

Smart learning based on augmented reality with android platform and its applicability

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Abstract— Since last few decades, AR technology has visualized fabulous growth, now it is ready to be used in consumable electronic items like PCs, computer and android phones. Here the aim is to showcase an overview of basic aspects of Augmented Reality and the main concepts of this technology. Now a day AR finds its involvement in various fields along with its smart application software which can be used in different fields including education, medical and many more. Augmented reality, better known as AR is a step towards latest technology enhancement program which enables us to experience virtual things in real world. By the introduction of Augmented reality into the education system teachers can convey their knowledge more preciously and in a very attractive manner. Students will understand more easily if this technology is introduced to them. Hereby in this manuscript, we are proposing an idea to use AR on Android platform which is more widely used now-a-days.

Keywords— Augmented Reality, HMDs, GPS, pattern recognition, astronomy.

I. INTRODUCTION

Augmented reality is a fast and an emerging research field of computer science and technology. The word augmented reality came into existence in 1990 by Tom Caudel [1][2]. Head mounted displays play a vital role in the field of AR. In AR technology, the information of real world is incorporated with the virtual word in a manner that the integration of these two shows no indication of disparity and incongruity [2]. If there is indiscrepancy, the end user may get puzzled. The AR algorithms work on the gathering of data from the real word and then converting it into electronic form for the user. There are numerous AR techniques; some of them make use of conventional input systems. The appropriate AR technique can increase the acuity of human being in various conditions and creating a delusion between virtual and real world [5]. Now a day AR has progressed up to a great extent where there is a plenty of software that provides a better interfacing techniques [4]. Marker based

and marker less are the two different approaches used to integrate the real environment with virtual word [4] [5]. Marker based approach works well under the supervised environment circumstances. Although due to technology advancement now marker based approach is compatible with semi- controlled circumstances as well [6].

Whereas, In Marker-less Augmented Reality, images are captured and processed using internet and GPS and displayed on smart phones [7]. The applications of marker based augmented reality includes domains such as medical science, education, gaming, fashion world, product information, military training etc [7] [8]. Still research is going on in different fields using augmented reality.

The AR envelops features, which help in learning, and these features are commonly used with the Virtual Reality and modern technologies like Simulations and gaming graphics. It is obvious that these features have enormous potential to foster learning new techniques whether it is AR and any other technology [9]. Instead of discussing these features in this research paper, we are going to explore the wider aspect of Augmented Reality and how it can link the virtual to the real ones [10] [11] [12].

II. LITERATURE REVIEW

Augmented Reality Technology in Education:

“The application of Augmented Reality in the field of education can be proved to be a key component in forthcoming learning atmosphere that are richly populated with a mix of hardware and software applications”. Similar to this, in the development of AR pop-up book in learning any concept, it allows the superimposition of the digital information into student's perception of the real world. In addition, Yuen, Yaoyune yong, and Johnson [12], describe in their research study that using augmented reality, learners can boost their perception and will be more interactive that are more appealing than digital native learning. The exciting presentations and experiences in AR technology will increase motivation in learning such as in unity - vuforia based mobile application. Students are able to interact with

the book using simply moving mobile's camera over the 2D images and signs. Also, Yuen, Yaoyune yong, and Johnson, have reviewed an example of AR book entitled "The Future is Wild: The Living Book" which is able to increase motivation in learning by encouraging students to build a connection to a book which was launched at the Frankfurt Book Fair in 2011[12] [13]. Further, learning with realistic audio-visual contents in AR technology will motivate learners by providing a better learning environment especially for learners in primary school, level 1 where learning with text itself is difficult. Related to this, according to Lee, Choi, and Park [15], in their research study on e-learning system using AR technology, "the proposed e-learning system augments the audio-visual contents as the students interact with the objects in the text book". The uses of audio-visual contents are proven to improve learning [16] [17].

III. PROPOSED SYSTEM

In this manuscript, we are dealing to foster the education system with the introduction of Augmented Reality at Android platform. The traditional and conventional teaching style on blackboard or book to describe about the particular element in depth may not impart completely to the students [18]. But by using Augmented Reality Android application for education system, teacher can smartly explain about the learning elements in 3-D model to students.

The objects can be observed from different directions like- right, left, top, bottom [19] [20]. It is well known that 3-D images are more helpful in comparison 2D images to analyse the object. This approach of learning will enable the students to understand more as compared to conventional teaching techniques like black board and white boards, and pen paper work, etc.

In this system, live feed camera image (i.e., 2D image on paper) is captured by the camera, called Tracker image. The next step is the Pattern Recognition phase, here the tracker image is processed with the help of Image processing model to identify Patten behind 2D image and connect that recognized Patten with appropriate 3D object shown Figure1.

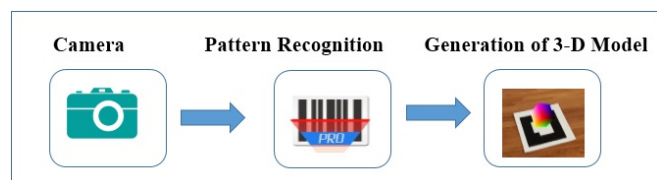


Fig 1: A block diagram to generate 3-D Model

In the below Figure 2, given an experimented result of one sample 2-D image weapon, transformed into a 3-D object model and Same procedure applied to rest samples to generate 3-D object models.



Fig 2: Generation of a weapon's 3-D Model

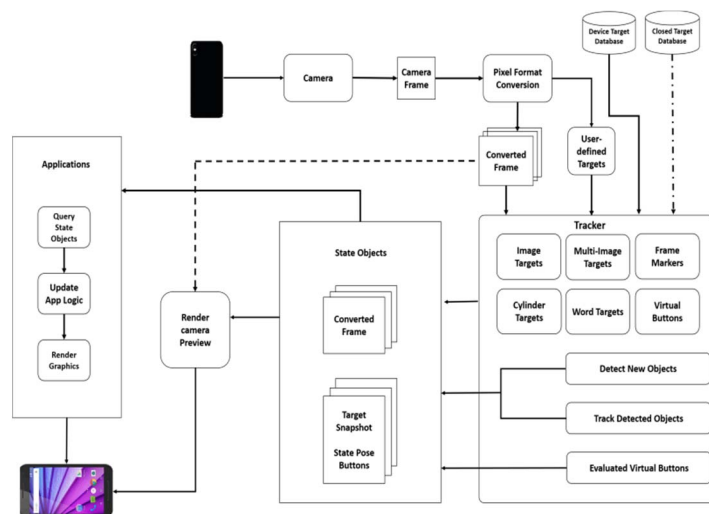


Fig 3: Data flow with Vuforia SDK

The development of augmented reality mobile application is performed using a number of software packages with some hardware requirements namely system specifications and software specifications.

3.1 System specifications

OS- Windows 7 SP1+, 8, 10; Mac OS X 10.8+
GPU- Graphics card with DX9 (shaded model 3.0) or DX11 with feature level 9.3 capabilities.
PC- 1 GB RAM, 20GB HDD space (minimum requirement)

3.2 Software specifications

- unity 3D(5.3.6+), a game engine is used as the main development environment.
- Qualcomm Vuforia Augmented reality library used to Perform all aspects of the AR from the image tracking to the image registration.
- Android Studio and SDK tools.
- JAVA development kit.
- Android SDK tools if testing on an android device.
- Xcode if testing on an iOS device.
- Monodevelope unity.

IV.DEVELOPMENT PROCESS OF AUGMENTED REALITY ANDROID APPLICATION

The Android application development process for Augmented Reality consists of following four steps mentioned in Figure. 3.

1. 3-D Model Creation – For creating interactive 3D Model with visual effects, art, animation, simulation, texture and raster graphics many open sources as well as commercial tools are available such as – Max 3D, Autodesk Maya , Blender and many more.

2. Creation of tracker image –Tracking of an image is done in such a plausible way that it is compatible with the real as well as virtual word. The formation of tracker image can be accomplished by using the vuforia software kit. Vuforia has its own patterns for every image that has been loaded on its website.

3. Embedded in Unity - The tool allow to embed 3-D model and Tracker image to into Unity package. Unity allow us to modify objects scaling and with X-axis, Y-axis and Z-axis. Unity also allows us to code in C# or Java Script that makes application more interactive and in customized form.

4. Development of .APK - With the help of Java (SDK) and Android Studio, enable to generate android file that executed in android mobile with version 4.0(ice cream sandwich) and above.

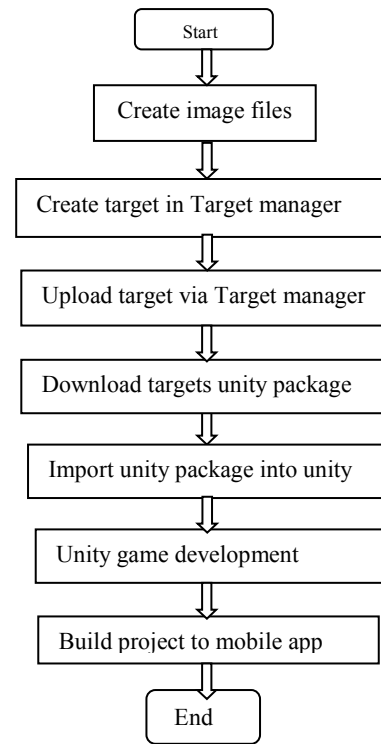


Fig. 5 The workflow of App development

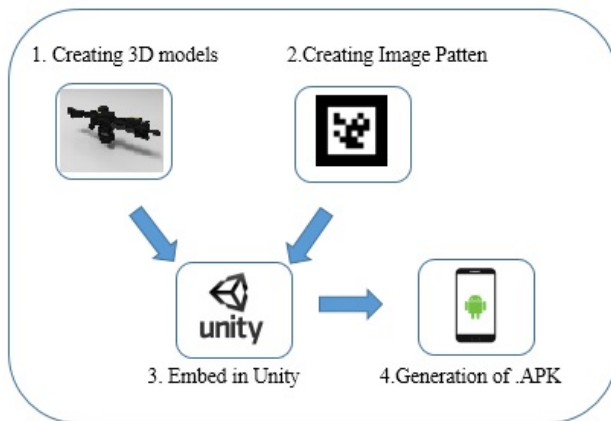
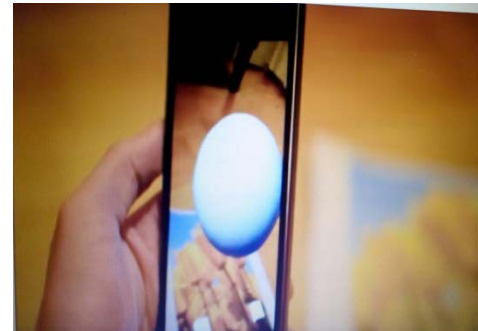
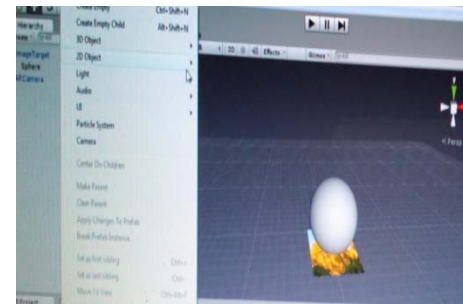


Fig.4 Android Augmented Reality Application Development Process

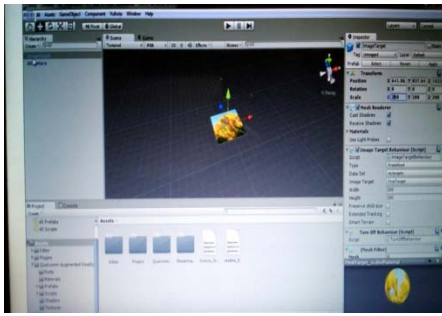
While conducting experiment and development of mobile augmented reality application, observed that the length of the tracker image and camera resolution also matters for generating 3D object.



(a)



(b)



(c)

Fig 6 Augmented reality with vuforia and unity.

V. APPLICATIONS OF AR

The application of AR technology has spread its usage to several fields of study in education. Few of them are namely, Medicine, Chemistry, Mathematics, Physics, Biology, Astronomy and History.

A. Astronomy:

Usage of this technology in astronomy is extremely out of the box thinking, because 3D simulations of the objects in the universe in computers and android devices will encourage the wish to know deeply and definitely increase the curiosity of the reader.

B. Sightseeing:

AR can play a tremendously amazing job in the field of sightseeing. Using this technology one can create immensely superb graphics, which will help to explore the sights more deeply and with curiosity. Total Immersion, a global leader in augmented reality, develops systems designed to enhance the experience of the museum attendee [12].

C. Artillery:

The AR technology can play a major role in the field of military weapons consisting of handheld ones and also the explosive ones like tanks, missiles. Using AR, the soldiers can be trained effortlessly and can gain enough experience with the weapons [21]. This is done creating 3D images of the weapons and then augmenting them in digital devices.

D. Health care:

Using AR, we can make the students as well as the fresher surgeons, to get proper knowledge of the several body parts and how to handle them with intense care during surgeries[22] [23].

VI. CONCLUSIONS AND FUTURE WORK

This research paper primary objective is to enhance the current learning and teaching approach by introducing concept of augmented reality through smart phones. With this technology, students and teachers both will get benefited. Moreover, teacher can create their subject topics augmented 3D Models and smartly explain to their students. Even, students can better understand the topics explained with the help augmented Reality 3D Models.

Furthermore, the important advantage of augmented reality android application is that even with the basic android enabled device with good camera can allow running the application. This application also facilitates the multiple targets recognition.

In future, augmented reality can be combined with Artificial Intelligence to develop more automated smarter applications that can be witnessed in next coming years.

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