

Enhance Education with Collective Augmented Reality

Mr. Sandip S. Kote

Department of IT, AVCOE Sangamner, A'nagar.
Maharashtra, India
sandip.kote@gmail.com

Prof. Bharat S. Borkar

Department of IT, AVCOE Sangamner, A'nagar.
Maharashtra, India
borkar.bharat@gmail.com

Abstract—Augmented reality (AR) is a live and combines direct or indirect view of a physical, real-world environment it's realtime data whose elements are augmented by computer-generated virtual content such as sound, video, graphics or GPS data. An AR system poses unique challenges including requiring a high quality camera pose estimate and operating on resource-limited platforms. We use AR for technology application transfer to enhance education and improve communication between student & their concept with AR to overcome traditional education system drawback and enhance application based research in AR to solve the question which are difficult to explain in all class of education system. This AR optic flow that is able to real time performance result is possible with platform specific optimizations, improve speed and extend the usable tracking range.

Keywords— Augmented Reality; Real Time; GPS; ; Hybrid Tracking.

I. INTRODUCTION

The advancement of mobile computing platforms has created a way for Augmented Reality (AR) technology to be diverse in many domain areas. Currently, research on AR is increasing. It has been used in many sectors such as marketing and advertising, military training, gaming industries and tourism. AR is mainly used for navigation, for example by using Google Maps where it provide route information to destinations by overlaying digital arrows, current traffic, time that can be seen on the mobile display. Furthermore, in tourism industries, user does not have to open their laptop or computer to find information about historical places. What they can do is, just simply walk around with their smartphone and point at the building or street by using LAYAR application.

Nevertheless, it is still not able to reach the mass market due to some limitation and challenges that developers and researchers need to solve. Even though current smartphone has equipped with basic components to enable AR function, still it consume a lot of processing power, memory, and storage. The focus of this paper is to enhance education with collective AR. It is important to address the current style of education in order for us to overcome so that student can benefits the use of AR technology in future.

Information or knowledge acquired by an individual normally occurs through different media. However, the traditional 'verbal' educational method is not necessarily effective [2]. Many studies [3] [4] have testified that students who solely rely on lectures are incapable of

recalling ideas, and seem to struggle to solve a given task. Regardless, many educational institutions are still using these ineffective and non-interactive approaches which often result in lack of interest among students. Thus, educators are forced to search

for better approaches that can help the students improve their learning experiences.

Learning experience is recognized as an very important part of an education system, and can be more meaningful when more senses are involved (sound, sight, touch, emotions, etc.) [5]. Educators are looking to adopt new technologies in their classrooms in order to enhance the learning experience of their students, partly because such methods can easily engage students and improve their academic performances [6].

The emergence of the augmented reality may possibly leave an impact on the teaching and learning process as well as offer new ways to educate. concerns over the use of emergent technologies necessitated the continuous monitoring of students' motivations during learning activities. Among the examples are computers, the internet, e-learning, social websites, semantic websites, learning objects, simulations, games.

A variety of instructional strategies that take advantage of the AR affordances are available. For example, This research have been used to design AR learning environments. However, too little attention has been paid to enhancement AR and hence, this paper intends to how it was used in previous researches and its potentials in the educational field.

II. MOBILE AUGMENTED REALITY

This use the new invention of portable devices such as smartphones rather than using special hardware to build AR application. According to Hollerer, mobile AR is a combination of several important components such as computational platform, global tracking technologies, wireless communication, display technology, data access technology and interaction technology [10].

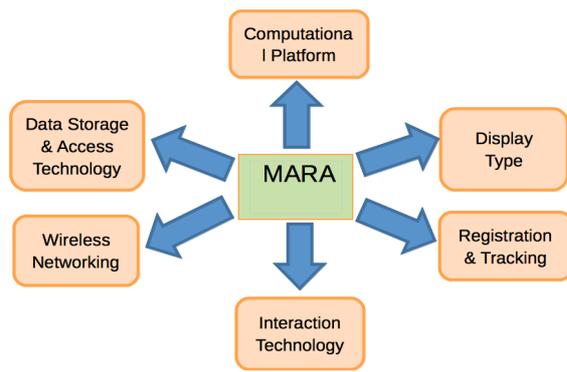


Fig. 1.Components of Mobile AR Application [10]

A. Computational Platform

The computational platform component is definitely used in mobile devices. The current trends are focusing more on mobility features where we can see from the mobile sales and growth in the market. Within this component, it should be able to manage the physical setting and generate virtual elements of an object and scene through the camera in mobile device. As smartphones are getting popular nowadays, AR has been made compatible in many kind of mobile OS platform such as Android, iOS and others. Qualcomm especially has developed software where developer can easily create their own AR application using Vuforia SDK [1][11].

B. Display Type

Some researchers have used head-mounted display where they have to wear it to see the virtual object or information. There are many types of display in mobile AR such as mobile display, eye-wear display, hand-wrist display, projector display and others. The purpose of display component is to show the virtual object in the context of the physical world [12]. In mobile display, camera is used as a view platform to capture object or images. When object is detected, 2D and 3D elements will pop-up on the mobile screen. While in projector display, image is projected on the real surface.

C. Registration and Tracking

According to Hollerer, in order to annotate the object, it is important to align the physical objects with the virtual elements. This is because AR requires precise and accurate position tracking and registration [10]. There are several types of registration in mobile AR such as location based-registration, orientation-based registration, image-based registration and others.

On the other hand, the view of oriented-based is augmented using device orientation.

D. Interaction technologies

Interaction technologies in mobile AR component should enable user to select, access and visualize relevant materials. This component able to make sure there is an interaction between user and device and possible communication with other user for collaboration purposes. In mobile AR, interaction can be manipulated in many ways such by interacting using device orientation, gesturing, audio command and others. It can be used in single application or multiple applications in which it depends on the user needs.

F. Data Access and Storage Technology

In order to provide information data access and storage is important to know about the current situation, object, environment or scenario to the user. As there is some limitation

in mobile device especially memory, it is important for mobile AR to have external storage where it able to access large information. For example by making use of cloud storage to store all the data and information related to the system for ease of access and secure the data.

There are some limitations and challenges that researches and developer need to encounter. Therefore, in the next section, we will present the current limitations and challenges face by developer in developing the mobile AR application.

III. CURRENT LIMITATIONS FOR MOBILE AR

Although mobile AR technology has been introduced for more than 40 years, there are some amazing uses for the technology that cannot be implemented. This is due to its limitation some issue either from developer views or user perspectives.

A. Technical Limitations

For technical limitation, is categorized it into 3 important factors which are hardware, algorithms and interaction technique. These factors are discussed in developer's perspectives.

1) Hardware

Small screen display still becomes the main issue in mobile AR especially in smartphone. This has become an issue where users are hardly to see what is on the screen. Not many information can be display using standard screen of smartphone. Furthermore, there is an issue of camera quality in mobile device. The imaging produce is sometimes poor due to bad lighting and color fidelity [13].

2) Algorithm

Kolsch et. al has stated that tracking often utilizes a high- end sensor which requires major computational resources. Due to the limitations of current mobile device, it would not be possible to develop new tracking algorithms on this platform [14]. For example, the noise in geomagnetic heading values can cause jitter in mobile display while presenting the information [15]. Furthermore, another limitation that can be addressed here is there are misalignments between real and virtual environment. This has prevents the acceptance of many serious applications.

3) Interaction Technology

Due to limitation in hardware, mainly in small screen estate, 'fat fingers' has become an issue in interaction which developers need to overcome. This is because it can lead to issue of precise interaction in mobile AR, where users are not able to interact precisely with some object causes by some misalignment in the algorithm. With the introduction of new interaction technique [15], it does not only solve the 'fat- fingers issue' but also supporting every task involve in the mobile AR application. Furthermore, it can also improve user sensing by engaging user into the AR environment feeling real like physical environment.

IV. POTENTIALS AND CHALLENGES OF AR IN EDUCATION

A. Educational Benefits

From this research the unique ability to generate objects or virtual information in the real- world environment, This characteristic is useful when constructing a immersive hybrid learning environment. It can also help improve process skills such as critical thinking, problem solving and communications. Additionally, the use of 3D registration of the virtual and real objects in an AR allows users to view the learning content in 3D perspectives. This affordance can help students who have difficulty visualizing complex learning concepts. [7][8][9] found that AR can assist students to understand and learn new concepts and phenomenon that cannot be viewed in the real world.

Freitas and Campos [8] and Campos, Pessanha, and Jorge [9] pointed out that by learning through play, the uses AR in education have actually reduced the gap between children and knowledge. As [8] argued; "poor students are, in general, more prone to physical activity, and playing with the physical racquets might positively influence their learning behavior". In fact, with its simulation of virtual objects in real time, The emergence and widespread use of mobile devices such as smartphones and tablets furthermore, have opened new opportunities for AR integration. Knowledge by discovering the outside

environment and interact with each other, through the AR's guidance.

Additionally, students were allowed to control the 3D virtual objects with peers or teachers to promote better collaboration. The AR supports collaborative learning on digital information and each other in the same space. This is believe that the AR has shown great capacity to be integrated into the teaching and learning environment.

B. TheChallenges

In many studies, researchers conclude that when participants encounter a large amount of information, the complexity of the task and their unfamiliarity of the technology (participants might never have experienced an AR technology) may cause cognitive overload. Therefore, designing proper scaffolding mechanisms or instructional prompts when using AR is necessary to help maximize students' learning capabilities and minimize cognitive loading problems.

V. AR FOR EDUCATIONAL ENHANCEMENT

A. AR with Unity 3D

To solve aforementioned challenges, we created a new version by Unity 3D and Vuforia AR Extension for Unity [1]. Unity 3D is a feature rich, fully integrated development engine that provides out-of-the-box functionality for the creation of interactive 3D content. Using Unity, you can publish to multiple platforms such as PC, Web, iOS, Android and Xbox. Complete toolset, intuitive workspace and on- the-fly play testing and editing feature of Unity makes developers to save the time and effort. The Vuforia AR Extension for Unity enables vision detection and tracking functionality within the Unity and allows developers to create AR applications and games easily.

B. AR Education Enhancement prototype

We create prototype model for Zilha Parishad school student and that model for having basic Zoo animal information using AR.It will give great outputs from student and interactive session as well as students showing very good response and showing great excitements while learning concepts .The AR can also catch and hold users' attention and increase students' level of engagement with the course content, which leads to better academic achievements. In fact, the AR learning environments have positively impacted students' motivation, allowing them to gain concise knowledge of the subject matter. Students have also shown high levels of motivation and interest while performing tasks and studying, particularly when they were allowed to go outside for physical exploration. These children were clearly motivated because they never gave up on the game until they have found the answer. This behavior implied that their motivations were fuelled

by the integrated AR technology in their learning environment.

VI. DISCUSSION

We trying to solve student concept using Unity 3D AR by Vuforia library and explore the study concept. Handle AR virtual objects & animation .In Unity based AR we give control buttons it possible for teacher or user to have more intuitive interaction by using their fingers directly. Another improvement was made on the graphical expression with Unity's built-in shaders. Moreover, its Unity's complete toolset made programming more intuitive and fast. However, there are still some challenges to be solved in future [1]. All targets tracked by Vuforia and Vuforia have their own coordinate system, with the origin being in the center of the target.

VII. CONCLUSION

It is shown that there are benefits and challenges in enhancement of education area through AR. By utilizing proper instructional strategies, AR may provide students with numerous benefits which may lead to effective learning experiences. This research may assist in understanding the role of AR in improvement learning. The integration has shown positive educational effects which have resulted in a higher level of motivation, learning performance, engagement and collaboration among students. As information technology evolves, the AR opens up new opportunities to AR for technology application transfer to enhance educational experiences that are more engaging and interactive its overcome traditional education system drawback and enhance application based research .

REFERENCES

- [1] Sung Lae Kim, Hae Jung Suk, Jeong Hwa Kang, Jun Mo Jung, Ajou University Suwon, Korea, "Using Unity 3D to Facilitate Mobile Augmented Reality Game Development", IEEE World Forum on Internet of Things (WF-IoT), 2014
- [2] R. E. Mayer, "The promise of multimedia learning: using the same instructional design methods across different media," *Learning and instruction*, vol.13, no.2, pp. 125–139, 2003.
- [3] R. E. Mayer, "Multimedia learning: are we asking the right questions?," *Educational psychologist*, vol.32, pp. 1-19, 1997.
- [4] R.E Mayer, *Multimedia learning*. New York: Cambridge University Press, 2001.
- [5] K. Kreijns, F. V. Acker, M. Vermeulen & H. V., "Buuren, What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education," *Computers in Human Behavior*, vol. 29, pp. 217–225, 2013.
- [6] Á. DiSerio, M. B. Ibáñez and C. D. Kloos, "Impact of an augmented reality system on students' motivation for a visual art course. *Computers & Education*, pp. 1–11, 2012.
- [7] R. Freitas & P. Campos, "SMART: a System of Augmented Reality for Teaching 2 nd grade students," in *Proceeding of the 22nd British HCI Group Annual Conference on People and Computers: Culture, Creativity, Interaction*. vol. 2, 2008, pp. 27-30.
- [8] M. Dunleavy, C. Dede, & R. Mitchell, "Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning", *Journal of Science Education and Technology*, vol.18, no.1, pp. 7-22, 2009.
- [9] P. Campos, S. Pessanha, & J. Jorge, "Fostering collaboration in kindergarten through an augmented reality game," *International Journal of Virtual Reality*, vol.10, no.3, pp. 33, 2011.
- [10] Hollerer, T. & Feiner, S., "Mobile Augmented Reality," In A. H. H Karimi, *Telegeoinformatics: Location-Based Computing and Services*, Taylor & Francis Books Ltd., pp. 1-39, 2004.
- [11] Qualcomm Connected Experiences, Vuforia Developer. [Online] Available : <https://developer.vuforia.com/>, 2014.
- [12] M. Gilbert, A. Acero, J. Cohen, H. Bourlard, S.-F. Chang, and M. Etoh, "Media search in mobile devices," *IEEE Signal Process. Mag.*, vol. 28, no. 4, pp. 12–13, Jul. 2011.
- [13] Alkhamisi, A.O., Monowar, M.M., "Rise of Augmented Reality: Current and Future Application Areas," in *International Journal of Internet and Distributed Systems*, vol.1, pp.25-34, 2103
- [14] Z. Zhou, J. Karlekar, D. Hii, M. Schneider, W. Lu, and S. Wittkopf, "Robust pose estimation for outdoor mixed reality with sensor fusion," in *UAHCI '09: Proceedings of the 5th International Conference on Universal Access in Human-Computer Interaction. Part III*. Berlin, Heidelberg: Springer-Verlag, 2009, pp. 281–289.
- [15] Chowdhury, S.A., Arshad, A., Parhizkar, B., "Handheld Augmented Reality Interaction Technique", *Advances in Visual Informatics Lecture Notes in Computer Science Volume 8237*, pp 418-426, 2013.