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3D Object Tracking And Manipulation In Augmented Reality.

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Abstract - *Augmented Reality (AR) is a technology which combines virtual objects and real-world environments. Technologies like Computer Vision and Object Recognition can be used with AR to create an interactive and enhanced user experience of the real world. We plan to use AR to leverage the increased computing power of smart-phones to build a system that displays 3D objects using a printed image without using any complicated equipment. The purpose of this system is to accelerate learning and understanding of concepts such as structures or mechanisms. Instead of reading long manuals, the user can watch and interact with a 3D video manual through AR. The average person learns better by observing and listening something than by simply reading something. We will be using this specific property of the human mind to accelerate learning.*

***Key Words*: Augmented Reality, Unity Graphics Engine, Fiducial Marker, Camera, Vuforia, Pattern Matching, Image Targets, Mobile, Computer Vision.**

1. INTRODUCTION

Augemented Reality(AR) combines virtual world objects with real environments. Over years, augmented reality has been used in many domains for a multitude of purposes. In most fields, AR is used as an assistive system for performing human tasks. AR has proven to be useful in increasing the efficiency and accuracy of the tasks especially in the domains related to surgery and aeroplane manufacturing. In case of surgery, it can be used as a tool to render 3D models of the patients operated area / organ that can help doctors perform surgeries with minimum risk and complications. In aeroplane manufacturing, AR can be used as a tool to assist wiring the electrical harness of a plane which is a long and tedious task and is still done manually.[4]

The 'Black-board' system of education is still used in many countries around the globe. Although this is a traditional system, it is not efficient for learning. However if AR is used in classrooms as a tool to teach, it accelerates learning because it is an audio-visual method of learning. It is a property of the human brain to absorb audio visual information more than textual information. AR in classrooms takes advantage of this property and accelerates learning.[3]

2. Related Work

[1] In augmented reality (AR) various types of 3D object are displayed in the real world. Head-mounted displays and goggles are some examples of AR They had limitations such as high processing cost, due to which they were only used in limited fields. Due to the rapid advancement and ubiquity of smartphone technology, AR is now available to a far bigger audience. Vuforia is an SDK that makes AR applications easier by handling the detection and tracking of image targets or fiducial markers. Rajawali is a graphics API for Android based on OpenGL-ES 2.0-3.0. that is used for rendering hardware accelerated 3D graphics. In this paper, Vuforia and Rajawali were used to create a proof of concept AR application. This application was used and tested on an Android smartphone.

[2] In this paper, the effects and responses of using AR on pre-school/kindergarten children were observed and recorded. Flashcards with pictures of animals were created. An application displays the corresponding animal over the flashcard when viewed by the camera of a handheld device. The application also allows simulation and interaction with 3D virtual animals. These cards contained static images of animals which started to move when seen through the camera on the device. This showed a great result as children were responding to gadgets and to the AR. These AR flashcards can be implemented in classrooms at a low cost. They conclude that AR technology is an effective foundation to use as an educational tool.

[3] In this paper, the changes in cultural shifts of students were compared and it was observed that young students are inclined towards video games. The paper also showed that there is a severe drop in the interest of students in the conventional education system. They also found out students specifically are drawn towards Multi-User Virtual Environments(MUVE). MUVEs are seen in chatrooms or multiplayer games where students interacted with a virtual representation of their peers on the internet. So they designed an app based on augmented reality and MUVEs to survey the response of students. The response was overwhelming and students were engrossed in it to the point of forgetting about the real physical world. This paper suggests using Augmented-Reality based environments that are integrated into the education system. The traditional K12 system is very rigid and unable to keep up with the cultural

shifts. Due to this, there has been cases of inefficiency and failure. The researchers observed that their AR based application fostered more collaboration in the students and efficiency due to their experience with technology. They suggest integrating these kind of experiences into the education system.

3. PROPOSED SYSTEM

The proposed system aims at creating high quality 3D video manuals using AR. Fiducial markers (ImageTargets) are tracked using a camera and the 3D models are mapped to the marker. These 3D models are representations of a product or concept that the user can see on his screen. The user can interact with these 3D models and observe the animations to understand the mechanisms, workings and details of a certain product or concept.

4. PROPOSED METHOD

We are planning to use the following components for developing an application that can run on smartphones as well as desktop clients. It will have the following components.

1. Smartphone/Computer
2. Unity
3. Vuforia
4. Server

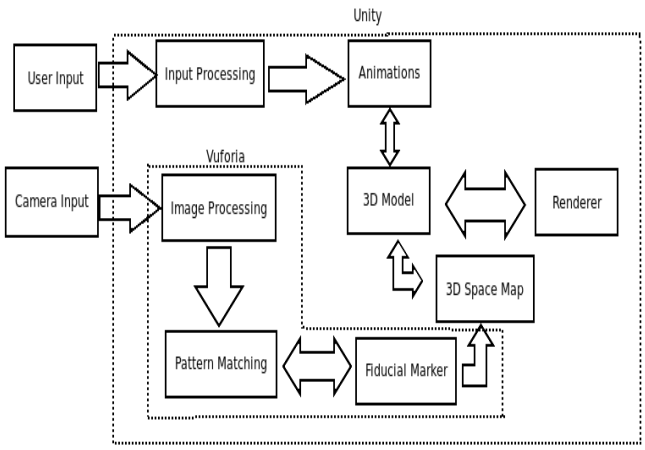

Fig.1 System architecture

4.1 Unity

Unity is a graphics and physics engine that is used to build scale-able applications that can be built for multiple platforms with the same codebase. Supported platforms include Linux-x86/x86-64, Mac-x86/x86-64, Windows-x86/x86-64, iOS, Android and WebGL . Unity also allows the user to select a graphics API of their choice (DirectX 9, Direct X11, Direct X12, Vulkan, OpenGL, Metal, OpenGL ES 2.0, OpenGL ES 3.0, WebGL 1.0, WebGL 2.0). Unity uses C# for internal scripts and logic.

4.2 Vuforia

Vuforia is an SDK that provides detection and tracking of image targets by using feature detection. A feature is any point in an image that is on the edge of multiple coloured sections. A coloured cube has 4 feature points. It was available as a plug-in for Unity and has been integrated into the engine with the release of Unity version 2017.2.

Fig.2 Sample Image Target

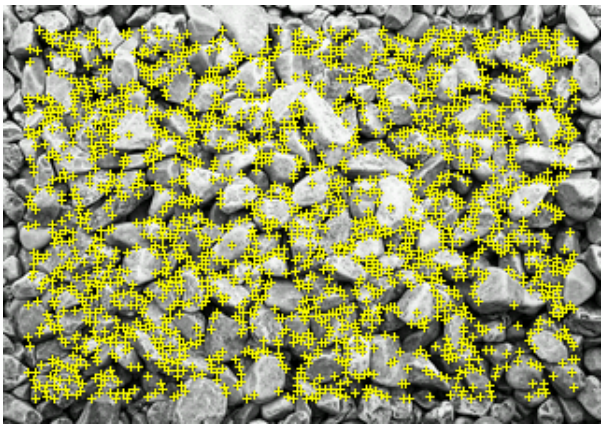

Fig.3 Features of Sample Image Target

5. CONCLUSIONS

We will develop a system, that will be use AR technology to improve learning and understanding of a product for electronics products consumers. In teaching, our system will help teachers to explain concepts to students effectively and enhance their learning. In the manufacturing sector this product will help workers understand a manufacturing process and assist them in doing so. Our system aims at helping and developing better training systems, 3D user manuals and interactive courseware materials that will aid efficient learning and training for people

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