International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Overview of Augmented Reality in Education

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Abstract - *Today, with the advancement of mobile devices across world, many exciting and knife-edge applications are getting developed which also consists of concept of augmented reality in them. Augmented Reality is what we get when we try to use technology in order to superimpose information-images, texts, sounds on the world we see. With the rise of applications that are capable of producing environments in augmented reality, the vast potential of AR has begun to be explored. In this paper, attributes of augmented reality is presented along with its presence in educational system. Further directions to how to apply augmented reality is introduced and discussed. The aim of proposing this paper is to provide an introduction to the augmented reality concept. This paper provides a starting point to all those who are interested in researching and using Augmented Reality for education purpose.*

Key words—Augmented Reality, Virtual Reality, Mobile Technology, Virtual Environment.

1. INTRODUCTION

Augmented reality a process of using technology to superimpose information audio, images and text on the world we see. It introduces the concept of interactivity among user and the application. Augmented Reality transforms how you work, learn, play and connect or interact with the world. Augmented Reality (AR) describes a combination of technologies that enables real-time mixing of computer-generated content with live video display. AR is based on techniques developed in VR and interacts not only with a virtual world but has a degree of interdependence with the real world.[8] "Augmenting" reality is meaningless in itself. However, it do makes sense as soon as we bring our focus on the human being and on his perception of the world. Reality can not be widened but its perceptions can be.[7]
Designing an AR system is very complicated process and involves three aspects which are given below:

- Combination of real and virtual worlds
- Interactivity in real time
- Registration in 3D.

Augmented Reality is one of the hottest trend in the industry right now and has made its strong position not only in entertainment but also it is getting used in various businesses and industries across the globe.[7]The word "augmented" is derived from the word augment which basically means to enhance or increase something. So basically the integration of digital information with the users environment in the real time or real world is known as augmented reality.AR overlays new information on the top of existing real world in the form of videos, audios, pictures and even on maps.With this the real world view gets enhanced.[8]
For Example- It can be understood with the help of very common and famous example social media applications or platforms, Instagram. This app provides features to capture your real world image along with amazing filters and videos.
Another very famous example of augmented reality can be described as Tik Tok app. In this app user can capture or record their real world images along with the audio content of various movies or any other famous dialogues.

1.1 Types of Augmented Reality

Augmented Reality are of four types. Each of them is given below along with its definition.[7]

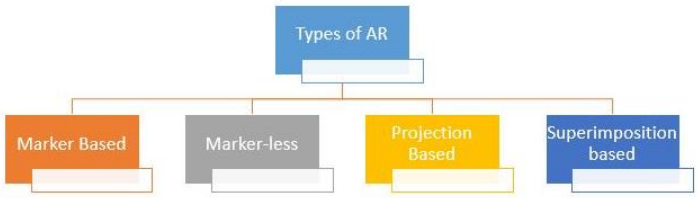

Figure 1. Types of AR

- **Marker- Based :-**Marker Based AR is also called Image Recognition AR. It uses the camera in the mobile device to produce the result. 2D and QR are the examples of it.In this user only gets the result when camera senses the marker.It detects the object in front of the camera and gives information about the detected object on the screen.It translates the words seen by the camera using Optical Character Recognition technology and shows them with the translated version.In this technology, the position , orientation of an object are calculated first and later the gathered data is overlaid by the marker, on that object.

Figure 2: Marker Based AR

- **Marker- Less :-**Marker-Less AR doesn't require recognition system & augmentation.In this, the location-based AR does not know about the object whereas recognition based AR apps do. To provide a fecund result, this technology uses various location tools and helps in recognizing location on your devices.

Figure 3. Marker-less AR

- **Projection Based :-**This technology is based on AR projection function, where lights from the device projected on the objects.There are numerous approaches which make this technology more interesting.the light is thrown onto the surface of the real world and interactive environment is made by by the human touch with the help of sensors.It can also be done in mid-air by the help of laser plasma technology. It thus , helps in determining the structure and configuration of the projected images.[7]

Figure 4. Projection based AR

- **Superimposition Based :-**It is indeed one of the most important types of technology where object recognition plays an important role. In this technology, the augmented image can replace the original image, either partially or fully. The technology is useful in the medical field. A doctor can thoroughly examine patient and gives a proper treatment.

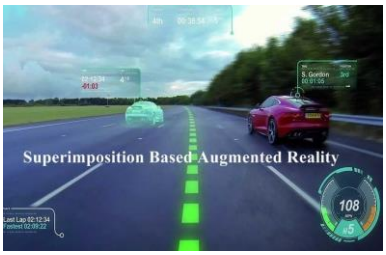

Figure 5 - Superposition Image

Many researchers are developing pragmatic theories and applications for AR into both academic and corporate settings. By virtue of those studies, some innovations of AR have been developed and are being used to enhance the education and training of students . But However, according to Shelton & Hedley (2004),there are still many questions that linger about its use in education and training, including issues of cost between AR systems and conventional methods.

2. Importance of AR in Learning Environment

With advancements in technology each day, changes in the learning environments too occur. The purpose is to raise individuals who can access and use information and adapt to the technological developments Augmented reality technology has an important influence and role in education and teaching as it allows the reality to be combined with virtual teaching materials and gives students the opportunity to have control over these resources. the individual can interact with the environment and learn actively from the mental perspective , undergo enriched experiences and has the chance to learn by discovering. Form this aspect, the augmented reality provides a learning environment and supports constructivist learning principles . Two-dimensional environments are generally preferred due to reasons like, exibility, portability,suitability and economy in the education and learning processes. However, two-dimensional environments are static and thus do not provide a dynamic content to the learners. The AR application ensures that the objects materials and information are enhanced by use of virtual objects prepared through computer systems and become more effective. As the augmented reality technology helps in converting the static monotonous textbooks in learning environments to multimedia possibilities, the functional nature of the environment improves and different cognitive channels work during the learning process.

Multimedia activates more than one sensory organ, thus multimedia materials developed through AR supports active participation and creates permanent learning. It provides more efficient learning by providing concrete examples for the topic.[5]

Experience gained by watching something is more effective than learning through reading, and moving an image on the screen to. A phenomenon that does not exist in real life can be felt as if it is in life, and human-computer interaction can be used more effectively in learning.

For example, Liarokapis, et al. (2004) demonstrated that AR can make complicated concepts in higher education accepted and understood by students with interaction to the visualized models using AR technology.In recent times we have find some excellent examples of augmented reality in education worldwide. Connection between reality and digital content has been steadily improving, opening more options for teachers and students.

3. AR in Education System

Using technology to superimpose information - sounds, images, and text - on the world we see is Augmented Reality.Nowadays 80% of young people own smartphones. Most of them are active smartphone users that uses the smartphones to access social platforms, play games and to be in connection with friends and relatives. In the meantime, some young adults uses phones for studying purposes, to do the homework, dig information about a subject, etc, they are lesser in number. The potential of combining smartphones and Augmented Reality for education is big, though it still has to be fully discovered. AR, in various ways, could grant students extra digital information about any subject, and make complex information easier to understand.

3.1 Augmented Reality Classrooms

One of the simplest AR uses in education is its introduction in the traditional classroom.Textbook materials with AR support examples helps with the learning process – a process that will become a hybrid of the traditional approach and innovative practical illustrations of complicated concepts.A simple example of how AR can be utilized in the classroom. By scanning the covers of textbooks, students get a short description of what they're about. Thus, smarter choices can be made for the selection of learning materials that are considered to be most suited to the task at hand.

Flashcards of 4D augmented reality are also in existence. Dinosaur 4D+ is a set of AR flashcards designed by Octagon Studio that provides students a better idea about what dinosaurs have looked like that simultaneously provide information about their habitats, biology, and the origin of dinosaurs.

Augmented reality is now considered to be best in making the educational experience fun for a young and restless group of people who have gotten used to visual stimulation and interactivity. Apps and AR resources are already being used in the classroom (successfully), and chances are that the scope of application will expand even further as more AR developers take on the task.

3.2 AR-Enabled Worksheets and the Educational Process at Home

Augmented reality can also helps in providing students in handling their homework and assignments better when they're not interacting with an educator. In the very near future, teachers should start providing their students with AR-enabled worksheets. The aim of providing these study aids would be to encourage students to explore educational content at their own time. Printable AR worksheets are already being tested out in a number of educational institutions.

The International Society for Technological Education provides better support and guides on the creation of such learning materials.Kids and teens rarely leave their phones. This fact can be harnessed to promote learning in a way that will interact to the contemporary students.

Augmented reality makes images and information "pop out" of a textbook or a worksheet. It puts emphasis on the most important concepts and it also breaks the drawbacks of textbook learning that's perceived as mundane and tedious by many students.

Once textbook materials and apps are chosen for this purpose, the implementation of AR technology in the learning process will become simple and easy providing better results. This is one of the reasons why the augmented reality technology is preferred over virtual reality developments. While VR necessitates the use of a headset, AR needs solely an app and a smartphone to bring educational concepts to life, which is available almost to everyone.

3.3 A Higher Level of Safety: The AR Lab

Lab experiments and demonstrations are undoubtedly one of the most effective practical options for providing challenging concepts to reality. Due to budget restriction, available equipment or safety hazards, however, many schools limit the scope of practical demonstrations that students are exposed to.
This is another fact that's coming to change through the adoption of AR technology. The number of experiments and demonstrations students can witness is going to increase. In fact, such educational tools are very helpful.Anatomy 4D is a

perfect example of such AR development. When printed targets are scanned, students interacts with a 3D model of the human body. Experience Chemistry is another similar development. It enables for virtual reactions to take place as students go through different levels and learn about chemical elements.

4. Pros and Cons of AR in Education

4.1 Reasons to use augmented reality in education

- Students and teachers can view 3D models at any angle, scale and distance in AR
- Students can interact with the 3D objects , getting a deeper insight on the topic,Coffin et al. (2008).
- Can bring objects into the classroom environment which in real would be impossible
- Students engage with multi-sensory learning experience
- Students are readily engaged with the content and are motivated to study more independently, Burton et al. (2011)
- Encourages students to use their imagination and creativity
- Improves cooperation between students and teachers and amongst students by enabling collaborative tasks that increase the students' social relation capabilities
- Enables students to learn on their own learning speeds and their own learning styles

4.2 Restrictions of Augmented Reality Application

Students need to acquire skills such as spatial skills, technology adoption, problem solving aptitude and co-operation in order to to fulfill the earning tasks in augmented reality applications. Same goes for teachers as they are expected to have these skills in order to manage the process efficiently and effectively. It is known from the surveys in literature that students who do not have these skills have some difficulties using these applications.
In addition to this, students should be cautioned of the dangers that may be caused by their use in the real environment, and that it may lead to permanent learning of false information because they could generalize the information they learnt through experiences in augmented reality environments.augmented reality is developed at this stage to teach useful visual simple models, but not useful in the visualization of very complex models.The teachers should be willing and trained to use the augmented reality. otherwise, the students' motivation on learning would reduce and their positive attitude towards the use of the augmented reality technology in education would decrease[31].
The results of a study by Folkestad and O'Shea (2011) where the users were frustrated while using the technology outdoors and had to ask their teacher for help. The results showed that although the students faced technical issues, they persisted with the process and engaged effectively in the unique way of learning. Despite all the challenges, the level of engagement in the outdoor AR activities was still very high (Folkestad & O'Shea, 2011).

5. CONCLUSION

The research conducted in the educational domains shows that AR technology has the potential to be further developed in this area. This is due to the advantages and beneficial uses of AR that engages a student in the learning processes and helps improve their visualization skills. The features can also help teachers to explain a topic well and make the students understand what is being taught. The use of AR technology has received positive feedback from teachers and students who have shown their interest in using AR for learning. These responses indicate the willingness of students to actively engage in their studies through AR tools. AR technology is very new in education, thus there are still some limitations.But, most of the limitations of AR are related to technical issues. Such setbacks can be overcome with time as the integration of AR in education is being explored and improved. When the potential of AR technologies is more fully studied in future , the advantageous functions of AR can begin to be used widely in all fields of education and the efficiency of the teaching and learning process will be improved.

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