Project Title: AUGMENTED REALITY

Course: COMPUTER VISION

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Abstract

In this project we create a augmented reality app using Easy Ar library and unity 3D platform, The purpose of this project is to study about augmented reality methods and practical representation of AR based 3D object in to real world environment

Introduction Definition & scope

Whereas virtual reality (VR) places a user inside a completely computer-generated environment, augmented reality (AR) aims to present information that is directly registered to the physical environment. AR goes beyond mobile computing in that it bridges the gap between virtual world and real world, both spatially and cognitively. With AR, the digital information appears to become part of the real world, at least in the user's perception. The most widely accepted definition of AR was proposed by Azuma in his 1997 survey paper. According to Azuma [1997], AR must have the following three characteristics:

- Combine Real and virtual
- Interactive in real time
- Registered in 3D

This definition does not require a specific output device, such as a head-mounted display (HMD), nor does it limit AR to visual media. Audio, haptics, and even olfactory or gustatory AR are included in its scope, even though they may be difficult to realize. Note that the definition does require real-time control and spatial registration, meaning precise real-time alignment of corresponding virtual and real information. This mandate implies that the user of an AR display can at least exercise some sort of interactive viewpoint control, and the computer-generated augmentations in the display will remain registered to the referenced objects in the environment

Augmented Reality Feedback loop

AR uses a feedback loop between human user and computer system. The user observes the AR display and controls the viewpoint. The system tracks the user's viewpoint, registers the pose in the real world with the virtual content, and presents situated visualizations

What is augmented reality can do in real life?

AR for navigation

The **Gatwick airport passenger app** just won a number of awards for its creative use of AR technology. With the help of more than 2,000 beacons throughout its two terminals, passengers can use the AR maps from their mobile phone to navigate through the airport. As the app matures, it might eventually help improve traffic flow in the airport. [3]

AR for healthcare

There are some incredibly exciting applications for augmented reality in healthcare from allowing medical students to train in AR environments to telemedicine options that enable medical professionals to interact with patients. In critical situations, augmented reality applications can deliver real-time information to the treatment area to support diagnosis, surgery and treatment plans. **AccuVein** is a handheld device that can scan the vein network of a patient that leads to a 45% reduction in escalations Surgeons can plan procedures before making the first cut, models can be made of tumors, and AR diagnostic tools can model disease conditions. Deloitte Research asserts that AR will disrupt the business model and operations of healthcare.

AR for Industry and construction and remodel

Ikea Place, Dulux Visualizer, and Lowe's help **remodel**

For those who have purchased furniture and discovered once it was delivered it did not work in the space, the Ikea Place app will help you avoid that predicament in the future. The app was built using Apple's ARKit technology, and it allows you to scan your room and design the space by placing Ikea objects in the digital image of your room to create a new environment with the new products.

The Dulux Visualiser helps you try out a shade of paint for your room before you buy. Just use your smartphone camera to scan your room and virtually paint it with any color of the rainbow.

Home improvement store Lowe's has Measured by Lowe's, a virtual tape measure that can be used inside and out, and Envisioned by the Mine (Owned by Lowe's) which allows you to place 3D images of furnishings and accessories into your home or commercial space.[3]

Industrial facilities are becoming increasingly complex, which profoundly affects their planning and operation. Architectural structures, infrastructure, and machines are planned using computer-aided design (CAD) software, but typically many alterations are made during actual construction and installation. These alterations usually do not find their way back into the CAD models. In addition, there may be a large body of legacy structures predating the introduction of CAD for planning as well as the need for frequent changes of the installations— for example, when a factory is adapted for the manufacturing of a new product. Planners would like to compare the "as planned" to the "as is" state of a facility and identify any critical deviations. They would also like to obtain a current model of the facility, which can be used for planning, refurbishing or logistics procedures. Traditionally, this is done with 3D scanners and off-site data integration and comparison. This process is lengthy and tedious, however, and it results in low-level models consisting of point clouds. AR offers the opportunity to perform on-site inspection, bringing the CAD model to the facility rather than the reverse. Georgel et al. [2007], for example, have developed a technique for still-frame AR that extracts the camera pose from perspective cues in a single image and overlays registered, transparently rendered CAD models

Maintenance & Training

Understanding how things work, and learning how to assemble, disassemble, or repair them, is an important challenge in many professions. Maintenance engineers often devote a large amount of time to studying manuals and documentation, since it is often impossible to memorize all procedures in detail. AR, however, can present instructions directly superimposed in the field of view of the worker. This can provide more effective training, but, more importantly, allows personnel with less training to correctly perform the work.

AR for fun and GAME

Rather than increase sales, sometimes AR is just created for fun or to engage with customers such as the Bic DrawyBook app or teeth brushing games from Georgia-Pacific's Dixie brand.

From gaming to construction to AR in browsers that provide detail for what the camera displays, augmented reality apps are being developed at a rapid pace to enhance many industries. As additional ideas get developed, we can expect augmented reality applications to touch many more aspects of our lives.

Augmented reality Methodologies

There are 3 common methodologies in augmented reality which are given below:

1 Marker based augmented reality (our project made with marker base)

2 Marker-less augmented reality Marker Based Augmented reality;

3 Location base

Marker based augmented reality works on targeted image which is pre stored in AR machine when user scan targeted image using their smart mobile and augmented reality app the mobile scan will trigger the 3d object on the top of the marker

Figure 1 marker base AR

Marker-less Augmented reality Marker less augmented reality is used to denote an AR application which does not need prior knowledge of user environment to display 3d object in real environment. Its use surface tracking to overlay 3d object. When user scan surface by using ar application its start tracking and after tracking environment its display 3d object in to particular surface

Figure 2 marker less and location AR

Location AR

Location based AR: the virtual world is in a physical space

Location based AR ties augmented reality content to a specific location. Imagine walking in a city street you're not familiar with and through your phone's camera seeing a virtual road sign displaying the street name, this is location-based AR. And exactly what our AR City app provides, it also allows you to navigate to your destination with directions displayed right on top of the physical roads in front of you. You might also be familiar with a simpler example of location-based AR -- Pokemon Go.

Placing virtual objects anchored to the real world is useful for a wide variety of applications, from walking directions to place labels, treasure hunts or even virtual tourist guides and local information. You can place virtual objects right on top of the physical space for example a city street, an indoor shopping centre or an airport. But to make sure the digital AR content appears in exactly the right place, your device must accurately figure out its location. The AR City app relies on a combination of GPS, the compass sensor on your phone, and Blippar's own computer vision system called Urban Visual Positioning, to place virtual objects at the right location.

We have also just launched our Indoor Visual Positioning System this allows for AR content to be triggered from a precise *indoor* location -- a specific shelf in a supermarket for example or directions to your airport gate.

Witch program use for create this app?

-Unity

-Vuforia

-java jkd

-java jre need to install file JRE before JKD

Problem and Solutions

Problem 1: Difficulty Activating Unity Key for New Project - Unable to Add Vuforia Package in Unity.

Solution 1: It is crucial when working with Unity and AR camera to successfully integrate the Vuforia package into the project's build settings. In cases where direct integration is challenging, consider an alternative approach by installing the package from the GitHub repository within the Windows package settings. Here are the steps to follow:

- Open the Package Manager window.
- Click the "Add+" icon.
- Select "Add package from git URL..." from the options.

Add the git URL directly from the Package Manger window by clicking the Add+ icon and selecting *Add package from git URL...*:

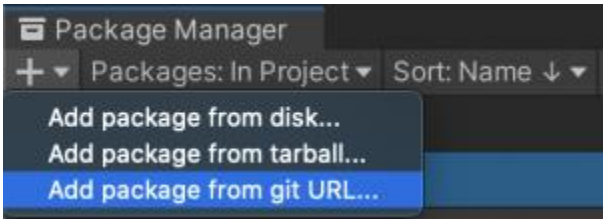

Figure 3 package manager tool

1. Insert the git URL with the desired version tag and press **Add**.

```
git+https://git-packages.developer.vuforia.com#9.8.8    copy code
```

Problem 2: Inability to Upload the App to an Android Device via USB.

Solution 2: Despite multiple unsuccessful attempts with USB data transfer, an effective workaround is to send the application to yourself via email. Follow these steps:

- Email the app to your own email address.
- Access your email on your cellphone.
- Download the attached app.
- Ensure you grant the necessary authorization to install and run the app.

Steps and procedures involved in this project:

1. Initiate the project by creating a 3D Unity project using Unity software.

2. Register for an Easy AR library account and obtain the Easy AR package designed for 3D Unity software.

3. Proceed to install the downloaded Easy AR package into the Unity project.

4. Generate a new license key within the Easy AR account and seamlessly integrate this license key into the Unity project.

5. Employ the web-based application Tinkercad for the creation of a 3D model.

6. Configure the system environment in accordance with Unity 3D requirements, which involves:

- Downloading and installing Java JDK, then declaring the appropriate path within Unity software.
- Downloading and installing Android SDK, followed by the declaration of its path within Unity software.
- Downloading and installing Android NDK, and similarly declaring the path within Unity software.

7. Install the 3D model package into Unity software.

8. Utilize the AR surface tracing library to fine-tune the positioning of the 3D model.

9. Save the project and rename it accordingly.

10. Conclude the project by building the Android application.

Project Results

Figure 4 AR with Marker base

Video presentation

https://drive.google.com/file/d/1haNAMtt5j8DqiuXmCwZqGLpxgv8H_UK8/view?usp=sharing

you can **DownloadAR APP click link below [android platfrom]**

https://drive.google.com/file/d/1oN7cu--BMg6rERK4rXdCL_-YgQ-jLIoc/view?usp=sharing

Reference

[1]https://www.youtube.com/watch?v=AT0bBTrHYro

[2]https://www.youtube.com/watch?v=cCOLdX1JMo4&t=2447s

[3] https://www.bernardmarr.com/default.asp?contentID=1540

[4] https://www.hackster.io/augmented-reality/projects

[5] https://pokeassistant.com/main/index?locale=en