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Marker Based Augmented Reality using Vuforia and Unity

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Abstract: Augmented reality is an enhanced version of the physical world that uses digital elements, audio, or various stimuli using technology. Augmented reality can be used to bring static/2D images to life i.e., convert 2D into 3D animation. Using an application that uses AR could animate images making it easy to understand concepts and visualize objects efficiently. It gives people a real-world hands-on experience and information in one's field of vision. People simply learn better when they are allowed to experience the subject matter in a simulation, rather than having to imagine it. The solution is an application that takes images as an input and simulates a 3D model that can be visualized with the help of our web camera.

Keywords **- Marker Based Augmented Reality, Unity, Vuforia, 2D-3D Transformation**

I. INTRODUCTION

Augmented Reality is an upcoming technology that involves the superposition of computer graphics on to the real world. AR is a part of a more general context called Mixed Reality, that talks about a multiple spectrum of areas that covers Virtual Reality, Augmented Reality, and telepresence. Virtual Reality includes computer generated 3D environments that allow interaction of the users with curated environments. The users are now part of the curated environment and interact with computers artificial world which is a simulation or a reality. The fundamental purpose of Augmented Reality is to upgrade sensory-motor facilities and problem-solving abilities in a remote environment. Telepresence is defined as a human or machine system in which the human knows sufficient information about environment, such that the user feels physically present at the simulated environment. Virtual reality is the achievement of the illusion of the physical presence of an operator inside a computer simulation. Telepresence aims to achieve the impression of the physical presence of an operator at a remote location. Augmented reality is a view of the physical and real-world environment whose elements are simulated by computer-based real- world sensory inputs such as sound, video or graphics.

II. RELATED WORK

AR technology is the perfect combination of things in the virtual world, the real environment around it and the real-time synchronization between the virtual world and the real world. In the visualization of augmented reality, the use of helmet mounted display allows the user to view the real world with multiple synthesis in computer graphics. Augmented reality includes multimedia, three-dimensional modelling, real-time video display and control, multi-sensor fusion, real-time tracking and registration, fusion, etc. AR system has three prominent characteristics: (1) the integration of real world and virtual world of information; (2) real-time interaction; (3) location of virtual object in the three-dimensional space. Unity3D provides easy-to-use interface operation, and provides the function of online multiplayer. Vuforia Engine is a widely used platform for AR development that involves various fields like marker based, game views etc.The main aim of Augmented Reality is featuring detection in the image. Image identification and recognition algorithm uses features like texture and color to remove the obstructions and distinguish the target from the image. It makes use of two categories of characteristics that are global and local features. Global features include: comparing images with the atlas inosculation template library and using a statistical classification technique. Global method is used for illumination and zooming. The local feature descriptor is using of objects' local feature such as distinguishable edges to describe. The local features include: identifying and mapping the characteristics of the image feature set to the template image set. This process is called matching. Error matching can be avoided by effective strategies. SIFT and SURF as described by the local feature descriptors reduce the amount of data that can be a very good solve to the problem of shade and so on. They have become by far the most common and most popular image recognition algorithm. In order to meet their different needs, at present there are many improvements based on these two operators. In order to correctly superimpose the virtual scene with the real scene, the system needs to know where the user is and what the user is looking at. The location and orientation ofthe camera are to be determined. The system should be able to render virtual objects in the stimulated space with the help of the camera. Tracking or calculating the relative pose, location and orientation of a camera is to be done in real time. Marker-based systems are easy to implement and well-known marker-based toolkits are readily available

III. Methodology

The solution is an application that takes images as an input and simulates a 3D model that can be visualize with the help of our phone camera. In Marker-Based Tracking, markers are images or objects registered with the application which act as information triggers. When the device's camera recognizes these markers in the real world while running an AR application, this triggers the display of virtual content over the position of the marker in the camera view. The steps involved are the following:

- Obtain the image of the camera
- Marker identification
- Position and direction detection of Marker
- Superposition the virtual scene with the real scenein a single sentence, from students who posted their views in online discussion forums.

3.1 *Image Acquisition*

The Vuforia platform provides both local identification and cloud identification. This method first identifies that an image has been placed in the view of the AR camera and then processes the identification image. The processing of the image includes matching of the local data. It then finally returns the matching result. The AR Camera object of the Vuforia SDK gets the image and converts the image captured by the camera from rendering format to the tracking format required by subsequent Image detection and matching and tracking module through Image Converter. The Trackable base class is used to identify objects in the real world that the Vuforia SDK can capture in three dimensions.

3.2 *Marker Identification and Image Matching*

Marker is a kind of 2D matrix code, which is usually used in image recognition technology, and image symbol recognition is carried out by a special template matching algorithm. Firstly, the system saves the information of the Marker image and calculates the position of the virtual object in the camera according to the information. Then the processor uses the image recognition technology to identify the Market image in the current image, and finally matches the virtual object with the real scene.

3.3 *Superposition of the Virtual and Real Scene*

After Marker identification and processing, setting the location of the virtual model, and combining the real world and the virtual model is to be done to present to the user. The process of virtual and real combination involves three aspects: 3D registration, object posture and light stripe. 3D registration is the registration of virtual graphics in real scene by tracking camera attitude in real time. The pose information of virtual object is completed in the phase of feature matching of virtual object model by comparing the similarity of real object image features and virtual model features. The system has an impression of the pose of the camera by taking down observations as a part of Visual Tracking. If the environment is not standard, then pose detection becomes a problem and therefore this is not ideal. The system hence selects the orientation of the coordinate axis randomly so that the superposition should work using any orientation Adding an easily detectable predefined sign in the environment would help overcome this problem. A marker is therefore a better way to detect images from a video image using image processing, pattern recognition and computer vision techniques. This is called marker-based tracking. A good marker is easily and reliably detectable. Differences in luminance are more easily detected than differences in chrominance using machine vision techniques. This is due to the poor automatic white balance of the cameras: the colours register incorrectly, and an object may change its colour in the image depending on what else is in the view, for example. Furthermore, the lighting changes the perceived colours of the objects and therefore colour detection is challenging. Naturally, the more contrast in the luminance the more easily objects are detected. In this sense, black and white markers are optimal. The superposition of the Virtual Scene and the Real Scene is shown in Fig 3.1

Fig 3.1 Superposition of the virtual and real scene using a 2D marker

IV. WORK FLOW

- Import
- Create
- Build
- Distribute
- Load

The workflow is discussed in detail below:

First and fore most the Vuforia Engine is to be added to the Unity Project. Importing a package allows one to let a script make the necessary changes in your Unity Project. The Vuforia Engine must then be setup in the Game Object Menu which is visible if all the imports are done properly. For the actual conversion of a 2D image into a 3D animation, the AR Camera is to be used. Hence select the AR camera and Open Vuforia Configuration from the Inspector. The Game View is a representative of how the final view of your rendered animation would look like. Unity's play mode supports various types of Targets from Vuforia. Unity has a Play, Pause and Stop button to interact with the rendered 3D animations. Vuforia is used here to create a database and import the assets and targets into this database. Vuforia has a feature that gives ratings for the targets that have been uploaded based on how clearly it is able to detect lines using Line Detection Algorithm. This is the method that is used for feature extraction from the uploaded 2D image. If there is no clearly defined lines or if the brightness of the target is low, Vuforia attaches a low rating to the asset which explains that the target may not be well received by the Unity Platform. An example of a high rated marker is shown in Fig 4.1 and the detection of the lines using the Line Detection Algorithm is shown in Fig 4.2.

Fig 4.1 2D Aeroplane Asset/Target

Fig 4.2 Feature Detection using Line Detection Algorithm of a 2D Aeroplane Asset/Target.

After activating Vuforia Engine in Unity, features are to be added from the Vuforia Engine menu to the project. A scene is to be set up in Vuforia to be able to view the 3D animations. To see a scene in action the Vuforia Engine Play Mode in the Game View using the Play Button. Evaluation and a rapid prototype of the scene can be viewed without deployment. A webcam, simulator mode, or recording mode is used to test Vuforia targets. The 2-D marker can be viewed in 3-D form as an animation, video, audio or even text. Whileviewing – running, jumping, walking, turning, rotating the 3-D animation can be done. For every movement of the animation, an individual C# script is to be written.

V. RESULTS

The Marker Based Augmented Reality using Vuforia and Unity is demonstrated using four different image targets – Barbarian, Diaphragm, Sun, and a house. Each of these targets are used to demonstrate the various way we can show the 3D animation. Some of the use cases of the 3D animations are – audio, video, text, animation. Fig 5.1-5.8 demonstrates various image targets and their respective animations.

Fig 5.1 2D Image Target of a Barbarian Character

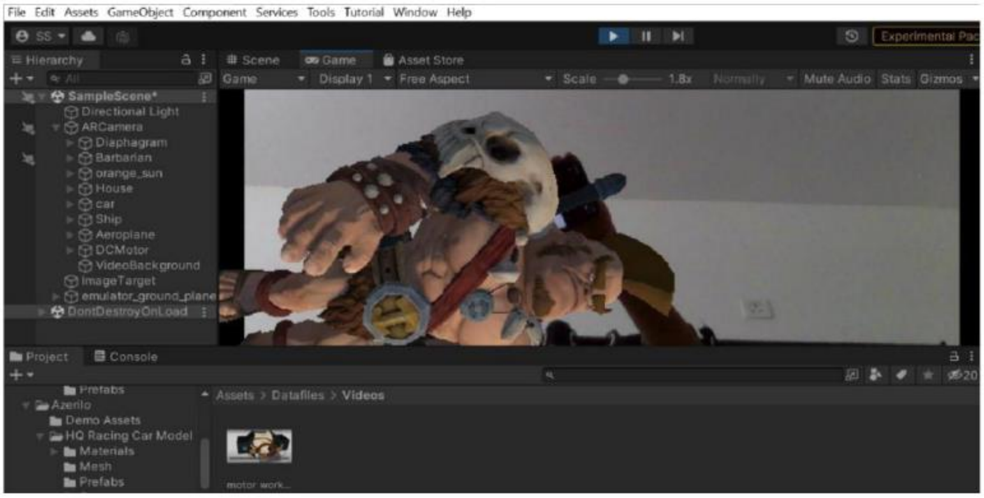

Fig 5.2 3D Animation of a Barbarian with movement

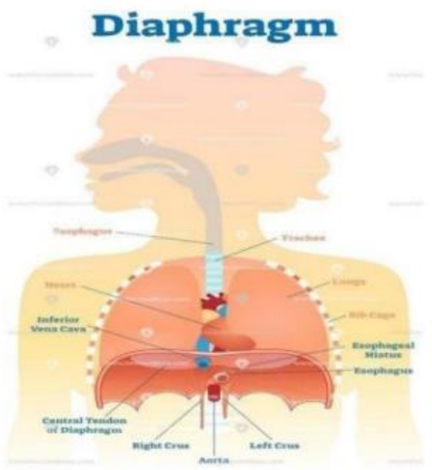

Fig 5.3 2D Image Target of a Diaphragm

Fig 5.4 3D Animation of Diaphragm with Text

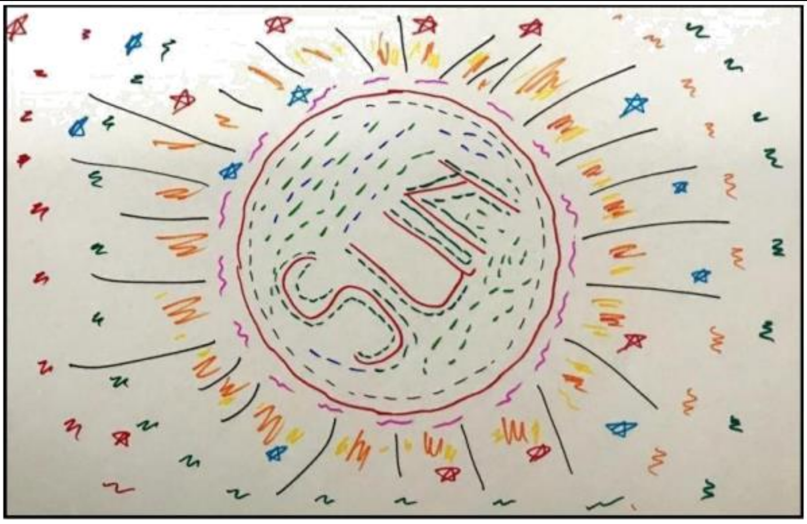

Fig 5.4 3D Animation of Diaphragm with Text

Fig 5.6 3D Animation of the Sun using a Smoky effect

Fig 5.7 2D Image Target of a House, Tree and Ground

Fig 5.8 3D Animation of a House, Tree and Ground using individual C# Scripts

VI. CONCLUSION

The existing AR mode requires users to align a model every time. Marker-based AR using Unity allows users to create a marker in the 3D model that can be scanned with a mobile device for instant model loading in the real world. Unity provides various powerful tools that allows one to have an engaging real-world experience using Augmented Reality. This way is easy to use and understand and makes interaction with images more interesting. The future will be heavily dependent on Augmented and Virtual Reality in all the different sectors. Hence, making Augmented Reality more accessible to every person is important.

REFERENCES

[1] ChangYuan Li and BaiHui Tang 2019 J. Phys.: Conf. Ser. 1168 032045, Research on The Application of AR Technology Based on Unity3D in Education.

[2] Lebo NiPeng Qi, Lina Yu and Wang Jing, "Research and Application of the Virtual Display Technology based on Unity 3D Products", Digital technology and application, vol. 09, pp. 54-55, 2010.

[3] Siltanen, Sanni. 2012. Theory and applications of marker-based augmented reality.

[4] Tigala Maijarern et al., "Augmented Reality for Science Instructional Media in Primary School", 2018 International Conference on Digital Arts Media and Technology (ICDAMT), pp. 198-201.

[5] Xingjie Wang and Chunhua Li, "3D Virtual City Research and Application Based on Unity3D Platform", Computer technology and development, vol. 2013, no. 23, pp. 241-244, 2013