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Implementation of Augmented Reality and Virtual Reality in Education

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A B S T R A C T

Nearly everything we task we undertake now involves technology. From our sophisticated cell phones to our state-of-the-art computers and advanced technical tools, technology is all around us. The world has been greatly impacted by augmented and virtual reality since their emergence. In addition to appealing to smartphone users, these technologies also caught the attention of both new and established businesses, leading entrepreneurs, and marketers to think about investing in the enforcement of AR and VR applications. As a result, it is anticipated that the number of AR and VR devices would nearly double, from 11 million in 2021 to 105 million in 2025.

Keywords: Augmented Reality, Virtual Reality, Education, Immersive Reality, Immersive Learning, Extended Reality, Futuristic Learning, Immersive Education

1. Introduction

AR and VR technologies are increasingly present in education as well. AR/VR technologies are an important contribution to the ed-tech sector because of their engaging features, ability to convey knowledge in fresh and interesting ways, and potential to deliver virtual experiences. Some studies have shown that AR/VR tools can improve learning outcomes in primary, secondary, and higher education settings, even though research into the benefits and effectiveness of AR/VR in education is still in its early stages.

2. Literature Survey

This problem statement has been extensively studied over the last few years by researchers and automotive companies in a bid to create a solution, and all their solutions vary from using AR and VR in literature to science.

Serafin et al. [1] presented various methods for incorporating augmented reality (AR) and virtual reality (VR) in melodic and acoustic learning from both a commercial and educational viewpoint. According to his research, both the knowledge gained and the student engagement levels had greatly increased. For the pupils to perform better and at more ease in public settings, various potential alternatives were explored. Consequently, the research did not result in a practical application and only lists methodologies and future improvements.

Like this approach, Dinis et al. [2], gave a highly useful method for increasing participation in classroom activities. During a 42-day preliminary class assignment, students pursuing Masters in Civil Engineering developed virtual worlds using models that were created by Computer Aided Design and were then transferred over to Unity. The Oculus HMD is then used to view the results. The research proved that this process was an unconventional approach as it resulted in increased student – teacher interaction. However, it is challenging for the users who are unfamiliar with technology or those who do not work in the same field.

Vinh T. Nguyen and Tommy Dang [3] research offers an all – inclusive architectural foundation for creating applications using AR/VR methodologies. It also clearly explains how each component of the foundation is integrated into Unity. Yet the foundation deals with problems regarding latency and illumination.

Surabhi Nanda and Shailendra Kumar Jha [4] based their research on an augmented reality software created for preschool or young learners. The software aims to teach the 26 letters of the alphabet, and for each letter, a picture representing a word which begins with the letter is displayed. The disadvantage with this approach is that it depends on a single target image, because of this, the expansion of the project will be difficult. It is also possible to enhance the camera's picture target identification and rendering.

Weiping Zhang and Zhuo Wang [5] studied on the principles and application of scientific education but the study was very narrow; quantity was compromised for quality. Only popular and reputable sources were chosen. Another drawback includes the omission the network of the other works or studies that were referenced.

Chang Yuan Li and Bai Hui Tang [6] presented a software strategy that works on multiple platforms easily and is multiple interactive. The application which is built using Vuforia + Unity, focuses on how the human tissue is structured. After numerous rounds of testing, the application achieved an accuracy rate of 98%. The drawback faced here is the concentration on only augmented reality and the use of one language only.

Seokbin Kang [7] proposed AUGMENTED REALITY SYSTEMS ANDUSER INTERACTION TECHNIQUES FOR STEM LEARNING. Nevertheless, this study does not provide any additional guidance on how to create a practical application; it just lists several potential methodologies and future research objectives.

3. Existing Work on Base Paper

In this approach, there is a need for only on image target. Once this is scanned by any mobile gadget, the 3D model will be displayed. For the scanning to take place, there should be an Android application created with the help of Unity. The first screen contains the "Start" button. The subsequent screens consist of the 26 alphabets. Each screen also contains three buttons:

- Home screen button
- Previous Letter Screen
- Next Letter Screen

If there is no previous or next letter, then it takes us to the home screen again.

4. Proposed Methodology

4.1 Augmented Reality Application

The augmented reality application is an educational creation for understanding various topics with visual and audio cues. It is created with the help of Vuforia, Unity and Unity Asset Store for 3D Models.

4.1.1 Vuforia

Vuforia is a widely used platform which provides a Software Development Kit (SDK) for immersive augmented reality applications. It gives us options to create Image Targets from a predefined Database. Each Database can have multiple targets and each target will have a rating from 0-5.

Any image target with a rating of 3 or above is preferred. The rating specifies ‘how augmentable’ the image is. The rating is also directly proportional to the amount of identifiable or unique features present in the image.

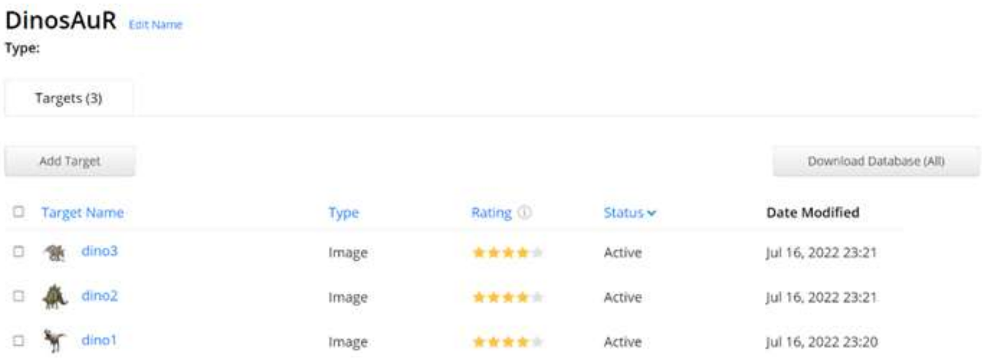

Fig. 1 – Target Manager in Vuforia.

4.1.2 Unity

Unity is a game engine that allows developers to create simulations, experiences and even games in either a 2D or 3D environment using the C# language. Required 3D models are downloaded from the Asset Store to the Unity Project. The application consists of 2 scenes: Home screen and the Information Screen.

Information Screen consists of the Image Targets or Markers and the respective 3D Models. This is referred to as marker-based augmented reality. According to the marker detected by the camera, the appropriate target image is displayed. The functions to be implemented when each button is pressed or when the scene is to be changed is done with the help of C# scripts.

4.1.3 Workflow

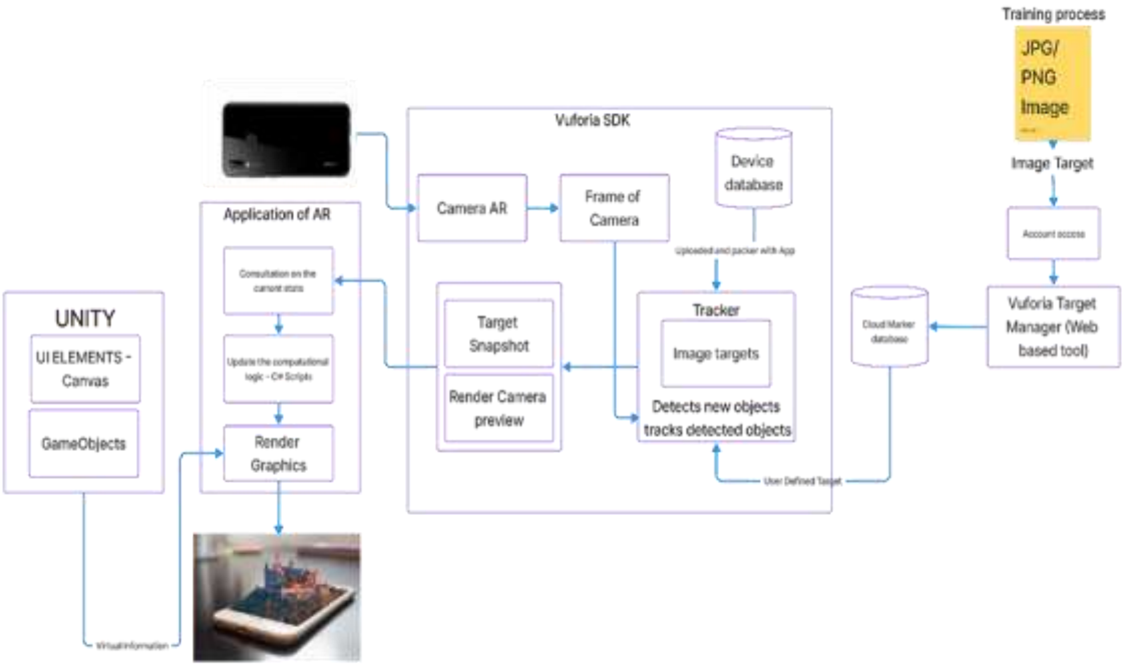

Fig. 2 – Augmented Reality Application Workflow

Make to choose images that include a range of intricate shapes and striking colour contrasts. It is convenient for the camera on the device to track the Image Target a visually complex image is used. Vuforia Database Manager manages all the image targets being stored. It is connected to Unity through the Vuforia Engine Package.

The camera of the phone captures a continuous video stream and this is tracked for any possible image targets by looking for any plausible feature points in the stream. The tracker detects new objects and tracks the detected objects. According to the target detected, the current state is consulted and then the computational logic is updated. This results in the rendering of the changed graphics.

The image overlay's location in the scene view corresponds to where it will show up when scanned with a device's camera. For instance, if the image is set up at the top of the image target, the user will also see it there when they scan the image target.

The number of image targets, can be increased or decreased according to the user's wish. Each time the target changes, the appropriate model, information, facts, and real time audio will be seen and heard.

The presence of an exit button helps the user to exit out of the application, directly from the target screen.

4.2 Virtual Reality Application

The virtual reality application is an educational creation for understanding various topics with visual and audio cues. It is created with the help of Unity and Unity Asset Store. The hardware device used is the Oculus Quest 2.

4.2.1 Unity

Unity is used to create the scene that the user will be met with, when using the Head-Mounted Display. Unity has a variety of built-in terrain features that consist of tools which let us create, modify, and delete landscapes. The terrain tools also have options to include neighbouring terrains, include vegetation such as trees, bushes, grasses, and flowers. It also allows us to define the texture and look of the terrain, by including materials, textures, and increasing the height to create mountains, and hills.

Taking the concept of a pre-historic world, the landscape is created with the usage of the terrain tools, trees, and brushes from the built-in library and from the Unity Asset Store. Three – dimensional models are also placed in the environment, with animations. Audio sources to mimic the sounds of the models are also included to give a realistic feel to the environment.

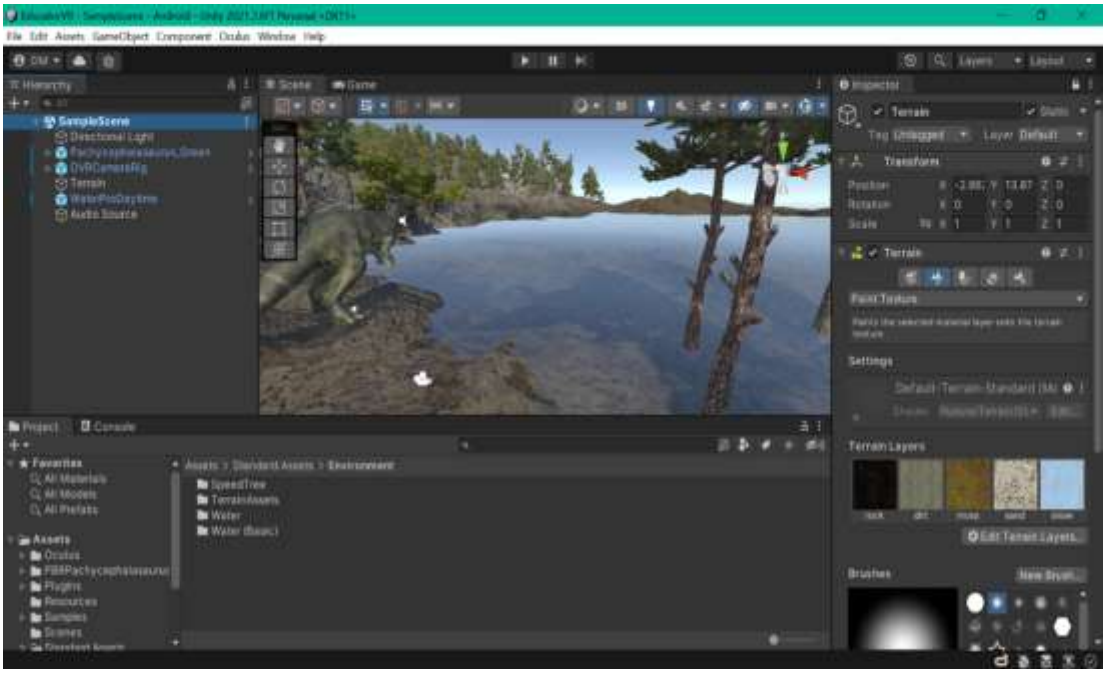

Fig. 3 – Unity Workspace with Terrain Tools

The main scene will be displayed when viewed through the Head Mounted Display. Although the user will be able to view a 360-degree world, movement is restricted.

4.2.2 Workflow

The Head-Mounted Display, in this case an Oculus Quest, will obtain the target information from the contents and this results in the scene being rendered. According to the user's controls, actions, or gestures (which acts as input) the intellectual environment will be updated. The interaction in turn also updates the contents of the scene. For example, when the user rotates their head, the scene accordingly changes or updates itself.

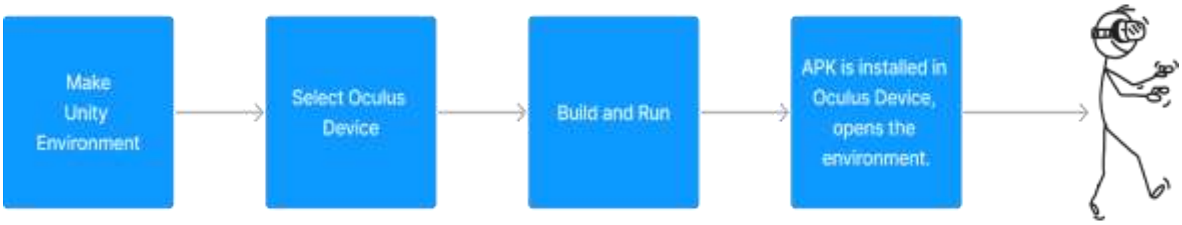

Fig. 4 – Virtual Reality Application Workflow

The Unity Environment is designed and build according the visual desires. The player and build settings are updated according to the Head Mounted Device used. Here, the Oculus Quest 2 device is used. It is connected to the development device and necessary permissions are allowed. The application is now built and run, after choosing the output device as the one connected. The initial build will take some time, while the patch builds after will be completed within 30 seconds to a minute. This causes an Android Package File to be generated, which is stored in the development environment and then copied over to the output device.

This causes the application to be immediately started up on the Oculus Device. The starting scene is according to the scene order defined and the position of the OVR Camera Rig that is defined. The visuals and sounds are all seen and heard according to the settings defined. The two controllers are also displayed as prefabs, to help the user easily exit out of the application.

5. Output

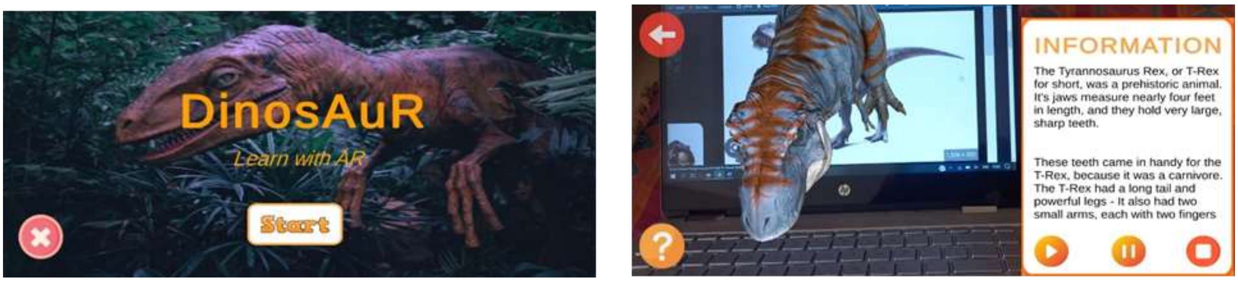

Fig. 5a, 5b– Augmented Reality Application

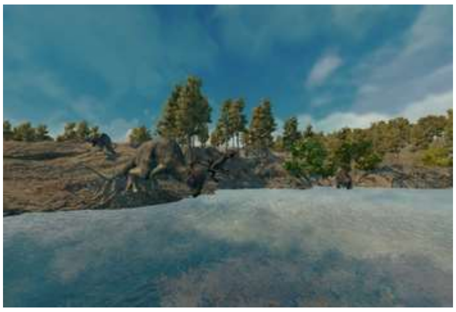

Fig. 6 – Virtual Reality Application

6. Conclusion

Technologies including but not limited to augmented and virtual reality can and will have a huge impact on the implementation of future practices. In particular, the education sector will boom due to the experimentation and advancements in the field of information technology. Augmented and Virtual Reality will prove to increase focus, concentration, imagination and understanding on concepts generally difficult to grasp. The blending of the three-dimensional objects and the environment of the user results in a realistic environment where the user can interact with both world's objects.

Future enhancements include, user movement and interaction, menu and interfaces, different fields within education.

References

[1] S. Serafin, A. Adjorlu, N. Nilsson, L. Thomsen, and R. Nordahl. Considerations on the use of virtual and augmented reality technologies in music education. In 2017 IEEE Virtual Reality Workshop on K-12 319 Embodied Learning through Virtual Augmented Reality (KELVAR), pp.1–4, March 2017. doi: 10.1109/KELVAR.2017.7961562

[2] F. M. Dinis, A. S. Guimares, B. R. Carvalho, and J. P. P. Martins. Virtual and augmented reality game-based applications to civil engineering education. In 2017 IEEE Global Engineering Education Conference (EDUCON), pp. 1683–1688, April 2017. doi: 10.1109/EDUCON.2017.7943075

[3] Vinh T. Nguyen and Tommy Dang 2017, Setting up Virtual Reality and Augmented Reality Learning Environment in Unity - IEEE

[4] Surabhi Nanda and Shailendra Kumar Jha, 2017, August. Augmented Reality- an Application for Kid's Education (ICCCS)

[5] Weiping Zhang 1 and Zhuo Wang - Theory and Practice of VR/AR in K-12 Science Education—A Systematic Review

[6] https://iopscience.iop.org/article/10.1088/1742-6596/1168/3/032045/pdf

[7] https://makeabilitylab.cs.washington.edu/media/publications/Kang_AugmentedRealitySystemsAndUserInteractionTechniquesForStemLearning__UMDCSPHDDISSERTATION2020.pdf

[8] https://www.researchgate.net/publication/335525338_Proposed_System_for_Education_Augmented_Reality_Self_English_Learning