IJCSN - International Journal of Computer Science and Network, Volume 7, Issue 2, April 2018
ISSN (Online) : 2277-5420
www.IJCSN.org
Impact Factor: 1.5

Improving The Learning Capability Of Students In Classroom Using Augmented Reality

[1] Jagadish P; [2] Anand R; [3] Prakash B; [4] Sridhar Patil; [5] Sathiya A

[1, 2] Assistant Professor
Department of Computer Science and Engineering
BMSIT& M, Bangalore, India

[3,4,5] Student
Department of Computer Science and Engineering
BMSIT& M, Bangalore, India

Abstract - Augmented Reality superimposes virtual objects over real world environment. Educators know that learning deepens, not just through reading and listening, but also through creating and interacting. This paper of ours aims to enhance current educational system using Augmented Reality. We are developing an application which will show animations, videos and 3D models of educational material. This paper can enhance learning, creativity and retention among students. Our application will also foster intellectual curiosity among students making them smarter. We aim to change the conventional way of education and open a new opportunity towards a smart classroom through HMD (Head Mounted Display).

Keywords - Augmented Reality in Education, Software engineering education, Head Mounted Display

1. Introduction

Many new interfaces have been developed to facilitate natural interaction between human and computers .This would be possible as lot of changes in computing environment. Augmented Reality (AR) is a concept by which live view of a physical, real world environment directly or indirectly by "Augmented" using computer generated perceptual information. AR could be created and implemented by various techniques such as desktop computers, handheld devices, head mounted displays(HMD) this will more efficient productive as definition suggests to the educators and designers in a broad way. The environment real time feed and is extended with some information and images from the system in AR. The advantage of virtual objects or information imposed physically objects or environments in AR, which results a Mixed Reality where virtual objects and real environments co-exist in a meaningful way to augmented learning experience.

AR being used in various ways from providing point of sale information to shoppers, tourist information on landmarks, computer enhancement of traditional printed media, service information for on-site engineers and in many more, In addition to that technologies that makes AR possible much more powerful than earlier and compact enough to deliver.

The feasibility of AR concept are more experienced not only in corporate areas but also in academic venues through personnel computers and mobile devices and also in several educational approaches. AR can be applied in different fields of education ranging from learning alphabets in primary schools to studying different body parts in post-graduate studies. AR is a very efficient technology for both higher education such as universities and colleges. Students in both schools can improve their knowledge and skills, especially on complex theories or mechanisms of systems or machinery. Learning mathematical formulas after visualizing how it is stated becomes very easy for students. Children with learning disabilities, communication disorders, emotional and behavioural disorders, physical disabilities and developmental disabilities can be benefited by the use of AR Technology.

The application of AR can be adopted in different fields of education ranges from learning alphabets to study the different body parts in higher studies. The AR is more efficient concept in both higher education like colleges and universities. The learners can improve their skills and knowledge, especially on complex theories, mechanisms of system/ machinery. The beneficiary by using AR is mathematical formulae after visualizing becomes very easy to learn.

The people who are having learning disabilities, communication disorders, emotional and behavioural disorders, physically disabilities and developmental disabilities can be more benefited by use of AR technology.

The AR concept is being used from several years, and in many improvements have been made in this field. It is 1.1 billion dollar market and its work is always increasing. We can see its description in old books but the idea has never been as applicable as it currently being used. Once it was restricted to screens and specific head mounted displays now it can be used on mobile phones also. Although the possibilities with AR are innumerable it has not been implemented to its full capacity.

2. Review of Literature

[1] In this paper, an augmented reality mobile application is developed which uplifts the learning curve of students allowing students to learn and understand the concepts effectively, specifically Chemistry. Augmented reality allows students to learn without any teacher is being taught, this makes them to learn in their own time and place.

This application also have an interactivity which cannot be found in traditional blackboard education. Chemistry is the subject where many reactions, atom structures have to be imagined, which is bit difficult to students. So this application brings those imaginary concepts live right in front of students. This paper mainly focuses on the Chemistry related concepts such as collision of atoms of two elements, playing an audio of difficult pronunciation of scientific names of newly formed molecules.

Two Dimensional pictures in the traditional textbooks have no motion in them, and converting them into Three Dimension by students in their mind has a complicity to understand the textual data firstly before visualizing the pictures.

[2] This paper proposes the 3D augmented reality keyboard which is wearable. Conventional interfaces like keyboard, mouse, joystick are replaced by virtual keyboard that performs as it is expected same as
Traditional input interfaces seamlessly. Augmented reality keyboard has a stereo camera which allows the system to sense the depth information in the environment.

This application has three main modules.
(i) 3D environment tracking.
(ii) Virtual interaction with fingers.
(iii) Video see-through through camera.
This system allow an AR applications to adopt a typing mechanism in the AR environment. Also, encounters the collision between the fingers and virtual keyboard with no sensors attached to HMD. Stereo camera senses the depth in the environment, a virtual keyboard is overplayed into the real world environment, the depth information is continuously feed to the system, as the depth is triggered at given depth value the key on the virtual keyboard is now activated and letter c or responding to it is displayed on the virtual screen which comes along with the AR keyboard.

3. System Design

This Augmented Reality Application that enhances the learning capability of students that helps them to visualize 3D objects and learn better, this application aims to visualize the Biological models like Human Organs, Plant organs, etc. Through Augmented reality computer generated images are brought into the real world scene this can help students to learn better.

3.1 System Overview

Augmented Reality system uses certain sophisticated computer vision technologies for estimating the position and alignment of virtual objects that are to be blended in real environment. These estimates are done using Marker-based approach, where a predefined marker (especially a high contrast image or easily detectable pattern) is placed in the real scene beforehand. These markers are tracked and used for estimating the pose and orientation of virtual objects that are to be placed in the respective environment. An example of marker-based AR System building mechanism is represented in Figure 3 where the final augmented image is obtained by tracking a known marker and the estimation of pose of virtual object is evaluated with respect to it.

This application mainly consists of educational tool software by means of marker based augmented reality application, When user opens that application and the user need to scan the marker as an input and then the its output as 3D model it will pop up on that marker for gesture options it has sub marker for animation, zooming, if the user touches that marker the corresponding marker will rotate and play the audio. The audio is a small description of the corresponding model with 2-3 minutes, and it has also another sub marker for labelling options, when user touches that marker the models get the labels. The overall application we can see through head mounted display device, and the software part i.e. this application is designed only for android devices. This application developed using Unity3D Engine [4] Vuforia Software Development Kit [3] and Autodesk 3ds Max for 3D models [14], and C# Programming Language for Scripting [15]. The application overall process is shown in figure1. The application mainly consists of unity3D Engine application components (those are dependencies on Vuforia components) and Android device components (are camera and image target database). The application will start by using android device camera is through HMD [5] and then Vuforia Software Development Kit links it to the augmented reality camera and the tracker.

The tracker module detects the targets (marker) by matching them to the target database which is in the android device memory. The tracker module gives the state of objects to the rendering engine and logic section. Finally, while images are still being tracked, output is then rendered and shown on the mobile device's screen through head mounted display as 3D objects alongside its associated components.

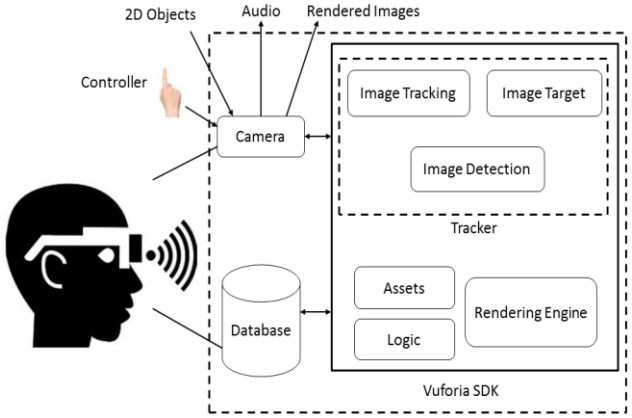

Figure 1: System Design

3.2 Requirements and Specifications

The requirements of the application is to maintain the overall application capability, there are four points where it satisfy the abilities of the application towards the users. First it should run on android devices (portable devices) such as Android device mobile phones or tablets. Second it has to recognise the all the markers and matches with models. Third it should be user-friendly. Finally the output of the application should delivers the educational content to the users with well rich graphics and animations.

3.2.1 Android Operating System

Android operating System is a mobile operating system developed by Google, based on the Linux kernel and it is designed for touchscreen mobile devices such as smartphones and tablets. Android is popular with technology companies that require a ready-made, low-cost and customizable operating system for high tech devices. Its open source nature has encouraged a larger community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which deliver updates to older devices, add new features for advanced users or bring Android to devices originally shipped with other operating systems. The minimum supported version for our application is Android 4.4 (KitKat).

3.2.2 Unity3D Engine

Unity3D Engine [4] is a cross-platform game engine developed by Unity Technologies and it is used to develop video games for PC, consoles, mobile devices and websites. Unity3D is popular environment where we can develop Augmented Reality applications and it has larger community support and also documentation for each and every components, it supports almost all versions of Windows, Blackberry, Android and IOS.

3.2.3 Vuforia Software Development Kit

Vuforia SDK [3] is an Augmented Reality Software Development Kit (SDK), it's the overall AR Tools included in this Software development kit, it provides the overall Augmented Reality application dataflow between android device and unit application development. It has massive tools such as 3D object creation, ground plane technologies, etc. and it also supports towards the position alignment and recognition of objects through camera (by tracking module).

3.2.3 Android Device

The requirements for Android Smartphone is:
(i) Minimum 1 GHz Processor.
(ii)Minimum 1GB Ram.
(iii)At Least 5 MP Camera.

3.2.4 HMD (Head Mounted Display)

A head-mounted display it's the main primary physical device of the application, there are so many head mounted display devices in the market for virtual reality, augmented reality and mixed Reality (VR+AR). The HMD's mainly have two portions left eye and right eye from that we can see the application in stereo mode for better immersive feel of the objects, through head mounted display we can see the objects in the real world with immersive AR feel.

3.3 Application Design and Features

This application is Marker Based Augmented reality application and it has the following modules:
1. Camera: The camera module detects the marker with appropriate position and size, then it sends marker feed to the image processing module, Camera should have minimum 5MP for reducing time complexity.
2. Image Capturing and Processing Module: This module gets the marker feed from the camera and analyse the marker feed, by analysing each marker-image, it generates the binary images which has only two values for each pixel, it then sends image feed to image processing module. The generated binary images obtained are processed using an image processing

technique to detect the augmented reality marker. Once the augmented reality marker is detected, then it's get the location and it is passed as an input to Marker Tracking Module.

3. Marker Tracking Module: In this module it finds the position and relative resolution in the real world then it passes to the rendering module.

4. Rendering Module: This module places the 3D models on the top of the associated marker with proper position and size, it also displays other virtual components such has labelling and animation.

5. Interaction Module: In this module, user will be able to interact with the object using gestures with hand on virtual sub markers.

The implementation process is comprised of three main phases: (a) Locate Marker module (b) Image Tracking Module and (c) Load model module, the models are predesigned and stored in the device target database. user points the camera towards the marker the locate marker module detects the marker by camera then the marker tracking module detects the marker by accessing marker details then the load model module load's 3D model from the database of the associated marker.

The models contains labelling and audio part, once the model is loaded then if we choose the labelling part it will synchronise the labelling with model then it display the complete model, when the model is loaded on the screen the user can control the model by using the virtual markers and markers also designed for controlling the 3D model.

4. Related Studies

Augmented Reality in Education Field

Educators and researchers are ready to bring AR technology to the classroom learning for the subjects like chemistry, biology, physics and astronomy. So that the subjects is easily understood by the students. Subjects like chemistry is not easily understood by the students concepts like Chemical reactions, molecular bonding etc. Hence they are in a way to bring AR in education. However, AR is not adopted to education because of more cost and lack of knowledge about the AR technology. This limitations can be overcome as increase in the research on the integration of AR in education. Integrating AR with education improves the understanding of subjects which they are made to learn. Furthermore this paper concentrates on biology, Also this can be extended to various other subjects.

Augmented Reality in Business Field

In the area of corporate, AR is more interactive, skill-learning, understandable, easy learnable tool for employers and customers. also business have better ability to maintain AR applications in terms of cost and technical skills many companies are interested to use AR technology for design so that it can be easily understand by the stakeholders. Employee can fulfil the customer need and requirements. It helps to demonstrate their project before they are actually implemented using resources.so that the faults can be identified earlier and designed without any faults. This helps the developer to develop a product without any fault.

The Current Position of Augmented Reality in Education and Training Field

In the recent years many researchers and professionals have been working on many theories and application to adopt the AR Technology in education and in the business.by virtue of those studies, some AR applications is developed and being used to enhance the education and training efficiency of students and employee. In addition to that number of research is going on to improve the applicability of AR in day-to-day life. Many researchers have identified learning as an interesting and promising field in which AR could be applied. AR increases the effectiveness of learning in both education and business.

5. Conclusion

This application enhances or provides the way of teaching or learning concepts to students and also it achieves the new way of learning Syllabus through augmented reality. AR technology provides better means for students learning in an interactive environment.it also helps the teachers to explain well and make the students easily understand the concept even if it is of higher complexity.

This application mainly focused on Biological human anatomy parts through an interactive and engaging user experience. It has interaction features and also audio features, and also it has virtual sub markers to move to different Biological models, playing audio files to pronounce the names of the Biological models upon detection. Although this technology can be created by integrating many tools and has a great potential to effectively support a learning environment.

There are some issues to consider when augmented reality is implemented in an educational field. Therefore, to provide a better learning experience to everyone (teachers & students) involved in the process, there is a need for identifying effective curricular and technological characteristics for the implementation of AR in day-to-day teaching practice. However, limitations regarding technical issues and support will overcome as research on the integration of AR in education is practiced and improved. Additionally, in-depth study of how augmented reality field supports learning and teaching may create many opportunities for future research to anticipate important ideas in education as

student content interaction enhances the learning outcome and gives a better understanding of the purpose of concept that students are made to learn. Furthermore, the paper also gives a few possible applications of augmented reality in different fields of education for making the interpretation of difficult topics way much easier and in future we can extend this application to various other subjects.

References

[1] Augmented Immersive Reality (AIR) Technology for High School Chemistry Education - Shayma Al Shehhi, M. Jamal Zemerly, 2016 IEEE Global Engineering Education Conference.

[2] ARKB: 3D vision-based Augmented Reality Keyboard - Minkyung Lee , Woontack Woo , KJIST U-VR Lab, International Centre for Automotive Technology(ICAT) 2015.

[3] Vuforia SDK https://www.vuforia.com/

[4] Unity 3D Engine https://unity3d.com/

[5] Head Mounted Display https://en.wikipedia.org/wiki/Head-mounted_display

[6] Google Glass https://developers.google.com/glass/

[7] T. P. Caudell and D. W. Mizell, "Augmented reality: an application of heads-up display technology to manual manufacturing processes," In Proceedings of the Twenty-Fifth Hawaii International Conference on System Sciences, 1992, pp. 659–669, 1992

[8] B. Fruht, The Handbook of Augmented Reality, Florida: Springer Science+ Business Media, 2011

[9] H. Mohsineh, K. Poon, J. Ng., M.J. Zemerly, "Augmented Immersive Reality (AIR) in Education: Implementation, Application, and Case Study," IC13 International iCampus Symposium, Abu Dhabi, UAE, pp. 90-93, November 2013.

[10] M. Billinghurst, "Augmented Reality in Education", New horizons for learning IX (1), October 2003.

[11] M. Billinghurst, H. Kato and I. Poupyrev, "The Magicbook: Moving Seamlessly Between Reality and Virtuality", IEEE Computer Graphics and Applications, vol. 21, no. 3, pp. 6-8, May/June 2001

[12] B. Teoh and T. Neo, "Interactive multimedia learning: Students' attitudes and learning impact in an animation course," Turkish Online J. Educ. Technol., vol. 6, no. 4, pp. 28–37, 2007.

[13] D. Zhang, J. L. Zhao, L. Zhou, and J. F. Nunamaker, "Can elearning replace classroom learning?," in Communications of the ACM, 2004, vol. 47, no. 5, pp. 75–79.

[14] Autodesk 3ds Max https://en.wikipedia.org/wiki/Autodesk_3ds_Max

[15] C# Programming Language https://en.wikipedia.org/wiki/C_Sharp_(programming_language)

[16] Priyanka, Anand.R1 Dr.Rajashekhar M.Patil " comparison of betweenness and closeness centralities using incremental algorithms in dynamically growing networks" ,IJACET, ISSN(PRINT):2394-3408,(ONLINE):2394-3416,VOLUME-3,ISSUE-2,2016.

[17] Anand.R, Pushpalatha. M, Dr Rajshekhar M Patil "A parallel algorithm for reading the different variables in social networks using data mining techniques" Journal of Advanced Computing and Communication Technologies (ISSN: 2347 - 2804) Volume No.4 Issue No.2, April 2016.

[18] Bharathi M , S. N. Chandrashekara , Anil G.N , Anand R , Muneshwara M.S " K-Anonymity for Real-time Social Network Applications with Network Based anonymization and processing framework" 2012 IACSIT Coimbatore Conferences IPCSIT vol. 28 (2012) © (2012) IACSIT Press, Singapore.

Authors -

Mr. Jagadish P is pursuing PhD in Computer Science and Engineering from VTU Belagavi, Karnataka. He has done his MTech and BE in Computer Science. He is currently working as assistant professor in CSE Dept, BMSIT&M, Bangalore. He is currently working as Research Scholar in the field of Image Processing.

Mr. Anand R is pursuing PhD in Computer Science and Engineering from VTU Belagavi, Karnataka. He has done his MTech and BE in Computer Science. He is currently working as assistant professor in CSE Dept, BMSIT&M, Bangalore. He is currently working as Research Scholar in the field of Data Mining.