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A Brief Study on Augmented Reality (AR) in Education

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***Abstract*: With rapid growth of technology, the education system is constantly improving by adapting new technologies which help the students understand the things better. Even with the help of modern techniques, explaining complicated concepts to students in real-time remains a big challenge for mentors. Augmented reality combines the real and virtual world and helps in visualizing the concept in real-time by superimposing the virtual object on the real world. The teaching system can be revised with the help of augmented reality making it interactive and easily understandable for the students. By Visualizing the concept, the overall classroom teaching experience can be improved. It can be done by augmenting a live scene of actual existing surroundings by computer-generated sensory input like audio, videos and graphics. This system would complement the traditional teaching approach by adding interactive visual factor in real-time which would help mentors to teach the complex concepts easily. Visualizing concepts make it easy to understand as well as memorize.**

***Keywords*: Augmented reality, Education, 3D education, Mobile augmented reality, Interactive learning.**

1. Introduction

Education is an imperative part in carving successful people. Education has always been about teaching, learning and processing the information. Teaching system have evolved significantly over years. There are two types of teaching systems -

a) Traditional system.

b) Modern system.

Traditional system in education is delivered through recitation and memorization ways, whereas modern systems in teaching/education supports a variety of technology, computer, projectors, internet, etc. Modern system in education is all about visualization. The main motive of any visualization in education is to accelerate the learning knowledge in an easy and efficient way. Augmented reality (AR) among the most is the finest concept being used in education to ease and make the learning methods more interactive.

Augmented reality (AR) is a category of interactive technology where real-world environs like object that resides in real-world are magnified by computer-generated percipient information that augments the scene with additional information as shown in Fig. 1.

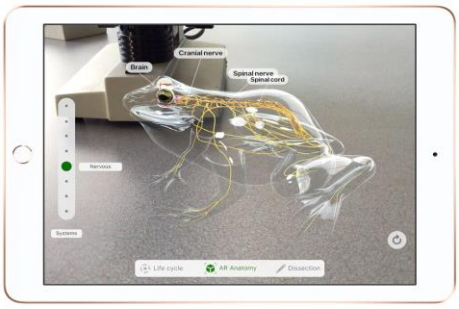

Fig. 1. Anatomy of a frog using AR

Augmented reality application in education benefits new ways of teaching and learning by bringing the gap between virtual and real world.

Augmented reality can turn an ordinary classroom into an engaging/interactive experience, helping students better remember the information they've just learned.

Different technologies are rising such as mobile devices and Head mounted display (HMD) that bring AR content in different ways.

Mobile Augmented reality is one of the most explosive growth areas for AR applications currently [6]. Mobile device is easy to use and less expensive and are highly portable. It improves the learning performance of students.

AR is working as a motivation for the learning process for students in schools, colleges and universities. It not only helps students to increase the focus on learning but also increases the curiosity to explore new concepts experimentally. Students can explore subjects like astronomy, anatomy, physics, chemistry in a digital created environment. These technologies are cutting-off the tools which used to be a massive part of learning.

2. Literature Survey

In 1994, P. Milgram, et al. [1], reviewed the augmented reality and classified its relations with bigger classes of technologies. It classifies the relation between the Mixed Reality and augmented reality.

In 1997, Azuma R, et al. [2] published the paper regarding the applications of augmented reality in various fields. This paper covered the characteristics of augmented reality and the

ways it can be used to tackle current problems.

In 2003, H. Kaufmann, et al [3] it covers the potential of augmented reality and the ways it can be used in education system to enhance the teaching. It covers collaborative engagement of users in augmented reality for mutual communication and benefits.

T. H. Höllerer, et al, [4] explained the augmented reality requirements and mobile computation as a solution. It surveys the requirements of augmented reality and explains how it can be achieved using mobile.

The paper by Sang Hwa Lee, et al., [5], put forward an interactive e-learning system using pattern recognition and pattern matching. It is made to supply learners with interactive audio-visual contents while they are learning. This helps students to grasp the concepts in desirable way.

H. E. Pence, et al., [6] covered the use of augmented reality for communication of devices to information using marker and marker-less based augmentation. It covers how location-based augmentation can be used for marker-less augmentation. Marker based can be done using two-dimensional bar-code to transfer the information.

Heen Chen, et al., [7], reviewed the utilization of augmented reality in Engineering Graphics to module and examine the presentation of visual view of Engineering Structures.

The review done by Iulian Radu, et al., [8] was a comparative study about the use of augmented reality by the students. It considers the positive and negative impact of augmented reality on the students and also find the root cause behind it. It would help to extract the full potential of augmented reality in the future with the present data.

M. Laal, et al. [9], gave the importance of collaborative learning for benefits of everyone involved in the process. It covers the meaning of positive interdependence and how it affects the learning process. It also gives a brief about the use of collaborative setting.

Lalita Bisht, et al., [10] in 2013, surveyed for the future scope of augmented reality. This covers the history of augmented reality, current status, possibilities and future scope.

Tasneem Khan,et al., [11], did the experimentation on the influence of using augmented reality in learning on motivational factors of healthy undergraduate student. It covers various aspects and impacts of using augmented reality on students by collecting feedback from students using augmented reality by making them answer a questionnaire.

Ikea mobile app has been using augmented reality since 2012 to show the placement of furniture in the room [12]. This uses augmented reality to show the furniture in the actual space and help users to actually see what they are buying.

Augmented reality is being used in games for interactive experience. Pokémon Go is one such game developed with the aid of augmented reality which uses GPS to locate, capture and train virtual 3D models Known as Pokémon [13].

Augmented reality is been increasing in the last few years. Disney released its colouring book few years back. This book uses the AR for the modelling of its 3D princess [14].

It is also been used in cosmetics by L'Oréal Paris [15]. They are using it so that the users can see how the cosmetic product would look on them before buying it. It can be considered as a snapchat filter with makeup.

The US army has been using augmented reality for real-time overlaying for their pilots [16]. It enables the soldiers to distinguish between friendly and enemy troops providing them extra required information in the form of visualizations.

AR is also being used for marketing by adding useful AR interactions in a location.AR being a comparatively new concept, attracts customers.

Hotel industry has also included AR for better guest satisfaction. Hotel Marriott uses AR for room modification by the customers as per requirements [17]. In this, the customer can modify the room and see the augmented view and hence decide the modifications.

The impact of augmented reality on students is explained in the such a way that it covers the motivational factors which are recorded and compared with the traditional learning methods. It also reviews how augmented reality affected confidence and attention levels of students.

3. System Architecture

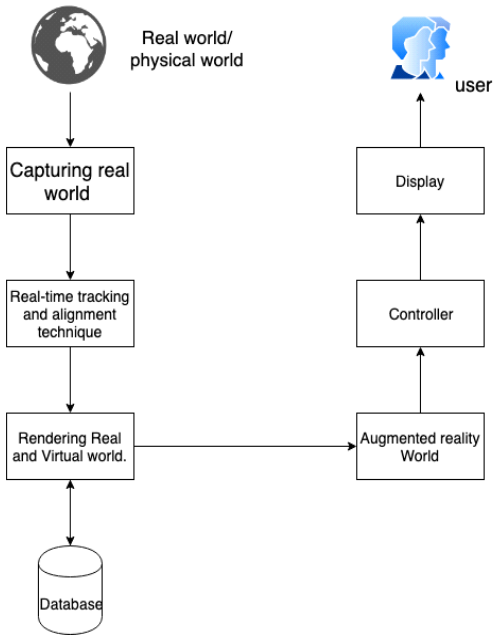

Fig. 2. AR-based education system architecture

Augmented reality (AR)-based education system architecture consists of different steps. The architecture starts with the step where the camera captures the real world. The captured real world consists of real-world entities that also refers as objects. These objects that are captured are send for further processing. When the camera captures the real world, there are unwanted objects present. These unwanted objects are neglected and the required object is targeted or marked. The required object is extracted by real-time tracking and alignment

technique. The tracking and alignment technique plays a crucial part in AR system. The tracking and alignment technique extract the required object and is considered as marker.

Once the marker is detected, image synthesis takes place of real and virtual world. The 3D virtual models get displayed on the marker in respected position. These 3D virtual models are generated by Rendering software. After the 3D virtual models are placed on the marker, learners can control it in any manner. They can rotate, move, zoom the 3D virtual models through controller. The controller helps in handling the 3d virtual models in a way the learner wants to view it. The Augmented real world that is created can is displayed and can be handled through controller, turning a normal classroom into engaging one.

In this, students can use camera to focus on marker where a 3D model will be displayed on screen on the real image. The models that are overlapped on the actual image will represent as process of envisioning any educational concepts subjects.

The multiple planes of the object can be seen by just rotating the real image, so as the virtual object will also be rotated accordingly.

AR-based educational application can be implemented on any Android device running on android version 4.0 or later. The app is developed using UNITY 3D and VUFORIA. The hardware requirement for unity3D depends on the version used.

4. Conclusion

In AR technology, the main highlight is that, students can understand the concepts effectively by looking at the display while the instructor explains it simultaneously.AR in education helps students to comprehend what they are educated. It creates an engaging environment towards learning for students. It helps in exploring more about a concept in depth and also helps clearing doubts with practical solving. Augmented reality inspires to increase the skills in visualization. The 3D models created are reusable without getting any damage. It helps in clarifying the basic doubts making the base foundation of learning strong in education.

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