ADOPTION OF EXTENDED REALITY AS A TEACHING TOOL

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ABSTRACT— Extended reality (XR) facets aid pupils in understanding difficult topics. Regular education has been reliant on 2D technology for a very long time. It no longer draws in pupils due to its lack of immersion and engagement assistance. The suggested remedy involves using AR to develop 3D models and educational components. The augmented reality (AR) application is more appealing to pupils than other approaches and can be utilized as an interactive tool to clarify difficult concepts in the classroom. The functions of the following human anatomy parts—the brain, heart, and pancreas—were supplied in a piece of note, and audio was added predominately. The 3d models were created using the unity3d application as a support system, and Sketchfab was used to import them.

Keywords—XR-Extended reality, AR-Augmented reality, 3D models

I. INTRODUCTION

It is typically not practical to immerse students in the real world and have them engage with it. Despite the fact that the world is three-dimensional, we choose to employ two-dimensional media in education because it is more practical, comfortable, adaptable, portable, and affordable. It does not, however, supply dynamic material and is static. Alternately, a three-dimensional virtual environment created by a computer can be employed, however, these scenes require pricey high-performance computer graphics.

Virtual worlds may offer a variety of teaching and learning opportunities, but it can be challenging to achieve a realistic enough level of realism [14]. Users lose touch with the actual world when they are totally immersed in this atmosphere. So, it simulates the real world you are experiencing to provide you with virtual items [1]. Many academic institutions are using Second Life as a platform for virtual classes, opening up career resources to a wider audience and, in some cases, bridging the "Digital Divide" by providing support to students who lack access to quality education. Additionally, Augmented Reality (AR), a subset of Virtual Reality (VR), successfully combines the virtual and physical worlds, creating a more immersive experience than traditional VR technologies.

The difference between augmented reality and virtual reality is that the latter builds a full-fledged virtual fantasy. Users lose awareness of the outside world when they are fully absorbed in a virtual one. Contrary to virtual reality, augmented reality simultaneously shows viewers the real environment and a scene with virtual objects. Users can interact with virtual objects that have been inserted into real-world scenes in order to have the most realistic user experience. Users may seamlessly connect the real world and the virtual world with the help of AR environments.

Utilizing 3D animation, Augmented Reality in the AR-based learning environment aids in clearly portraying both the micro worlds that only exist in learners' imaginations and the real world that is inaccessible to them. This will make it simpler for students to examine these issues closely and study the principles and disciplines that underpin them. Additionally, information is rationalized by augmented reality, which means that it is blended into users' actual surroundings. Bridging the gap between learners and the knowledge to be learned makes learning processes as natural as typical student-teacher interactions [2].

Review papers on using AR to teach biology are still hard to come by, though. Consequently, the primary goal of this research is to present an in-depth assessment and analysis of the creative content and design of augmented reality for learning biology.

II. LITERATURE REVIEW

Although there are several studies and applications for biology e-learning, there isn't a suitable digital tool to experience human anatomy in the actual world. Few of those gadgets have ever offered to learn ideas or 3D animation experiences; instead, the majority of them are exclusively focused on delivering biological concepts through questions or paragraphs. Only picture categorization is the subject of research. Rarely can augmented reality and human anatomy approaches coexist on one particular platform [3].

A. Related Works

The use of augmented reality in math, physics, and chemistry classes is common. They focus on the educational system of the students. Nevertheless, because of the difficulty of the curriculum, biology is rarely used. To grab students' and instructors' attention, we focused on the key biological ideas in the Amazon Biology mobile app. Augmented reality is utilized in various methods to get pupils to pay more attention. The use of AR supports avoiding traditional learning methods and simulating classroom activities. According to certain studies, employing augmented reality cuts down on the time wasted learning material in conventional lectures. They primarily aim to create a system of AR literacy for students [4].

This study tries to assess whether prior research has demonstrated that 3D imaging of breast cancers is too successful. The primary focus of this study is to describe how augmented reality (AR) may be used to give medical practitioners a more accurate visual portrayal of breast tumors. The goal of this research on a virtual reality-based educational game is to raise autonomous, resourceful, and kind young people. At the moment, augmented reality is widely used in educational games. Using augmented reality to bring greater attention to challenging subjects can considerably help to learn. Due to its intricacy and depth, students find it tedious to understand these topics. So, implementing a game-based augmented reality application can address all of these issues [5].

Numerous mobile programs are available that deal with biology. These applications' properties have been identified, and a comparison of them is provided below. An educational augmented reality software for learning science is called AR-3D. It is a smartphone application that includes various 3D components of human anatomy. The application's capabilities let pupils touch, spin, and zoom in and out. The explanation includes graphic 3D human anatomy models that depict each piece [6].

A haptic interface, according to the author Soon-Ja-Yeom, can enhance the understanding of three-dimensional things. The author of this work, "Augmented Reality for Learning Anatomy," set out to determine if haptic augmented reality is a valuable teaching tool. To address some of the inquiries surrounding this issue, they conducted many polls among the pupils. Most of the comments were supportive of the research and favorable. The study looks at whether haptic augmented reality can be used to teach anatomy while ensuring that everyone has access to more fun activities [7].

III. BLOCK DIAGRAM

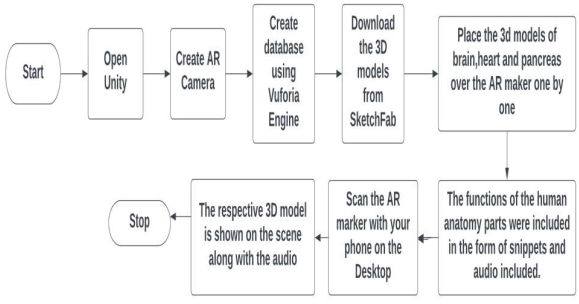

Fig 3.1. Block Schematic of the Process

IV. HARDWARE AND TECHNOLOGICAL ADVANCEMENTS

A. Unity Game Engine (cross-platform)

Unity is one of the most effective cross-platform game engines. There are 27 platforms that are supported by Unity. It is created by Unity Technologies, the top third-party game development platform in the world. According to the PR page on the Unity website, more than 45% of developers prefer using the Unity game engine. With Unity, professional 3D and 2D games may be produced and released on mobile, desktop, console, virtual reality (VR), and augmented reality (AR) platforms. Since the Unity Game Engine includes a lot of augmented reality support, we use it for our software development.

B. Blender 3D

Building 3D pipelines for modeling, rigging, animation, simulation, rendering, compositing, and motion tracking, as well as for video editing and game creation, requires the usage of the open-source Blender-3D graphics toolkit. A significant user and developer community backs the Blender project. Its market is likewise substantial. The ideal platform for creating assets for our project is Unity 3D, which has the best support for files with the "blend" extension.

C. Sketchfab

A website for publishing, sharing, discovering, buying, and selling 3D, VR, and AR material is called Sketchfab. It offers a viewer built on WebGL and WebXR that enables users to show 3D models on the web, viewable on any mobile browser, desktop browser, or virtual reality headset.

D. Vuforia Software Development Kit (SDK)

A software development kit (SDK) for developing augmented reality apps is called Vuforia Engine. With the SDK, you can integrate cutting-edge computer vision capabilities into your application, enabling it to identify pictures, objects, and locations with simple configuration choices for interacting with the physical world.

V. BUILDING 3D MODELS IN BLENDER

Each of our 3D models is formatted as "blend" in Blender and has the following features:

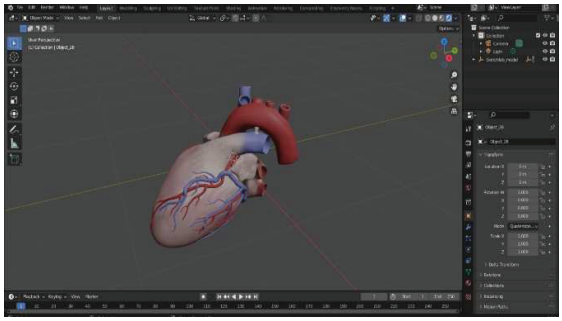

Fig 5.1. Model Development of heart in Blender

In the sculpting mode of Blender 3D, a user may shape and define a mesh using a variety of tools and 20 different brushes.

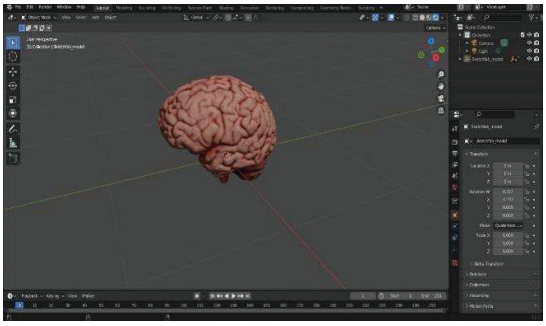

Fig 5.2. Model Development of Brain in Blender

The versatility required at various stages of the digital production process is provided by these solutions. Faces are created to completely ring the mesh in its initial state, giving it the same shape as the sculpted mesh itself. When all of the faces have been combined into the object, a "blend" file may be retrieved from it.

Fig 5.3. Model Development of Pancreas in Blender

VI. PROCEDURE FOR IMPLEMENTING THE APPLICATION

A. Integrating Vuforia SDK in Unity

The Vuforia Software Development Kit was the first thing designers loaded into the project for the AR camera (SDK). Since this is a Marker AR application, we didn't need to build up any databases for markers. We handed away an AR camera from Vuforia together with a complimentary license key.

B. Integrating human anatomy parts (virtual models) into Unity 3D

Blender is used to import the 3D models, choose the perspective shading, and export the final product. After that, Unity imports the exported models.

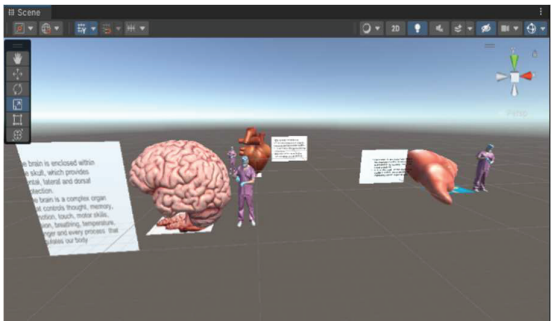

Fig 6.1. Importing Blend files to Unity

C. Development of Application

Place the 3D replicas of the pancreas, heart, and brain over the AR maker one at a time. There were also included audio clips and snippets outlining the functions of the major human anatomical parts. Play the scenario and use your phone to scan the augmented reality marker on the desktop. Together with the sounds, the corresponding 3D model is shown on the scene.

VII. RESULTS AND DISCUSSION

Numerous uses of augmented reality in education are investigated, and performance standards are also assessed. From this, we may begin to understand the various strategies and procedures used in those applications.

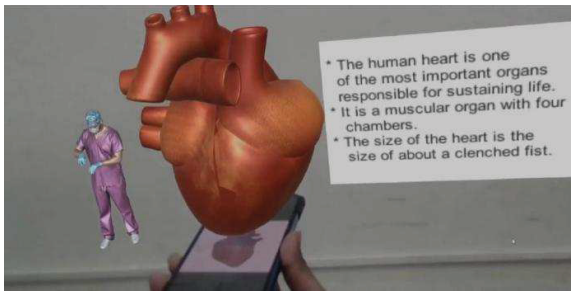

Fig 7.1 Output obtained from Unity

Due to its intricacy, biology is sometimes a difficult topic for both high school and college students to comprehend. Students frequently study textbooks and attend seminars as two methods of learning biology. Most schools lack the required lab facilities, anatomical features, and resources to make biology an easy subject to study because it is based on more practical principles. The topics will thus be learned fast if the learners use this form of 3D learning.

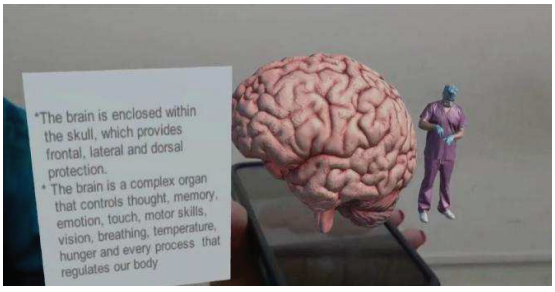

Fig 7.2 Output obtained from Unity

Fig 7.3 Output obtained from Unity

The AR application is currently built with simple control operation and remarkably sensible FPS animations. Applications for augmented reality will improve learning motivation and effectiveness in the classroom.

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