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An Augmented Reality Application in Education – Learn Smart

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Abstract- *Augmented reality (AR) has gained popularity recently across a range of sectors, including education. With the introduction of interactive and immersive learning opportunities for students, the Learn Smart project, an innovative augmented reality initiative, aims to enhance the existing educational system. The project comprises 3D models of relevant concepts and processes, with a concentration on the disciplines of science. The Learn Smart project employs augmented reality (AR) technology to build a virtual classroom that enables students engage in realistic and exciting interactions with 3D objects. The visual depiction of difficult ideas and occurrences that the 3D models offer helps pupils comprehend and remember the material. The Learn Smart project is an innovative new approach to teaching that makes use of augmented reality technology to enhance students' comprehension and memory of difficult ideas. The project has being able to fundamentally alter the way we view education and open the door to future novel and creative methods of instruction and learning. The current study examines the application of augmented reality (AR) technology in education, concentrating on physics, chemistry, and biology. The study suggests using Vuforia, a popular AR platform, to create 3D models that could aid learners to picture and comprehend difficult ideas. As a result, students will interact with 3D models by using AR technology, giving them a more interesting and immersive learning experience.*
Keywords*—Augmented Reality, education, technology, marker, application,3D models*

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I. INTRODUCTION

The phrase "augmented reality" describes a technology that overlays digital media, such as images, videos, or 3D models, over the actual world. A virtual object is added to the user's physical surroundings in augmented reality (AR), as opposed to virtual reality (VR), which offers a completely immersive experience. Numerous sectors, including those in industry, healthcare, and education, marketing, entertainment, and architecture and design, among others, have substantial uses for augmented reality. AR may be used in the lecture hall to create immersive, engaging educational opportunities for students to visualize and understand difficult concepts. For example, AR could be used to display scientific experiments or historical occurrences. The healthcare sector may use augmented reality to enhance patient outcomes and medical education. In one instance, using AR to simulate operations would allow surgeons to train before performing them on actual patients. AR improves the precision and efficiency of industrial processes. For instance, to give workers immediate instructions and visual support as they assemble complex equipment.

AR enables marketing by creating engaging and interactive advertising that allow potential customers to see and engage with products before making a purchase. By allowing users to engage with virtual objects and people in real-world settings, AR can enhance gaming experiences in the entertainment sector. By using AR to visualize and model building projects, architects and designers may test and refine their ideas before construction ever begins. Because it has the ability to fundamentally alter how we work, learn, and communicate. the world around us, augmented reality is an important technology with a wide range of applications. The augmented reality platform, called Vuforia, was made by PTC.It enables the creation of AR applications for mobile devices and other platforms by developers. Vuforia recognizes and tracks targets, which might be pictures, objects, or environments, using computer vision technology. This enables AR applications to create interactive experiences by superimposing digital content on the real world. Image recognition, word recognition, and 3D object recognition are only some the functions offered by Vuforia. It also has capabilities for adding and modifying digital information, maintaining targets, and creating targets. By Unity Technologies, a cross-platform gaming engine was created called Unity. It is employed in the creation of video games as well as other interactive activities including simulations, apps for virtual and augmented reality, and more. Unity supports a number of platforms, including web, console, mobile, and desktop. Unity AR has a range of features, including support for both marker-based and markerless AR, depth sensing, and support for both 2D and 3D content. Additionally, it has tools for adding and modifying digital content in addition for organizing and creating targets. Based on how they employ digital material to improve the real-world experience, there are normally two categories of AR:

Marker-based AR: This sort of AR activates the display of digital material via visual markers, such as QR codes or image targets. When a marker is spotted by the camera of a mobile device or other AR-capable device, the digital content is superimposed on top of the marker. The marker acts as a point of reference for the AR system, enabling it to anchor the digital material and display it in the appropriate place and orientation with respect to the actual environment.

Markerless AR: Also referred to as location-based augmented reality or position-based augmented reality, this technology employs the device's sensors, including the GPS, accelerometer, and gyroscope, to detect the user's location and orientation. As a result, real-world things and places may be overlaid with digital material without the need of a marker. Applications for markerless AR include virtual tours, navigation, and advertising.

Another sort of augmented reality is projection-based augmented reality, which projects digital media onto actual surfaces using projectors. However, compared to marker-based and markerless AR, this sort of AR is less often employed.

II. LITERATURE SURVEY

[1] Evaluates a research project called "PicsAR" that uses augmented reality (AR) technology for teaching physics. The study aimed to assess what works well of the PicsAR app in improving students' learning outcomes and engagement in physics. The research involved two student groupings, one using traditional learning methods and the other using the PicsAR app, to compare their learning outcomes. The research revealed that students who used the PicsAR app achieved better learning outcomes and were more engaged compared to those using traditional learning methods. Students using the PicsAR app also showed better retention of information and the interest to learn. Students could benefit from an interactive and immersive learning environment thanks to augmented reality technology. making learning more engaging and enjoyable. The authors suggest that the PicsAR app could be improved by adding more physics concepts and expanding its features to support group work and assessment. The study highlights the potential of AR technology in providing an effective and engaging learning experience for students in physics education. Further research is needed to explore the potential of AR technology in other areas of science education.

[2] Provides a summary of how augmented reality (AR) technology perhaps utilized to represent and manipulate 3D chemical structures for the benefit of education. The authors discuss the potential benefits of AR, such as increased engagement and spatial understanding. They also highlight several of the challenges in implementing AR, like the necessity for appropriate hardware and software. The paper provides examples of AR applications in chemistry education, including interactive textbooks and lab simulations. The authors emphasize the requirement for additional empirical research to assess AR's performance in chemistry instruction. In general, the article serves as a useful resource for educators and researchers interested in exploring the potential of AR technology in chemistry education.

[3] Discusses the application of mobile augmented reality (AR) technology in biology education. The authors reviewed four articles and analyzed three apps to identify important features for developing science AR apps. The paper highlights the potential benefits of mobile AR, such as increased engagement and motivation. However, the authors also acknowledge the challenges in implementing AR, such as limited device compatibility and integration with the curriculum. The paper provides a useful resource for educators and researchers interested in exploring the potential of mobile AR in biology education. The authors suggest that mobile AR could offer an

immersive learning experience that facilitates active student engagement. The article highlights the necessity of conducting additional empirical research to assess AR's performance in biology instruction. The paper functions as a whole as a valuable contribution to the literature on the use of AR in science education.

[4] The paper discusses ChildAR, an interactive augmented reality game designed to help kids with their schooling. On mobile devices, the game's main menu appears when it is launched. The player is given directions on how to do the task after pressing the start button, which brings up a page of instructions. When the picture target is picked up by the phone camera, the AR scene is opened so that you may view the 3D models of the game. By identifying the tag, the playmat image target is used as a tag to augment 3D objects on the playmat. The Unity game engine was used to build the game for both Android and iOS. To identify car accidents and load mission success or failure scenes, invisible box colliders are rendered in the AR view. Students must locate and correctly identify each of the five locations in the game, which has two places with names and three with photos. The playmat image is found and recognized using the Vuforia image recognition technology, and then virtual objects are placed on it. The application can recognize the various playmat images stored in the game's local database. The software development kit (SDK) flowchart used to create this game has been mentioned.

[5] Examines the use of augmented reality technology in elementary school education. The authors discuss the benefits of using AR, such as its ability to enhance student engagement and improve learning outcomes. The study involved 20 students in elementary school who studied animal habitats using an augmented reality software. The findings demonstrated that, in comparison to conventional teaching techniques, the application of augmented reality greatly increased the students' motivation and knowledge retention. The authors also discuss the challenges and limitations of using AR in education, including the cost and technical requirements. The study concludes by recommending further research into what works well for AR in different subject areas and age groups. Overall, the paper highlights possible outcomes of AR to transform the way we approach teaching and learning in elementary schools.

III.PROPOSED METHODOLOGY

Define the learning objectives: The learning objectives for the instructional content must be determined initially. This will make it easier to decide what sort of AR experience is required to achieve those goals. Create 3D models: Making 3D representations of the items or ideas that will be an aspect of the AR experience is the next phase. A web-based application for viewing, generating, and publishing 3D models is available called Sketchfab. Utilizing the collection, tag, and category capabilities of the tool, users may arrange models using this technique. Sketchfab 3D models may be shared and integrated on websites, forums, and social networking pages. Import models into Unity: The 3D models may be imported into Unity after they have been made. A gaming engine called Unity offers resources for building interactive, including augmented reality, experiences.

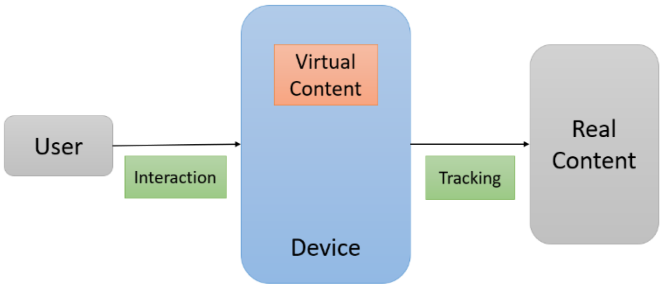

Fig 1) Architecture of the application

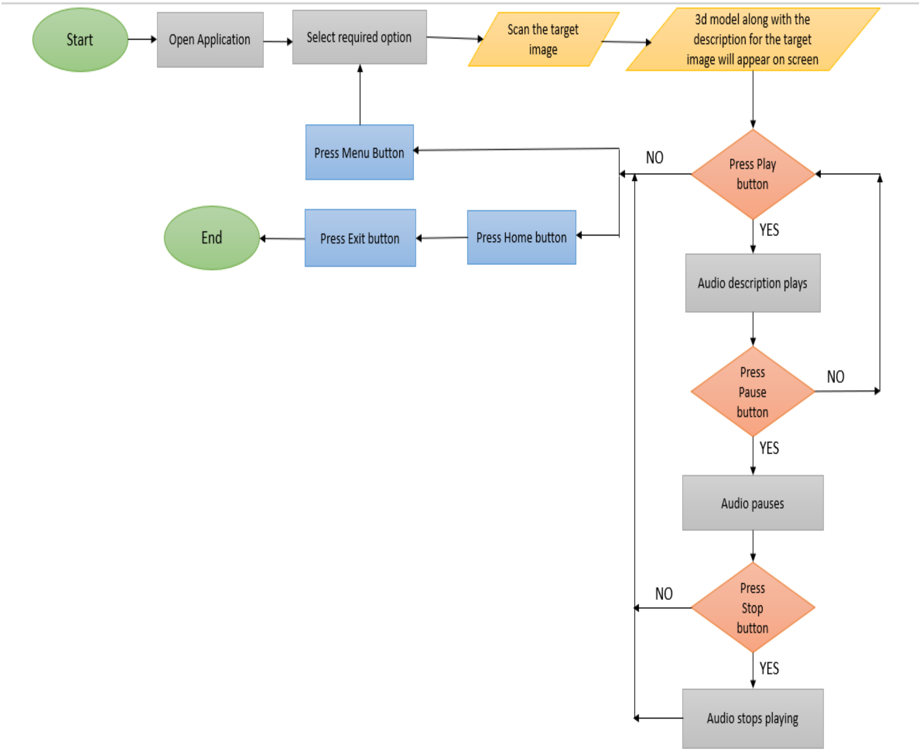

Fig 2) Workflow of the application

Set up Vuforia: To develop AR experiences, Unity perhaps utilized with Vuforia's AR SDK. It offers resources for identifying and following pictures and things in the actual world. The user requires the app license key, which they may get through free project registration on the Vuforia website. Additionally, a recording at the Vuforia site is required for the database image target. The database may be downloaded as a unity package file once it has been registered. Setting up Vuforia in Unity so that it can recognize the images or objects that will be used in the AR experience is the final stage.

Create AR scenes: The next step after setting up Vuforia is to develop the AR scenes in Unity. This entails setting up the 3D models to react to user inputs and putting them in the actual environment. A user could be able to tap on a 3D model, for instance, to get more details about it.

Interactivity by adding audio: It is crucial to include interactive components in the AR application to keep the user interested and improve the learning experience. The audio module allows developers to play audio clips in response to user engagement with certain simulated objects or specified events. For instance, the audio module can play a sound effect when a user touches on a virtual button.

Test and refine: It is crucial to test and adjust the AR scenarios after they've been developed. This might entail changing the location of the 3D objects or including more interactivity in the experience.

Deploy the AR experience: After all configuration is complete, the application is ready for testing. If successful, the 3D AR will appear on the screen while the camera is turned on and targeted at the marker. Two devices will be used for testing: a smartphone and the notebook that was used to develop the AR because it has a camera. Since the AR system is typically activated by a specific object, it is desired that AR only runs when the camera is pointing towards the target marker. If the target marker is moved away, the AR animation likewise stops. The Android application package (.apk file) is the project's final output. An installer file made specifically for Android-based devices is an .apk file. The Android smartphone initially needed to have the .apk files installed. Open the app after installation, then position the camera in the direction of the "marker." Figure 1 above serves as a marker example. The 3D AR will appear on the smartphone's screen if the app identifies the tag, whether it is on the paper, just on the monitor, laptop, or tablet screen. The sound, animation, and images were all excellent. The AR experience will finally be usable by people. This may mean making the experience available online or integrating it to a mobile app. Overall, this suggested technique calls for the development of interactive AR learning experiences utilizing Unity, Vuforia, and 3D modelling tools. This method allows for the creation of interesting and useful educational content by specifying precise learning objectives and carefully planning the AR experience.

The Fig 1) represents architecture of an AR application involves a user interacting with a device that can display both real and virtual content. The device uses tracking technology, such as marker-based tracking, to locate and track a physical marker in the real-world environment. The target image is used as a reference point for overlaying virtual content onto the real-world environment in real-time. The device makes it easier for the user to engage with virtual content, which displays the content in a way that is seamlessly integrated with the real-world environment. This creates an immersive and interactive experience for the user, blurring the boundary separating the physical and digital worlds.

IV. CONCLUSION

The potential to completely alter the education industry through the usage of Vuforia and audio descriptions in AR is enormous. Through an immersive and interactive learning environment, augmented reality (AR) technology may help students visualize and engage with abstract ideas in a fun and engaging way. A better customized learning environment that accommodates various learning styles is produced by the combination of 3D models with auditory cues, which encourages improved comprehension and memory of the material. For students who might encounter challenges to traditional schooling, augmented reality technology's inclusion and accessibility open up new opportunities. Learners now have more autonomy and control over their educational experiences because to AR technology, which enables self-directed, flexible learning that is accessible whenever and wherever. Additionally, AR technology has the ability to close the discrepancy between theoretical and practical knowledge by giving students hands-on practice in a secure setting. The incorporation of AR into the learning environment can also help pupils get ready for the rapidly evolving technology landscape of the future by providing them with the abilities they require to succeed in the digital world. It is anticipated that AR technology will grow and become more adaptable as it develops. Therefore, it is crucial to keep investigating the possibilities of AR in education to be able to give future generations of students' access to the best learning opportunities. The use of AR technology has the ability to transform the conventional classroom and produce a more effective, engaging, and personalized learning environment.

V.RESULTS

Fig 3) Home Screen

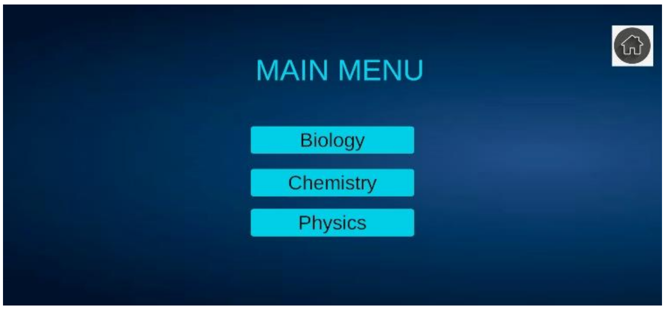

Fig 4) Menu Screen

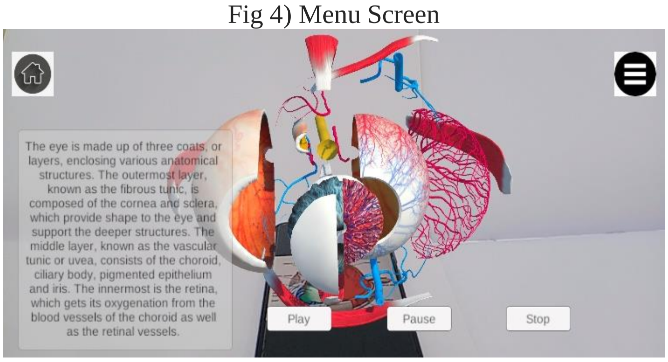

Fig 5) Augmented biology(eye) model

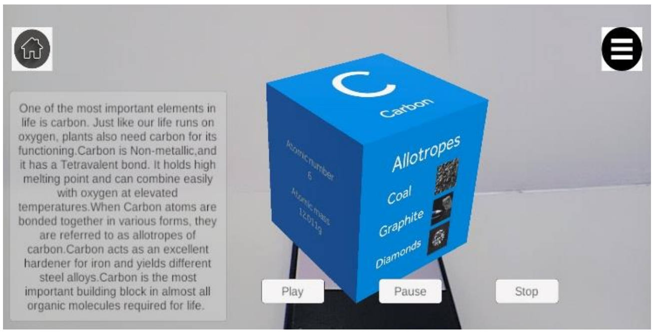

Fig 6) Augmented chemistry (Carbon) model

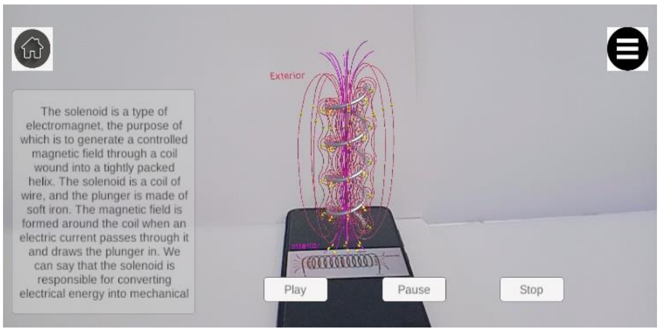

Fig 7) Augmented physics (Solenoid) model

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