EduAR: Transforming Education with Augmented Reality

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ABSTRACT: With the rapid digitalization taking place globally, augmented reality turns out to be the bridge that connects real and virtual continuum in such cases. The paper proposes an android application catering the needs of education providing a rich learning experience to student community through AR along with preserving art of reading. Humans perceive what they see and sometimes it might turn troublesome to interpret real life problems or queries which in turn might hinder a sense of understanding about a particular subject .Traditional approaches today have been trying hard to justify the concepts but sometimes some concepts just require a visual representation which can be put forward by the concept of augmented reality. The paper proposes a cloud based application which provides an intuitive learning experience with the help of augmented reality for students and learners with varied interests.

KEYWORDS: Android, Vuforia Portal, Cloud Storage, Augmented Reality.

I. INTRODUCTION

The digital era has brought many changes to the technology and havemodernized traditional techniques and ushered the development and growth of the human race in terms of technological and scientific advancements. Smartphones are now replacing the conventional wired systems and large cellular devices boosting up the computing abilities and functionalities with a much reduced size giving it a touch of portability. Improved computing and business capabilities, global communication and the evolution of internet have brought the digital world together in form of smartphones. The quality of learning and knowledge has improved greatly with the evolution of internet.

With the discovery of Augmented Reality, the digital world found a new side towards advancement. Traditional learning system might give student an idea about a topic or a subject in particular but it might hinder their perception when it comes to abstract, extinct or the objects which might not be visible or found in real life which would make learning a more tedious and a tiresome process creating a lack of interest in most of the masses. Moreover, it turns out to be a difficult job for most of the students to learn through set of books or other conventional means due to the lack of interactivity in the world of social media and other digital trends.

The Auducation solves these problems by placing an augmented approach over the traditional approaches and help educating students in a more interactive manner and in a more user friendly manner pushing down the traditional approach to a simple smartphone application making it more easy for the students(even disabled students or students suffering from any disorder related to study) [1] to learn things themselves and interact with a more user friendly interface to learn subjects of interest.

II. RELATED WORK

Auducation is a augmented reality learning platform for students and make it easy to interpret things and factors. The basic flow of the idea for Augmented Education emerges from two IEEE approved papers which put forward the idea to impart the augmented view to the mainstream education. Apart from the motivation that we mentioned in the previous section, these papers put forward a closer view and a clear point of the ideas which will be planned and implemented in the project. The IEEE papers mentioned give a review and a basic outline of the project which provides an interactive environment and a more brief description of the project in the making.

The paper[1]which is an immersive augmented reality system for education put forward by MhdWaelBazzaza, Buti Al Delail, M. Jamal Zemerly. This paper enables us to understand how an immersive Augmented Reality in conjunction with a book can act a new smart method for learning by engaging as many of the user's senses and human functions possible. It gives us the basic work flow of the system.

The paper[2] speaks about Providing Augmented Reality Based Education for Students with Attention Deficit Hyperactive Disorder via Cloud Computing: Its Advantages by Nor AzlinaAb Aziz a, KamarulzamanAb Aziz b, Avijit Paul c, AnuarMohdYusofd,NoorShuhailie Mohamed Noor e. This paper aims to provide AR based courseware to the Attenetion Deficit Hyperactive Disorder which show lack of interest, frequently day dreaming, moody and overly sensitive, impulsive students an interesting way to study. It also gives the advantage of augmented reality in education to be used with cloud computing.

Thus, the Auducation is a product or the mashup of the two papers along with some other features to add on. Auducation uses the cloud based feature to store the images for the model and when the track points of the images match with the image on the cloud, it creates an augmented object which then performs basic activities in the augmented view.

III. WHAT IS AUGMENTED REALITY?

Augmented Reality (AR) allows us to view virtual objects in a real world. With the discovery of Augmented Reality, it has turned into one of the most trending technology across the globe. Augmented Reality, being a much newer technology, is attracting masses. Internet might be full of generic and specialized websites providing information from the amateur to professional stuff.

Some of these websites provide education through video tutorials but not all of them ensure genuine content. These videos, audio and other form of resources tend to follow the same traditional practices but just in a virtual perspective. The traditional concept or the way might not fit the modern generation and people living in the digital world.

Smartphones can serve as a platform to implement augmented reality which in turn requires no extra costing for hardware. Smartphones have been charging the new generation to the fullest usage and another billion people will be connected to the internet through smartphones by the constant efforts of major tech giants like Facebook and Google.

Fig.1. Educating Masses with Augmented Reality

Conventional educational means might tend to hinder the concepts and ideas leaving them obscured from the original idea behind the subject. Traditional theoretical learning makes it difficult for curious minds to quench their thirst of knowledge. Augmented Reality (AR) can pave down a way to more intuitive and effective learning making it feasible for students and people of all ages to learn things in a quite easy and simple manner saving time and giving up faster results [2].

Educational Institutions or Schools can adopt this model for improving their teaching and learning experience [3]. Students can read the related subject content from paper along with interacting with its related content and information about that topic in particular through Augmented Reality on their Smartphones. This enriches the learning experience preserving the traditional art of reading. Students can get the required content related to the subject saving time rather than going with traditional approaches or searching for the content from large books and encyclopedias from the libraries.

TABLE I

TRADITIONAL LEARNING VERSUS AUGMENTED EDUCATION

FACTORS	TRADITIONAL EDUCATION	AUGMENTED EDUCATION
Method of learning	Tedious and difficult method of learning for modern generation.	More intuitive method making learning easy for youth and people of every age.
Type of learning	Based on the learning through books and resources.	Based on learning with the help of smartphones, laptops.
Teaching Techniques	Book,lecturers,presentations etc.	Any handheld smart device with a camera.
Psychological factors	Reading,listening and writing.	Augmented Reality(combines traditional approaches like reading,listening with more cognitive and practical approach) easy to grasp by the brain.

IV. IMPLEMENTATION

Auducation aims towards an augmented approach to education. It is a cloud based application [6] [7] which generates an augmented view on the screen after the camera is focused on the image. The cloud based application [2] facilitates students to interact with the spawned 3D model. It allows them to make a study of a particular topic of interest with an augmented approach from remote locations [4].The application provides students and learners with a detailed description of the subject or topic and helps them to get a better idea when the camera is focused on the image. It couples a voice assistance feature making it feasible for physically challenged to learn and understand things.

A. Prerequisites

The application must be run on a smartphone which has an autofocus camera and sensors namely gyroscope, accelerometer, and proximity sensor in order to function in a proper manner. Vuforia Engine plays an important role in the entire process by processing a certain image. This image is later stored in the cloud space by creating a database of all the processed images. The Vuforia Engine basically has the work of placing up proper track points on an image with the help of various image processing algorithms. The better is the quality or resolution of the image, the more trackable the image becomes and generates better results in the output generated.

B. Camera focussing and Image Tracking

The camera focusses on the targeted image and the mobile application scans the image and takes it as an input [5]. The input image is then compared with the image or images (depending on the size of database) present on the cloud with the help of the track points. The track points provide an ease in comparison for the input image and the existing database on the cloud. A data connection is required to keep the application connected with the cloud. The application then compares the input image with the processed image with the help of the track points resulting in a proper spawn of object in case where the track points of the input image and the processed image match.

C. 3D Model spawning and description

The 3D models are a part of the mobile application and are stored on the mobile itself rather than on cloud to provide a faster and quicker access to the resource pool. It also reduces the cost and time overheads giving faster results even in conditions of poor data connectivity. Storing the models locally also reduces the cost incurred by the service usage of Cloud Service Providers (CSPs) even though it might lead to an increase in the size of application. The application

would then produce a spawned object on the screen along with a detailed description of the object along with a voice assistance feature. An augmented view or 3D model is rendered only if the image at the cloud matches with the input image where the comparisons is made with the help of track points. If the track points of the input image match with those of the image on the cloud then a 3D model is obtained as output. Otherwise the system will not process an augmented view and the camera continues the scanning process till it finds the match to the input track points and verifies it with those from the cloud.
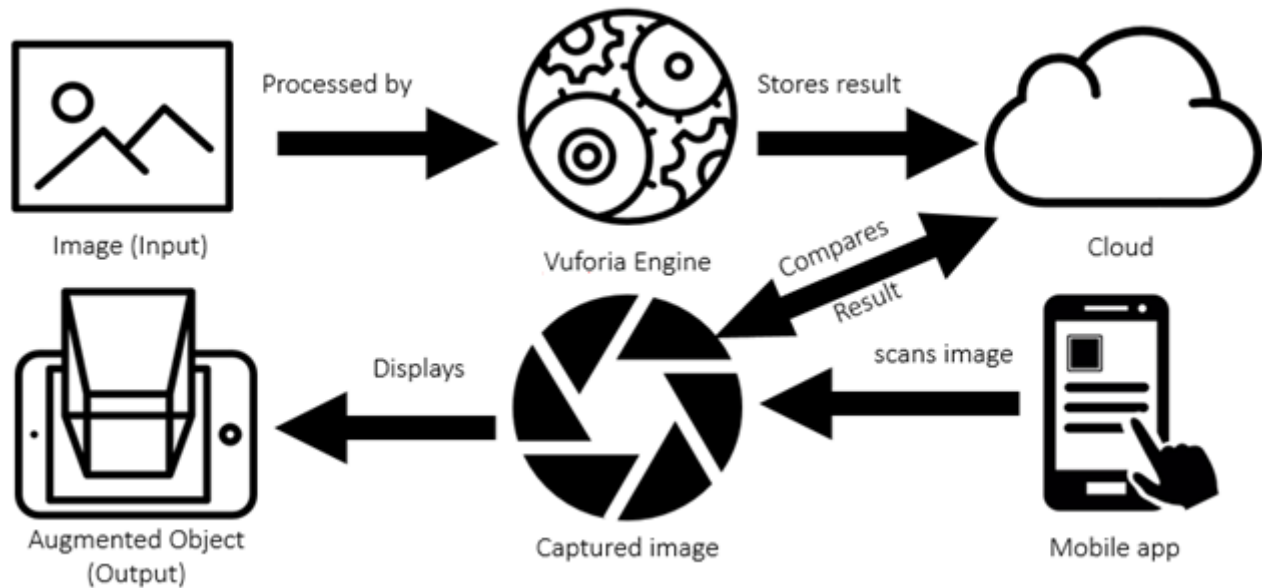

Fig.2. Implementation Overview of Auducation

V. SYSTEM ARCHITECTURAL DESIGN

A. *Client Server Architecture*

Client Server architecture basically refers to a distributed application structure which partitions the tasks or process between the service requestor called as client and service provider called as server. The client server communication takes place with the help of a communication channel. For Auducation, the internet connection stands out to be a communication channel providing a connectivity between the application and server. Proper measures must be taken in order to ensure a secured flow of data through the network. Auducation works on the Client-Server functionality where the mobile application is at the client end and the Vuforia Engine and cloud stays on the server side.
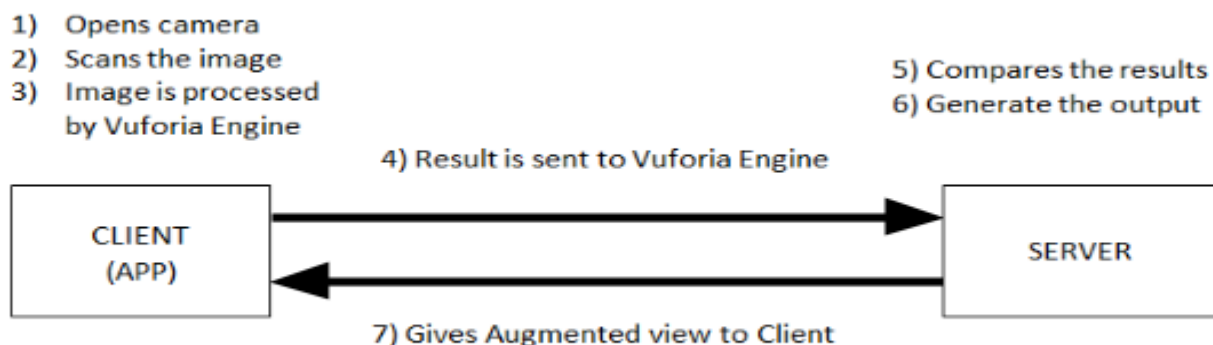
1) Opens camera
2) Scans the image
3) Image is processed by Vuforia Engine

5) Compares the results
6) Generate the output

4) Result is sent to Vuforia Engine

CLIENT (APP)

SERVER

7) Gives Augmented view to Client

Fig.3. Simple Client Server Architecture Demonstration

VI. TOOLS USED IN IMPLEMENTATION

The implementation of the given application is done with the help of various tool, technologies and softwares such as Unity 3D, Blender, Vuforia SDK, Android SDK. Each of these being used to implement and attain the following results:

A.   *Unity 3D:* A gaming engine which basically serves as a standard platform for development of the application.

B.   *Blender:* A freeware used for modelling objects, animate them and add basic functionalities to them in a 3D space.

C.   *Vuforia SDK:* A standard development kit or a plugin required for implementing augmented reality with Unity engine as a platform or base.

D.   *Android SDK:* A standard development kit for deployment of android applications.

VII. RESULTS

When the user opens up the application from his smartphone and focuses the camera on the image from a book provided, the image is scanned and tracked. Proper internet connectivity is required to ensure that there is a proper communication taking place between the client and server.

Fig.4. Butterfly Animation

As shown in diagram (Fig.4.) the image represents the scanning target on top of which the augmented model is rendered. The augmented vies also shows the animation of the corresponding model.
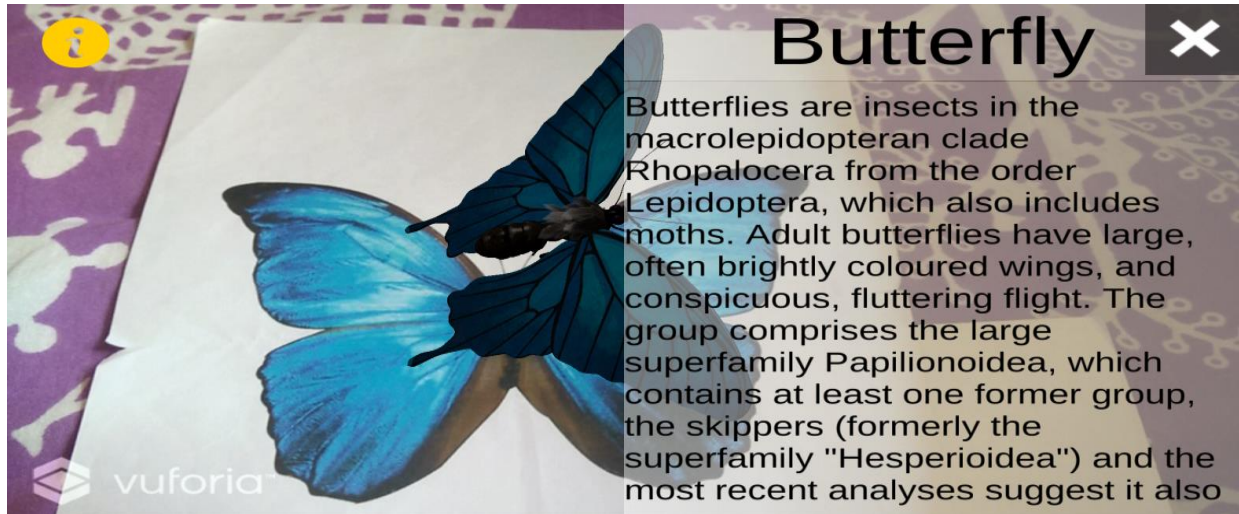

Fig.5. Butterfly Information

User can see the detailed description without leaving the augmented view, using the UI elements as shown in the diagram (Fig.5.). User also can see the augmented view of other objects such as Animal, Bird, and Plant implemented in Auducation as Allosaurus, Pigeon, and Sunflower respectively.

VIII.   CONCLUSION

Augmented reality and Cloud Computing are the future of technology and provide a portal from traditional and conventional practices to their revolution. Auducation integrates both of these ideas to create a platform to solve the real world challenges for interactive and digital learning. The application provides an enhancement to the learning experience with augmented reality as compared to the traditional idea of learning solely from book. The application made from the heterogeneous combination of the two ideas will surely help the students to have a great digital learning experience.

IX.   FUTURE SCOPE

Currently AR technology is limited and generally needs a marker image to work. But with the emerging AR technologies like SLAM (Simultaneous Location and Mapping) and other markerless technologies like the google project TANGO, We would like to incorporate the above mentioned technologies in our application. Newer application versions will addup the 3D models and their database. Technologies like Hololens and other mixed reality HMDs like META are using special hardware sensors to determine the depth of the environment, if we get a chance to use one of these technologies then we would like to develop application for the respective HMD.

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