

# Interactive Learning in Education Using Augmented Reality

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**Abstract**—In this paper we describe the use of advance technologies in field of education. Augmented reality is such technology which opens a new interactive way of teaching style. It is a technology which adds virtual objects in real world and these objects interacts with real environment. It combines virtual world and real world in 3-dimensional. Recent trends in these technologies enables it use in field of education. Here the tough concepts in engineering and other fields can be explained using these technologies by creating virtual object of the subject and made an interactive presentation of its working using animations. These paper mainly focus on creating augmented reality enabled text books for learning touch concepts in an attention-grabbing way.

**Index Terms**— Augmented Reality, Animations, Education, Interactive way of learning, Mixed Reality, Virtual Reality, 3-D

## 1 INTRODUCTION

**A**UGMENTED REALITY is an interactive technology which enhance computer generated virtual model in real world .it derived its existence from virtual reality. In simple words augmented reality is nothing but augmenting virtual object in real world registerd in 3D and the virtual object interacts with real environment. Augmented reality has the features of combining virtual and real objects in a real space, registered in 3D and interactive in real time, normally GUI has some Limitations like gap between computer and real world, explicit operations etc.. In order to over-come these problems computer augmented has been evolved.

AR technology causes people to feel charmed from the first time of their involvement. In theory, augmented reality began to be creatively invented at 1960s. It is necessary to understand the working processes AR. Here a 3D model will be augmented into real world

In this technology the output image can be viewed using HMD (head mounted display) or through webcam. It has various applications uses in field of medical for conducting major operations and for explanation, in field of manufacturing, entertainment etc...

Augmented reality evolved with a timeline invention of various technology if we take a look of its history started from developing a stimulator called "sensorama" by Morton Heilig in late 1950's. In 1962 Ivan Sutherland created a "sketchpad" the first computer graphical user interface and the first HMD patented by Morton Heilig. In 1966 Ivan Sutherland developed the "Ultimate Display with cathode ray tube screen". In 1975 Myron Krueger created an artificial reality laboratory cal-

led "video place". In 1980's Steve Mann created a wearable computers. In 1989 Jaron Lanier coined the term "Virtual Reality". In 1990 Tom Caudell termed the word "Augmented Reality". In 1992 L.B. Rosenberg developed "Virtual Fixtures" one of the first functioning AR systems. In 1999 Hirokazu Kato developed AR ToolKit in japan. In 2000 Bruce Thomas created the first outdoor mobile AR game called ARQuake.

Due to recent developments Augmented Reality advacnes its use in mobile applications known as Mobile Augmented Reality. So many companies are developing applications for mobile using this technology and these companies' focuss on developing AR games changing gaming industry and some applications focus on navigation applications

Augmented Reality is closely tied with Virtual Reality since the concept of AR is an extension from VR where VR is a virtual environment generated by computer models in which we can't see the real world we will be in virtual world created by computer. Extending these concept the virtual object is intergrated with real world so that the user can see the virtual object and real world and virtual object is enhanced with the real world.

## 2 HOW AUGMENTED REALITY WORK'S

Augmented Reality super impose graphics, audio, video into real world environment in real world. Basically Augmented reality can be viewed in different formats like QR codes (Quick Response) normally we can view these types of codes in normal web applications through webcam where a link, video, audio, 3D graphics superimposed in that marker. Here QR codes is termed as markers. When the marker held near a webcam using AR applications through computers it recongineses the code and displays the relavent model, graphics, related to that marker and software. When the user roates the marker even the virtual object moves with the marker and we have another viewing option known as HMD (Head Mounted Display) by wearing HMD we can view the content perfectly without using webcam

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Actually when the marker is placed near a webcam the software in the computer tracks the marker and impose the respective 3D model or digital content at the place of marker. Same happens with the HMD when we see the marker wearing HMD the software verifies the model and superimpose the digital content at the place of marker and the virtual object interacts with real world when the marker is rotated, moved the virtual object obeys the real world change and moves with the marker exactly.

Recent trends in mobile application development enhance the use of this technology and due to increase of smart phones boost up the development of mobile applications using AR applications user can view the world in new dimensions



Fig 1: Mobile Augmented Reality

Technology advances in gaming industries especially Virtual Reality made its appearance creating a virtual environment of gaming where user can be immersed in a virtual world just like second life game. Where as AR games get a benefit of within the real world. User can get the gaming experience with virtual and real world. Other gaming devices are wii, playstation 3 and xbox captures the movements of the user and apply it to the virtual avatar in game creating a virtual environment. Researchers are very much interested in creating AR applications right now Microsoft is developing an AR enabled gaming device for next level of gaming devices.

Recent developments made augmented reality more interesting by introducing markerless augmented reality in which we don't need marker to specify the place for augmenting virtual object. It projects the virtual object as programmed for a specific object or location. This made mobile augmented reality more interesting as we can view about entire location without need of any markers. For example a user want to know about hotels in his place he can view from his mobile placing the mobile cam at a building or at a place he can view the hotels near by with navigation using GPS, he can view the history if that place or any interesting aspects about that place this type of applications are very useful for tourists when they are in new place

Some companies started their own applications like Wikitude an awesome application for tour guide and Layar Company is providing various platforms for creating an Augmented Reality applications, various add-on are integrated within applications like identifying a person using webcam searching

various records in internet and displaying about the person details. There are so many applications which guides tourists in a new places



Fig 2: using wikitude identifying various shops

Using these technologies various different innovative products came into its existence starting with google project glass it uses a glass just like head mounted display for interacting with real world creating an virtual objects a user can email, can send a text and lot more options to explore. Project glass uses augmented technology

### 3 AUGMENTED REALITY IN EDUCATION

Education system is modernizing day by day with the use of recent trends in technologies starting from normal board room teaching to projector presentation. Right now teaching field depends on PowerPoint presentations with animations to make students interesting and to understand concepts more effectually. Using the concept of augmented reality we can create markers of 3d models and we can project them to students. Recent trends in technology made new gadgets like iPhone, iPad, android devices, tabs made eBooks as a part of their educations in some colleges and schools encouraging eBook reading. In china and japan iPad are used for studying. Now usage of gadgets increasing day by day it mark up for augmented reality in the field of education. We can operate augmented reality using this gadgets so many companies are making augmented reality apps for games and advertising. The birth of AR in education take place at 2002 in which hitlab made an augmented reality method of storytelling. The work carried out in different phases starting with sketching the animation the story is divided into different modules and in which a document is prepared on that story with basic requirements and sketching is done for each scenario so step 1 is creating a story board roughly sketching out what was going to be shown on each page of the book. These sketches showed important things such as who the characters were in each scene, what they were doing, and where they were placed relative to each other. The storyboard was drawn several times before the final sets of pictures were selected. Second step was 3d modelling the process of modelling involves making a 3D model from picture. They used special computer modelling

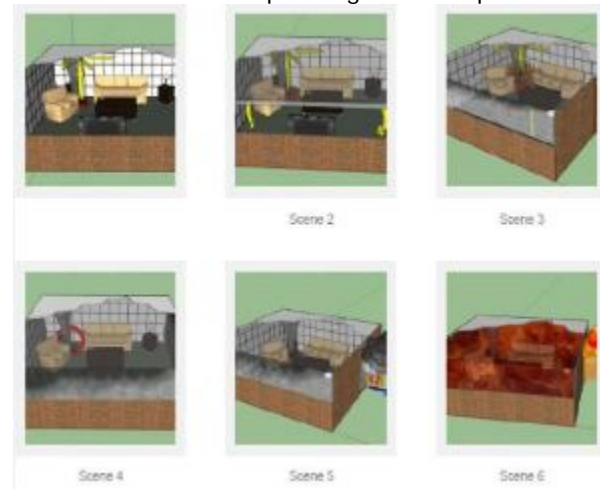
software to create and colour 3D objects they worked particularly hard to make sure that the virtual images looked exactly like sketched pictures. This was helped by using scans of parts of the pictures and applying these scans as textures on the virtual images. The final result was a set of computer generated 3D scenes that looked very similar to sketched illustrations. Moving on to the step three the completed 3D models animated using some animation software's according to the story and it's just like making an animation movie of storytelling and step four nature feature tracking makes the animated computer model to be augmented in a book animated using augmented reality software. It projects the model in 3D such that we feel the real story experience in 3 dimensional view of approach finally a finished project is viewed by handheld devices or head mounted displays. Getting basic knowledge from this so many companies starting making apps on this technology recent trends in mobile computing made augmented reality more expandable such that we can use mobile based augmented reality for studying purpose and understanding the tough concepts easily

#### 4 USING AR CONCEPTS IN EDUCATION

With reference to augmented reality so many come up with different models in education. Preparing a AR books is an innovative approach to solve major problems in education. So many technologies are explained in board teaching which is so complicated and couldn't reach students. So this animation based augmented reality approach can make the things clear with small effort from the teachers side for interactive learning. The basics need for it was a 3D model, AR software and a marker. This marker will be printed in the textbook in middle of the book and the entire content in the book was animated in 3D model. When the student placed his hand held display or head mounted display or a mobile enabled AR device he can see the concept in 3D animations. So we come up with an idea of publishing an AR BOOKS for mind-blowing method of teaching. So that make a student a learning with augmented reality environment. Normally it can be done by using markers let's see how we can prepare an augmented reality application for an educational concept. Starting with the basic concept requirements. In this technology the basic requirements are 1) marker, 2) camera (integrated or connected with computer) 3) computer running with AR software and 4) an output device it can be an AR glasses or a projector, or monitor for viewing virtual object at first we have to prepare a marker model and specify to the software running in the computer after that we must generate a 3D model of the concept with animation and integrate with the AR software. When we run the software our webcam will turn on automatically searches for the marker. We will print the marker in a textbook such that if we point the textbook software recognizes the marker and virtual image will be augmented showing the entire description of the concept

Let's see an example from arined website a concept for fire engineering. Enclosure in fire dynamics is the concept its bit tough to explain in other means. Here we took a 3d models

from Google sketch up and started with animations. For this we create six scenes explaining this concept



**Fig 3:** No of scenes for explaining enclosure fire dynamics

First scene depicts a 3d model of room with several fuel packages as the smoke raises upwards since it's a closed room the smoke will hit the ceiling and spread all over the room Scene 2 gives us a model of larger flames and redirection of smoke from ceiling and interactions with walls. Direction of the smoke is animated eventually such that we can analyse the smoke direction and spreading it in the room with different directions after scene 2 the model for scene 3 as the upper layer starts to form and descend from the ceiling, we start to see more and more smoke developing. Since the door in this compartment is closed, the pressure inside of the compartment will increase. As the ceiling layer begins to develop, we start to see involvement of additional fuels after scene 3 if that smoke has nowhere to go then Upper layer is slowly descending and starting to interact and interrupt with the combustion process. After scene 4 due to increase in pressure when the cooler air enters in the scene the incoming cooler air and outgoing heated gasses filled with hydrocarbons and carbon monoxide. That mixing allows for flammable limits to start forming. As soon as we have flammable limits, and those flammable limits reach the ignition source, we begin to see the backdraft event. This event will start near the ignition source and will start to propagate the flame when the flammable limits are met from the incoming rush of air and the mixing of the hydrocarbons, one can see the combustion reaction within the suspended fuel in the air. That is also called a propagating flame a hot air balloon is seen in the last scene

These scene is held by tracking a marker where ever the marker appears 3d model will augmented and all scenes are animated by order it makes the presentation effective as we are viewing the concept in 3d model. So by using these technology we can create AR textbooks by placing markers in a theory text book by using gadgets like smartphone,ipads we can view the animation of that concept so that students can get a interactive way of learning by using these technolgy

## 5 CONCLUSION

Use of technology is not limited to one field augmented reality has so many uses in field of education and making an AR textbooks can enhance the present education system and use of recent trends in technology and by publishing AR textbooks and providing AR software's in mobile phone based on android, ios etc. enables the augmented learning platform to the students in any subject and make an mind blowing presentation about the concept. The future of the world depends on the education. Finally augmented reality can be used in education field and making AR textbooks enhance its involvement in education field

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