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CERTIFICATE
OF PRESENTATION

THIS CERTIFICATE IS PROUDLY PRESENTED TO

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Paper Title : Virtual Reality in Education Sector during Covid-19 Pandemic

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Virtual Reality in Education Sector during Covid-19 Pandemic

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Abstract— **this paper highlights the technological advantages of virtual reality, primarily focusing on the possible applications of this technology in the educational sector and the necessity of utilizing it during times like covid-19 pandemic when regular remote learning is hindered. Covid-19 pandemic created many issues and its influence on the educational system is particularly concerning. The conventional methods of education have come to a standstill and students are suddenly pushed into a world of computerized learning, which is inadequate for providing a wholesome and effective learning experience. At a time like this, we should maximize the resources available and implementing virtual reality in education will enable students to learn by getting a perception of the real-world objects rather than what is presented on a computer screen. After reviewing over twenty-two research papers and articles we identified that the implementation of virtual reality in education not only gives essential knowledge to the students but also allows them to "experience" what is being taught on their own. This will make the learning process interesting and easy. Virtual Reality can erase the challenges confronted by the educational sector and can provide students a safe environment with socially distanced and low-risk health situations.**

Keywords—Virtual reality, Education, Oculus Rift, Wired Glove, Augmented reality

I. INTRODUCTION

The COVID-19 pandemic has created the necessity for transformations of remote learning to not only survive a deadly pandemic, but to be potentially acceptable to a new environment. Students have to take classes online. In this situation a trend among governments across the world has been emerging to emphasize the potential for new technologies such as artificial intelligence, virtual reality and augmented reality to mitigate the problems of remote learning. This paper will provide an introduction to the technology of VR and its possibilities in the educational sector bringing two worlds into a unique perspective. On one side, virtual reality with its technological peculiarities and on the other side, the education sector during covid-19 pandemic. Virtual reality is the logic of immediacy and control that creates an atmosphere of being there in the real-world. VR alters the mode of interaction of learners with subjects. VR requires interaction. It helps students in active participation and to discover the unknown extents of knowledge. VR also makes it conceivable for disabled students to learn and do science experiments. Thus it provides an atmosphere where students can study by experiencing each

and every matter in their peculiar way. In virtual reality new models are made possible for creating a virtual world for studying things that are not realized before.

II. VIRTUAL REALITY

Virtual reality is an environment that consents the physical presence of the real world to each user. The definition of virtual reality is that it is an environment generated by a computer which mimics reality by means of interactive devices that send and receive information and are used as goggles, headsets, gloves, or bodysuits. The delusion of being in the shaped environment is acquired by motion sensors that pick up the user's movements and alter his or her vision accordingly. Using different methods of VR and artificial experiences a replication of the real-world environment can be reached. Not only vision but other senses like touch, smell, and hearing will be made possible. Head Mounted Display devices allow vision of 360-degree in a virtual environment. VR came into being from the 1950s. The Sword of Damocles [6] is known as the first virtual head mounted display system invented in 1968 by Ivan Sutherland a computer scientist and one of his students Bob Sproull.

III. VIRTUAL REALITY IN EDUCATION

Virtual reality creates a virtual atmosphere for learners where they can develop their skills without any real-world consequences of failing. They can change from a two-dimensional view of objects to three dimensional experiences where learning becomes easier. Primary education, anatomy teaching, military, astronaut training, flight simulators, miner training, architectural design, driver training and even bridge inspection has been applicable by virtual reality. VR enables engineers to see prototypes in a virtual manner. Expanding remote training methods with virtual training systems is becoming useful in military, engineering and healthcare training.

In Japan, some students at a new online high school appeared in their opening ceremony by putting up headsets created using virtual reality. The N High School, operated by publishing and Media Company Kadokawa Dwango Corp., stated that out of its 1,482 freshmen 73 of them participated in the ceremony using the headset-figure 1. These headsets and School campus were connected so that the wards would have a 360-degree vision of the surroundings inside the campus. The students need not have to visit the campus regularly because they promote every activity to be held online.

A. Covid-19 Pandemic

In the on-going COVID-19 pandemic situation, virtual reality features and theories can be employed in teaching as well as learning areas so that it can be effectively implemented to solve or confront many of the issues regarding online classes arising nowadays. Implementation of VR technology increases recently due to the prevailing epidemic of the SARS-CoV-2 virus. People are restricted for gatherings, the number of people in quarantines is increasing and recommendations related to maintaining social distance and avoiding face-to-face meetings have led to this rapid evolution of the existing educational process focused on remote book learning. This crisis has made limitations on tools available in the process of remote education. These limitations were significantly related to practical training areas, access to advanced equipment, apparatus and whole stands and technological lines. So, understanding this situation, it is clear that VR technology makes up an alternative form for practical education. [18] Unexpected situations like a calamity or pandemic in this rapidly increasing world of technology can create a new education revolution using virtual reality. Application of experimental and situational learning makes VR technology more consistent and efficient to use. [22]

Research conducted on Virtual Reality in Education Sector Market Research Report by Component, by Application, by Region - Global Forecast to 2026 - Cumulative Impact of COVID-19 depicts that COVID-19 is an incomparable global public health threat which is creating a negative impact on every industry. The study is centered on the forecasts of the effect of COVID-19 on the markets. The figure 2 shows that Global Virtual Reality in Education Sector Market size was estimated at USD 1,393.04 Million in 2020

and expected to reach USD 1,775.93 Million in 2021, at a Compound Annual Growth Rate (CAGR) 27.82% from 2020 to 2026 to reach USD 6,076.50 Million by 2026.

B. *Efficiency and Benefits*

The COVID-19 pandemic created a state where students and educators are led into a world of computerized learning. Although it is a sudden drastic change it helps to implement many technologies into the education system for students. But the students are experiencing more difficulties focusing on one screen. Implementing VR technology implemented in classes creates the advantage of concentrating on things in front of the eyes with much attention and also provides interaction with live study materials and excludes any potential side stimuli. This technology can make books, lectures and exercises more interactive and immersive thus becoming an ultimate solution for seizing the attention of students. Benefits seen using virtual reality learning techniques are:

1) Learning using Virtual reality

Virtual Reality apps are available for students which makes it easier to have hands on all study materials in real world experience. Apps like IMAG-N-O-TRON make the pages of a book come alive. EON Experience [7] provides many virtual reality courses that include vast studies on countless subjects.

2) VR and distant education

Virtual reality applications in school education allow students to take part in any classes from anywhere on Earth. Different technologies like rumii, Engage, AltSpace allows students enroll in different courses or to join different groups acquiring knowledge and practical skills.

3) Virtual College Tours

Virtual college tour is an interesting thing at a time like this. Columbia University offers students virtual college tours. VR technology for professionally playing football which gives a real experience of playing in a full stadium has been adopted by Michigan University.

4) Training and Vocational Education

Technological applications like zSpace provide a virtual environment which allows technical training for students in specialized manner.

5) Determine Future Careers via VR

Creating virtual environment in education benefits students to determine their future careers with "Google Expeditions". It drives through an individual expert's workday, duties or career paths.

6) Education for specials

VR in school education provides aids for special students. Technology called Near Sighted VR Augmented Aid helps students with vision problems. SignAloudGloves allows such students to communicate within a virtual environment using sign language.

IV. VIRTUAL REALITY DEVICES

Development in technologies has brought different specific devices for enhancing the use and working of Virtual Reality (VR). Here we mention some basic descriptions about the highly advanced and most frequently used technology devices with VR, these devices are popular devices in the market.

A. Head Mounted Display

While talking about VR, an image comes to our mind of someone with a device on his head, covering his eyes. Many Head-Mounted Displays (HMDs) are used and purchased from our market. Some devices have solid displays and tracking systems that enables its user to visualize 3D images/videos through a virtual medium and consists of a virtual camera which moves according to the user's head movements. [10][2] Commonly used HMDs are:

1) Oculus Rift

The Oculus Rift (figure 3) is a headset device which is used repeatedly and is focused on gaming and learning purposes. It comes up with an extended view, in-depth vision, and fast head movement detections. It works by processing data which is observed through a 3-axis gyroscope, accelerometer and magnetometer, which gives the user a fast and clear image, without any delays. It is having innovative maintenance and improving technology day-by-day. [2] Four years after

introducing oculus rift to the market, the first market introduction was launched in early 2016 and sold initially from the official Oculus VR website which gradually made its path in the market between retailers and users from different parts of the world.

2) Cave

Cave Automatic Virtual Environment also known as CAVE (figure 4) is a room used for visualization, mainly to set up a virtual reality environment and creates much experience virtually. Many projectors cover the walls of a room with stereoscopic images and the user has to use head mounted devices or glasses which coexist to various alternating images through projectors and speakers that are placed on all corners of the room to deliver a better high-quality sound [3]. The device named ImmersaDesk was developed and created for the CAVE. It shows a screen which corresponds to one wall of the CAVE and furnish with stereoscopic vision of desirable images with a head movement tracking device, which uses a particular screen and is denoted as semi-immersive VR. [2]

B. Input Devices

The usual perspective to input data in VR systems includes movement recognition. Having a device which reads senses and processes natural movements would change the human-computer interaction to a more instinctive way. The most commonly used data input devices associated to virtual reality is:

1) Wired Gloves

A wired glove is a device which comes up with various sensing detectors and data input using human-computer interaction (figure 5). A motion tracker is a magnetic tracking device which is connected to attain the position and movement of the glove. The movements get collected and analyzed by certain software, so that these can be structured and developed into useful information to recognize signs or other symbolic languages. It senses the movement of hands and fingers to give instructions based on its movement.

2) Wands

In wands (figure 6), the console has the ability to acquire the IR light by a sensor which is placed at the top/bottom of the television and has five emitters of infra-red in each of its sides. The console calculates the area between the console and screen so that the movement of the controller is measured by triangulation which denotes the distance between a certain point and the place where the controller reads the infrared to get information regarding the user movements.

C. Computer Vision

The Microsoft Kinect is one of the most famous device technologies for computer vision. It is used by many industries, universities and hobbyists as it gives a perfect visualization technique through reverse engineering and particular motion sensors. [2] [19]

V. VIRTUAL REALITY APPLICATIONS

As you know virtual reality is a leading technology now-a-days and has many applications. From our detailed studies we found certain main applications that are given below:

A. In Laboratories

We know that virtual reality is a modern technology for experiencing the Real World (RW) virtually by computer-generated content on a particular range of a system or presentation. In the last few years, the applications of VR have changed the marketing levels and have got many users. It is portable and widely accepted and is now available on mobile and other technological devices. They can create a wide impact in laboratory purposes and for students who use these technologies for learning in an exciting manner. It can immerse the user into a virtual computer world, where you get a chance to visualize things much better and clearer.

In laboratories, this can be implemented in various forms of simulations and learning. VR helps in providing professionals use laboratories as an opportunity to experiment, evaluate studies and improve their skills and ideas in a safe and well-mannered environment. Also, the traditional scheme of education for engineering students is through lectures or seminars which are usually held in classrooms or halls. The verbal explanation along with use of educational tools like a white board, projectors and desktop or laptop lets the teacher to avail the digital materials

such as slideshow presentation or multimedia projecting through a digital projector onto the white board will create a learning approach which is active from the instructor side but passive from the student side as described by Sampaio, et al. [14] So definitely use of such small methods can bring changes in students perspective to traditional education and VR can issue them much advanced and innovative method of learning.

Following points shows the importance of implementation of VR Labs in your Institutions:

- Ease of Learning
- Useful and futuristic design
- Continuous improvement and update
- Reduces installation costs
- Varied range of experiments
- Environmentally harmless

Based on our team research, we found that last year Samsung India inaugurated their Samsung AR-VR Innovation Lab at IIT-Jodhpur, to train students on augmented and virtual reality and make them job-ready. This initiative has inspired in choosing VR over any other technology as it stays so close to the minds of learners and will benefit in the growing digital technology market and develop their talent.

They create an advantage for the universities, promote distance learning, and help students who need special attention or have disabilities. Utilizing this VR application, the basic need for laboratory works is shifted from being location-to device-oriented. If distance learners have the means to buy their own VR devices, they can absorb by experiencing the same level of education as full-time students on campus as detailed by M. Soliman. [15] VR Laboratories avoids any possible physical, chemical or biological waste that is produced as a final result of various experiments.

B.   In School Education

For education purposes, virtual platforms usually simulate the children in classrooms as we find that human beings learn different things by their experiences, interactions with their surroundings and by using senses to gather information from all around the world. Virtual reality gives an experience the same as in the real world by the sensory input created by computer simulations. It provides an interactive atmosphere by responding to the human acts and movement by the natural behaviors of humans in the real physical world. So, it verifies that VR is a powerful and useful resource that helps in teaching by visualizing things through a virtual environment that allows students to learn to experience various situations, which is better than creating imagination of various topics. The nature of VR systems derives from three sources: immersion, interactivity and multi-sensory feedback as explained by Chris. [4]

Now the virtual environment is more reliable than the real environment and it undoubtedly develops a better education system for students in primary, intermediate or higher secondary levels of schooling. Virtual reality allows the user to build their ideas and critical thinking. In this covid-19 pandemic situation, the traditional mode of teaching cannot be applied effectively to an extent and introducing certain modern techniques and devices such as VR can improve the mode of education for each student. Virtual reality is attempted in classrooms by following ways:

1)   Augmented Reality

Augmented reality (AR) is a technology which imposes virtually created images onto the physical real world. The visualization of the virtual objects in this real environment have encouraged and motivated students in experimentation and developments of things that are not applicable in this world. [13]A study done by Antonietti et al. (2000) found that by analyzing some children through an in-depth virtual tour of a painting and allowed them to examine every characteristic of the painting made them understand by their description and interpretation of the paintings, compared to another group that studied the painting without using of VR. [1] This study conveys how learning by virtual visualization is better than any modes of education induced. Another experiment was carried out on 91 primary students in sixth-grade where they used an AR application "WallaMe" which educated them on instructive methods in education of arts. After analyzing the end result of studies, they found a great significant improvement in academic performance, gathering of information, collaborations and motivations. [13] According to Wikipedia use of virtual and augmented reality in

primary education, augmented reality has developments for more mainstream academics. 3D customized and printed textbooks for students provide a more collective way of educating and evoking. The Institute for the Promotion of Teaching Science and Technology has launched a geology textbook which gives students a chance to learn traditional information of virtual interaction with the various layers of the earth's core.

2) Virtual Field Trips

Exploring field trips virtually, students can study and visit places as part of their education which is much reliable in this COVID-19 scenario. Virtual field trips help in developing learning simulations in students while experiencing the lessons. They could visit museums, historical monuments and to different regions through a complete virtual enhancement. Virtual field trips can also allow primary school students in rural areas to have an improved career exploration opportunity that's hardly available for them. These experiences develop a growth in their interest and encourage them to pursue better careers and create a whole new world of intellectual learning and growth. Close visualization of objects which are difficult to find in this physical world improves their educational values.

The main focus of the Virtual Field Trip at present is not to substitute the traditional field trip but to introduce students to the fundamental and basic skills needed to recognize the environment before going for the 'real' field trip. [16] This mode of field trips encourages the participation of the students and engages them in the virtual environment with their instructors or tutors.

3) Historical Studies

With the capability to create immersive simulated experiences, virtual reality is evaluated as an enhancing teaching method for history classes. A study on findings from the history of the Roman Empire with a virtual reconstructing mechanism of a Roman city showed remarkable improvement in the learning and academics of the students. [11] Researchers who studied this research suggested that the increase in incentive for learning boosts interactivity and its vivid experiences are keys to the accomplishment of this experiment, it also developed interests in conducting larger-scaled

studies on teaching history for students using virtual reality. [11] A VR museum can help in visualizing finest and best museums from all around the world, as it exhibits visuals without any protective glasses, crowds by tourists, and security procedures. The advanced technology to see everything by its excellent graphics gives the users much realistic and enthusiastic moment in watching the world's most historical and finest collections in the museum. VR museums have been developed and are still in practice over different countries. It will support them during this COVID-19 pandemic to develop learning and explore things without travelling across each place.

C. Astronomical Research

A virtual world or virtual representation is used for many purposes, mentioning one among the many applications is for space representation and for studies regarding astronomy. Creating a virtually visualizable world where researchers and scientists can inspect and study about various astronomical objects and notice various studies. NASA has been using VR technologies from past decades and primarily used for training astronauts before flight and visualizing the take-off. Apart from scientists, for students it creates a development in imagination and aids in sighting the space from our world. The most notable feature of VR is the immersion. The immersive characteristics of Virtual Reality Learning Environment (VRLE) shown over figure 7 utilizes role playing and learning by much interactive experience on learning main science and astrophysics. To enhance immersion through VR, we can wear stereo glasses to see the 3-Dimensional visuals or we can use a 3D head mounted display (HMD). [9]

This empowers students to study and get further concepts about each planet, celestial bodies, comets, galaxies and several other astronomical objects.

According to a research conducted by, Heebok Lee, Sang-Tae Park, Hee-Soo Kim and Heeman Lee, for twenty-two undergraduate students doing majoring in science education in Kongju national university of Korea to survey their opinions of their IVRS (Immersive Virtual Reality System) for the intellectual effectiveness which is shown over figure 8. The idea for the study was for their

Virtual Solar System programs. The scholars were supposed to learn about our planet Earth and its Moon system and the characteristics of the orbits. Then after presenting the virtual solar system visualization and many other class activities, they tested the students' knowledge developments and noted the students' suggestions and reviews on the virtual solar system program and IVRS. [9]

D. Medical Informatics and Technology

The medical need for virtual reality is developing frequently, and the ideology has changed from a basic research level to a complete clinical area for health informatics and for various other developments. [12][5]

Researches and studies are well encapsulated by the yearly "Medicine Meets Virtual Reality" meetings. [20][21] The conjunction of physical and informational technologies: options for a new era in healthcare, technology and informatics and the commercial impact on this technology are already at an advanced stage. [5] The practice of virtual reality in training for different medical groups embraces diverse aspects. In some cases, virtual reality is effective. VR can help with the study of gynecology and obstetrics which could show much on the growth of infant and maternal health. Image guided surgery is another application where virtual and actual objects are fused into a single plot, calling for virtual and AR techniques. [17]

VI. FUTURE OF VIRTUAL REALITY

So, looking more towards the future developments of VR, we can see that it's still advancing technology which is capable of transforming the educational, business, and medical system. By looking onto current COVID-19 Pandemic, and this situation by taking safety measures by social distancing and having remote online-learning, jobs, events, researches we can approximately say that the invention of VR is an additional tool for which is likely to become more trending in the upcoming years, rather than technology and educational unfamiliarity. By enhancing the use of these technologies, we could later bring an outstanding education system to schools and universities. We have to be heavily dependent on the use of technologies like virtual and augmented reality; therefore the educational institutions, universities and several other education systems can apply it and will have a certain mode of use and provide high educational growth as well as standard method of education system from their institutions to students. [15]

There are a number of proven advantages of using VR expertise in education. Firstly, VR enables an outstanding visualization, which might not be possible to obtain in normal traditional classrooms. This reflects the world of thoughts and minds of our future young generations and finds it comfier. It's making everybody be anywhere they want to discover, despite their status, financial backgrounds and inability to be a part of various educational methods. It allows virtually accessing unlimited resources, information, books or articles. These modern technologies should be accessible and implemented in classrooms and based on our current scenario where students struggle in traditional methods of learning practice and find it hard to understand various lessons and practical skills. Throughout this pandemic and remote learning situation, introducing these technologies to curriculum could easily help students in effective learning and also increase engagement, cooperation and their involvement in studies. It will help undergraduates in using this mode for highly efficient technique of learning, which encourages self-study and individual pursuit of knowledge. [8]

CONCLUSION

Everyday technology is bringing drastic deviations to our world and virtual reality is one among them. It can rise to the next footstep towards development in future. VR technologies should be increased to higher levels as it helps to level up the social, economic and educational status in our lives. The method of bringing virtual worlds or objects to the actual world just in front of us and visualizing them through machines from anywhere is mysterious. Virtual reality makes it possible for us. So far, this technology has brought many innovations and will develop amazing inventions that can be executed over

time. During situations like COVID-19 pandemic where lockdown and social distancing is maintained, VR can remain as a leading technology to bring up the loss of reality. Moreover, virtual reality in our education will erase the burden and competitiveness that classrooms often bring and can create an atmosphere for students to feel more encouraged and empowered while learning and practicing

through VR devices. As a conclusion, we can attain ideas and end results from our paper about virtual reality and how its expansion in the market leads to a promising fast-growing technology for future generations throughout their life.

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Figure 1-Virtual ceremony held by N High School in Tokyo
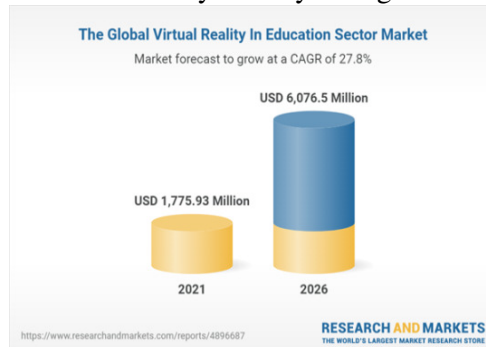

Figure 2- Estimation of Global Virtual
Reality in Education Sector Market size

Figure 3- Oculus Rift

Figure 4- Cave Automatic Virtual Environment
Model (CAVE)

Figure 5- Wired glove

Figure 6- Wands for VR and gaming console

Figure 7- Virtual Reality Learning Environment (VRLE)

Figure 8-Example of Immersive Virtual   Reality System