

Research Article

SMART BOOK USING AUGMENTED REALITY

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Abstract

Augmented Reality has brought significant contributions to the field of Education. This paper presents an Augmented Reality application for mobile devices that complements and supports learning of geometric figures. The lack of understanding through theory reading is the major issue for more students to hate studying. For many people reading books and learning in a theoretical manner is a difficult and frustrating experience they justifiably want to avoid. So here come's our solution SMART BOOK, where it combines the theoretical book with augmented holograms from which students can study by seeing real time holograms of interesting videos through that book just by clicking a button image in a book. It combines both theoretical and real time learning experience. For example if our book contains a page with universal solar system image, below it also contains a button image which if a student presses that button image on our book it will show the whole solar system model appearing and starts revolving around on top of the book like a hologram. So with that the student can see how it actually looks in real life. We are going to draw and create a handwritten book for our prototype and make that book as a SMART BOOK. For example to learn a crow fox story book initially the outline of the story is written on the paper and below a button can be drawn (everything will contain within a single page of a book). And using augmented reality it could make that button drawing as a touch tracker image, where by touching the button virtually it will play the video of crow fox story as a computer generated 3D video above your smart book like hologram. It can be experience this either by using Mobile Phone / Hololens etc.

Keywords—Augmented Reality; Virtual Reality; Unity3D Vuforia; SketchUp; Image Target

I. INTRODUCTION

According to the reality-virtuality continuum [1] by Milgram and Kishino (1994), AR is one significant part of the general representation of mixed reality. The area between two extremes, where both the real environment and the virtual environment are mixed, is called mixed reality [2] or hybrid reality. It consists of both augmented reality and augmented virtuality. Augmented Reality is becoming an emerging multi-platform application.

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Augmented Reality is an extension of virtual reality with more advancement in our day to day life. VR attempts to create an artificial world a person can experience and explore, through his or her sense of vision, audio, and other different forms of feedback. AR brings about a similar

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interactive experience, but also aims to supplement the real world, instead of creating an entirely artificial environment. The physical objects in the individual's real life surroundings acts as the backdrop and target images for computer-generated illustrations[3]. In Augmented Reality, the user is more aware of the real world environment than in VirtualReality.

Augmented Reality is a relatively young technology and is the way of future technologies and innovations. It has large number of applications in the fields of medical[4][5], marketing[6], advertisement[7], entertainment, education and training, industrial design[8], manufacturing and maintenance[9], architecture[10], navigation[11],emergency, search and rescue systems[12], interactive gaming[13][14] and tourism[15].

Scripting is the most important aspect of unity 3D and has the advantage of quick prototyping and better organization of code. Unity supports two programming languages which are C# and Unity Script. Everything from the creation of 3D models to the enhancement of features like rotation, Scaling, Zooming and showing the simple movements of 3D models, applying materials and textures require the use of scripts.

This paper focuses on Augmented Reality and its related application in the field of education. We attempt to create a new education tool that combines a mobile application for the learning of 26 alphabets of English language with augmented reality technique [16]. The textbooks, newspaper, magazines, comics and other reading materials can contain certain images or markers when scanned by any AR device such as mobile phone, tablet or a computer system supported by and platform produces additional information in the multimedia format. The textual, graphical, audio and visual information superimposes on the student's real time environment. Such application enable the students to actively participate and interact with computer generated simulations. We introduce an application that presents new and exciting ways to get children involved in learning alphabets .This application can change the way children learn alphabets with the technology of Augmented Reality. The technology helps interleaving the concepts of theoretical and practical learning. Augmentation can serve to aid and enhance individual's knowledge and understanding of concepts. It enhanced the educational potential that scholars, teachers and students are embracing. AR is bringing a revolution to the entire education system and way we teach andlearn.

The paper is organized in the following manner: Section II explains related works, Section III briefly explains the methodology, the procedure for creating an app based on augmented reality, the hardware and software requirements, section IV is based on the results and conclusion for the entire application and section V presents the future work to modify and enhance the applications for education and other related areas.

II. RELATEDWORK

There are various examples of research on the Augmented Reality applications in the field of education. Therefore, before describing our contribution and its related methodology we provide a brief overview of the related projects that utilize AR technology for developing educationalapplications.

a) A 3D pop-up book has been developed. It is a Augmented Reality 3-Dimensional pop-up book namely “the Seed Shooting Game”, for Grade three students, in Bangkok, Thailand. This Augmented Reality (AR) 3D pop-up Book employed a research and development process through storytelling technique[17].

b) Augmented Reality for academic purposes is growing in the same upward direction as the expansion of smart multimedia into education and lifelong learning. This paper reports on an AR curriculum materials research and development project which employs storytelling as a teaching technique. This technique has a long lasting effects on its user due to it liveliness and interactivity. The primary rationale supporting this research was the high demand and appreciation of the potential to integrate Augmented Reality into classrooms effectively to enhance learning[18].

c) Semantic and content-based multimedia exploitation for European benefit – is developing a solution for museums to create and manipulate digital representations of museum objects. The Sculpture project utilizes multistereo and silhouette techniques to create 3D museum object reconstructions stored in a database together with other multimedia data. The project is also aimed at developing a semantic layer providing a variety of search and content analysis opportunities. A system that allows museums to build and manage Virtual and Augmented Reality exhibitions based on 3D models of artifacts is presented[19].

d) There has been a growing interest in augmented reality with the recent advancements in computer technologies. Head mounted displays which were once very expensive hardware devices are now available at low cost, which has led to the increase in the applications of AR technology. Methods/Statistical Analysis: In this paper, we describe an AR coloring book with a transitional user interface. It comprises a paper book and a smart phone application. The proposed AR coloring book enables the user to enjoy content by switching between real world, augmented reality, virtual reality, and networked virtual reality[20].

e) Teaching English and correct way to pronounce word to children who do not come from an English speaking background is a challenge for educators. In this paper, the authors present an augmented reality tool, TeachAR, for teaching Basic English words, colors, shapes, and prepositions to children for whom English is not a native language. In this paper the author also compares AR system to a traditional non-AR system. The results indicate a potentially better learning outcome using the TeachAR system than the traditional system[21].

f) A case study was conducted in a typical kindergarten in Hong Kong, with a class of four- to five-year- old children. The results indicated that all the children could design, control and interact with the animated objects generated by the AR application, all the stakeholders interviewed were supportive of this pedagogical innovation and the principal, teachers and parents were concerned about the side effects of using AR in earlychildhood[22].

III. METHODOLOGY

A. *Software andalgorithms*

The software must derive the real world coordinates, independent from the camera, from the images captured by the camera. This process is called dynamic image registration [23]-[24] which uses different methods of computer vision, and consists of 2 stages. The first stage is the feature detection method, used to detect fiducial markers, interest points, or optical flow in the camera images. The second stage restores a real world coordinate system from the data obtained in the first stage using some mathematical representations[25].

Some of the software that we have used are Unity 3D, Vuforia and Sketchup.

- a) **Unity 3D:** Unity 3D is one of the most efficient gaming platform which allows us to build 3D and 2D models. It also has various features like adding animation, sound, text, images and many more.
- b) **Vuforia:** Vuforia is one of the well-known SDKs for the rapid development of the AR applications. It include impressive digital features like recognize, analyse and improve user designed target image for better performance of application.
- c) **Sketch Up:** Sketch Up is computer software, provides a large number of interesting tools, used to generate or to create 3D models for a wide ranging applications. The users may upload and download 3D models to provide a user friendly environment. The models created using this software can be directly imported to unity solves some kind of modeling problems.

B. Hardware

The Augmented Reality applications can be implemented by varied technologies such as desktop computer, hand held devices, head mounted displays, optical projection systems and so on. The application described in this paper requires only one hardware device that can either be a smart phone, a tablet with pre-installed AR application. Our application focuses specifically on the android devices.

C. Stages of AppDevelopment

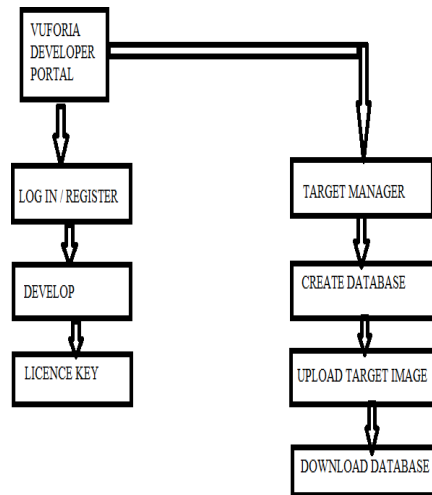


Fig. 1. Working of Vuforia

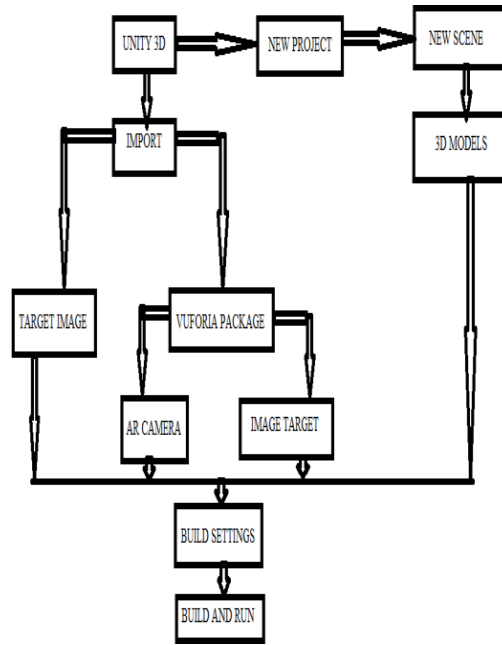


Fig. 2. Working of Unity3D

D. PICTURES

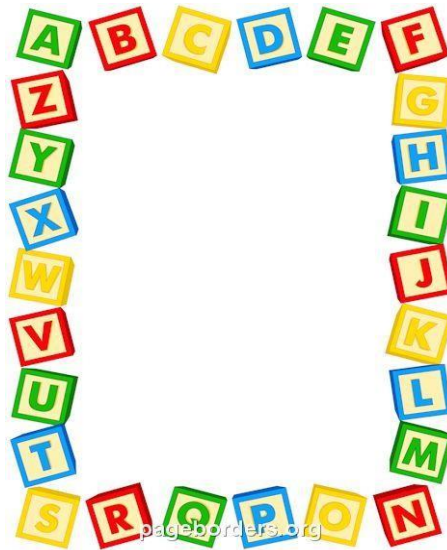


Fig. 3. Target Image.

(By- <https://pageborders.org/download/alphabet-blocks-border/>)

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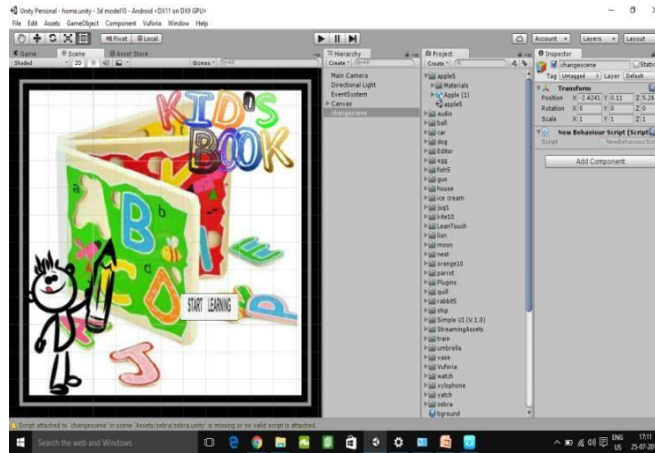


Fig. 4. ApplicationHomepage

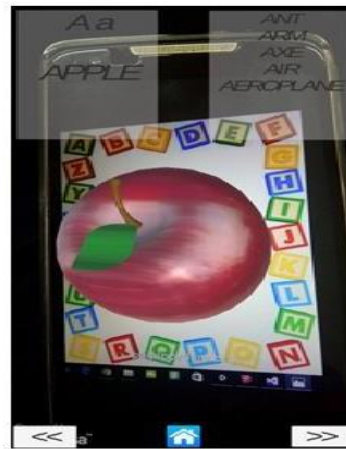


Fig. 5. Screenshot AlphabetA

Fig.3 This is the target image for our application. The user must scan the target image by any smart device, using an application created by unity and the result will be 3D model for the alphabets.

Fig.4 The front page contains a button START LEARNING. This button will directly connect with the first alphabet A.

Fig.5 This is the first alphabet. It consists of three buttons at the bottom. The previous button connecting to the home screen, the home screen button, the next button connecting to next alphabet B.

Fig.6 This is the second alphabet. It also consists of three buttons at the bottom. The previous button connecting to previous alphabet A, the home screen button, the next button connecting to next alphabet C.

Fig.7 This is the last alphabet. It also consists of three buttons. The previous button connecting to the alphabet Y, the home screen button, the next button connecting to the

home screen

V. SAMPLE OUTPUTS

These are the two of our augmented smart book's pages..



Fig. 1. Design

Fig. 2. Cube and Sphere diagram

For cube sphere video screenshots. These are the outputs of one of the pages in our Smart Book.

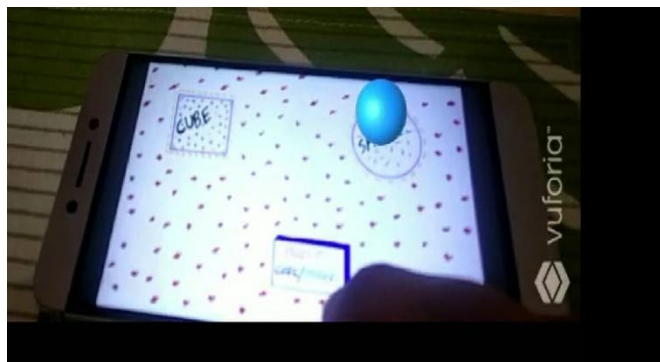


Fig. 3. Sphere

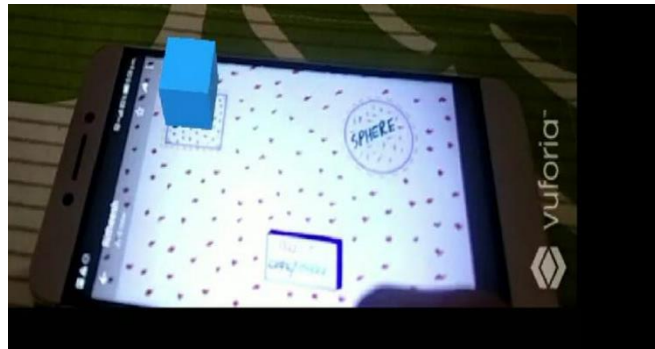


Fig. 4. Cube

Here it will help students to identify how a 3D cube and a 3D sphere will look like in real world just by pressing a button box of this page in our book. This will give a augmented 3D models placed above our book.

For my intro page video screen shots :



Fig. 5. Idle page

- These are some of the the outputs of our intro page which has all the details of us explaining in a video.
- Whenever the corresponding button is pressed the video for explaining that will play in front of the page in our book.
- For example if we press on introduction box it will play a short introduction video describing about us.



Fig. 6. Introduction video

- And if we press on Profession box it will play a short video of explaining our profession.



Fig. 7. Profession video

- Similarly for other buttons as per the button box described the video will play accordingly.



Fig. 8. List of games video

- And for turning off the video we need to press on the same button again.

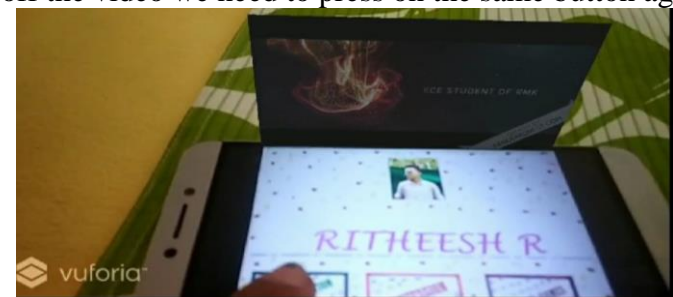


Fig. 9. Pressing button to off the video

- This will help the users to know more details about the authors of each and every book in a awesome way.

VII. RESULTS AND CONCLUSION

Augmented reality allows the user to create layers and layers of digital information over the top of physical information in 2D configuration. This paper tries to create a more efficient and learning environment through augmented reality. The results indicate that AR systems are a positive step towards reducing the distance between children and knowledge. This prototype of AR application enables the children to increase the familiarity with the recognition of letters, pronunciation of letters and enhance their skills and improve the memorization of students.

VI. FUTURE WORK

The potential of AR technology in education is just the beginning to be explored. Since AR interfaces provides seamless interactions between the real and the virtual world, therefore educators should work with the researchers to explore how these characteristics can best be incorporated in the school environment. For future development in this application various extra features can be added like direct navigation to a particular letter and the same application can be developed for various platforms which is now restricted for an android. Presently, the application is dependent on a single target images. The application can however be developed for multiple image targets or applications which does not require any image target in order to make it more interesting, more interactive and less dependent on a single or multiple image targets. Image target detection and rendering of images captured by the camera can be improved. Gesture and voice control can be added for navigation between various scenes. Also it is possible to develop 3D digital books for higher education.

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