Augmented Reality for Education and Entertainment using ARCore

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ABSTRACT

Although the physical world is three-dimensional, principally we tend to choose to use two-dimensional media in education, that don't let the imagination power of the scholars to explore the real-world entity (monuments, biological-objects etc.) effectively. By considering this issue the concept of Augmented Reality for Entertainment and Education came into our mind which will enhance the imagination of students. The combination of Augmented Reality(AR) technology with the education and entertainment content creates new style of applications and acts to reinforce the effectiveness and attractiveness of teaching and learning for college students in world eventualities. The aim of our "Augmented Reality for Entertainment and Education" is to assist the scholars to grasp theoretical concept practically (virtually) by using 3D models. Our project application provides a interesting way of teaching and learning process that will help teachers to explain the concept more effectively to be understood by students in much easier way. In this application, there are two sections i.e. Education and Entertainment. In Education section, we provided education related 3D models ex: heart, animal cell, DNA, piston, steam engine, skeleton with description which is opened by clicking on that question mark provided with all the 3D models and in Entertainment section we created a museum with ancient 3D models to create interest about history among students. As we create the museum for entertainment section, we can also add different 3D models like tourism, celebrities, spiritual places, etc.

Keyword - *Augmented Reality, 3DModel*

1. INTRODUCTION

Augmented reality is what it sounds like: reality, enhanced with interactive digital components. The foremost commonly used AR applications lately believe Smartphone showcase the digitally augmented world: users can activate a Smartphone's camera, view the real world around the month screen, and believe on an AR application to reinforce that world in any number of the way via digital overlays: Super imposing images, digital information and/or 3D models, Adding real-time directions, Inserting labels, Changing colors, Altering the user or the environment's appearance via "filters" on Instagram, Snapchat, and other apps. Augmented Reality (AR) maybe a new technology that involves the overlay of computer graphics on the real world. Augmented Reality (AR) in education features aspects that enhance learning of talents like problem-solving, collaboration, and creation to raised prepare students for the longer term. It's also good for ancient pedagogy target technical data and proficiencies. Using augmented reality within the schoolroom can flip a standard class into an emerging experience. So, while teachers can use it to bring lessons to life, they also got to maintain a attention on more traditional ways of delivering content. Augmented reality is best suited to enhancing those traditional lessons instead of acting as stand-alone methods of instruction. AR technology provides virtual examples and adds animated components to support textbook materials. As a result, classes become additional interactive. AR helps students better remember the knowledge they've just learned. Teachers have now a robust tool in Augmented Reality. AR will encourage and have interact students creating the STEM (Science Technology, Engineering and Mathematics) and writing learning

me to the quicker, fun, and better than ever before. Schools need to start preparing programs that are flexible enough to be adapted and modified quickly consistent with the young Alpha's inquisitive mind. Augmented reality can simulate potentially dangerous situations like engine failure, letting workers safely practice their actions in such situations. Trainees can practice repairing high-voltage equipment or identifying and handling potential emergencies. That means that AR lets students and trainees prepare for critical situations without endangering themselves or anyone else by simulating these situations.

2. LITERATURE SURVEY

Tim Pedure published a paper in 2017, which specifies that AR technology has matured to the point where it can be applied to a much wider range of application domains, and education is an area where this technology might be especially valuable. The educational experience offered by Augmented Reality is different for a variety of reasons. It was found that it Support seamless interaction between real and virtual environment, use tangible interface metaphor for object manipulation and has ability of transition smoothly between reality and virtuality. Proposed system was difficult to use as it as many bugs as a result it requires expensive hardware. Shaunak Shirish Deshmukh1 , Chinmay Mandar Joshi2 , Rafiuddin Salim Patel3 , Dr. Y. B. Gurav4 published a paper in Jan 2018, which specifies that use of AR to leverage increases computing power of smart-phones to build a system that displays 3D objects using a printed image without using any complicated equipment. The purpose of this technique is to accelerate learning and understanding of concepts like structures or mechanisms.It was found that System aims at helping and developing better training systems, 3D user manuals and interactive courseware materials that will aid efficient learning and training for people. Unity is a graphics and physics engine that is wont to build scale-able applications which will be built for multiple platforms with an equivalent codebase. Given system does not support Mac Operating System. Riya Agrawal, Abhishek Singhal publishedpaper July 2019 published a paper on Augmented Reality and that analyses various types of augmented reality, its applications and its advantages and disadvantages. This paper also gives us knowledge regarding those major threats that augmented reality will face within the near future and about its current and future applications. It gives us a comparison between the two related topics, Augmented reality and Virtual reality. AR is overlapping of digital images on real world object using various AR objects. Teresa Roselli, Rosa Lanzillotee 9 June 2020 published a paper on AR application, called Geo+, for supporting primary school students in the acquisition of knowledge on the solid geometry. Geo+ has been developed by following a Human-Centered Design approach, thus several formative evaluation studies were performed to reinforce the standard of resulting application. Pupils really appreciated the ease of use of the game; they were satisfied and felt engaging and cozy during the interaction, none of them invite help during the execution of the training activities. The results showed that Geo+ is effective in terms of student learning gain. For developing and maintaining of Geo+, expert of geometry is required. Raskar R, Welch G, Fuchs H. published paper in Dec 2019 on the effectiveness of AR applications in improving the learning and skill acquisition of individuals with special needs. Following the PRISMA guidelines, a metaanalysis of the general effectiveness of AR on individuals with different disabilities in singlesubject studies was conducted. This study offers a crucial insight into the relative success of AR in promoting academic and functional living skills to individuals with special needs. It also offers research-based guidance to decisionmakers for supporting adolescents with special needs, such as autism spectrum disorders and intellectual disabilities. Sixteen single-subject studies on a more restricted subset of special educational needs types that matched the eligibility criteria were considered to explore the effect of AR on the acquisition of four sorts of skills: (a) social, (b) living, (c) learning, and (4) physical. Nor Farah Saidin, Norraffandy yahaya June 2015 published a paper on describes the application of AR in a number of fields of learning including Medicine, Chemistry, Mathematics, Physics, Geography, Biology, Astronomy and History. This paper also discusses the benefits of AR compared to traditional technology (such as e-learning and courseware) and traditional teaching methods (chalk and talk and traditional books).AR technology offers a learning experience that's linked to the formal classroom in order that students can learn outside of sophistication hours. Proposed system is difficult to understand and use and as a result it is time consuming. Reitmayr G, Drummond T. ISMAR 2018 published paper on a model-based hybrid tracking system for outdoor augmented reality in urban environments enabling accurate, real time overlays for a handheld device. The system combines several well-known approaches to supply a strong experience that surpasses each of the individual components alone: an edgebased tracker for accurate localisation, gyroscope measurements to deal with fast motions, measurements of gravity and magnetic flux to avoid drift, and a back store of reference frames with online frame selection to reinitialise automatically after dynamic occlusions or failures. The system automatically performs detail culling and only searches for edge features that are likely to be visible at the present scale. The system is in a position to extract an appearance signature for every edge that it wishes to localise within the live feed, thus increasing the accuracy of matching. A convincing tracking solution must overcome inherent

limitations of individual techniques by combining different complementary methods. Gerhard Reitmayr and Dieter Schmalstieg Vienna University of Technology, Feb 2018 published paper on the work to create a mobile collaborative Augmented Reality system that supports true stereoscopic 3D graphics, a pen and pad interface and direct interaction with virtual objects. The system is assembled from off-the-shelf hardware components and is a basic workplace for interface experiments associated with computer supported collaborative work in Augmented Reality. A mobile platform implementing the described features and collaboration between mobile and stationary users are demonstration. Mobile computing allowing users to access the knowledge independently any time from anywhere computer supportive collaborated work lowering the utilization of computer for human communication. There is need to collaborate between the computer and mobile, for this versions also need to match, which is extremely complex work.

3. PROPOSED SYSTEM

This system is aimed at building application which will provide interactive 3D models to students and teachers for better way of learning by using AR technology and as well as it is use for Entertainment purpose so that user can capture interesting and attractive pictures of themselves from their places. There is not an exact application developed for education and entertainment both, by using AR technology.

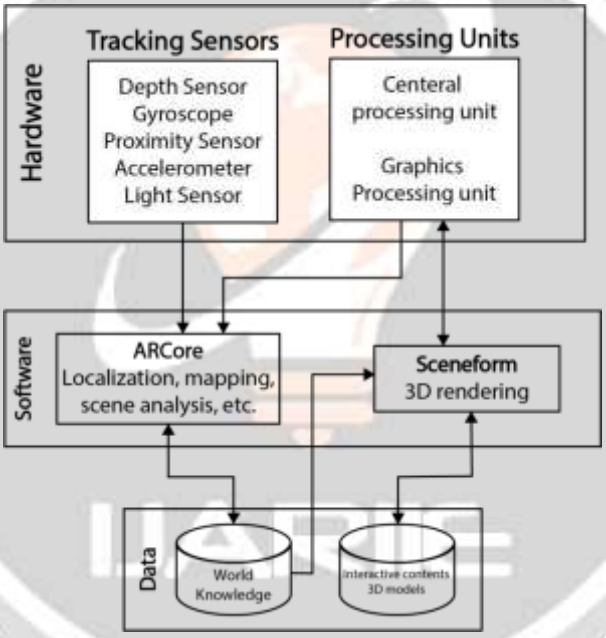

Fig1: Proposed System Architecture

3.1 Hardware

The hardware refers to your equipment through which the virtual images are projected. During this case, they are your Smartphone, so as for AR to work on these devices, they have to possess sensors and processors which can support the high demands of AR. Here are a number of the key hardware components:

3.1.1 Processor

This is the brain of the device. It determines the speed of your phone and whether it is able to manage the heavy AR requirements, additionally to its normal phone functions.

3.1.2 Graphic Processing Unit (GPU)

The GPU handles the visual rendering of a phone's display. AR requires high performance GPUs in order that the digital content are often create and superimposed seamlessly. Sensors: This is the component that gives your device the facility to make the sense of its environment. Common sensors required for AR include:

- Depth Sensor: To measure depth and distance
- Gyroscope: To detect the angle and position of your phone
- Proximity Sensor: To measure how close and far something is
- Accelerometer: To detect changes in velocity, movement and rotation
- Light Sensor: To measure light intensity and brightness

3.2 Software

3.2.1 AR Core

ARCore also referred to as Google Play Services for AR, it is a software development kit developed by goggle that allows for augmented reality applications to be built. ARCore uses three key capabilities to integrate virtual content with the real world:

3.2.1.1 Motion Tracking

As your phone moves through the world, ARCore uses a process called Simultaneous Localization and Mapping, or SLAM algorithm, to understand where the phone is relative to the world around it. ARCore detects visually distinct features with in the captured camera image called feature points and uses these points to compute its change in location. The visual information is combined with inertial measurements from the device's IMU to estimate the pose (position and orientation) of the camera relative to the world over time. Simultaneous Localization and Mapping (SLAM) Smartphone camera is most used for tracking in AR. It acts as the eyes of the phone in conjunction with sensing tools. Collectively motion tracking in AR Core is known as Simultaneous Localization and Mapping (SLAM).

3.2.1.2 Environmental Understanding

ARCore is consistently improving its understanding of the real world environment by detecting feature points and planes. ARCore looks for clusters of feature points that appear to lie on common horizontal or vertical surfaces, like tables or walls, and makes these surfaces available to your app as planes. ARCore can also determine each plane's boundary and make that information available to your app. You can use this information to put virtual objects resting on flat surfaces.

3.2.1.3 Light Estimation

ARCore can detect information about the lighting of its environment and provide you with the typical intensity and color correction of a given camera image. This information allows you to light your virtual objects under an equivalent conditions because the environment around them, increasing the sense of realism.

3.2.2 Sceneform

Sceneform SDK allows you to import and view 3Dmodels (in such formats as .obj, .fbx, .sfb, or .gltf) then render realistic 3D scenes for ARCore apps, without having to find out OpenGL. Sceneform includes a high-level Scene Graph API, a Physically Based Renderer (PBR) provided by Filament and Android Studio plugin for building 3D assets. ARCore is made for tracking and scene understanding stages.

4. BLOCK DIAGRAM

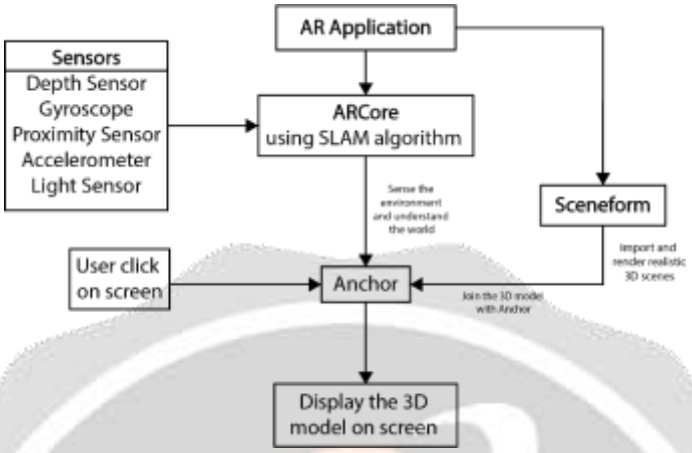

Fig2: Working of Proposed System

For developing AR app, we used Android Studio 3.5.3 as an IDE (Integrated Development Environment). In Android studio we used ARCore and Sceneform library, AR Core trigger SLAM i.e. Simultaneous Localization and Mapping Algorithm. SLAM is break down into 'Localization' & 'Mapping' as the prominent elements of SLAM. The device tries to simultaneously localize – find the location of some object/sensor with regard to its surroundings – and map the layout and framework of the environment that the device is in. This can be done using a range of algorithms that simultaneously localize and map the objects. SLAM is an optimization problem, for the machine to understand, the device's sensors collect visual data from the physical world in terms of reference points. These points help the machine distinguish between floors, walls and any barriers. Google's AR platform uses advanced SLAM to interact with the surroundings. Measurements are constantly taken because the device moves through the environment and SLAM takes care of the inaccuracies of the measurement method by factoring in 'noise'. Different sensors use different algorithms. SLAM largely makes use of mathematical and statistical algorithms. This Slam algorithm of AR core uses the Sensors (Depth Sensor ,Gyroscope, Proximity Sensor, Accelerometer, Light sensors) to trace the 2D plane Surface of real world. ARCore detects visually distinct features with in the captured camera image called feature points and uses these points to compute its change in location. The visual information is combined with inertial measurements from the device's IMU to estimate the pose (position and orientation) of the camera relative to the world over time. ARCore looks for clusters of feature points that appear lie on common horizontal or vertical surfaces, like tables or walls, and makes these surfaces available to our application as planes. ARCore can also determine each plane's boundary and make that information available to our application. Afterwards, Anchor point is formed on the plane surface and by using Sceneform library, that vitual3D model is placed in real world. Sceneform import and render realistic 3D scenes where it convert .obj files into .sfa and .sfb format. Sceneform SDK allows you to import and view 3D models (in such formats as .obj, .fbx, .sfb, or .gltf) then render realistic 3D scenes for ARCore apps, without having to learn OpenGL. Sceneform includes a high-level Scene Graph API, a Physically Based Renderer (PBR) provided by Filament and Android Studio plugin for building 3D assets. ARCore is not ready to import and render 3dmodels. ARCore is formed for tracking and scene understanding stages. In this way, the 3D images are displayed in an application. We use two section i.e. for Education section and Entertainment section. In Education section, we use various Biological, mechanical and electrical based models with labels and with the information. All the 3D images are linkup with the description as we click on question mark it redirect us with the corresponding topic related to that model. Similarly, in Entertainment section, we use museum to display the ancient models and try to create interest of students in ancient things.

Fig3: Education Section (DNA Model)

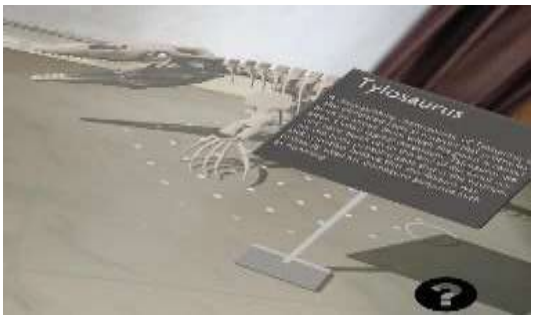

Fig4: Entertainment Section (Tylosaurus Model)

5. CONCLUSIONS

In Augmented Reality for Education and Entertainment both the tracking registration accuracy, display equipment performance and the nature of human-computer interaction have been greatly improved. This system will overcome the earlier method of education system and simultaneously increases the knowledge of the student and teachers in a brief about the 3D models which are labeled models and each models are linked with the browser links so that user get the core knowledge of that chosen 3D model. This application enhance the creativity of the student as well as giving them new option for learning to explore their knowledge and the entertainment section provide the whole new tour to ancient history where the student can click the pictures with 3D models. AR application blur the line of difference between the virtual and real world, thus increasing its usability and effectiveness in the area of education and entertainment As well as this application makes it easy to use for almost any sought of person(students) even though anyone including mentally and physically disabled individuals(students). With the help of this application students are able to access more relevant information according to their need and in a very less time. Also, the ratio of concentration and result of the students will automatically increase if they learn their topics by using this technology and AR application

6. FUTURE SCOPE

In a nutshell, it can be summarized that the future scope of the project circles around the following:

1. We can make the application available for every classroom which will give the knowledge about the 3D models in a group of audience rather than only making it available for single handset systems.
2. As the System only works on the 3D models that we added, we can give few permissions to the teachers so that they can also add the varieties of informative 3D models.
3. As our application only gives the core knowledge about the specific 3D model, we can add the feature in future that will provide the particular knowledge about the labeled parts of the models.
4. By storing the 3D models online we can also decrease the size of the application in the user's system. The above mentioned points are the enhancements which can be done to increase the applicability and usage of this project.

Here we are trying to make the education system more interesting, interactive and knowledgeable for the students. We have left all the options open so that if there is any other future requirement in the system by the users for the enhancements of the system that it is possible to implement them.

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