IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Interactive AR Based Learning Using Chroma Key Technique

[1]Vignesh K, [2]Jayasri R, [3]Mala T

[1]M. Tech (spcln. In Multimedia), [2]M. Tech (IT), [3]Associate Professor

1 [1]Department of IST

2 [1]Anna University – CEG, Chennai, India

Abstract: The combination of Augmented Reality with Chroma Key makes the learners more interesting in learning as the learners do not get diverted due to visualization. The learners can visualize with interacting experience using 3D models and also the objects can be rotated. Automobile technology involved in AR allows for designing three-dimensional computer graphics and 3D modelling which is the process of developing a mathematical representation of any surface in an object through specialized software. There are many modelling tools available for AR designing. Augmented Reality is an interactive computer-generated experience taking place within a simulated environment, that incorporates mainly visual and audio. It is a high-end user interface that involves real time interaction and simulation. AR growing market presents an opportunity and an alternative channel for online classes and interactive environment classes inside a room.

Keywords: Augmented Reality. 3D Modelling. Automobile Technology. Computer-generated.

I. Introduction

Augmented Reality has become a necessity in most of the fields nowadays like television, teaching, military, etc., This term AR has come to use from 1990. Since then, it has been used in most of the industry with specialized benefits which mainly includes education. AR motivates students as this latest technology in the classroom as well as in the practical fields. The learning experience through AR technology creates a completely different experience. The positive impact that AR experiences have on learners are increased content understanding, learning spatial structure and function, learning language associations, long-term memory retention, improved physical task performance, improved collaboration, increased student motivation. Creating AR and VR content and activities designed especially by using tools and applications makes an existing world within the classroom, it expands the world physically, layers of digital information added that can be seen with naked eye. Sound, video, graphics are added.

Virtual Reality on the other way an environment which is completely different is created. An artificial world that is replaced by the real one, characters can also be added to it. AR technology application bridges the gap of teaching and learning between the virtual and real world. Research has recognized increasingly the benefits of AR in education. AR skills that make the learners for a long-term retention of memory, physical tasks can be improved language association, understanding of the articles will be increased easily, and student motivation. Presence and movement underscores, information and text are overlaid in the real world in AR. It influences the learning process itself, how the students learn efficiently. In this technology world the AR improves the student's capacity to learn at an early age, how to meet the challenges and avail the opportunities learning can be in more active forms that the students use their hidden potentialities with the technologies in AR and VR. It serves as a catalyst for a better change.

Dealing with nature images makes matting complexity of high computational cost at times and also manual operation that is tedious. Image/Video editing is not the only concern in nature image matting because of user friendliness, automaticity and real time process. Chroma keying is applied most widely technique in video segmentation, making films, advertisement, broadcasting etc., In this system in front of a blue or green (usually) background colour foreground is shot. Mainly this colours simplicity and background of foreground colour distinction.

Once the background colour and background video sequence is given, along with the transparency property, a Chroma Keying system "Keys" out the foreground objects. The pixels are removed with similar lightness and chromaticity as the background colour is provided and the transparency is estimated for pixels with the mixed colour and background colour. The ideal background colour to be solid, the actual background colour to be changed along with the studio environment such as shadow light and rugged background. If the foreground scene is reflective and transparent chroma keying is more challenging. In front of the monochromatic background the image/video to be the chroma key is often pictured, that should be apparent in a chroma-key scene. Because of the uneven lighting on the background in real world production it is also a known variable.

With the benefit of monochromatic background mostly industrial algorithms of chroma keying tries to solve the equation by mapping alpha values to colour variances and corrects foreground colours that is based mainly on manual input or automatic analysis, Primate by photos limited are advanced algorithms may feature upto 128 different colour ranges in linear colour space. Real time processing and automaticity are also provided on some proprietary hardware.

Augmented Reality (AR) instructions: Actual task is registered with the instructions. Animated 3D models are to be matched with the object's position to detect with the computer vision algorithm or markers. Usually, such types of systems are found in mobile phone applications or computer screens with stationary cameras. In some cases, Deployment is also a problem as due to low battery life in mobile devices, cooling design is poor, processing power is very low. It is very demanding on computing power of computer vision algorithms. Time saving benefits have not yet proved.

II. Related Work

To develop high school students, learn chemistry. Ling et al. [1] proposed AIR based education mobile system, code named AIR-EDUTECH. To visualize chemical structure and their reaction using sphere-and-sticks. The content includes audio, video, and 2D/3D animation of the model of molecules immersed within multimedia. A set of cards are provided to allow interaction between the user and the system each of which represents an element or a chemical substance. when one or more cards are detected by the system, camera view is put towards each other, the card contents their corresponding molecular structures or chemical reaction will be recognized and the action related to the corresponding card will be taken by the system as by the scripted logic.

Kamran et al. [2] proposed for children and adolescents with Autism Spectrum Disorder (ASD). Researchers to identify the learning skills to be targeted. The primary studies targeted in the learning skills include social communication, attention management, facial expression, object recognition focus, empathy, emotions, figures, writing, simple daily routines such as brush teeth, etc., Almaas et al. [3] proposed systematic mapping study to review by incorporating educational systems with mixed reality technologies with introduction of head mounting display, by encouraging educators to support collaborative educational environments.

Tugbagul et al. [4] proposed Students with neurodevelopmental disorder were made to compare the traditional 2D display, touch screen with 2D display, and AR virtual display on education environments. Joao et al. [5] proposed Augmented Reality system with mobile five senses.the result that was shown was effort expectancy, social influence and facilitating conditions. There were the key constructs for the users to drive and accept M5SAR's technology. Wenyi Wang et al. [6] proposed a new chroma keying method to remove the background colour automatically in an image and the foreground objects to be segmented accurately along with their property of transparency. Chroma keying methods compared conventionally based on colour difference, colour clustering, the method which was proposed analyses the colour confidence and colour statistics of the image globally. Local lightness variation, image colour statistics is analysed and human visual perception is experienced in HSV colour space, quadmap, a segmentation map is automatically generated to segment the image region into 4 types.

Ling Yin et at. [7] proposed a monochromatic background which extracts the object of interest (foreground) based on a chroma keying algorithm presents an automatic, human perception. The image to be chroma keyed is given, analysis is done on local texture property and global colour distribution in CIECAM02 colour appearance model. Three parts are segmented automatically in the input image after the analysis. They are foreground, background, and uncertain regions. By using interpolation function propagation of background colour from known background to uncertain region. linear lost criterion and global colour distribution estimates the foreground colour. Matting results on the perceptual and quantitative comparisons shows that the method proposed can correctly restore the intrinsic foreground colour, remove the background region, and keep the fine details accurately. Apart from this the proposed method implements workload among different processors efficiently distributed on a heterogeneous parallel architecture.

Borja Vidal [8] proposed feedback on chroma key visual based in retroreflective screen on the non-retroreflective polarized reflection. Polarized light is reflected in the non-retroreflective mode by using retroreflective fabrics. Thus, the technique exploits the observation that it is possible to use polarization filters to project onto a retroreflective screen two polarization-orthogonal images. The combination of the monochromatic surface and the real object is only captured due to polarization filtering of the camera whereas with the background image viewers of the real scene can interact.

Yinlong Liu et al. [9] proposed to Determine the relative pose and corresponding between a set of 3D points and a fundamental problem in computer vision of its 2D projection. The point sets are contaminated by noise and outlier the problem becomes difficult. As optimizing the problem the pose of the 3D points in the SE(3) space to make its 2D projection is best aligned with the point set of 2D. The cardinality of the inlier set on the 2D projection plane is measured. Eg Su Goh et al. [10] proposed a technology which

improves day by day mobile phone, tablets, etc., which are referred to as handheld devices becoming a major output medium for AR. The usage among the devices under this category is especially touch screen smart phones, this is due to the upcoming release of consumer-oriented communication devices. Table top or desktop AR and systems of head mounted display based requires different interaction techniques in which single hand interaction is mostly utilized and also limited in small screen display and limitation in activity time due to the handheld mobile devices battery operation hour. Research is still lacking in handheld mobile AR, mainly research on 3D interaction is focused for virtual object manipulation.

III. Proposed Work

AR is incorporated in learning automobile technologies in absence of faculty and improves the performance of students in academics. For developing apps, unity engine, Vuforia AR SDK is used. Chroma Key Technique is used to segment the object from the green screen videos. ICP Algorithm is used to refine 3D models and reduce the error. Scaling, Rotation, Translation are used to get the modified 3D avatar by mobile touch input.

The touch-based concept is utilized by using touch input through multiple contact points instead of using the traditional keyboard or mouse inputs that have already been verified much slower than real object manipulation. Besides, by performing touch-based interaction, users can perform direct manipulation by touching the 3D data directly on screen. Finger gestures that include multi-contact points especially for object rotation are used to manipulate on-screen objects which is an example of touch-based interaction technique used to manipulate 2D data on touchscreen tabletops using RNT (Rotate N' Translate) mechanism. However, touch-based interaction has only been widely explored to do 2D object manipulation that includes x and y-axes only while depth manipulation (z-axis) is still unexplored. This arises due to the difficulty of mapping 2D touchpoints to 3D attributes to perform the complete 3D object manipulation while the 3D object manipulations consisting of 6DOF are mostly executed significantly in virtual environments. Thus, to understand touch-based interaction better firstly we need to learn more about its basic concepts that rely early on the multi-touch tabletop display.

The videos are stored in the device target database. The database consists of automobile technology concepts. Figure 3.1 shows the system architecture for interactive AR learning. Using handheld devices such as smartphones, the images in the video are detected. The target image is identified using the VUFORIA tool which triggers augmented reality. The input to the target image/marker is green screen video and 3D objects. The green screen video is segmented into objects by the use of chroma keying. Once the objects are segmented, the virtual avatar is developed by the process of scaling, rotation and translation. The virtual avatar is displayed by mobile touch input. 3D models are produced by using the iterative closest point (ICP) algorithm. The refined 3D models are obtained based on the threshold value. Finally, the automobile technology concepts are learned in the form of 3D avatar virtual objects.

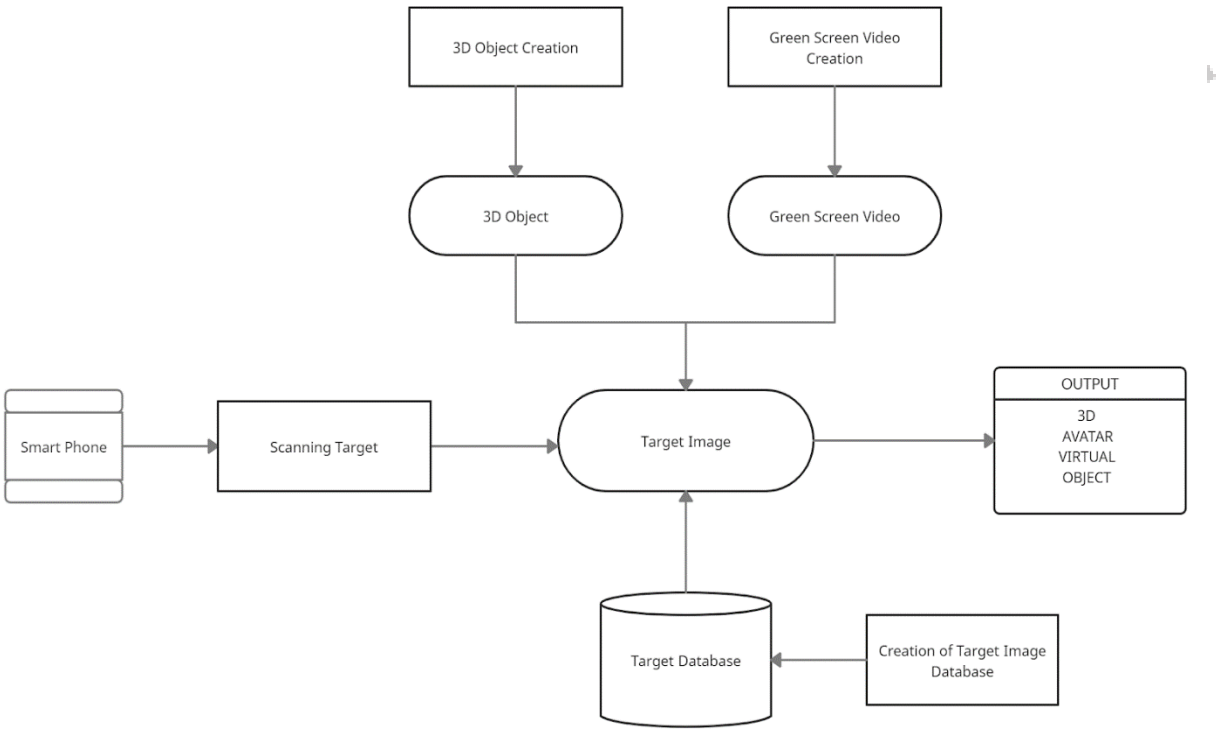

Figure 1: System Architecture for Interactive AR Learning

IV. Experimental Results

The proposed project Augmented Reality combined with chroma keying technique explains with the modules about the Target Identification, Chroma Keying, Interactive Learning Visual Object and Refined 3D models.

4.1 TARGET IDENTIFICATION

Frames can be obtained from the video and read frame by frame which is stored in the database. In each frame, the image is targeted by the VUFORIA tool. The target image is identified by obtaining the images from the video as shown in Figure 2. The output triggers the augmented reality.

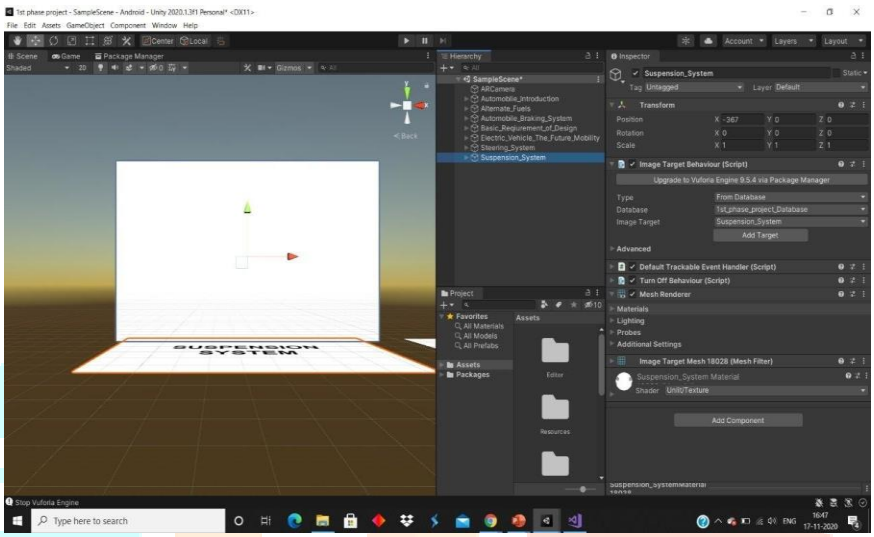

Figure 2: Image Target

4.2 CHROMA KEYING

Chroma key compositing, or chroma keying, is a visual-effects and post-production technique for compositing (layering) two images or video streams together based on colour hues (chroma range). Figure 3 depicts the chroma keying technique. The technique has been used in many fields to remove a background from the subject of a photo or video particularly the newscasting, motion picture, and video game industries.

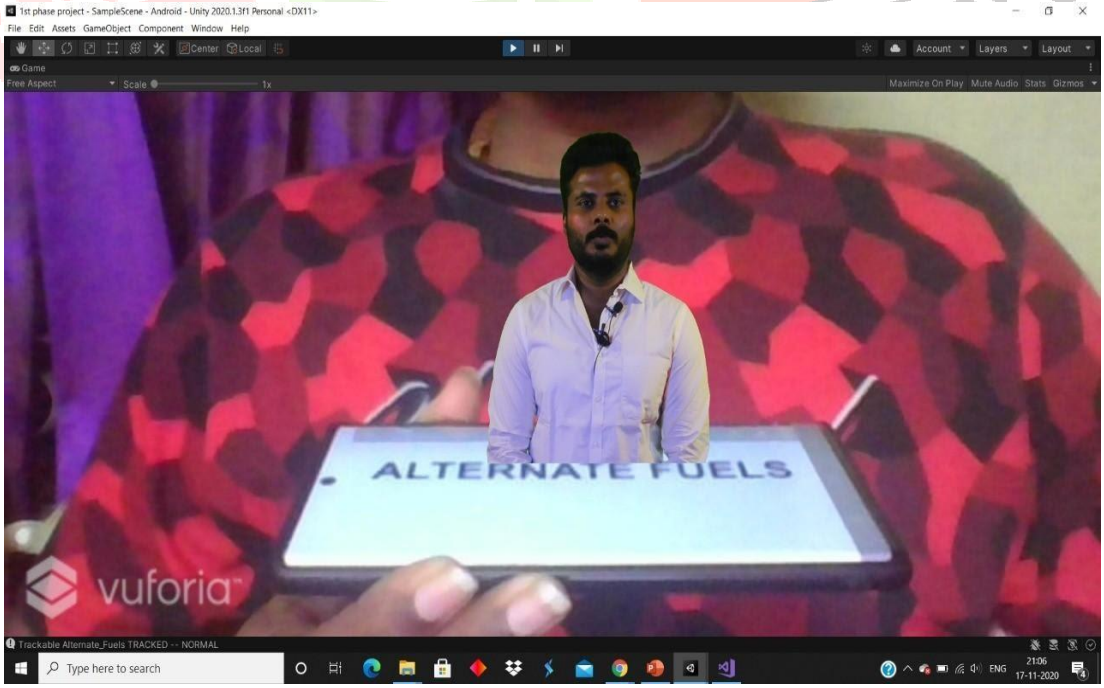

Figure 3: Green Screen Video with Chroma Keying

4.3 INTERACTIVE LEARNING VIRTUAL OBJECTS

The mobile touch input is given to produce the modified avatar as shown in Figure 4. In this technique, the scaling, rotation and translation are performed for developing the avatar to learn the automobile technologies in augmented reality. In the virtual realm, avatars are used for graphical representation of people, much like 3D characters used in video games.

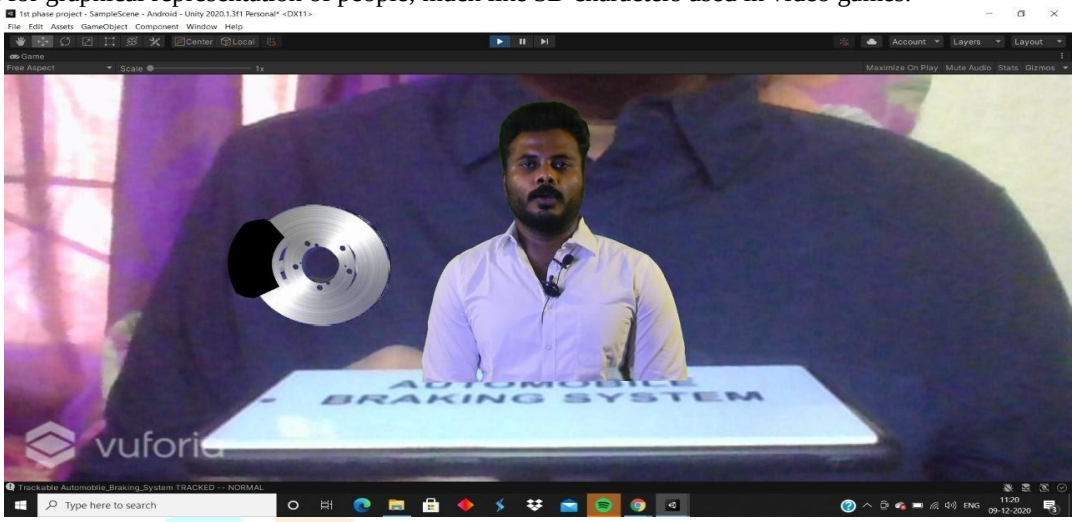

Figure 4: 3D Avatar Virtual Object

4.4 REFINING 3D MODELS

Once the chroma keying is applied, the virtual objects are developed in the marker. Then, the marker selects the 3D models of selected automobile technology concepts from the database. Finally, the refined 3D models are displayed as shown in Figure 5. once the mobile touch input is given.

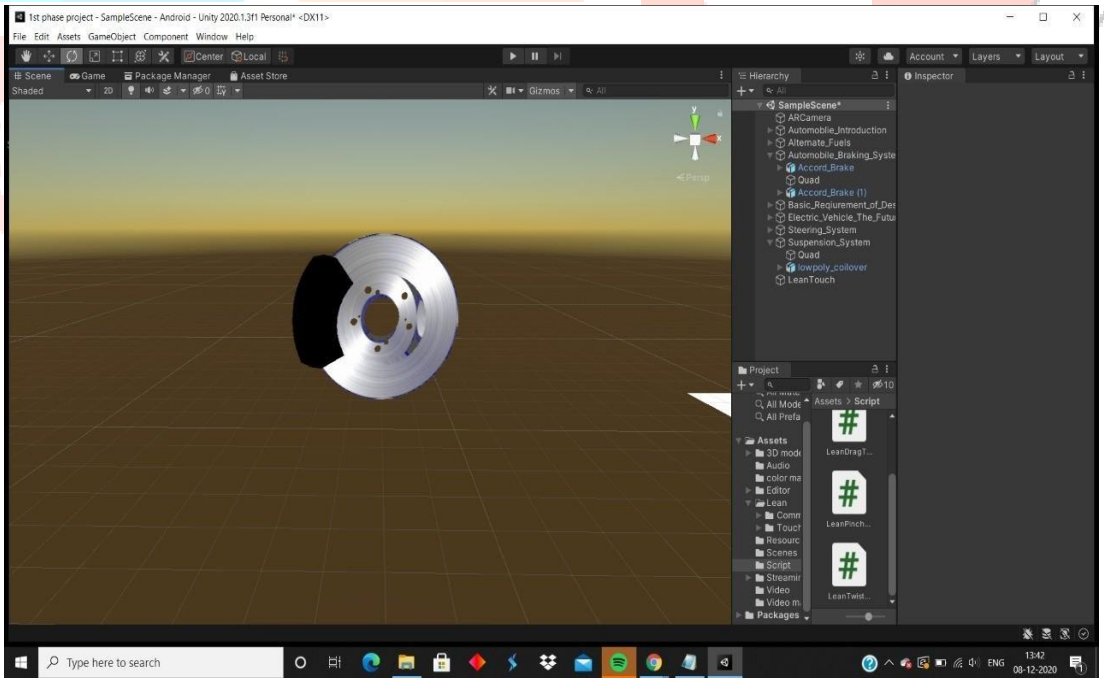

Figure 5: 3D Model-Brake

v. CONCLUSION

The proposed system intends to identify and characterize the impact of the application of AR technologies in education, specifically to determine if they have the potential to improve learning performance. An educational mobile system used to learn the automobile technology concepts which helps the college students learn in an augmented and interactive environment enriched by a variety of multimedia content including 3D animated models. A novel chroma-keying method is proposed to improve the accuracy and reliability of transparency estimation in chroma-keying systems. Compared to other chroma-keying, reflective regions are no longer considered as transparent and it is processed differently from transparent regions. Based on global color distribution and local texture gradient, the generated trimaps are more effective because of the smaller unknown region and richer details. It reduces the computational cost and provides a smoother and cleaner background plate in less time. The proposed method can robustly deal with images with background light variation and can significantly improve matting results when there is a reflective part on the foreground object. Future work of this project is to conduct assessment for both students who followed traditional learning and education mobile systems. Performance will be higher compared to traditional learning. Comprehensive quantitative analysis of the results carried out to gain deeper understanding of the nature and impact of augmented reality in the education system.

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