An Augmented Reality Based E-Learning System

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***Abstract*- The value of quality online education has emerged recently. Children can understand simple concepts when instructions are presented visually. A new online learning approach that uses Augmented Reality (AR) to teach children in a fun and meaningful way. While AR is best known for its use in video games, it offers important opportunities to enhance learning and improve learning outcomes. Augmented reality (AR) applications have become important tools for virtual learning. An AR-based Android application is presented that provides educational tools that help children acquire knowledge and teachers engage them in their search for knowledge. This application was developed using Android Studio and Blender software and can be installed on devices running the Android operating system. A model designed to improve the social, communication and cognitive skills of primary school students.**

***Index Terms*- Augmented Reality, Virtual Reality, E-Learning, Android application, Blender.**

I. INTRODUCTION

The use of technology in education is quickly altering how pupils learn. As a result, learning tools can be developed that offer learners greater interaction, creative engagement, and adaptability. One of these cutting-edge technologies that can speed the creation of new teaching aids is augmented reality (AR). By supplying human-centered learning environments, augmented reality has effectively demonstrated its ability to enable new types of learning pedagogies. Technology for augmented reality has advanced to the point where it can now be applied to a much wider range of products and in the educational sector, where it will be extremely useful. There are a variety of factors why AR values educational experience. Includes aid for seamless contact between the actual world and the virtual one, using the GUI metaphor to control things in a real-world setting, a seamless transition between actuality and virtuality. Teachers, however, are aware that collaboration and ingenuity should be central to the learning process. However, the state of the economy and destitution prevent us from making additional investments in this field.

Kids today are born holding smartphones, according to popular belief. As a result, younger generations are more interested in smartphones, and they frequently use them for entertainment and education. Eighty percent of young people own smartphones, and they use them frequently, according to a survey. While exploring Augmented Reality (AR), we came up with a solution to the problem. It doesn't have to be as thrilling as a virtual reality roller coaster to give them something new. Our augmented reality tool will provide students with the motivation they need to study. Users of our augmented reality software, which is similar to mixed reality, may see and hear 3D models of actual fruits in addition to all of the English letters. We will provide them with a platform where they can explore with all 3D models and move them in any manner imaginable in order to maintain their interest. One can learn more about the topics the smartphone contains by simply exposing a flat surface to the camera.

II. RELATED WORKS

In the paper by Mohammad Fahim Hossain, Sudipta Barman, and A. K. M. Bahalul Haque “Augmented Reality for Education; AR Children’s Book” [1], by augmenting the real world with virtual information, Augmented Reality provides new possibilities for education. Creativity and engagement should be the focus of the educational process. The most effective learning occurs when a lesson is interactive. For their mental development, it is vital to give them a platform where they can engage with the subject. This app is a method for achieving that objective. The article "A Survey on Future of Augmented Reality with AI in Education"[2] by Kaviyaraj R and Dr. M. Uma outlines the broad definition of augmented reality and organizes it into a detailed survey of how it will be a cornerstone of the new educational system and how it can be used in other fields as well. The discussion of recent studies on representative examples of the current state of the field, which aims to motivate educators to enhance mixed reality experiences and conduct more research in support of interactive learning environments, constitutes the main contribution of the whole work.

According to "An Augmented Reality based E-Learning Tool for Engineering" by Nathaly Veronica Orozco Garz[3], Henry Ramiro Carvajal Mora, Cesar Josu 'E Torres Hinojosa, Jos 'E Julio Freire Cabrera, and the applications for augmented reality (AR) or virtual reality (VR) have become essential tools for online education. They set up a hypothetical augmented reality application in this study that shows various tools or equipment typical of engineering labs. This program can be downloaded and installed on devices using the Android operating system or the HoloLens. As a case study, they looked at the virtualization of a number of components used in telecom engineering labs. There is also a link that may be utilized to download and set up the application (.apk file). The reader is therefore able to view several samples using his own Android handset. In the words of Liping Li and Xiaosong Wu in "Application of Virtual Reality and Augmented Reality Technology in Teaching"[4], the employment of virtual reality and augmented reality technology in the field of education offers several possible applications. A learning system and a human-computer interaction system

based on augmented reality and augmented reality technologies are also introduced, along with a classification of virtual technology. The main VR and AR-based education system technologies as well as the difficulties in implementing them in the classroom are discussed.

The authors of "ScoolAR: An Educational Platform to Enhance Students' Learning Through Virtual Reality" by Mariapaola Puggioni, Emanuele Frontoni, Marina Paolanti, and Roberto Pierdicca [5] propose a revolutionary platform called ScoolAR that was created for educational reasons. Without any programming experience, one may construct AR/VR applications with ScoolAR. There is currently no proof of a pedagogic tool that enables the creation of AR/VR apps without programming knowledge. Based on these presumptions, ScoolAR was created in order to get beyond these restrictions, enabling an autonomous content production system, and increase awareness of the use of AR and VR applications in regular educational contexts. This paper describes the findings of tests carried out in a genuine didactic setting in addition to outlining the architectural framework of the proposed platform. Scottie Murrell, Fang Wang, Eric Aldrich, and Xinhao Xu present a study using a mobile AR (Augmented Reality) App to enhance large lecture classes both inside and outside the classroom in "MeteorologyAR: A Mobile AR App to Increase Student Engagement and Promote Active Learning in a Large Lecture Class"[6]. Animated instructional materials, such as various cloud formations, are provided immediately on each student's mobile screen when they scan the target photos using the App as instructed by the instructor during class.

III. System Design and Description

A. System Architecture

The whole system of this application is represented by this flowchart Fig. 1

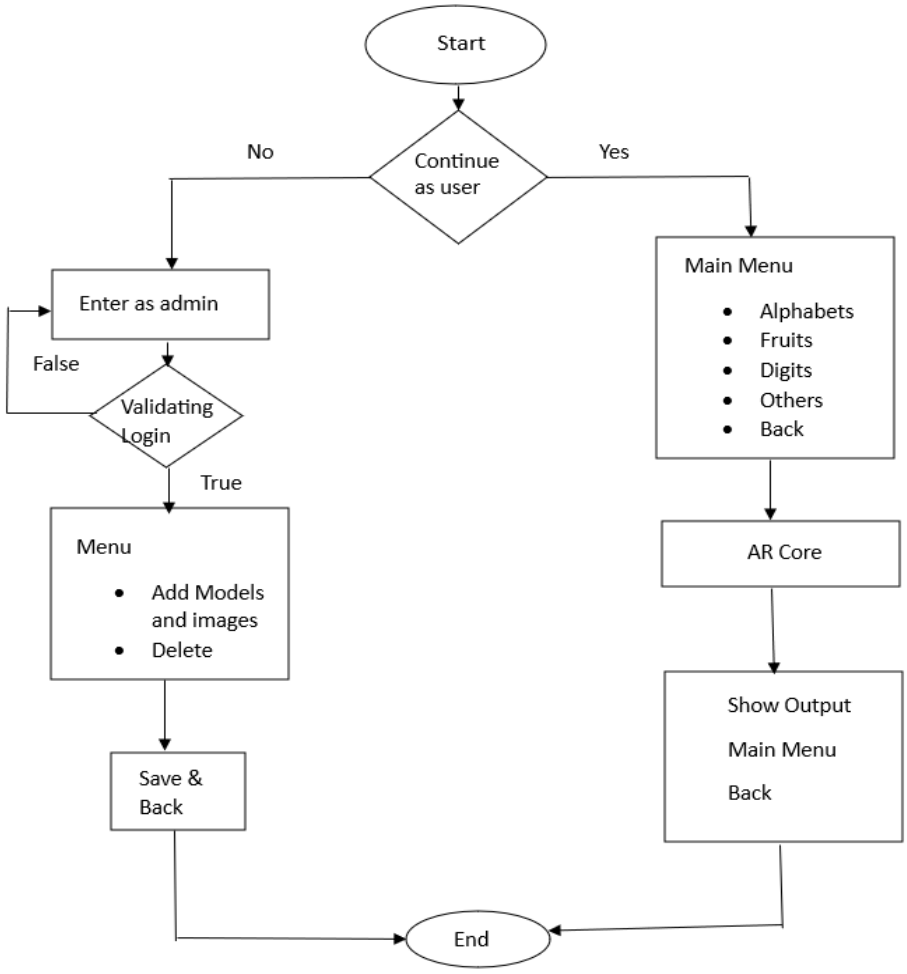

Fig. 1. Architecture of proposed system

B. System Description

Our system provides users with two different user interfaces for English version. From start the process directs to the Main Menu (language selection) window where the user can select either English or Exit (to quit the app). Selecting one language will take the user to that version of options that includes Alphabet, Fruit and an option for navigating back to the previous window. Choosing one of the first 3 options will direct the user towards the first window which is actually the main scene of this application. With this app, the smartphone camera is used to detect any target image and display a 3D model in real time. Of course, there is an option to switch back to the previous window or exit from there.

IV. TECHNOLOGIES AND TOOLS

A. Blender

Blender-3D Component Graphics Software Toolset is a 3D creation suite that is both free and open-source. It is a public project, made by people all around the world. It supports the entirety of the 3D pipeline: modeling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation [1]. Blender can handle a lot of file formats such as OBJ, FBX, 3DS, PLY, STL, for example. Furthermore, Blender includes an internal format converter that allows you to modify any 3D model format without having to install any external converters. The 'blend' format is the most supported of the listed formats.

B. Java

Java runs on a variety of platforms. It is simple to use and simple to learn, secure, quick, powerful, and open source. Java is an object-oriented language that provides programmers a distinct structure and permits code reuse, reducing development costs. Java is similar to C++ and C#, so programmers can easily transfer from one to the other.

C. Android studio

Android Studio offers the most efficient tools for building apps on all Android devices, ensuring high-quality output across all devices. By using functional UI testing tools and frameworks, Android Studio helps test Android apps. Additionally, Android Studio helps integrate the app with Google Cloud. Many advanced features make it possible to automate processes, manage dependencies, and customize configurations once and for all.

V. 3D MODEL CREATION

A. Alphabets

English alphabet 3D figures are included in this area. Figure 2 illustrates how the English alphabet can be broken down into a total of 26 upper case letters to resemble cubes. Each figure has a distinct target image that can be used to identify it.

B. Numbers

This section contains 3D figures of 0-9 numbers.

C. Fruits

This section contains some attractive and simple-to-understand 3D figures of certain common fruits. The figurines resemble their matching target photos and have textures akin to those of the real fruits. To test the app, we just included the strawberry, mango, orange, banana, and apple fruit figures.

VI. APPLICATION DEVELOPMENT

The application is developed in Android Studio. The programing part is done using java. The user can select from the menu what to see and render it using the application. Blender models are used to create the appropriate 3D objects. The option to add sounds to objects and render animations is available.

Here are the images from the application Fig. 2.

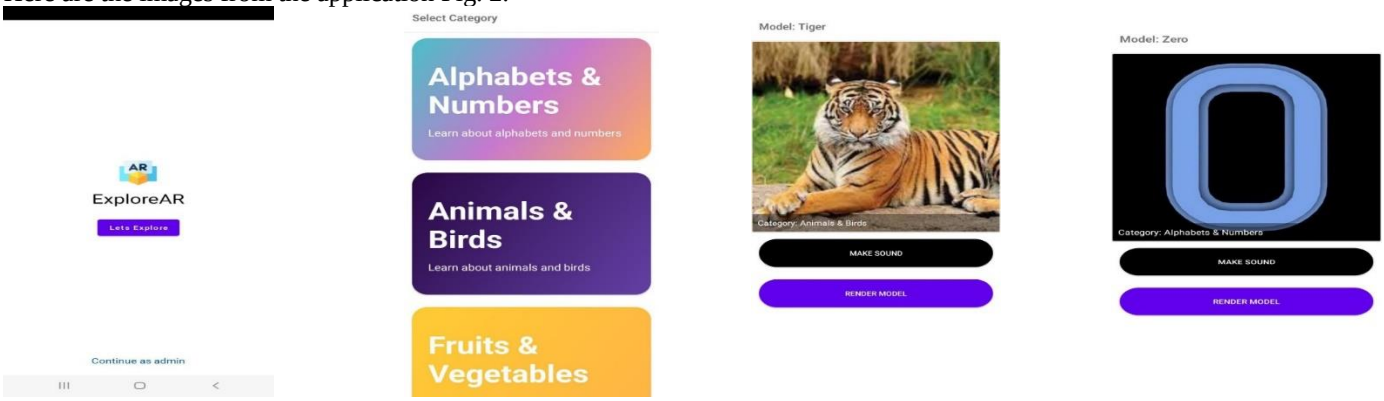

Fig. 2. Welcome page, Main menu, Model menu of Tiger and Zero.

We can see the models in different angles. For eg: Fig.3

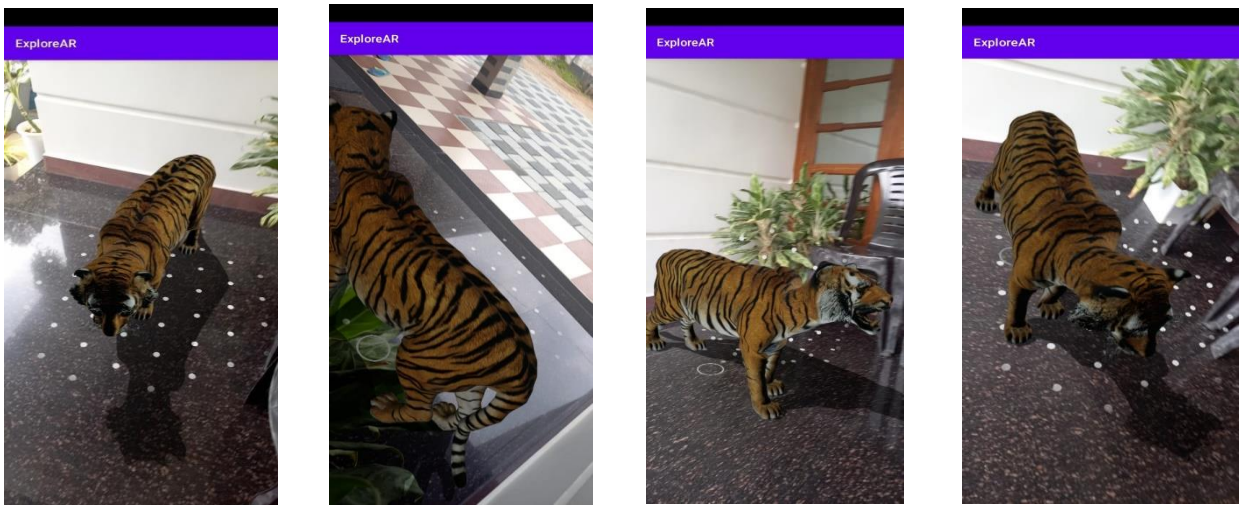

Fig. 3. Multiple direction views of 3D model

VII. Overview

Although the functionality and user interface of "magic book", a work that is similar to our application, are very different. For kids, we kept user interface straightforward. The language selection option is provided in the first window. It will serve as a application's main menu. Choosing one will open the new window with the available options (Alphabet or Fruit). When you tap alphabet or fruit you will be taken to the main screen where the program uses your phones camera to search for a target image that is already in the real-time database of ARCore. A 3D object corresponding to it will appear over the target image upon detection. Only the phone screen will let you see this 3D object. Via the sound system, the alphabets pronunciation or the fruits name will be made available. The user can exit the application by hitting the 'Exit' button from the main scene or return to the previous menu by tapping the 'Back button'.

VIII. Future work

It is always in demand for applications that enhance the standard methods of teaching, and this is true now more than ever before. Instructor-led classrooms have the disadvantage of not being able to address the individual needs of students, which results in a lack of interest and attention. Using Augmented Reality technology, this application provides learners with visuals that can enrich the learning experience and assist educators in creating content that links visuals with reality. Application such as this provides educators with a method of delivering content that makes learning interesting and more accessible.

IX. Conclusion

This application's development goal is to support our children's learning and foster fun learning environments. This system can be used by teachers or parents at home to teach children the alphabet and give them the minimal background information they require for mental development. We can draw the conclusion that Augmented Reality is a ground-breaking tool that we can use to accomplish more. It can undoubtedly elevate the learning experience to a whole new level. Only a small portion of what augmented reality (AR) has to give to the new.

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