Research on Object Based Augmented Reality Using Unity3d in Education System

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ABSTRACT

Technology has touched all aspects of our lives. Technology has had a huge impact on the quality of life that we lead in the modern age. The educational sector has benefitted tremendously due to the advancement in technology. A lot of technologies have been used in the educational sector. Augmented Reality is one such emerging technology that has huge promises in the field of education. Researcher from the field of technology believes that Augmented Reality will provide opportunities to design engaging learning environments. Researcher idea is to allow the user to view the virtual object in the real world using an Object based AR system. The user could provide images of the object which would be the front, back, top, bottom, left and right side pictures of the object. They will be placed onto a 3D cube which will make up the complete virtual object. Thus an extended environment will be created through the amalgamation of real world and generated object and it will appear as though the real-world object and virtual object coexist within the environment. This research paper describes Augmented Reality (AR) and Unity3d, how it applies to learning and training, and the potential impact on the future of education.

KEYWORD: -. *Augmented Reality, Virtual Reality, Unity3d, Education, Interactive learning ENVIRONMENTS*

I. Introduction

Augmented Reality (AR) is used to describe a combination of technologies that enable real-time mixing of computer-generated content with live video display. AR is based on techniques developed in VR [1] and interacts not only with a virtual world but has a degree of interdependence with the real world. When we started to focus on the human being and on his perception of the world then we realized Reality cannot be increased but its perceptions can be. We will however keep the term of Augmented Reality even if we understand it as an "increased perception of reality". Milgram et al (1994) provides a helpful visualization to represent how reality and virtuality are connected (see Figure 1) [2]. It shows a continuum that encompasses all real and virtual objects and environments. Mixed reality is an area in the middle, where the two extremes meet, and is considered a blend of both the virtual and the real:

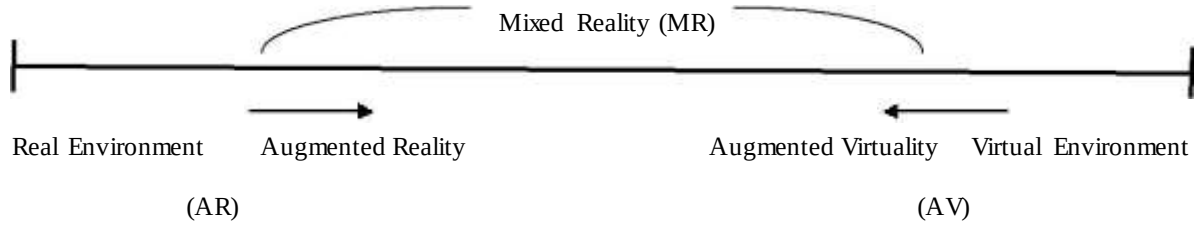

Figure 1: [2]

Whilst it is clear that virtual as well as Real Environments can be augmented this falls under the category of Augmented Virtuality as shown in Figure1.Augmented reality is said to be a type of virtual reality.

Virtual reality mean: - virtual reality is a combination of both virtual and reality.

IN technical terms it can be defined as three-dimensional and computer generated environment which can be interacted with by a person

- **The difference between Virtual Reality and Augmented Reality**: It is always said than AR is closely related to the concept of Virtual reality but there are certain key differences between the two which can be very well explained as follows:

Virtual Reality	**Augmented Reality**
75% Virtual	75% Real
25% Real	25% Virtual
100%	100%

Unity 3D is a fully integrated development engine that provides out-of-the-box functionality for the creation of interactive 3D content. Using Unity, you can publish to multiple platforms such as PC, Web, iOS, Android and Xbox. Complete toolset, intuitive workspace and on- the-fly play testing and editing feature of Unity makes developers to save the time and effort. The **Vuforia** AR Extension for Unity enables vision detection and tracking functionality within the Unity and allows developers to create AR applications.

II. VIRTUAL REALITY

Virtual Reality is a computerized simulation of natural or imaginary reality. User of VR is fully or partially immersed in the environment. VE is the term used to describe the scene created by any computer program in which the user plays an interactive role within the context of the computer generated three dimensional worlds. The user represents an actor within the system and has an essential presence within the virtual world. Virtual reality (VR) is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds.

Advantages*:*

- Total immersion within environment.
- Increased user presence perception within system.

Disadvantages*:*

- In VR environments people live in the virtual world instead of dealing with the real one.
- Another concern is VR training. Training with a VR environment does not have the same consequences as training and working in the real world.
- This means that even if someone does well with simulated tasks in a VR environment, that person might not do well in the real world.
- Despite advances in technology equipment is still expensive.

III. AUGMENTED REALITY

3.1. ARCHITECTURE OF THE AUGMENTED REALITY SYSTEM

The four tasks carried out by the AR system are: **Scene capture; scene identification; scene processing and visualization of the augmented scene. [3, 4]** These Tasks are described in details as follows:

3.1.1. SCENE CAPTURE

The devices used in scene capture are physical components which recognize the reality which should be boosted. There are two types of scene capture devices:

- Video-through devices: Such devices capture the reality in a different way than the other devices used for visualizing the augmented reality (for instance, video cameras, and smart phones) [4].

- See-through devices: Such devices capture reality and give a picture of it with the augmented information (for instance, head mounted displays) [4].

3.1.2. SCENE IDENTIFICATION TECHNIQUES

Scene identification classifies the scenarios. There are two basic types of scene identification techniques which are discussed as follows:

- Marker-based: The marker-based approach uses the markers which are in the form of visual tags contained within the real scene which is perceived by the AR system[4].
- Non-marker-based: The Non-marker approach uses the real object image for scene identification in device. There are two types in non-marker based AR
  : Object base.
  : Location Base.

3.1.3. Scene Processing

After calculating the spot of a specific Non-marker image in real space the system looks for the corresponding virtual model to each no-marker in the 3D.

3.1.4. VISUALIZATION SCENE

At the end, the systemproduces the image of the projected 3D object and present digital information [3].

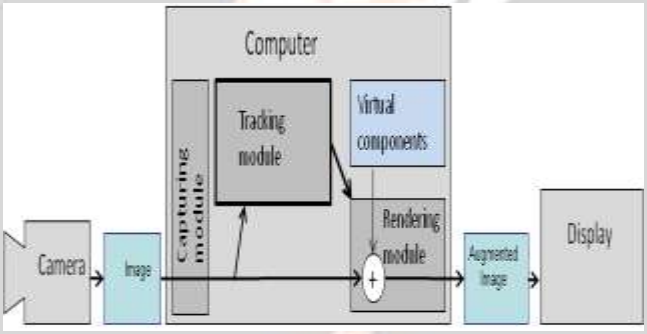

Figure2. Flowchart for a simple AR system. [9]

3.2. TYPES OF AUGMENTED REALITY:

3.2.1. MARKER BASED:-

Markers are images that can be detected by a camera and used with software as the location for virtual assets placed in a scene. Markers based image are square and using black and white color. Simple augmented reality markers can consist of one or more basic shapes made up of black squares against a white background

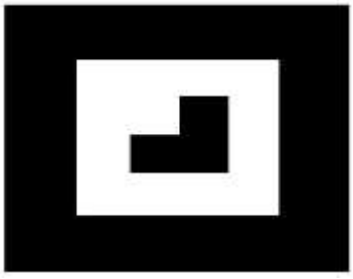

Fig 3: Simple marker [10]

A camera is used with AR software to detect augmented reality markers as the location for virtual objects. The result is that an image can be viewed, even live, on a screen and digital assets are placed into the scene at the location of the markers.

Example:

Fig 4: Simple marker-based [12]

3.2.2. OBJECT BASED:-

Object is nothing but any Real Image we used as scene, tracks its position, and display by playing a video or any digital information in the image's place.

Example:

Fig 5: Object Based [12]

3.2.3. LOCATION BASED:-

In Location Base augmented reality the image is gathered through internet and displayed on any specific location (can be gathered using GPS). It is more interactive than marker based augmentation. The only real difference from a consumer's perspective is that the surface itself as object.

Example:

Fig 6: Location Based [10]

IV. Problem statement

4.1. TO MAKE LEARNING ENGAGING, INTERACTIVE AND EDUTAINING FOR THE SMARTER GEN X! TO MAKE EDUCATION ENJOYABLE!

Classroom-based learning within subjects like chemistry, mathematics, biology, physics, astronomy, and other K-12 education or higher education study of Science is all a complex process that includes identifying a problem, investigating the problem, making hypotheses, planning the data collection method, testing the hypotheses, collecting the data and making the conclusion and results . Participating in these processes helps the student to think critically in each step in order to gather the best results. [8]

With the advancement in technology today, children find that learning in traditional ways are dull and boring since there are so many entertainment alternatives out there which are more interesting then learning. Not only that, preschool children have difficulties attending classes. They feel that preschools are boring and there is less entertainment in preschool compared to their homes. Preschools have also come out with some ideas to get these children to participate in activities, storytelling, and dramas Teachers too feel that children learn faster if they can interact with the object or even play a role in a story or situation presented to them. They are also trying to come up with other innovative ideas which will attract the children's attention or interest in order

To make their learning sessions more interesting, fruitful and full of fun in order to encourage the learning process.

Children have difficulty learning to read and write. This is because children who do not read at a young age tend to have difficulty to develop their vital language skills. Therefore, it is very important to create an engaging environment to encourage them to learn. Children are naturally curious and playful. They learn when they explore and play, manipulate a wide range of real objects and get to see the results of their actions immediately. The way children learn is by internalizing the activities, habits, vocabulary and ideas of the members of the community in which they grow up. In other words, children learn best through primarily a social activity and participant in the social life of the school. Researchers also believe that the earlier a child starts receiving education, the faster the child can absorb more knowledge.

V. Purpose Of The Study

The focus of this research was to evaluate the effectiveness of using AR technology in a Classroom-based learning. AR technology is an effective tool that integrates the real learning world with the virtual world created by computer software. This research aims at studying the effectiveness of using augmented reality technology in education. Besides that, by using learning resources that is partly virtual and factual could increase the participation of the children in learning. They become more relaxed And the learning process becomes more engaging and interesting.

Why Augmented Reality Used For education
Advantage:

- **EYE-CATCHING PRESENTATIONS**

By integrating augmented reality into your lectures, you'll capture the attention of your student.

- **INTERACTIVE LESSONS**

Let your student participate! Students are able to access models on their own devices via Augment's app. By viewing augmented models, the students can gain a better understanding of the concepts they are studying.

- **PORTABLE AND LESS EXPENSIVE LEARNING MATERIALS**

Schools do not have enough money to buy all the supplementary learning materials. After some time these traditional learning materials get worn down, lose their relevance, and get misplaced over time.
With Augment, you do not have to invest in physical materials. Students can access models from any device at any time. Whether they are at home or in the classroom, your students can study and interact with the course materials.

- **HIGHER RETENTION**

With a simple a scan, students can access augmented models. Also, students can access websites directly from the Augment's app. For example after scanning a photo linked with a 3D model of the Eiffel tower and viewing the augmented Eiffel tower, students can go directly to a web page with more information on the famous monument. Students will retain more knowledge for a longer period.

- **FOSTER INTELLECTUAL CURIOSITY**

Incorporating Augment into your lessons will make your students excited about learning.

VI. PROPOSED SYSTEM ARCHITECTURE

Unity3D development software is a very powerful development programs, and augmented reality is a very powerful technology, how to put the Unity3D game development software with augmented
Reality closely unifies in together, this is what I want to say next.

5.1. HOW TO AR TECHNOLOGY WORK IN EDUCATION:

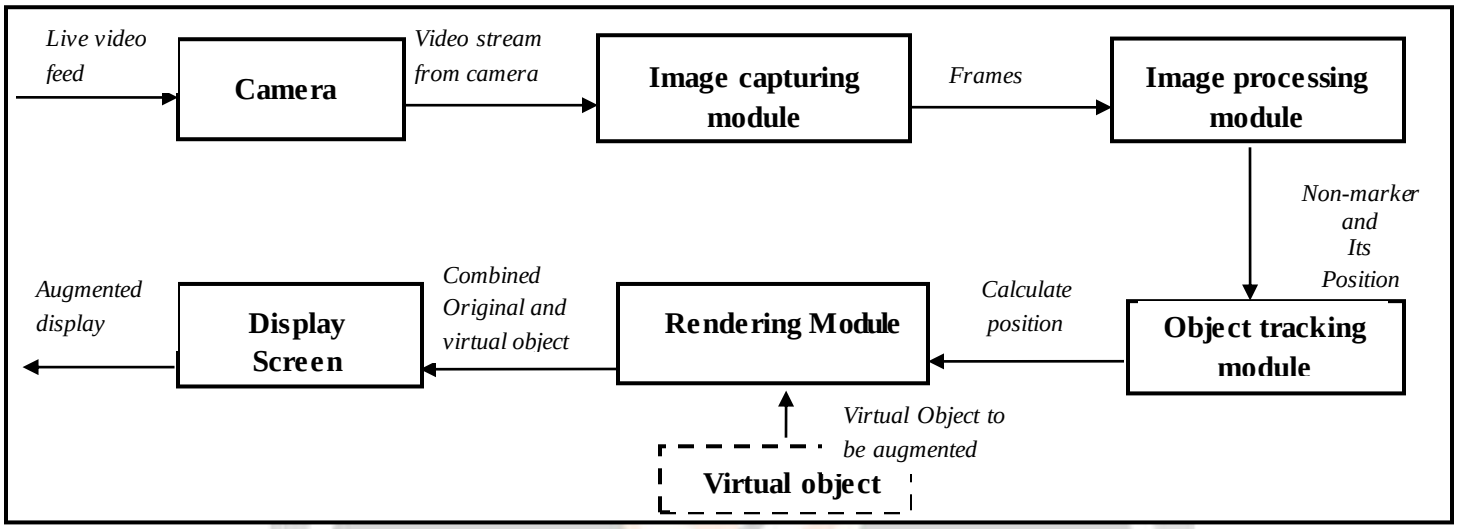

Fig 7: PROPOSED SYSTEM ARCHITECTURE

The proposed system is an object based system and its architecture as shown in figure 7 contains following modules.

5.1.1. Camera

A real-world live video is feed as an input in unity module. This live video stream is given as an input to the Image Capturing Module.

5.1.2. Image Capturing Modules:

The input to Image Capturing Module is the live video feed from the camera of a mobile device. This module analyses the camera feed, by analyzing each frame in the video.

5.1.3. Image Processing Modules:

Inputs to Image Processing Module are the images from Image Capturing Module. These images are processed using an image processing technique to detect the AR camera. Detection of AR camera is essential to determine the position, where to place the virtual object. Once the AR object is detected, its location is provided as an input to the Tracking Module.

5.1.4. Object Tracking Modules:

The tracking module is "the heart" of the augmented reality system; it calculates the relative position of the camera in real time.

5.1.5. Rendering Module:

There are 2 inputs to Rendering Module. First is the calculate position from the Tracking Module and other is the Virtual Object to be augmented. The Rendering Module combines the original image and the virtual components using the calculated position and renders the augmented information on the display screen of the mobile device

5.2. IMPLEMENTATION AUGMENTED REALITY IN UNITY3D WITH VUFORIA TOOL:

5.2.1. Steps for Vuforia

- **Create a Database**
  - Open the vuforia Portal
  - Click on the database option
  - Give the name as Education System
  - Click ok

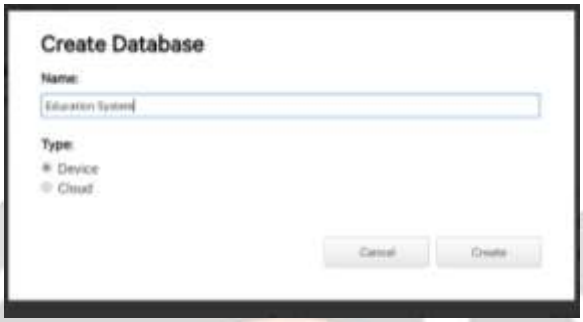

Fig: 8 Create Database in vuforia.

- **Add a Target in Vuforia**
  - Select a database
  - Click on add target
  - Choose file from image (jpg image)
  - Give a target dimension (width)of image
  - Click on ADD

Fig: 9 Add Target in vuforia Database.

- **Download Selected Target from Database or complete database**

Fig: 10 Download The Databse.

- **Create license key in vuforia and copy that key to add in unity package.**

Fig: 11 Create License in Vuforia.

5.2.2. Steps for Unity

- **Add AR assets and prefabs to scene in Unity**
  - Create a new project in Unity.
  - Select "vuforia-unity" database package "Education" then import the packages in unity by click import to import the target device database.
  - Now open the " /Vuforia/Prefabs " folder
  - Drag ARCamera a prefab into your scene.
  - Drag an instance of the Image Target prefab into your scene.
  - Select the image object in your scene and look at the inspector there should be an image target behavior attached with a property name Data Set.
  - Select the Data Set and image Target from project example select brain image.
  - Now we will need to add the model (video image) to the image target from Assets folder.
  - Now adjusted the image as per main camera and AR camera.
  - Then we can see project in the scene

Fig: 12 Add image in unity.

- Then we can see project in the game window also

Fig: 13 Adjuest the parameter and set the image with vuforia assets in unity

- Coding window

Fig: 14 Add C# coding in unity.

- Then compile the project with android mobile.
- Then unity package will install in your android device then open it and scan the image.

5.3. Result Augmented Reality In Unity3d Tool:

- **While scanning the real object from android device camera we can see the digital information related that object in unity**

  Example:-

  Here we take one brain or any image as object but here we take one brain image or second is H alphabet image and scan that H alphabet image from mobile.

Fig: 15 scanning brain image from unity camera.

Fig: 16 Scanning H alphabet image from unity camera.

When we start Capturing brain image from unity module. Camera try to match the coordinates between image and video when coordinated are match unity will display related video like any brain parts video.

Fig:17 Video show in Andriod Mobile.

VII. Conclusion

AR technology is an effective tool that integrates real learning world with virtual world created by computer software and it is Easy to use and interactive. Student can acquire much more knowledge and experience in learning by using this technology in education as compared to the traditional method of learning. This technology has also increased their motivational level and the results indicated that the AR technology provided a fun and engaging environment. All the 3D models can be used again and again (reusable) without getting damaged. Therefore, it's an effective foundation to use AR technology as an educational tool. AR features are able to engage students in Learning processes and help improve their visualization skills. The features can also help teachers to explain well and make the students easily understand what they are taught

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IX. BIOGRAPHIES

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