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AR based smart education in android platform using unity

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ABSTRACT

Augmented reality is a rapidly growing subject of computer science and technology study. AR brings technology to life by allowing users to interact with their surroundings in real time. Information and communication technology now supports the growth of human contact with physical, computer, and virtual environments in fields such as science, commerce, banking, and education. This technology is a part of computer science that concerns with the merging of reality and computer-related data. It is common knowledge that our existing educational system falls short in several areas. We still follow the traditional blackboard method of teaching which fails to provide every student with proper guidance. By introducing Augmented reality into the education system, teachers can convey their knowledge more precisely and in a very attractive manner. Some concepts are difficult to understand and even harder to properly depict and present in a textbook. However, augmented reality serves as a new medium where it is much easier to achieve. In this application the topics can be observed in 3D graphical image and video format replacing the traditional 2D view. This system is designed to provide virtual training to the hyperactive person as well to conduct intelligent assessment to the same person. Therefore this deployment can also be done for creating a classroom environment for all the learners, which initiates more interaction to learners via MQTT protocol, and they can see all practical implementation of their subject through a virtual mode, reducing learners' stress in understanding a subject. This system will help the students to view the 2D images in 3D which gives students better visualization and helps it easier to understand various layers, structures which otherwise is difficult to understand based on just a 2D structure.

Keywords— *Augmented Reality, Marker Detection, Rendering*

1. INTRODUCTION

Augmented reality (AR) is a technique that enriches physical environments or circumstances by delivering perceptually unique experience. The information about the person's surrounding world becomes participatory and digitally modified using advanced AR techniques (e.g. adding computer vision, putting AR cameras into smartphone applications, and object identification). The Actual world is loaded with information about the environment and its things. This data can be digital or actual, like viewing other real-world felt or measured data, including electromagnetic waves, overlaid in perfect alignment with their true point in space.
In addition to accumulating and sharing tacit information, augmented reality offers a lot of possibilities. Augmentation techniques are often used in real time with ambient factors in semantic contexts. Over a live video feed of a sporting event, immersive perceptual information is occasionally integrated with extra information such as scores. This incorporates the advantages of both augmented reality and heads-up display technolog+y (HUD).

Our "AR based Education Application" goes a step further in the present educational system by allowing users to view a 3D generated model -a virtual resemblance of 2-D images in Books that can be viewed and customized in real time using our Augmented reality application. Our application allows a 2D object to be visualized in a 3D format thus providing a detailed explanation of each and every layer of that image which otherwise would have been inaccessible.

1.1. Related Work

- In 2016, Mahesh G et al developed a “smartphone Integrated Classroom” in which a Wi-Fi router is connected to the mobile phone and is connected to a server to control student attendance and take face recognition. There would be no need for the internet. The Wi-Fi would only be available within the classroom.

- Khan M M et al have proposed a "Using Mobile Devices and Social Media in Supporting Engineering Education" in 2014 which Investigates how students at university use smart phones with respect to engagement and interaction in various learning activities. Studies how students engage with learning tasks and what social interactions occur when they are trying to achieve their academic goals.
- Xinxin Deng et al have proposed a "Smart Learning Environment" in 2019 which uses IOT as it completely studies the matching degree, satisfaction degree, advantages and disadvantages between the general multimedia classrooms and the smart learning classrooms.
- Nallapaneni Manoj Kumar et al have proposed "Use of Smart Glasses in Education" in 2018 where Applications of wearable smart glass in education include the augmented reality, documentation of lecture, on-site report preparation, recording lectures as videos, capturing essential points as images, tele-mentoring, trainee's evaluation, understanding the listener's experience and nature, student concentration evaluation.
- Gambo Yusufu et al have proposed a "A Novel Model Of Smart Education for The Development of Smart University System" which is a student- centric intelligent learning environment enriched with digital learning resources to provide smart pedagogies that support smart learners' personalised learning experiences anywhere at any time using smart portable device and linked across educational institution or training workforce through the advancement and superiority of smart and wireless technologies.

1.2. Proposed Work

In the education sector, AR has not yet been fully deployed. People today are well-versed in technology and use cellphones that support augmented reality. Thus, the concept of building a "smart education software based on augmented reality" puts the current educational system one step closer to being technologically sophisticated. Better cameras and more precise sensors have recently appeared in soon-to-be mainstream products. We use Vuforia in this current implementation to precisely recognize the relevant material and digital 3D portrayal of the concept that has to be visualized.

The envisioned system using marker-less tracking helps the user with a better perception of objects. Marker less tracking is a type of positional monitoring that determines an object's positioning in relation to its surroundings without using markers. This is a crucial component in this technology, since it enables the environment to adapt to the user's field of vision and perspective, including the positioning of 3D material in accordance with the actual world. While marker-based motion tracking requires the use of specific optical markers, marker-less positional tracking does not, making it a more versatile solution. It also eliminates the need for fiducial markers to be set in a prepared area. This application enables us to view the 2D image in a 3D format. The Android application development process for Augmented Reality consists of following steps mentioned:

- 3D Model Creation - Creates interactive 3D Model with visual effects
- Creation of tracker image –Tracking of an image is done in such a plausible way that it is compatible with the real as well as virtual world.
- Embedded in Unity - The tool allows to embed 3-D model and Tracker image into Unity package. Unity allow us to modify objects scaling and with X-axis, Y-axis and Z-axis
- Development of .APK - With the help of Java (SDK) and Android Studio, enable to generate android file that executed in android mobile with version 4.0(ice cream sandwich) and above.

1.3. Modules

The application implementation consists of four modules.

- Creating Augmented Reality Objects.
- Developing Scenes for User Interface.
- Place the Object on the Surface Area.
- Development of .APK

A. Creating Augmented Reality Objects

The Unity 3D project must first be opened and then select GameObject from the menu bar. The GameObject Menu contains many elements that is used to make a game. From there, we can choose a 3D object and the form choices that best fit our needs. We can choose the rotation tool to aid in the rotation of our plane object. It also assists us in rotating the items in our scene. We can create the assets by using the hierarchy view which helps us to combine various shapes within the unity. There is a pro builder in Unity which allows us to edit our shapes helping us to obtain our 3D furniture objects.

B. Development Scenes for User Interfaces

In this module we create scenes for every slide of application using Unity 3D. The main interface contains 3D model, buttons that helps to move to next model, to scan the surface area of educational material and place the equivalent 3D object over there. In order to implement these functions, we make the scene display to ratio of Android display and add the buttons to the scene that helps in moving to next scene. Later we use the 3D model developed in Unity 3D and functionalities like rotating the 3D models will be displayed using C# code for that object and add functionalities to move to next scene.

C. Place the Object on the Surface Area

For this project Android studio is used with the Vuforia package. Vuforia packages is used because it offers 3D model demonstrations, to create applications for customers to personalize their products and gives a robust AR experience with the vision technology. We upload our target image in the Vuforia cloud, it renders the features of the target image and stores it such that when we scan the environment it identifies the target image. After the identification, our 3D object gets placed over the target image. Target image acts as a position indicator such that the 3D image gets fixed wherever we place our target image.

D. Development Of APK

With the use of Java (SDK) and Android Studio, we can create an android file that will run on Android devices running version 8.0 (Oreo) or higher. When this application is used, it will automatically display the appropriate 3D representations of the material we needed, allowing us to demonstrate a better technique of explanation to the pupils.

1.4. System Architecture

The system basically uses mobile phone built-in camera which supports Augmented reality to collect view as the real scene view observed by human eye and stacks the 3D models on the screen displayed. First of all, we need to setup the scenes in Unity 3D for User Interface of application like buttons, text areas, background image and virtual object selection.

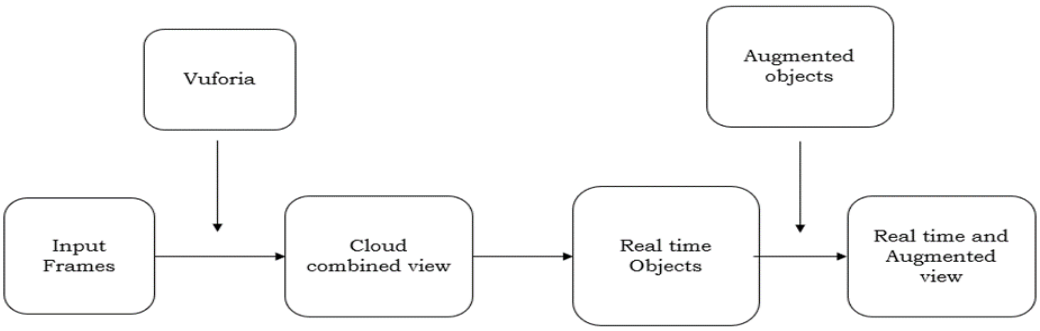

Fig 1. System Architecture

As shown from the above figure 1, it describes the architecture of the application that take the real view as input with the help of AR camera then process it with virtual object to get the resultant output as augmented display.

1.5. Advantages

Have a better environment for students to interact with chemicals than they would in the real world.

- Using virtual growth cycles to learn about plants and how they communicate with their environments when space, season, and other factors are taken into account.
- Save money by preventing students from making these findings and analyses in the classroom.
- Using manipulation and multi-angle observation of virtual 3D structures to improve perception of abstract, spatial geometric principles.

1.6. Experimental Results

Unity 3D, Vuforia, and Android Studio were used to construct our project. Unity 3D is a game development platform that includes a development environment for interactive 2D and 3D content, a rendering and physics engine, a scripting interface for programming interactive content, and a content exporter for a range of platforms (web, mobile, etc). It is used to generate scenarios for our product. Vuforia is a mobile-based augmented reality software development kit that allows developers to construct augmented reality apps. Using computer vision technology, it recognizes and tracks planar images and simple 3D objects like boxes in real time. The target image is scanned and stored using Vuforia so that when the camera is put over it, it identifies it and inserts our 3D item on top of it. The android studio is used in the creation of the .apk file.

A. Home Page

Fig 2. Home Page

The home page of our app consists of four sections from which you can choose from: Book, Sun & Earth, Brain and Exit.

B. Output 1 (3D Image of Book)

Fig 3. Elements in a Book

This page of book contains 3 instances of the 3D images, video and audio. We make use of the virtual buttons which can be seen as the red rectangular boxes. When you place your fingers or any other item, in this case the scale, covering the red mark, the 3D elements pop up. The first one is the Malayalam alphabet (A) on the top left corner of the book. This is an audio element where it recites the wordings "a for amma". The next one is the cupboard which is a 3D image. The last one is the elephant which a 3D video element. So, when you place that ruler or any other item over the red virtual button, the elephant video pops up. It's a video of elephant walking in the above image.

C. Output 2 (3D Image of Human Brain)

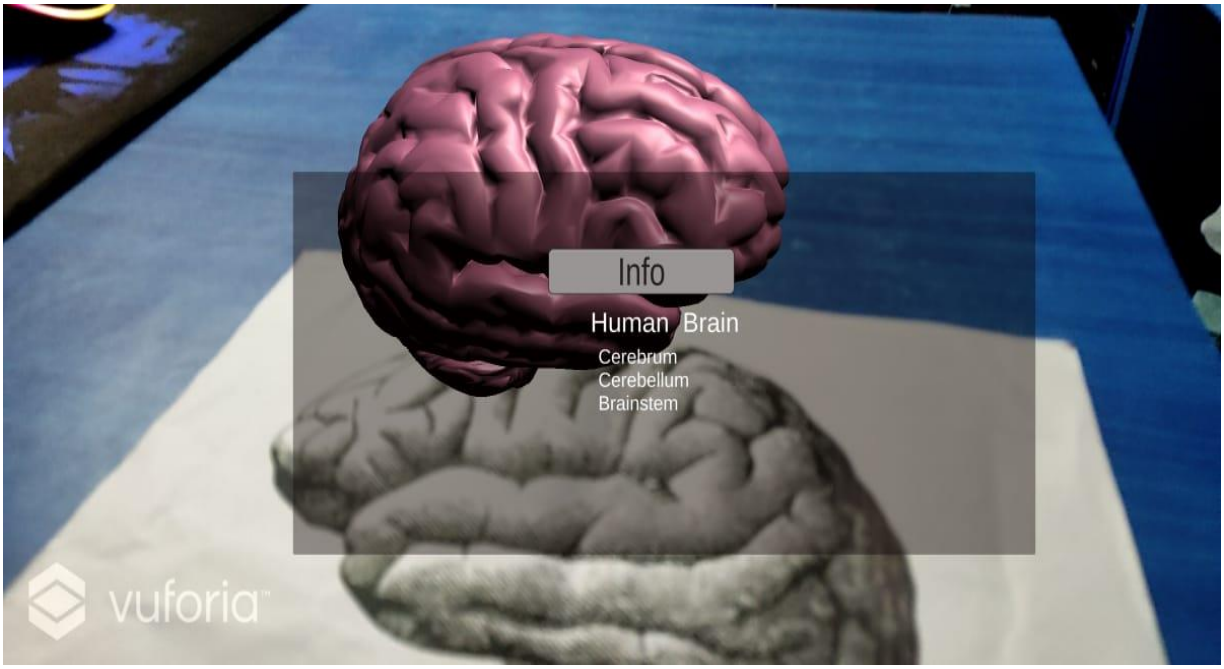

Fig 4. 3D Image of a Human Brain

The 3D image of the Human Brain has been successfully positioned on the target image, which here is the black and white printout of the Human Brain. Here we can see the parts of the brain mentioned on the top of the 3D image which appear when we click on the image.

2. CONCLUSION

The major goal of this proposed system is to investigate the usage of augmented reality in the educational sphere. This technology will assist us in improving our current traditional education system, which primarily employs blackboards and textbooks. This software will help students better comprehend particular topics by displaying 3D models in real time and providing a full look and description of the topics. Thus making the explanation of topics easier as well as fun to understand.

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