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Innovative Approaches to Fun Learning in Early Childhood Classrooms

Dr. Vidhya D.S.[1], Mr.Gnanesh[2], Ms.Michelle Araujo e Viegas[3], Mr.Amitravindrannambiar[4]

[1]Associate Professor, Don Bosco College of Engineering Goa University,Goa, ds.vidhya@dbcegoa.ac.in
[2]Student, Don Bosco College of Engineering GoaUniversity,Goa, gnaneshmurthy5@gmail.com
[3]Assistant Professor, Don Bosco College of Engineering Goa University,Goa, michelle.araujo@dbcegoa.ac.in
[4]Student, Don Bosco College of Engineering GoaUniversity,Goa,nambiatamit@gmail.com

Abstract– *Education is an important part of a children life. In schools, teachers have been teaching children by interacting with them. Trying to make children learn and remember words through picture books, telling stories, etc. But grabbing their attention has always been a difficult task for teachers. Augment Reality is a technology to integrate virtual object into real world. Through Augment Reality we can visually experience it in real world even though it does not exist in reality. Augment Reality has been used in different field and when it comes to education it is mostly used in universities. Using Augment Reality technology in education can improve students' performance, keep them motivated and increase their engagement in learning. It can also help to improve their creativity, problem solving skills. Learning through augmented reality is a fun way to peak their curiosity and keep them engaged. This project is about creating an application using augmented reality to integrate alphabets, 3D models, and audio. This unique interface of combining real and virtual objects does act as a natural attention grabber, creating an engaging and fun learning tool for children. This app uses a mobile platform, which is easy to use and provides a better learning experience.*
Keyword- *Augment Reality, 3D models, mobile platform*

INTRODUCTION

Teachers have traditionally engaged students in schools through interactive methods such as storytelling, picture books, and other creative techniques to help them learn and remember words. However, capturing and maintaining students' attention has always been a challenge. The COVID-19 pandemic further intensified this issue, as students began spending less time on electronic learning platforms. For teachers, the sudden shift to online education posed significant difficulties, both due to the unfamiliarity of the medium and the added challenge of keeping students engaged remotely as shown in figure 1,

Some teachers who had previously experimented with e-learning platforms were selected to explore the use of augmented reality (AR) in education Augmented reality refers to the addition of augmentation of computer-generated image or 3D objects inside the real world.

Figure 1 Traditional Learning

Augmented reality consist of visuals sound and other sensory information that is overlayed on two a device such as a phone or glasses. Digital information is overlayed on the device to create a seamless experience that alter the user perception of the real world. The underlying digital information can, in turn, add to or Mask natural surroundings [1]. Using augmented reality to enhance learning can enhance learning by allowing educator to create interactive classrooms that increases students' engagement. AR technology can also be used for entertainment, medicine, education and games.

As augmented reality becomes more prevalent in education settings students are offen able to gain a better understanding of subjects. However, augmented reality in early childhood education is the least exposed to the technology [2]. As a result of using AR technology, it is possible to improve the following: student engagement and interest, learning environment, content understanding, collaboration, memory, sensory development, and cost-effectiveness.

The different types of augmented reality used are:

- Marker-based augmented reality
- Marker-less augmented reality
- Projection-based augmented reality
- Superimposition based augmented reality

A. Marker-based Augmented reality

In Marker-based augmented reality system, you have kept a marker in front of the smartphone camera, the marker can be in form of QR code or a 2D image [3]. When this marker is recognised by the camera, we can see a digital 3D object or virtual object on top of this marker. Marker-based augmented reality system is also called as image recognition AR as we are basically recognising an image.

B. Marker-less augmented reality

Marker-less Augmented reality as the name suggest do not require any marker or image for its working, but instead it detects the surface plane that is the floor and on top of the surface plane we can place augmented objects [4]. Marker-less augmented reality is also used in location-based augmented reality applications. Pokémon Go is the best example of marker-less AR as the Pokémon go takes input from the GPS sensor of your smartphone and when you reach at the place where Pokémon is showed in the map you can see the digital Pokémon image.

C. Projection based Augmented reality

Projection based Augmented reality requires a small projector for working and this projector projects light on any surface [5]. Google glass is example of projection-based augmented reality. Google class consist of mini projector which projects light on small prism and because of these were able to see augmented data like time (clock), weather information and location data in front of our eye.

D. Superimposition based augmented reality

Also called as object tracking augmented reality. In super imposition-based augmented reality we replaced the original view of the object with a new augmented view. For example, projecting a car 3D model on top of an actual car object. Augmented reality is increasingly being adopted in educational settings, often to help students with better understanding of subjects. Augmented reality in early childhood education is the least exposed.

BACKGROUND

At the beginning of the year 2000, researchers began to recognize the educational applications of Augmented Reality (AR) and anticipated the need for additional research in this area. Since then, a variety of approaches have been used in AR research. What has been studied in the AR field regarding mobile augmented reality is the subject of this study. It aims to comprehensively examine the articles' approaches to learning and pedagogical issues. Due to the small form factors of mobile devices and their capacity to allow students to move around freely while learning, mobile augmented reality has become increasingly interesting in recent years. The purpose of this study is to conduct a comprehensive analysis of educational applications of mobile augmented reality [6]. The development of digital technologies has transformed the framework of the conventional classroom and elevated educational curriculum to a new level [7]. The global education systems, which have been profoundly impacted by the shock of the COVID-19 crisis, need to rely on digital resources and innovation more than ever. The technology known as augmented reality, or AR, can give students and teachers access to specialized materials that transcend space and time. An in-depth analysis of recent research on augmented reality (AR) in education is presented in this paper [8]. Augmented Reality opens up new avenues for education by supplementing the real world with virtual information. The education process ought to be all about interaction and creativity. When the lesson is interactive, a child learns the most. For their mental development, it is therefore necessary to provide them with a platform where they can interact with the subject. This app is an approach to achieving that objective. This paper presents a system for augmented reality education in which users are able to interact with an interactive flower garden with the assistance of interactive agents in the augmented picture. We use a mobile device to test the effectiveness of the proposed system by allowing users to participate in the collaborative task with the animated character.

METHODOLOGY

The app leverages mobile augmented reality to create an engaging and interactive learning experience for students. By incorporating 3D animations and objects, it captures children's attention and enhances their comprehension and retention of new information. Designed to be user-friendly for both students and teachers, the app features

looping audio clips for each alphabet and includes movable 3D models to make learning more dynamic and enjoyable.

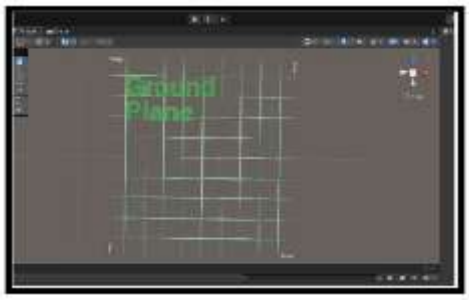

Figure 2: Ground plane stage

Algorithm steps:
***Step 1*:** Developing an AR Application Using Unity and Vuforia
***Step 2*:-**.Software Setup
***Step 3*-** Project Initialization
***Step 4*-** Ground Plane and Target Setup
***Step 6*:-**3D Model and Asset Integration
***Step 7*:-**Plane Finder Configuration.
***Step 8*:-**Audio Integration.
***Step 9*:-** Event Handling via Scripting
***Step 10*:-**Scene Testing
***Step 11*:-** Android Deployment

Visit the Vuforia engine from the menu. To select a ground plane as shown in figure 2, select the ground plane stage. The ground plane stage is 1x1 cm square in Unity and 1x1 meter square when augmented. Import a 2D image onto a cube with dimensions of 0.7x0.7x0.01. Download 3D models from websites like free 3D and canvas and add them to the assets in Unity. Click the menu option and visit the Vuforia engine. To select a ground plane fig 1, select the plane finder. Drag the cube and 3D models to the scene surface and check them on the game scene. Assign the ground plane stage to the parent object, and all the 3D models that need to be augmented should be assigned to the child object. In the plane finder, drag the ground plane stage to the anchor stage.

Select audio from the menu, followed by audio source. MP3 should be used for the audio Figure 3. Add an mp3 file to the audio clip in the audio source. For the audio source, pick the loop option. Deactivate the "play on awake" option from an audio source, select the ground plane stage, and set an "Event When the Target is Lost" and "Event When the Target is Found" so that audio is played when the target is found plays, and the audio stops when the target is lost.

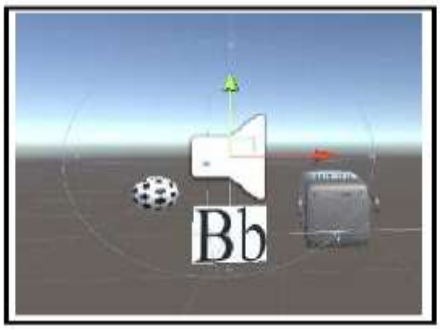

Figure 3: Audio Button

Because it determines how our objects will behave, scripting is essential. The components that are affixed to the game objects can influence their behavior.We can use scripts to do a lot of different things, like trigger game events, change a component's properties over time, and respond to touch, keyboard, or UI buttons input from users. The figure 4 C# programming language is compatible with scripting in Unity.

The UI toolkit is used to create user interfaces for a variety of games and applications. Components and the Game View are used to rearrange, position, and style user interfaces in this game object-based UI system. In the Unity Editor, UI cannot be used to create or modify user interfaces. Touch events, mouse clicks, and keyboard interactions are handled by the various components of the UI system. Button, scrollbar, dropdown, toggle, and other UI elements are just a few examples. These interaction components cannot be seen by themselves and must be in conjunction with one or more visual elements in order to function properly.

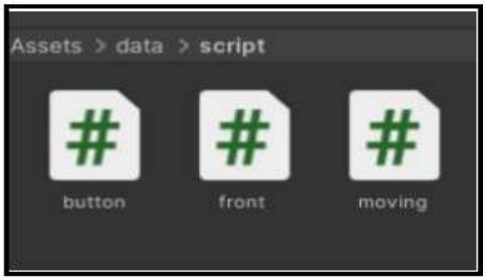

Figure 4 C# module

Utilize the Vuforia Engine Play Mode in the Game View to see your scene in action. By pressing the Play button, which can be used to start the game. Without deploying your scene(s) to a device, you can quickly evaluate and prototype them using this feature. Testing the Vuforia by setting Play Mode in the Configuration section figure 5.

Targets using a recording mode, a webcam, or a simulator modem. Open the Build Settings window in Unity to configure and build Android apps.

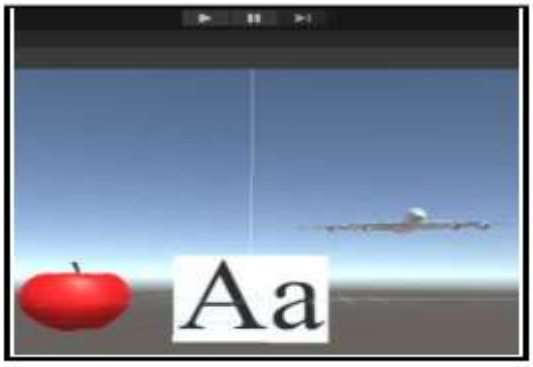

Figure. 5 Play Buttons

To make Android the default build target, select Android from the Platform drop-down menu and then click the Switch Platform button. Click Build to begin the build process once your build settings have been set up. Alternately, select Build and Run to run the app on your connected Android device as well as build the project. The generated. apk file, which can be installed on any Android device, is also saved to the specified location by this option.

RESULT AND DISCUSSION

The prospective teachers showed excitement, emphasizing the strong potential of augmented reality to enrich educational content. They believe that the interactive nature of augmented reality —blending real and virtual elements—can make learning more engaging and enjoyable for children, naturally capturing their attention.

A. Vuforia Engine

Vuforia, also known as a Software Development Kit (SDK), is a powerful engine that enables the development of augmented reality (AR) applications. It leverages the Positional Device Tracker to provide accurate image and object tracking, making it possible to integrate AR experiences with Unity and deploy them on Android-based mobile devices as figure 6. Vuforia can recognize both planar images and three-dimensional objects in real time using advanced computer vision technology. Its performance relies on the mobile device's camera to sense and track images—a process known as tracking. The most sensitive points of an image used for tracking are referred to as "markers" or "trackable."

Vuforia analyzes data by comparing features in the target image with the incoming frames captured by the camera to identify "feature points."

Figure 6 Vuforia Engine

A target image is any image in the real world where digital augmentation is applied. Android studio is a software development kit (SDK) with a complete Integrated Development Environment (IDE) to build Android applications for mobiles, tablets, etc. With Android Studio, to build Android apps more quickly and effectively. It offers features such as grade-based systems and a fast and feature-rich emulator as shown figure 7.

Figure 7 Main Screen

B. Smartphone

The smartphone or tablet should support at least one of the following features:

- Ground Plane detection capability
- Augmented reality Kit support (available on iPhones and iPads)
- Augmented reality Core support (available on high-end Android smartphones)

Since augmented reality Kit was developed by Apple, any app utilizing augmented reality Kit will run on compatible iPhones or iPads. Augmented reality core, developed by Google, is supported on many high-end Android devices. A camera is essential to scan the ground plane for projecting augmented content. Mobile-based augmented reality applications are user-friendly and widely accessible figure 7. The launch screen will appear as soon as the augmented reality application is opened. To begin learning the alphabets figure 8, select "Start Learning" and "Exit" respectively.

Figure 8 Augmentation of 'A'

After selecting "Start Learning," a list of alphabets for learning will appear on mobile devices. To return to the main screen, there will be a back button in the upper left corner of the screen. The camera will turn on and scan the "ground surface" upon selection of any alphabet.

Figure 9 Augmentation of 'D'

Play becomes the foundation for literacy and learning, as it encourages children to actively participate, think critically, explore ideas, and gain meaningful experiences Figure 9.

Figure. 10 Augmentation of 'G'

The square button will appear on the display. The augmented model will appear when click on it both visible and audible Figure 11.

Figure 11 Augmentation of 'Z'

Conclution

A mobile Augmented Reality (AR) application showcases how AR technology can revolutionize traditional methods of early childhood education. Unlike conventional methods that emphasize critical thinking alone, our Augmented Reality-based solution fosters passive learning by providing a visually engaging and interactive experience. Designed specifically for preschool learners, the app simplifies educational content through animated 3D models and sound loops for each letter, capturing young students' attention and enhancing concept retention. Its mobile accessibility ensures ease of use for both teachers and students, making learning more inclusive and enjoyable. By leveraging augmented reality technology, this application successfully breaks down conventional learning barriers and redefines the delivery of foundational education for young children.

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