Google Cardboard & Virtual Reality

EEC 687

PROJECT PROGRESS REPORT 1

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Virtual Reality:

In its mere form, virtual means something which you see but doesn't exist in real. Similarly, **Virtual reality (VR)** is a computer-generated environment that lets you experience a different reality with the sense of vision, hear, touch and smell in some cases. It includes simulating user's physical presence in this virtual environment. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds. VR are displayed either on a computer monitor, a projector screen or in most cases virtual reality headsets also called as **head-mounted display (HMD).** [1]

Digging deep, virtual reality is different than augmented reality in a manner explained further. In Augmented Reality, the computer uses sensors and algorithms to determine the position and orientation of a camera. AR technology then renders the 3D graphics as they would appear from the viewpoint of the camera, superimposing the computer-generated images over a user's view of the real world. Whereas, Virtual Reality rather than locating a real camera within a physical environment, the position of the user's eyes is located within the simulated environment. If the user's head moves, the graphics react accordingly. Rather than developing virtual objects and a real scene, VR technology creates a convincing, interactive world for the user. [2]

Virtual Reality dates back in the 1950's when the concept came from "science fiction. Stanley G. Weinbaum's 1935 short story "Pygmalion's Spectacles" [3] describes a google-based virtual reality system with holographic recording of fictional experiences, including smell and touch." Major advances under VR begin in the year 2013 when Nintendo applied for a patent for the concept of VR to produce a more realistic 3D effect on 2D televisions.

Speaking about the scope of VR, we feel it is the future. Gaming, Entertainment, Engineering, theme parks, and education and training are a few fields to name, where presently VR is implemented. PlayStation VR headsets, VR installations in roller coasters, incorporating virtual reality to add more dimension to design the prototype of devices related to automobile, aerospace and ground transport industries, using VR as a platform to train people to be pilots, doctors, etc., are real world example and with further developments, we would have a lot to look forward to.

VR devices over the time:

The first platform of the VR was developed in 1962 named Sensorama, which was an excellent example of digital computing. It included four different senses: sight, sound, smell and touch [4]. Further at MIT, Aspen Moviemap was developed where user could view the same scene in three different modes: summer, winter and polygons. Even though VR was not popular, movies like Brainstorm and Lawnmower Man portrayed the idea of VR in late 1980's. In 1990's, majority of ideas remained theoretical because of the banal computing capabilities.

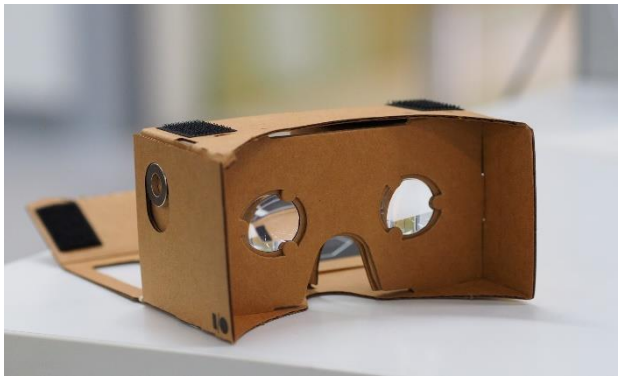
The major changes were observed in the beginning of the 2000, when google introduced street view in their maps which showed a panoramic view of the major and minor streets including buildings, roads and traffic details. In 2013, the VR technology was developed to produce an 3D effect on a 2D television. Major breakthrough in the field of Virtual Reality was in the year 2014 where multiple activities were cited. To name a few, Facebook purchased Oculus VR: a leading company that manufactured VR HMD's, Sony declared project Morpheus which incorporates VR into PlayStation: most popular tool for virtual gaming, Google announced the Cardboard which is a cheap alternative to HMD's. It is a device which holds a smartphone and the user can view the phone's display through a pair of lens. The functionality has been explained in the later section.

Applications of VR:

In the education field, VR is used by trainers to conduct experiments without actually stepping out in the real environment. For example, The Civil engineering department at our university has a VR Software/Hardware where in a person can sit in a real car and pretend to be driving with all its attributes and the monitor in from of the driver displays the driving environment and makes the driver feel like he is driving in the displayed conditions. This way, the trainers can utilize the virtual setup to experiment with different driving styles and issues related to it. Video games in VR are one of the most popular application which use the graphics, sound and input technology. Wii remote, Kinect and PlayStation are most popular VR platforms for games which can track and send motion input of the player. VR is also used in the Engineering like in CAD and printing the 3D objects. Its includes one more dimension to virtual prototyping which enables engineers to view the objects from different scenario so they can build and test things without going to actual scene [4]. The 3D views enable interactive viewing of different places. The best example are some museums that provide a walk through guide. VR is also being used in urban design and planning, the software developed in 2010 has ability to locate geometry coordinates and perform activities like designing the different views, surveying the design and testing different component. Software was capable enough to draw lines and curves on subdivision plats and surveying plans. Moreover, VR has been installed in different roller coasters to ameliorate the adrenaline rush on particular rides.

Google Cardboard:

It is a wearable device developed by google in 2014 which acts as a gateway to experience virtual reality in a simple, fun and affordable way. It holds a smartphone in the back on which the actual VR application is running. This application is then viewed through the cardboard to get a VR experience. Cardboard is intended to low cost, to encourage interest and development in the Virtual Reality ground.



Viewer's assembly and operation:

Cardboard is inexpensive, simple in design and easily available on Google store. It's a piece of cardboard cut into precise shape which includes the 45mm focal length lens, magnetic or capacitive tape, a hook and loop fastener and rubber band. A google Cardboard application splits the smartphone display image into two, one for each eye. It's also applies barrel distortion, means it produces the hemispherical view which ultimately results in stereoscopic (3D) image. In its initial stages, Google Cardboard was only supported by the Android operating system. Later in May 2015 Google released a plugin for iOS operating system in order to support the Cardboard by iOS devices. Google has made all documentation and software support available on the internet and made it open source to support their concept of developing VR application and experiencing VR by any person.

Software Development Kit:

A software development kit (SDK) is typically a set of software development tools that allows the creation of applications for a certain software package, software framework, hardware platform, computer system, video game console, operating system, or similar development platform. To create applications, you have to download a specific software development kit. For example, the development of an Android app requires an SDK with Java, for iOS apps an iOS SDK with Swift. It may be something as simple as the implementation of one or more application programming interfaces (APIs) in the form of some libraries to interface to a particular programming language or to include sophisticated hardware that can communicate with a particular embedded system. [5]

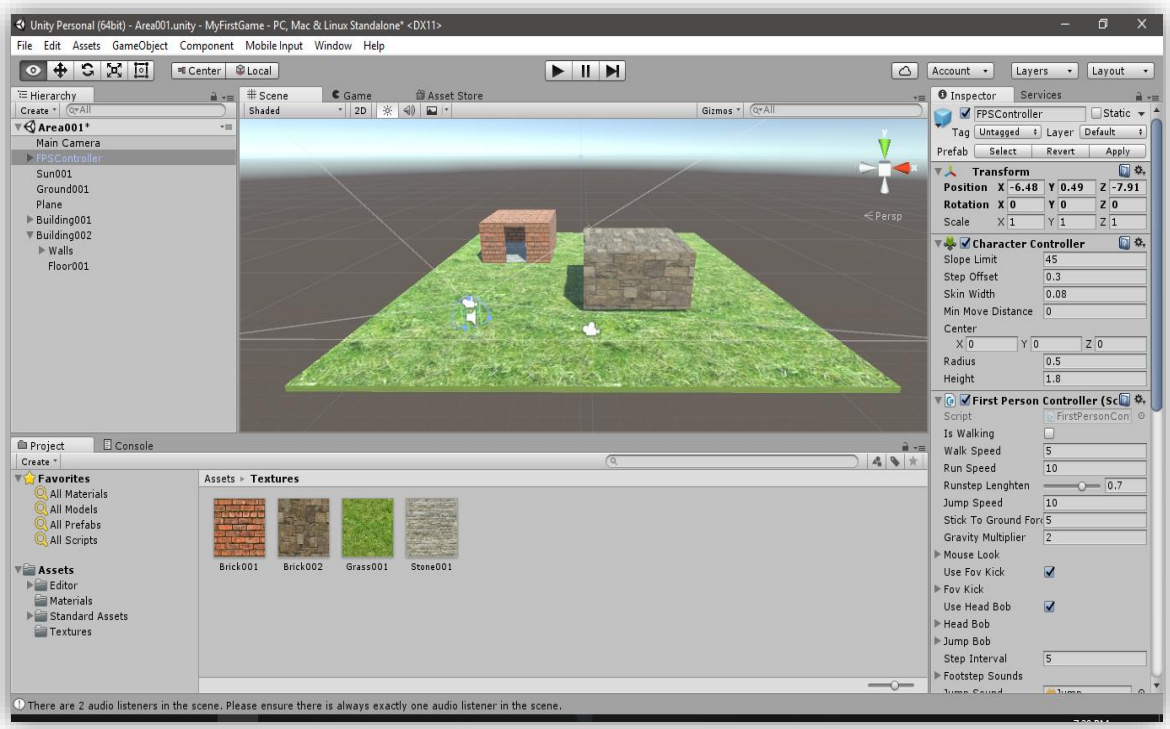
Google provides distinct development kits for developing VR application on different platforms: SDK for android, SDK for iOS, SDK for Unity and SDK for Unreal. Android basically works on java codes. iOS application requires codes to be written in objective C. Unity is a cross platform game engine developed by Unity Technologies which can be used to develop 2D and 3D games for PC, Consoles and Mobile devices. The coding for Unity components is done in C#. Unreal engine is another game engine developed by Epic Games which is primarily used for developing first-person shooting games, other general games have also been developed on this platform. The code is written in C++.

Work Completed:

We have tried to understand the concept of virtual reality. We explored a few articles and were able to get a hands-on experience on the cardboard and VR application provided by Google for the same. We further studied the technological background of developing VR applications by inspecting the possibilities in and complexity of different platforms. Eventually we decided to work on the Unity Platform and android OS because of the ease to implement a variety of components and customize the desired attributes with the functionality of interesting options.

We downloaded the Unity software and the cardboard SDK for the same. Further we explored different functions and the method of using the software. We learned to develop a small scene which made us comfortable with using the software for future complex implementations.

The following image is a screenshot of the scene created in the Unity software. The concept of first person character control, main camera view, creating a building using walls, plane and detailing them with different assets were the task performed. Also, importing assets and packages was learned.



Future Work (Until next report):

- We plan to decide on the idea of the application/game we would be developing.
- Explore Unity in depth including its tool and features.
- Develop a demo app to understand interfacing of the software and hardware
- Test different functionalities after executing the demo app on the mobile phone
- Try implementing a component coded in C#

References:

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2) http://www.marxentlabs.com/what-is-virtual-reality-definition-and-examples/
3) "Pygmalion's Spectacles". Project Gutenberg. Retrieved 21 September 2014.
4) https://en.wikipedia.org/wiki/Virtual_reality
5) https://en.wikipedia.org/wiki/Software_development_kit