INTERACTIVE EDUCATION USING AUGMENTED REALITY THROUGH HANDHELD DEVICES

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Abstract - *Engagement in a class gives students a shared experience and develops their understanding of the topic. Traditional education may not be interesting to our generation or may be inadequate to give them knowledge enough to make an informed decision and learn the knowledge that they require. Augmented reality is a highly visual, interactive way of delivering pertinent information in the context of the real world. Using Augmented Reality can make learning more fun and can help achieve a deeper understanding of the subjects. Apps that use augmented reality allow you to overlay and analyze a layer of 2D or 3D data on a surface. Any 2D or 3D surface, as well as many trigger points on practically any surface, can usually initiate the interaction. Objects with flat surfaces, such as books, can fall under this category. Our project will be a traditional textbook that will use a real image of the object as a marker for the portable device to detect and create one or more 3D virtual objects above this marker and help us to interact with 3D objects through various interactions like gaze, touch, voice input etc. These interactions will trigger different actions, animations and sound output. This will let us have a fun experience learning while also helping the user get a deeper understanding and let them apply the knowledge much easier with more confidence.*

Key Words: **Augmented Reality**, **Interaction**, **Gaze**, **Trigger**, **Voice**, **Touch** etc

1. INTRODUCTION

The Conventional education system is mainly based on textbooks. Textbooks books include text and additional with that pictures and diagrams. we couldn't extend the possibilities of a textbook beyond a particular limit. But technology has evolved a lot from the days when we begin to use textbooks for education. so our project aims to include the possibility of technologies such as augmented reality in the education sector. Imagine a scenario of our existing system, suppose we are going through the circulatory system in a textbook to understand how it works, we have to go through long paragraphs and some images which are printed there. Now we can think about how our project can make this situation more interesting. Smart phones are an inevitable part of our daily life, by just moving our mobile phone over that particular picture of the heart, leads to a virtual textbook that includes animations audio and so on. This will improve the imagination and be helpful in understanding the concept thus it will be interesting for learners. Augment reality is a leading edge technology that extends the real world into a virtual environment and provides capabilities of computer-generated visuals audios texts and other effects to create an interesting experience for the user. It is also possible to combine emerging technologies like machine learning artificial intelligence deep learning etc along with an extended reality environment. Some of the real-time examples are Snap chat, Mondly and ink hunter.

2. EXISTING SYSTEM

The article "Revolutionizing education system with interactive augmented reality for quality education" by D.Roopa, R. Prabha and G.A.Sentil [1] , aims to implement an interactive augmented reality experience to promote situation and experimental learning. They have developed an augmented reality based system to describe the working of an Alternating Current(AC) generator. AC generator working was explained through augment reality with help of unity 3D engine and Vuforia developer portal. C# is used for the coding purpose which is needed to provide instruction for interactions and animation. Android Software Development Kit(SDK) is used to build an Android Application Package (APK) file for the application.AC generators have different parts like slip rings magnets etc, these objects are combined using the blender application. Blender application is helpful in creating 3D objects. Buttons and sliders were provided to interact with the application like increasing the rpm value of the generator. It helped students to understand the concept easily and to enhance their imagination. it does have only one manner of interaction that the student is able to perform.

3. RELATED WORKS

K. E. Kouzi and colleagues[2] developed an application that allows elementary school students to interact with a fully three-dimensional human skeleton model by pressing particular virtual buttons. Students can examine this sophisticated structure and learn the names of the

main bones using a tablet, a photo, and their hands. The primary concept behind this augmented reality is that when users aim their mobile device at a relevant page in their class textbook, a 3D model of a skeleton appears on top of the book. The five bones of the enhanced item, which is a skeleton, can be interacted with by the users. These bones include the skull, clavicle, ribs, femur, and pelvis. They used Auto desk 3ds Max to generate the 3D model of our skeleton and the words that represent the bone names, then converted their model into a mobile application environment using the Unity game engine and the 2 Vuforia Framework. They created software that recognized the relevant page from the student's textbook as a marker, allowing them to show their 3D model on top of it after photographing it. The 3D writing visibility was adjusted using the invisible buttons on top of the bones. In summary, the application is used to create an augmented object of a skeleton on a book. The system will display the name of the bone the user touched by touching the virtual touch associated with distinct bones. Virtual buttons are used to interact with the application. Though touch input is preferable in this circumstance, using voice to trigger the bone names will aid the user's pronunciation skills. Non-English speakers would benefit from additional sounds out to pronounce the name of the bone instead of or in addition to text. It will also be useful to be able to zoom in or scale the enhanced object.

X. Liu, Y. Liu, and Y. Wang [3] propose an augmented reality-based real-time visualization method for 3-D magnetic fields that can visualize magnetic flux lines in real-time. It allows students to move the magnets about in 3D space while simultaneously watching the magnetic flux lines. With the suggested method, which visualizes the invisible variables in a 3-D magnetic field, students will have a real-life reference for learning electromagnetic. They first calculate the number of magnetic flux lines and their approximate sparse distribution in the high field region, then calculate the magnetic flux intensity using the derived analytical expression of the 3-D magnetic field, and finally use the particle tracking method to simulate the calculated spatial trajectory of the magnetic flux line. To build the magnetic flux line visualization method, they employed Unity 3D, a 3-D engine that can create augmented reality applications with the support of the Vuforia AR SDK. Vuforia AR SDK captures real-time video with a web camera, from which it can swiftly locate photographs and objects in the real environment, as well as duplicate electromagnetic field ambient content. When the magnetic flux lines are visualized in real-time with the movement of the magnets, learners may easily investigate the electromagnetic phenomenon. By flexibly moving the two magnets around, the geometry of magnetic flux lines can be modified in real-time. In short, the application draws two magnets and their associated magnetic flux density on a piece of paper based on where the camera is pointed. The mechanism allows the user to move the

magnets, which vary the flux density. The employment of a web camera in a laptop is a key disadvantage of this method. Switching to portable devices like mobile phones or AR headsets will be a suitable alternative because laptops and desktop PCs are not easily portable. Only touch interaction is used in this manner. More types of interactions, such as voice input and gaze technologies, will improve the user's experience. It will be more engaging to users if the augmented magnet and magnetic flux can be accompanied by sound effects.

"Hand Gesture Control of Virtual Object in Augmented Reality" [4], The study proposes employing hand gestures to manipulate virtual objects integrated into the real world. The hand gesture control system is made up of two basic components: a back-end system and a front-end application. In the back end system, image processing algorithms are used to recognize motions and overlay the virtual item on top of the video feed. The front end application uses interpreted hand gestures to control the virtual item. The design of an augmented reality system that allows for hand gesture control of virtual objects is detailed. It does, however, require numerous systems and devices, making it non-portable, and the technology is substantially more expensive and complicated, making it unavailable to a certain percentage of students. As a result, widespread deployment is impossible.

"A Card-Based Interaction to Design Visualizations in Augmented Reality Environments" [5], discusses an app that is being created to help people learn about information visualization. Charts can be used by such people to create visualization, alter them, and learn from them. As a result, find data and learn about each aspect of the visualization process. The objective of cards is to visually and intuitively convey the action. It is expected that learning will occur during the creative process, which will need to treat each user as an individual and make the design process transparent. Visualizations will be easier with the use of cards for interaction and visualization. On the other side, while creating data visualization, a large number of cards makes life more difficult .The vast majority of cards, on the other hand, are worthless. Only the visual mode is accessible, drastically limiting users' access to information. It's an interactive and virtual experience. Because the user's or student's information is at stake, this can be dangerous. It's possible that your attention will be drawn away from you.

4. PROPOSED SYSTEM

The proposed system has improved functionality than the existing system. In the Existing System, the possible type of interaction used is virtual buttons and slider adjustment through the mobile touch screen. Associated actions and animations will be triggered. In addition to the slider and virtual button interactions, our model includes gaze

interaction, voice interaction and the ability to move around the 3D objects via mobile touch screen. Unlike the existing system, our model has more than one page of augmented reality. The reason we did that, is to show the interactions efficiently.
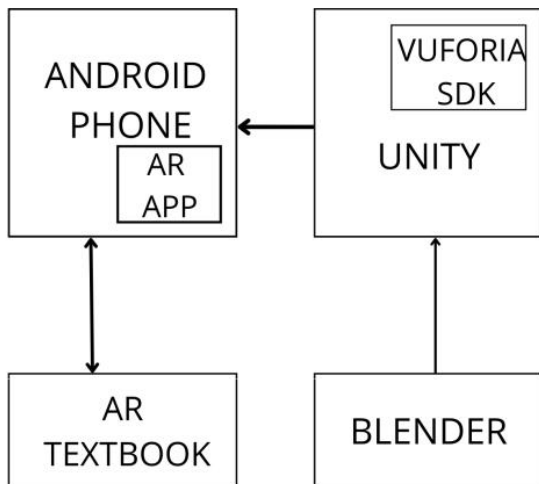

Fig -1: Block Diagram

5. IMPLEMENTATION

The AR system is designed to project 3D virtual objects over 3 pages. As we scan each page using the Android mobile camera, associated interactive 3D objects will be virtually placed over the page. C sharp scripts to program the 3D objects. The Vuforia SDK will provide the AR camera, with the option to include target images and virtual buttons. We are using a 3-page textbook as our 3 image target or markers.

The first page is a map. The main interaction used here is gaze. Gaze interaction works such that, when we focus the camera of the mobile on the collider object, the associated function or action of the collider object will be performed. On this page , as the mobile hover over the states of the country, a text containing the name, population, population density and the total area of the state will be popped - up. Only the state on which the camera focuses will perform with action. Once 3 the camera loses focus on the 3D object, the pop-up text will disappear. We used the concept of Ray Cast to intersect the 3D objects collider. A script for the pop-up text to follow the camera is also written, so whenever a pop-up happens, it will face the camera.

The next target image is a circuit with an adjustable resistor, light source, and battery. We have the option to adjust the resistance of the resister through a slider. We can also place a 3D diode on the circuit in a forward or reverse biased position, where the diode is not part of the image target. When we adjust the slider the resistance

changes and so does the current in the circuit. when the diode is placed in reverse bias, the circuit will pass current, hence the bulb will not glow. We can drag and drop the diode to the circuit. Here, we also make use of a voice command called "reset" to reset the whole circuit. So a speech to text module is used for this image target.
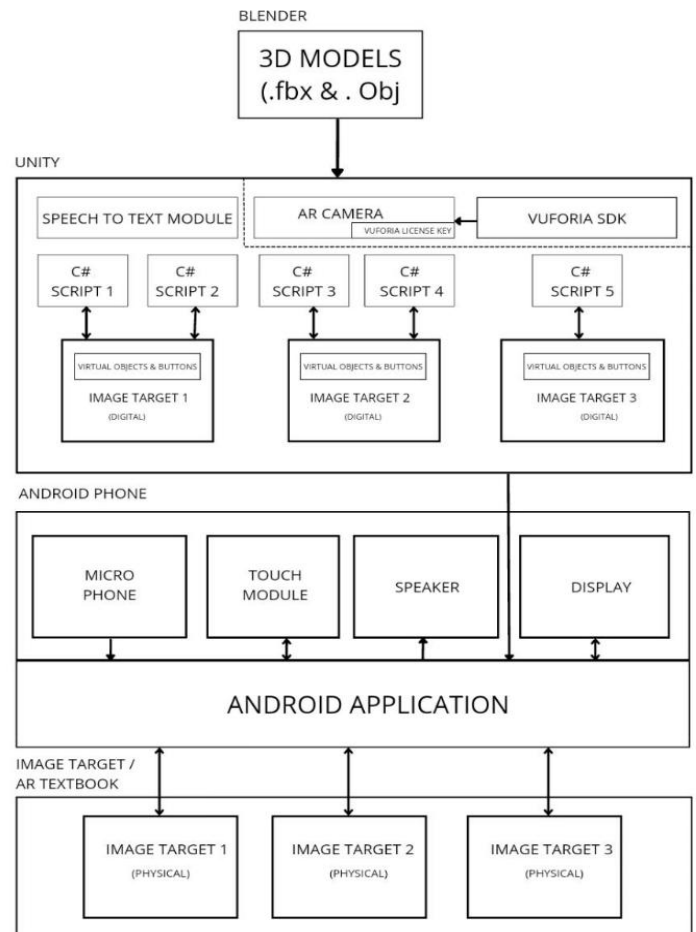

Fig -2: Architecture Diagram

The third target image is an image with the names of some periodic table elements like hydrogen, oxygen, and carbon and compounds like H_2O, CO_2. when we place our mobile over this image target, respective atoms will appear above this element name. when we touch these atoms, a short summary of the atoms will be provided as output audio. We make use of the concept of a virtual button, to animate the formation of hydrogen dioxide, carbon dioxide and carbon monoxide. for instance, when we place our finger on H_2O, a hydrogen diode compound will form with animation. The main idea is to show what the chemical bond looks like.

6. CONCLUSIONS

We had developed an application that makes augmented textbooks. Extending the real world to the virtual world

opens a wide opportunity in the education sector. During the Corona Fig. 2. Every trigger image is linked to their own respective 3D models which will have multiple interactions, this is done using unity. then using Vuforia SDK it is made into an application for hand held devices and the device's own tolls like micro phone. touch, speaker, camera etc are used for various interaction upon identifying the trigger image through camera and generating its respective 3D model pandemic situation, online education got wide acceptance. There are a lot of subjects like science history etc which have students from worldwide. so we are planning to choose some standard textbooks and provide virtual textbooks and make them available worldwide. we are also focusing to develop options for community learning. Community learning includes interaction between students through the application, combined learning etc. We are also planning to provide an opportunity for lab experiments.

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