

Virtual Reality based Classroom



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Abstract: In today's world, we come across a number of technologies. We have acquired majorities of technology as we come across them. In the same way, Virtual reality is also a computer-based technology that accumulates various input and output devices by allowing the user to interact and experience with the virtual environment which seems to be real but not real.

After taking inspiration from the technology, we are eager to present Virtual Reality based Classroom. In this virtual classroom, the user can do all the things as done in the real classroom.

Virtual Reality Based classroom will be working for the user like it stimulate the reality of its presence. The user's will be present physically via VR device with all other users to interact. When users will mount the VR device on their head, they will be redirected to their default dashboard (3D environment, which will be customizable) which will be constituting of different menu and that will be controlled via Pensil (3d mouse, used for interaction in the virtual world). When user will be online via server connection, then the connected users will be notified and hence, they all will be presented in a particular environment which will be different and all of them will be present their physically (their avatar). The designing will be done according to the requirements of the users.

This will be the future of education that will mainly erase the problems of the student comprising distance learning, economical and deprivation of the practical aspect of knowledge.

Keywords : Education, Hardware, Virtual classroom, Virtual Reality

I. INTRODUCTION

Virtual Reality is a simulated experience that can be identical or completely different from the real world. It is virtual or not real in reality. This is the technology which will impacts the way of presenting different objects. An environment with the required participating entities. It is a way to create a computerized environment that immerses the user to provide with the virtual experience that makes the user completely aloof from the actual environment. A virtual reality-based classroom is a classroom that doesn't exist but it is present virtually to give access to various entities to interact in a real-time in different 3D environment.

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Key elements in Virtual Reality

A. Virtual World

A virtual space which is usually obtained through a particular medium immersion which can be done using rendering pipeline, display, etc. It can also be said as collection of objects in virtual space and rules associated with these objects.

B. Immersion

Sensation of being in the virtual space(world). It can be a mental state or can be obtained through physical means. Sensory feedback: It is the virtual sense that receives feedback based in user's position. These feedbacks require high-speed computers as a medium.

C. Interactivity: It is the user's ability to interact with the virtual world by changing positions, picking up objects and settling them down, and so on.

D. Components: Parts that need to be integrated with other parts to give a working product. (3)

Virtual Reality Based Classroom has two aspects: 1. Hardware, 2. Software

A. Hardware Used

Raspberry PI

Series of small single-board computers bundled with on-board Wi-Fi, Bluetooth and USB boot capabilities, GPIOs, etc. It is basically a central processing unit of the device. Raspberry PI is acting like a processing unit in which various tasks will be performed. This will constitute of many sensors as well, which will track the moment of head and the motion as well. It will be installed in the cardboard as a component.

Arduino UNO

The external hardware used to interact in the virtual environment created by the designer is the microcontroller-Arduino UNO. This will be accessed as 3D-Mouse to interact in the environment created in virtual. This will consist of different sensors such as Gyroscope, Accelerometer etc. It will work as it sends the coordinates to the Raspberry PI to process it further in order to perform some certain tasks.

VR Box

VR Box will be acting like an infrastructure for our device. This will be constituting of Head mounted Display which is connected with the Raspberry PI in order to provide the immersing experience. It is an affordable device for the immersion in virtual world. It consists of a smartphone segment in which smartphone get popped into. It also consists of a suitable adjustable belt, so that it gets well-fitted around the head. In the device, the smartphone will get replaced by the raspberry PI and

amoled display which will be acting like a smartphone.

AMOLED Display

Amoled is a display technology that usually have a better frame rate in order to have a clear picture that will result in the true immersion. This amoled display is being connected with the raspberry PI in order to carry out the further process. AMOLED display will be used as an output display having a frame rate of 120fps. In order to reduce the distortion of images, this display will be used as the output.

Sensors

A sensor is a device that detects and responds to various inputs from the environment. The output depends upon the sensors used in the processing unit nad microcontroller. So, we are using proximity sensor, gyroscope, accelerometer, as a motion sensor.

B. Software Used:

Unity 3D

The environment of Virtual Reality based classroom will be made on Unity Editor. His platform helps in carrying out several processes including cinematics, video tools, audio tools, animations, UX designer, etc. Main integration is also done using Unity 3D platform. This platform is also used to develop several games.

C# Language

The scripting is done via C# language at the back-end side of the project. In fact, Unity Editor is also running the C# language at its back-end side.

II. WORKING PRINCIPLE OF VIRTUAL REALITY BASED CLASSROOM

VR based classroom requires a processing device such as smartphone, computer or another machine to create a digitally virtual environment. In this case, Raspberry PI is used as a processing unit which is further connected to amoled display. It is also connected with microcontroller via Bluetooth communication. Usually a 100-degree field of view and minimum 90 frame per second of frame rate is required to get the distortion free images. If frame rate and refresh rate is different then it can result in the latency which further results in the distortion.

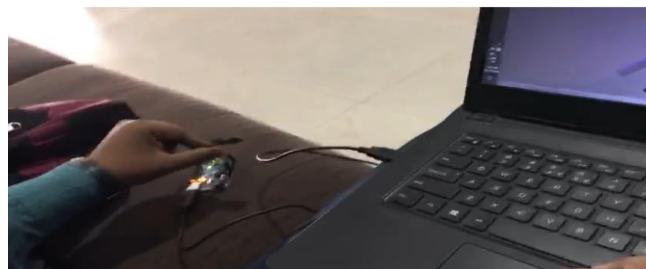
The Basics of How VR Works

Virtual Reality is a way to create a computer-generated virtual environment that helps the user to get immersed into a virtual world. When the user put on the device, they get immersed into a simulated environment which makes them completely unaware from the actual surroundings. Virtual Reality (VR) is the use of computer-based technology in order to create a simulated virtual environment. A classroom that doesn't exist but it is present virtually to give access to various entities to interact in a real-time in a different 3D environment. The primary subject of virtual reality is of simulating the vision. Every headset aims to perfect their approach to creating an immersive 3D environment using the various characteristics of field of view, frame rate and refresh rate. Each VR headset puts up a screen in front of eyes thus, eliminating any interaction with the real world. Two autofocus lenses are generally placed between the screen and the eyes that adjust according to the individual eye movement and positioning. The visuals on the screen are rendered either by using a mobile phone or HDMI cable connected to a PC.

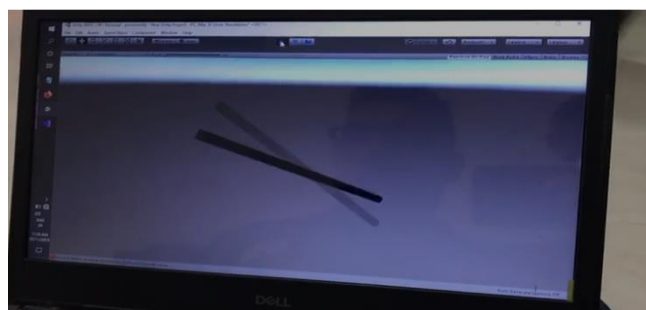
In this case, it will be done using the application installed in the raspberry PI which is based on android. To create a truly immersive virtual reality there are certain prerequisites - a frame rate of minimum 90fps, an equally competent refresh rate and minimum 100-degree field of view (FOV) (though 180 degrees is ideal). The frame rate is the rate at which the GPU can process the images per second, the screen refresh rate is the pace of the display to render images, and FOV is the extent to which the display can support eye and head movement. If either of these doesn't work as per the standards the user can experience latency i.e. too much time gap between their actions and the response from the screen. We need the response to be less than 20 milliseconds to trick the brain which is achieved by combining all the above factors in the right proportion. Another issue that needs to be catered here is to prevent tearing (cybersickness) resulting due to the inconsistency between the frame rate and refresh rate. If the GPU's fps is more than the screen refresh rate then the image can become distorted. To counter this issue, we limit the framerate to the monitor's refresh rate this done using a tech called Vertical Sync (VSync).(2)

A. Hardware perspective

The main part of the project (Virtual reality Based Classroom) is the device that will be assembled by our team. That constitute of a VR device which specifically constitutes of a cardboard or (Google cardboard) for settling of super AMOLED display of frequency of greater than the minimum of 90Hz. The device will consist of its own operating system (OS) which will be custom-android and it will be installed in Raspberry Pi Model 3b. The device will be used to make the user available in a particular interactional environment. On the hardware side, there will be an interactional pensil (Arduino – Microcontroller) that will be used to interact in the virtual reality. Most of the operations in the virtual environment will be carried out by the Pensil.



Microcontroller



Working Pensil

B. Software perspective

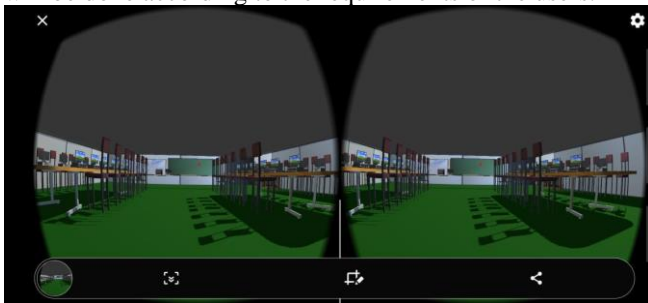
The device VR will be connected to the server when the user will install VR via head-mounted display, the user will be redirected to their default dashboard and it will be an interactional dashboard in which the user will be connecting to the server with all the different users from their respective environment. The dashboard will be containing different menu as it feels like it will be using Augmented reality. The dashboard will be interacted via Pensil. That environment will be designed using either of software (such as unity, blender, etc).



Virtual Classroom

C. Output

Finally, it will be working for the user like they will be present physically via VR with all others to interact. When users will mount VR on their head, they will be redirected to their dashboard (3D environment) which will be constituting of different menu and that will be controlled via Pensil. When user will be online via server connection, then they all will be presented in a particular environment which will be different and all of them will be present their physically (their avatar). This will constitute all the features as we can do in the real-life which means in the real classroom. The designing will be done according to the requirements of the users.



Output

III. CHALLENGES AND ISSUES

It was proved that VR has a great future in education but again it lacks much in-depth research. The majority of VR based system is based upon the head mounted displays. That results in several issues of using those head mounted displays. One of the key issues that has to be focussed is realism and the interaction according to realism. In the creation of the VR world, maximising the appearance of reality is an ongoing challenge. But still it is improving by taking consideration of the factors involved in making the VR works on a realism. Realistic VR environments require computationally powerful hardware for rendering and carrying out several task, which goes hand in hand with the price. High costs of developing or purchasing a VR system is a significant hurdle which has to be overcome. Currently the

VR devices like Oculus rift, HTC Vive costs around \$400-600 and also, they should be supported by the high-end PC, which is still a costly deal. However, the experience generated using mobile is not as better as done using PC. Also, mobile solutions have minimal interaction than that of PC. Human factor and physical side effects are another issue. Recent reports suggested that the use of HMDs may have unwanted physical/ physiological side effects such as anxiety, stress, addiction isolation and mood changes. Further, simulated motions can affect one perception of time and space, inducing dizziness and nausea, called VR sickness or cybersickness. However, there are only few investigations that are done on the usage of HMD. HMD used are really of older version. Not much advancements have been done in the field of Head mounted display. With the advancements of several technologies, the further new investigations are required in the field of VR. Furthermore, every man is unique and may have different perception; therefore, scenarios preparing for education, especially for kids or handicapped should be accurately examined and evaluated which has to be consulted with the professional psychologists and educators.(4)

IV. RESULT & DISCUSSION

As per the requirement consideration of the user's, The Virtual Reality based Classroom is implemented eradicating the problem of :

- **Geographical barriers** – It gives the learn anywhere attitude to the students eradicating the distance that needs to get travelled to get the knowledge.
- **Time efficient** – This classroom leads to organize the session or lectures as quickly as possible providing the environment of learning.
- **Communication** – It also provides the communication facility via audio system giving the illusion of being real in the reel environment.
- **Cost efficient** – The device manufactured will be as much minimally cost as possible. This will provide the relaxation of spending money on education.
- **Practical knowledge** – As practically gained knowledge tends to be in the memory forever, so using this device practical aspects of knowledge can be gained.

V. CONCLUSION

Since education system is been evolving at a rapid pace. It is adapting to the technologies that are coming in the way. Several advancements are reportedly done. With the advancements, it is the duty of teachers, scholars, professors to embrace the changes in the education system. Also, VR based classroom is also a result of the advancements in the technologies of VR. The generations are embracing those changes and they are accepting the digital world along with the real world. This virtual world will help in filling the gaps in the education. This makes the education more interesting than ever before. There are numerous proven advantages of using VR technology in education. First of all, VR provides outstanding visualisation, which cannot be obtained in traditional classroom. It reflects the world that young generations feel comfortable in. It is inclusive, allowing everybody, everywhere, regardless of status, financial situation and disability to participate in education



process. It gives virtually unlimited access to information, books or articles.

Modern technology used in classroom increases engagement, stimulates cooperation and involvement. It is used for highly efficient blended learning, encouraging self-study and individual pursuit of knowledge.

Virtual Reality based Classroom is really proved to be benefitted for the learners who are eager to learn some practical implementations over theoretical concept. This can also erase the problem of traveling miles to attend the lectures by the student. The concept is basically to establish comprehensive learning rather than the overpowering theoretical learning. With the points described above, we can conclude for the future that VR based classroom will be the doorstep to the educational revolution and in the upcoming century, then much will be moving beyond just books and boring lectures. We will enter into the technologically advanced phase of learning where exploring every microdetail with interesting reconstruction would be the prime focus. This will inspire the whole generation of young budding engineers, doctors, artists, explorers to understand what they actually want to innovate to change the face of the world continuously.

But we cannot forget that along with these teachers has to evolve too continuously for the apt decision making and open perceiving attitude to accept these changes inside their classrooms. The whole aim of this technological update is to make education more available, compatible, affordable to everyone out there even with geographical restrictions.(4)

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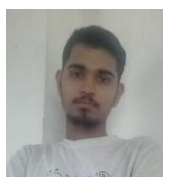
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