBASE, later it was acquired by GOOGLE. It provides the facility of data synchronization among the developers by providing an API so that data could be easily stored in the firebase database. Also, it offers several compatible libraries which can be easily integrated with JAVA, SWIFT, JAVASCRIPT and ANDROID platforms. The clients can effortlessly make their data secure amidst using the real-time database by utilizing the server-side security policies and rules. One can rely on firebase for secure uploads of files and downloads. The accessibility of databases can also be done through an API which uses the server-sent protocol and is coined as REST API.

Literature Review

Augmented Reality has come a long way from a science-fiction reality to a science-based reality. Until recently the costs of augmented reality had been so sizable that designers could simply dream of working on layout initiatives that worried them – nowadays things have changed and augmented truth is even available on the mobile handset. That means design for augmented reality is now an option for all shapes and sizes of UX designers.

After the usage of several applications to buy furniture online. We analyzed the one of a kind prospects of those apps like their advantages, disadvantages (if any), and upgrades which may be made to make the user experience better. After going via those apps and going through a few user evaluations we got to work upon this paper.

Through the improvement of this software we have completed more and take a look at augmented reality and virtual reality.

ANCHORINGVIRTUAL IMAGES TO REAL WORLD SURFACES IN AUGMENTED REALITY SYSTEMS.(By Giuliano Maciocci, Duxford; Andrew J. Everitt, Milton; Paul Mabbutt, Werrington ; David T. Berry, Impington).

A head installed device gives an immersive virtual or augmented reality experience for viewing information and permitting collaboration among multiple users. Rendering images in a virtual or augmented reality device may include shooting an photo and spatial records with a frame installed camera and sensor array, receiving an input indicating a first anchor floor, calculating parameters with admire to the frame installed virtual camera and showing a virtual item such that the virtual item appears anchored to the chosen first anchor floor. Further operations may include receiving a second input indicating a 2nd anchor floor within the captured image that is one-of-a-kind from the primary anchor floor, calculating parameters with admire to the second anchor surface and showing the virtual object such that the virtual item appears anchored to the selected 2d anchor surface and moved from the primary anchor surface.

SYSTEM AND METHOD FOR AUGMENTED REALITY GAMING.(By Martin S. Lyons, Henderson,Roderick Ang, Brett Jackson, Henderson,; Joseph Randy Hedrick, Reno)

Disclosed is a method for permitting an augmented reality interaction system and a mobile device to overlay a virtual 3D component over a physical 3D thing with which the virtual 3D components interact. The method includes: enabling a consumer to seize a live digicam image of a machine cabinet through a camera at the mobile device; producing a digital rendering of the cabinet; determining digital 3D components to be displayed over an image of a virtual machine cabinet; comparing a digital depth rendering of the digital 3D components to a digital intensity rendering of the digital gaming gadget cabinet; and overlaying digital 3D additives without the subtracted factors onto a live camera image of the digital machine cabinet on a show of the mobile device.

1.A method of permitting an augmented reality interaction gadget and a mobile device to overlay a digital 3D factor over a bodily 3D component with which the virtual 3D component interacts, the method comprising: controlling a digital camera at the mobile device the use of the augmented reality interaction gadget; allowing a person to capture a live digital camera photo of a machine cabinet thru the camera; producing a virtual rendering of the machine cabinet; determining virtual 3D additives to be displayed over an picture of a digital machine cabinet, in which the digital 3D components consist of a plurality of elements every having a depth value and the virtual gaming gadget cabinet includes a plurality of elements each having a intensity fee; comparing a virtual depth rendering of the virtual 3D components to a digital depth rendering of the virtual machine cabinet; in reaction to the comparison, subtracting the elements of the digital 3D components which have a decrease depth fee than elements of the virtual gaming gadget cabinet at corresponding spatial positions; and overlaying virtual 3D components without the subtracted elements onto a live digital camera picture of the digital machine cabinet on a display of the mobile device.

2. The method of claim 1, further comprising: using a depth buffer to determine which elements of a 3D rendering are visible to a virtual camera.

3. The method of claim 2, similarly comprising: determining the z-fee of every component is compared against an present depth buffer z-cost at the equal display coordinate, wherein if the present z-cost is greater, the pixel is drawn, and wherein if the prevailing z-price is much less than an present intensity buffer z-fee at the same display coordinate, then the pixel is discarded.

4. The method of claim 1, further comprising: combining the camera video image with the rendering of the additional virtual 3D component minus the virtual machine cabinet.

5. The method of claim 1, wherein the virtual rendering of the machine cabinet is a virtual depth-only rendering of the machine cabinet.

6. The method of claim 1, wherein virtual rendering of the gaming machine cabinet extracts 2D information from the display of the gaming machine to produce a 3D image of the gaming machine.

7. The method of claim 1, further comprising: overlaying virtual graphics in a position within 3D space on a display of the mobile device that augments the display of the gaming machine with 3D to create complex augmented reality.

8. The method of claim 1, wherein an object recognition system of the augmented reality gaming assistance component establishes a communication channel between the augmented reality component and the gaming machine enabling additional elements of the game to be augmented on the mobile device, and elements of the game content to be influenced by the augmented state.
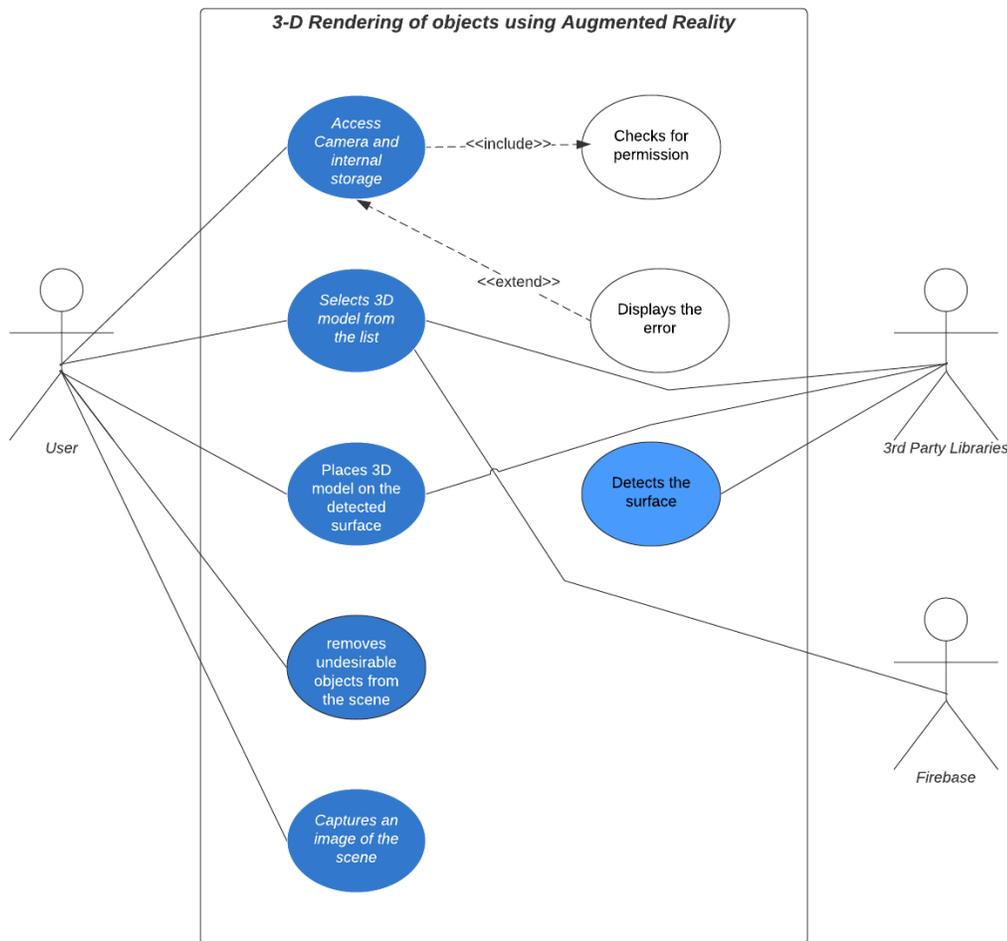
9. The method of claim 1, wherein the augmented reality translation system of the augmented reality assistance component extracts a first language from the display of the gaming machine and translates the first language into a second language that is visible to the user in place of the first language.

Working Methodology

Firstly the application asks the user for camera and storage permissions, after allowing them the camera opens. Now the user has to simply point towards a flat surface(important) and then an indicator appears telling the user to move the phone in order to detect the surface. The surface is detected with the help of **AR Core**, It is a platform to create **Augmented Reality applications on Android and IOS**. The application consists of several 3D objects which can be placed on the surface detected, their images are stored in Firebase storage and rendered through **Picasso** which is an image downloading or image caching library. The 3D Furniture objects are downloaded from google **3D Warehouse** and then converted in an **.fbx** file using **Google Sketchup.**

The 3D object files are imported into the application with the help of **Google Sceneform plugin**. **Sceneform** provides the high level **API** for rendering 3D models using Java. This helps in making the **AR creation** experiences easier. The user then selects a 3D object from the list and then places it on the surface detected. It is possible to place multiple objects at a particular point of time. The 3D object can be resized, rotated and moved from one point to another in the space detected. The user can also remove the undesirable objects from the scene in a "**Last in First** out" fashion.

The application has a functionality which lets the user to capture the image of the current scene which gets saved in the user's internal phone storage. In simple words, the user selects the 3D furniture items placed on the surface detected(a vacant room) , resizes or rotates them accordingly and takes a snap of the scene which gets into the phone's storage.

Working Model

Fig 1.0

Discussion of Result

We were able to detect a flat surface on which multiple 3D objects can be placed. We created a list of 3D objects which were downloaded from Google warehouse and imported it into our android application using Scene form. After placing the objects on the detected surface, the 3D objects can be rotated, resized and can be moved from one point to another in the detected scene. We were able to remove the unwanted objects from the scene and most importantly we added the functionality of taking a snap of the current scene and saving it to our phone's internal storage

Presentation of Results and their analysis

Image 1 shows detection of flat surface by the application

Image 2 shows the placement of 3D objects in the surface detected

Image 3 shows that multiple objects can be placed in the scene

Conclusion

We have observed that people are busy and do not have time to visit stores for shopping. Seeing this change many entrepreneurs have come up with new age shopping experiences. We now can order everything online be it grocery, electronic items, fashion items and even food from restaurants. Recently some new entrants offering facilities to buy furniture online also came up. They really solved a problem but still some people could not rely on it as the image did not give them the idea of how the furniture will fit in their home or will the color combination go well with the current room setting. Our app will solve these problems up to an extent and help users make better choices while shopping for furniture online.

Acknowledgement

References

1　S. Boivin and A. Gagalowicz. Image-based rendering for industrial applications. ERCIM News, 2001.

2　R. Azuma. Tracking requirements for augmented reality. Communications of the ACM, 36(7):50-51, 1993.

3　R. Azuma et al. Recent advances in augmented reality. IEEE Computer Graphics and Applications, 20-38, 2001.

4　K. Ahlers and A. Kramer. Distributed augmented reality for collaborative design applications. European Computer Industry Research Center, 3-14, 1995.

5　https://www.instructables.com/id/How-To-Create-An-Android-App-With-Android-Studio/

6.https://medium.com/mindorks/what-is-arcore-by-all-you-need-to-know-to-get-started-b3715734cdd3

7   https://developers.google.com/ar/develop/java/sceneform

8   https://towardsdatascience.com/fundamentals-of-augmented-reality-ar-89ce986f70f8

9 https://www.interaction-design.org/literature/article/augmented-reality-the-past-the-present-and-the-future

10 https://developers.google.com/ar/discover/concept

11   https://experiments.withgoogle.com/ar

12 https://www.howtogeek.com/364232/what-is-sketchup/

13 https://3dwarehouse.sketchup.com/

14 https://uxdesign.cc/building-the-perfect-splash-screen-46e080395f06