Augmented Reality (AR) - In the field of Education
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Abstract—In today’s digital world, teacher face lack of attention in student as a major challenge in the learning process. With every student having own mobile device, student demand interactive tools and teaching method. Upcoming Technology AR has significant potential to transform the way content is taught in classes. This paper covers the Introduction of AR followed with, design of Making AR, Advantage and disadvantage of AR. This Paper gives a complete overview of what would happen if AR will used in Education and where it can be used. It further covers the benefits of AR and tells how it is used in education. It further introduces Stakeholder such as (Student, Teacher, Developer and Platform builder) it shows what problems they face currently and how AR would benefit them. Then it tells what are the different platforms available to build AR, followed by the problem which is faced by the developer and conclusion.

Key words: Augmented Reality, History of AR, Advantages and Disadvantages of AR, AR benefits in education, Different stakeholder perspective on AR- Teacher, Student, Developer, AR SDK’s, AR apps in education

I. INTRODUCTION
Physical real world environment that has been enhanced/augmented by adding virtual computer generated information to it through sound, video, graphics or GPS data. Augmented Reality is an enhanced image produced by putting a computer-generated display over a real-time view of one’s surroundings.

Augmented reality displays superimpose information in your field of view and can take you into a new world where the real and virtual worlds are tightly coupled [1]. It is not limited only to Mobile, Desktop, Google glasses, it supports many other devices.

There is thin line of difference between Virtual Reality and Augmented Reality. Virtual reality shows the simulated version of real world objects, whereas augmented reality is conventionally in real time and include environmental elements.

Augmented reality is an old concept but with release of concept like google glass it’s booming a lot. AR is best way to present the real world information in an interactive way by placing the virtual information on top of real information.

Research on augmented AR has demonstrated its usefulness for increasing the student motivation in the learning process [2]. However, AR concept is pretty old and has evolved over a period of time. Also like any other technology, it has its advantages and disadvantages. But if properly encouraged through governed coordinated between stakeholders, it does have effective application in various fields such as education.

II. HISTORY
AR concept was first introduced by scientist Mortin who is also referred as "Father of Augmented reality". He created first instrument – Sensorama simulator using AR concept in Aug 28,1962. The innovation gave a recreation of an affair by utilizing a visual picture, breeze and vibrations.

In 1997, Ronald T. Azuma's "A Survey of Augmented Reality" inspected the fluctuated employments of increased reality, for example, therapeutic, producing, research, mechanical operation and diversion.

In 2011, AR contact lenses are made. Which allow the soldier to focus to on close-to-the-eye AR images on spectacles and also the distant real objects at the same time. In January 2015 Microsoft introduce Holo Lens which is an independent smart glasses unit.

III. ADVANTAGES
Increased Reality is set to change the portable client experience as did signal and touch (multi-modal collaboration) in cell telephones. This will rethink the versatile client experience for the cutting edge making mobile seek undetectable and decrease look exertion for clients.

Enlarged Reality, as multi-modal association (gestural interfaces) has a long history of convenience examination, investigation and experimentation and in this manner has a solid history as an interface method.

Increased Reality enhances versatile ease of use by going about as the interface itself, requiring little association (this Interaction Design system is known as Direct Manipulation). Envision turning on your telephone or squeezing a catch where the space, individuals, objects around you are “detected” by your cell phone giving you area construct or connection delicate data with respect to the fly.

IV. DISADVANTAGES
1) Current execution levels (speed) on today’s iPhone or near touch contraptions like the Google G1 will take two or three times to make Augmented Reality achievable as a general interface methodology accessible to the general populace.
2) Price – as the technology is still developing it may be quiet expensive to use it in everyday life and it might be less accessible for small businesses.
3) Threats to privacy and issues of the privacy control.

V. AUGMENTED REALITY IN EDUCATION
Imagine living in the magical world of Harry Potter, where the school hallways are lined with paintings that are alive and interactive. Now imagine creating an atmosphere like that for your students. Augmented Reality (AR) allows educators and students to do just that: unlock or create layers of digital information on top of the physical world that can be viewed through an Android or iOS device.
Most people who interact with AR for the first time have a mind-blowing experience but fail to consider classroom applications. In our elementary school classrooms, we use AR to create active learning experiences hitherto inconceivable, and in the process redefine the learning space!

Educators know that learning deepens, not just through reading and listening, but also through creating and interacting. Augmented Reality is a new technology, which have been making all kinds of waves recently. AR is not only going to be used for gaming, several companies are exploring applications for AR to be used in education. Around 90% of what we see and do is retained, which is something that has always been missing from education; students do not retain as much information if they are just reading a textbook compared to having more real applications of what they’re learning. Which is why AR in education are so beneficial; these technologies engage students in a completely new way which is more fun and engaging for them, and it increases retention. Several companies are currently working on innovations in this space; and the work we’ve seen so far is surely a good sign of things to come.

Today, a number of professors and educators are applying augmented reality in different subjects like astronomy, chemistry, biology, physics, etc. They are also using this technology in higher and K-12 education. No doubt, AR technology is very much helpful in learning but this technology has been adopted by a very less number of schools. In one of the research, it was estimated that AR has not been approved in many educational establishments because the lack awareness as well as the financial support from the government.

VI. BENEFITS OF USING AR FOR EDUCATION

A. Eye-Catching Presentation

By integrating augmented reality into your lectures, you’ll capture the attention of your audience. You will have their undivided attention.

B. Interactive Lessons

Let your audience participate! Students are able to access models on their own devices via Augment’s app. By viewing augmented models, the students can gain a better understanding of the concepts they are studying. This is a fun way to engage students and reinforce concepts they’ve seen during class lectures.

C. Portable and Less Expensive Learning Materials

Prototypes, physical models, and detailed illustrations and posters are all extremely expensive. More often than not, schools do not have enough money to buy all the supplementary learning materials they would like. Further, these learning materials get worn down, lose their relevance, and get misplaced over time.

With Augment, you do not have to invest in physical materials. Students can access models from any device at any time. Whether they are at home or in the classroom, your students can study and interact with the course materials.

D. Higher Retention

With a simple a scan, students can access augmented models representing anything from a part of the human anatomy to a famous monument to a molecule. Also, students can access websites directly from the Augment’s app. For example after scanning a photo linked with a 3D model of the Eiffel tower and viewing the augmented Eiffel tower, students can go directly to a web page with more information on the famous monument. This experience creates a complete learning cycle. Your students will retain more knowledge for a longer period.

E. Foster Intellectual Curiosity

Incorporating Augment into your lessons will make your students excited about learning. Born in the digital era, your students will be continuously stimulated with augmented reality. They will be excited by new ideas and think critically about the world around them.

Introducing augmented reality to your students, will enable them to discover unknown passions and inspire their future endeavors.

Though AR has made waves in various field, education field has rather been slow to adopt this new technology in the world. In order to improve adoption, it is important to understand impact and perspective from different stakeholder who will participate in AR projects – Teachers, Students, Developers and Platform Providers.

VII. STAKEHOLDER PERSPECTIVE

There would be various categories of people who would be influence and benefited by using AR in the field of education.
but we would be focusing on Students, Teacher, Developer and Platform provider.

![Student's Perspective](image)

**Teacher's Perspective**
- Practical implementation of concept
- Interactive Learning

**Student Perspective**
- Need pro-active participation in content creation
- Enhanced learning experiences through AR

**Developer's Perspective**
- Need quality content for apps
- Adoption of new technology like AR

**Platform Providers**
- Few SDK available which provides end to end solutions

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Fig. 3: Stakeholder Perspective on AR.

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A. **Students**

Though student are very adaptive to new technology why AR is behind?

1) This is because of education system does not support new technology.

2) There is very less content available of augmented reality.

3) Student does not take part pro-actively in building AR Product

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Fig. 4: Student interactive learning

1) **How Can Students Start Using AR In Classroom?**

Using the different app which is available on different store, students can create their own AR experiences, and use them to engage students in creative ways. For example, jazz up your school’s art show, or make math come alive through videos of students solving math problems--perhaps students can trigger an Aura by pointing their Smartphone at a particular equation. You could even attach a trigger image to a Google Form to request time with the school counselor, or make a class picture image on your teacher website trigger a virtual tour of a classroom.

2) **And Why Exactly Should Student Start Doing This? It Sounds Like A Lot Of Work**

Augmented reality apps connected to content can create mind-blowing learning experiences and endless learning possibilities. These type of learning experiences really speak to the needs of visual learners.

The beauty of Augmented Reality is that the learning experiences can be as easy or as complex as you want. You can create your own, or download the numerous already-made apps connected to various content. But what’s even more enticing is that students can easily create these experiences on their own in a matter of minutes.

B. **Teacher’s Perspective on Augmented Reality**

It is little surprising that in present scenario around 71 percent of the student possess smart phone's. So teachers can use AR technology to engage their student which will be more effective. As augmented reality helps the teacher to add the digital content and also allow to add the geographical location of object. These digital information is presented on the paper and then by using AR technology information is delivered to the student. The information is collected from various 3d models, website, video etc.

1) **Allow Students to Dig Deeper**

Augmented reality helps the kid to do more than just watching video. They become director of their own learning. They can do more of the analysis on the objects which helps them to better understand the concept and they can go in-depth of the objects.

2) **Facilitate Learning for Students with Different Needs**

AR apps helps the student to learn at their pace and revisit the material to multiple times as per their need. Families with autistic children can use augmented reality to show the tutorial about the different objects at home which will help children to better understand the objects and complete their task independently. The kids can watch the same tutorials multiple times and helps them to reinforce the learning.

3) **Increase Time on Task and Retention**

Students spends lots of their time in plying games, watching movies. AR helps the student to enhance their learning and can utilize their time effectively for learning the different object. A student can take a printout of object and like open up Anatomy 4D, and see the different part of human body on table. These helps student to utilize time and enhance their learning experiences.

4) **Promote Collaboration**

Getting kids to work together is hard. In class, Student usually doesn’t work together everyone have their own approach to solve the problem. AR helps the student to come together and share their knowledge which helps them to solve the problem using different approaches.

C. **Developers**

Developer also play the vital role in creating AR app. And have their own unique challenges.

1) **Availability of Content for AR Apps**

AR application is content delivery system that contain a lot of digital information in the form of text, audio, video .3D models and is finally superimposed on the real world. Creating quality and optimized content for AR app is most important as the experience of the app is depend upon the quality of the content.
Augmented Reality (AR) can be created using Audio, Video, Still photos. These type of content can be easily created using camera, computer and then multiple tools are available which can be easily use to convert it to AR content. Creating AR content also require powerful hardware and software and plenty of choices are available. Because of authoring solutions creation of AR content becomes easier.

2) Challenges Faced By the Developer

Today’s Smartphone's have limited screen size and it is difficult to show to all the information within the limited space and also most of the AR apps require tracking of user location because of which privacy issues arises.

AR require high computation power in order to display the static content and if we want to display the dynamic content then tracking the device and user location is biggest challenge.

Augmented reality as an emerging technology has limited acceptance level in the field of education, this is because of people have not utilized this technology or haven’t heard about this technology.

Majority of AR apps are developed by the programmer without the pedagogical point of view which leads to ignore the potential benefit of the technology in the education sectors.

There are multiple SDK developed by different platform holder

D. Platform Holder

Augmented reality supports different framework and SDK, but there are few SDK available which provide end to end solutions, choosing the appropriate framework is depend upon the type of the application and business requirement. Augmented reality SDK consist of multiple component within AR application: AR tracking, AR recognition, AR content rendering. The recognition component is brain of AR apps. Tracking component is known as eye of AR experience. Content rendering is hypothetical virtual object and scene of real word information, AR SDK provides an array of tools to the developer for recognition, rendering and tracking of an AR application.

1) ARPA SDKs

ARPA SDK offers features such as image detection, tracking and user interaction through 3-D objects for building the iOS and android AR apps. ARPA SDK also provides the geo-location based AR functionality: which allow you to define your own POIs, when detected allow user to select them and provide more information about them and also allow to perform action on them.

Fig. 5: Different types of SDK and platform supported [7].

2) ARLab SDKs

This SDK allow the adding and removing of the POIs independently from pictures in real time, ARLab allow you to create your own local matching pool with lots of images and can be used to match the images without the connection if the internet. Also provides the supports for the QR code and barcode recognition.

3) Droid AR

DroidAR is an open-source framework that adds location-based AR functionality to Android apps. Gesture detection, support for static and animated 3-D objects that the user can interact with and marker detection are part of the functionality that DroidAR offers and that is only shaded by the poor documentation that exists for the project.

a) Different AR Apps Available

- Augmented Reality apps used for education. [8]
- Some of the free AR apps
- AR Flashcards – Alphabet: Helps kids to learn alphabets.
- AR Flashcards – Shapes & Colors: Helps student to learn about color and shapes.
- Chromville: This app help the student to design and color the character.
- Barcy: This app help the student to understand usage of water and water life.
- Elements 4D: It’s a chemistry app that helps to understand the element of life. It contains data for different levels elementary, intermediate etc.
- Anatomy 4D: Helps to understand the different part of human body with their functions.
- Arloon Geometry: An amazing way to learn geometry! This app features 3D models with AR for most geometric shapes. By directly interacting with the figures, your students will improve their spatial visualization.
- Arloon Mental: This app helps to learn the basic operation of mathematics like addition subtraction etc.

VIII. CONCLUSION

The currently available technique of Education System uses textual and graphical image. But as the AR is growing in the field of Education, Soon it will completely change the
ecosystem of Education. It helps every student to impart knowledge in a better way. Teacher would be finding it easy and interesting to teach. The Existing difficulties is lack of ecosystem, where all the Scholars from different field would come together and work as a team As the Augmented Reality is the combination of real ob and virtual world object. There has to be some form partnership between academics and technology, There is need for the government to step-in and set some policy which will benefits AR. Government should take initiative to clearly define policies that will differentiate the virtual and real IP. We need environment where the developer’s, Designer’s and Teacher’s would come together to build some really great product. As looking at the current Condition the augment reality is the THING.

REFERENCES

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