Virtual Reality (VR)

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Understanding virtual reality

Virtual reality, an environment generated with the help of computers where all the scenes, objects, surrounding seem to be real but aren't. Virtual reality dips people into a simulated, virtual and computer-generated reality where people can see, feel and even touch the virtual environment. VR uses different sensors, head mounted display (HMD), displays and also other features like pose tracking, movement tracking etc. for creation of a controlled, simulated virtual environment.

Additionally, VR technology can also include haptic feedback, which provides sensations and spatial audio, which creates realistic sounds. Equipped with this, users can totally immerse into an environment of their choosing.

Types of virtual reality

1. Non – Immersive virtual reality
   A simulated controlled environment where users themselves can control some of the characters within the software indirectly which means a user can enjoy a virtual environment but can still be aware about the physical realm.

   For example: Playing a shooting game where a user can control the in-game character within the game with their own provided movements and controls. Technically, yes, the user is in a virtual environment but the users can still be aware of their physical surrounding.

   In this modern era Non – immersive virtual reality is being widely used in people's day to day life. Playing a mobile phone game, pc game is

also an example of non-immersive virtual reality. You're on a business meeting on skype with someone, this is also an example of non-immersive virtual reality.

1. Fully-immersive virtual reality

- Fully immersive virtual reality isa type of virtual reality where users are fully engaged in a virtual environment without being aware about the physical realm. Users are provided with Head mounted display (HMD), gloves etc. which can help them not just to see the virtual realm but also to touch and feel the environment.

  An example of fully immersive VR is VR gaming zone where HMDs, different gears and stuffs are used so that a player can visualize, feel, control almost everything available in the controlled virtual environment.

2. Semi-immersive virtual reality

- Semi immersive virtual reality is a type of virtual reality where users are neither completely in a fully immersive virtual reality nor in a non-immersive virtual reality. They are somewhere in between.

  For example: A user on a virtual environment wearing HMD where all the images inside the environment are 3-dimentional images but the user can't control the things or anything present inside the virtual environment. For example: 3D, 12D movies.

Uses/Application of virtual reality

- Engineering industry
  VR is widely used in Engineering industry. Civil engineers use VR to experiment the build of a house. First civil engineers check design the house in virtual reality then they start making it in the real physical world. VR is also widely used in automobile engineering where engineers design the build of a vehicle in VR first before launching it. Companies such as BMW, jaguar have been doing this.

- Health industry
  VRs are widely being used in health industries. Doctors are first trained in a virtual environment before getting engaged in an operation. Doctors can practice almost every kind of surgeries, operations etc. in a virtual controlled environment and prepare themselves.

- Tourism
  Virtual reality is used in tourism to show people places in a virtual environment. For example, a person from America can see the great wall of China without actually physically being present in China. They can just see and walk around great wall of China in a virtual reality.

  VR tourism in the post-Covid era allowed you to test a vacation before you buy it. In order to sample a vacation in virtual reality before making a reservation, Thomas Cook developed "Try Before You Fly" VR experience back in 2015 where people tested the 5-minute VR vacation as a result there was a 190% increase in reservations for New York trips.

- Interior design
  As the population of the world is rapidly increasing the demand of houses are also increasing and once the outer structure of a house is completed interior designing is also required where virtual reality is used to mimic the interior design and show people how the design would look in their house. Companies like flipspaces have already implemented this concept.

- Military and Defense
  In the field of military and defense, VR is being used to create simulations for military training. VR technology can be used to create realistic simulations of combat scenarios, allowing soldiers to train in a safe and controlled environment. This can help soldiers to hone their skills and to prepare for real-world combat. It can also be used to create simulations of different environments, allowing soldiers and commanders to plan and rehearse missions in a virtual environment. This reduces the chance of errors during the actual missions

Working mechanism of VR

1. **HMD**
   Users need to wear the head mounted display (HMD) in order to fully visualize in the virtual environment. When a user wears the head mounted display (HMD) cannot see the physical world. Sensors like Accelerometer, Magnetometer are used in HMD to track the motion of the head of the user. Accelerometer is widely used in most VR's and some use magnetometer too. There are also lenses and a screen through which the user can visualize the virtual environment.

2. **Gloves**
   Except for HMD gloves are also used. Gloves in VR have sensors too and it vibrates as you touch anything inside a virtual environment which helps us give the feeling of sensation and touch.

3. **Controllers**
   Controllers are also used in some VR for enhancement of user's experience. Controllers are available in VR video games.

4. **Immersive audio**
   Immersive audio or surround sound is used in HMDs so that the sounds can come from both directions or one for each ear. This helps the user to exactly know where the sound came from. It is also called spatial audio or surround sound.
   When all these small components work together properly a user can fully experience a virtual environment.

The current state of VR

The current state of VR is rapidly evolving, with advancements in both hardware and software.One of the key trends in the current state of VR is the increasing affordability of VR headsets, which is making the technology more accessible to a wider audience. Companies such as Oculus, HTC, and PlayStation are releasing more budget-friendly options, which is driving the growth of the VR market.

Another trend in the current state of VR is the improved graphics and haptic feedback technology, which allows for more realistic touch and tactile sensations in VR environments.

This is making the VR experience more immersive and realistic, which is driving its adoption in various industries, such as healthcare, education, and tourism. Super-fast mobile networks are boosting the potential of VR to strengthen its presence in entertainment and making further inroads into industry. The potential for data transfer speeds of up to 3 gigabits per second – by comparison, the average home broadband delivers well under 100 megabits per second – means 5G should be fast enough to stream VR from the cloud. (Marr, n.d.)

The greatest factor of current VR is perhaps the frame rate. Ten years ago, if someone said 60 FPS is adequate, everyone would agree. Currently, at the lowest, 90 is acceptable, anything lower and users can notice. Which brings the current hurdle for VR systems, not optics, but compute power.

The concept of metaverse has also been one of the trends in the present. The "metaverse" is a hypothetical iteration of the Internet as a single, universal, and immersive virtual space world. In 2019, the social network company Facebook launched a social VR world called Facebook Horizon. In 2021, Facebook was renamed "Meta Platforms" and its chairman Mark Zuckerberg declared a company commitment to developing a metaverse. Many of the virtual reality technologies advertised by Meta Platforms remain to be developed. (Ravenscraft, 2022)

In terms of key players, Oculus, a subsidiary of Meta, is one of the major players in the VR market, with its Oculus Quest and Rift S headsets. PlayStation VR is also a major player in the VR market, as it is compatible with the popular PlayStation gaming console.

History

The concept of virtual reality may seem futuristic or new but the idea of virtual reality build upon ideas that dates back to 1800's. The history of VR technology can be traced back to the 1950s, when the first VR-related patents and concepts were filed. However, the key concepts that VR uses can be dated back to the 19th Century.:

Invention of stereoscope

Invented during 1832, stereoscope is a device where two pictures are taken of a same object with different angles and are viewed together creating a sord of 3D image. A typical stereoscope has a lens for each eye that makes the image seen through it appear larger and more distant, it also shifts the apparent horizontal position. Stereoscope was also used in mid-20th century in view master which was patented in 1939 was used for virtual tourism. Also, in 2014 google released template for papercraft stereoscope called google cardboard.

Invention of sensorama

Sensorama is one of the earliest known examples of immersive, multi-sensory which is now known as multimodal technology. Sensorama was developed in 1962 by Morton Heilig. Sensorama includes stereoscopic color display, odor emitter, a motion sensor. With the help of sensorama a simulated motorcycle ride of New York was created and experienced where the user sits in an imaginary motorcycle and sees the image around New York through screen. This was also called as first simulator.

Sword of Damocles

Sword of Damocles was first HMD with 3D tracking capability. The Sword of Damocles was created in 1968 by computer scientist Ivan Sutherland with the help of his students Bob Sproull, Quintin Foster, and Danny Cohen. The setup of Sword of Damocles had stereoscopic display system displaying output from a computer program which updated according to the movements of the user.

VR Arcades

In 1991, VR was released for public, arcade games like Tetris and other were available to play in VR. Even here in Nepal in different malls, we can use VR to experience the virtual world.

Portable VR

During 2015, companies like oculus released the concept of portable VR. The main motto of these companies is that every people should be able to experience the virtual reality at anywhere at anytime. With this motto they released oculus quest was released which was a portable VR with HMD's and sensors so that people can experience VR anywhere. Many other companies like Microsoft, Samsung, iTechArt, Sony also joined the race later.

VR enters mainstream

After 2015, many companies like google, Facebook, also started the development and use of VR. Facebook launched metaverse which is also a virtual reality. Google as well as Samsung these days uses Augmented Reality (AR) lens in their phone's camera.

How VR impacts us

Although several applications of VR promise to improve the quality of life, the technology also raises ethical and societal implications, some serious. There are high level problems that still need to be solved in the world of VR and how we solve them could have a major impact on the future of the industry. Some of the ethical questions of VR:

1) User Privacy

As with most new technologies, we also need to think about user privacy. Users will be able to take more actions and interact with more types of content than ever before, engaging in behaviors they may avoid in the real world. Who is responsible for ensuring users' privacy, and how could this data be used?

2) User Protection

Users may require at least some physical protection, depending on the nature of the headset. If deprived of real-time sensory feedback, users could end up walking into walls or fail to recognize key dangers in their immediate surroundings.

3) User Isolation

Addiction is already a huge problem for technology, some individuals are so consumed by social media or technology that they isolate themselves from

society. When entire, immersive worlds are available to explore, what prevents users from delving too deep into the virtual reality?

4) VR used negatively

VR has already shown its capabilities in the field of psychological health people can recover from traumas using virtual experience. But what if this power is used negatively? What if one could traumatize people using VR?

5) Unrestricted travel

VR can help people explore the world, introducing them to new countries and locations they might otherwise never get to visit. But what about sites that severely restrict visitors? Or what if someone used VR to stalk people and their home? Where can we draw the line in a virtual reality?

It is important for society and the VR industry to consider these societal and ethical implications and take steps to mitigate any negative impacts. This can include implementing guidelines for data privacy and promoting responsible use of VR technology.

Future of Virtual Reality

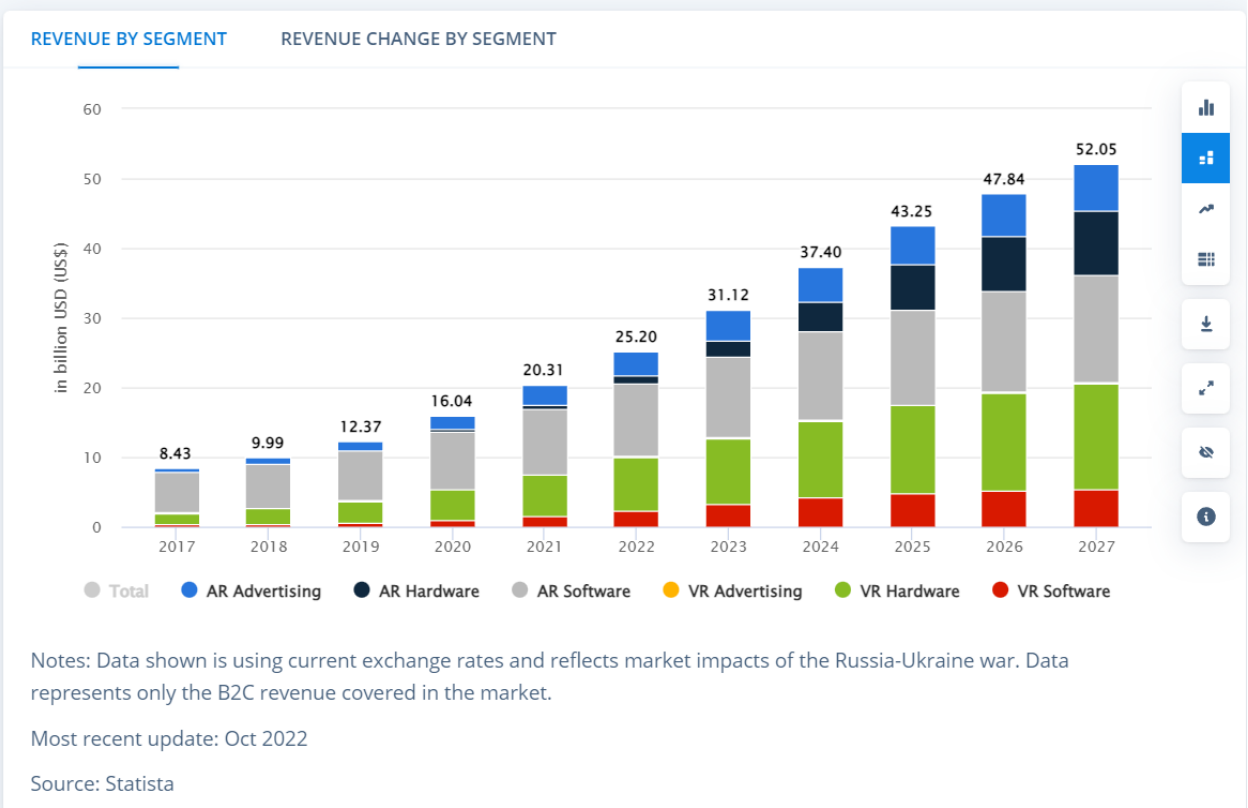
Today's market requires applications that can go beyond entertainment, tourism, and marketing, as well as those that are more affordable for users. As a result, we as users are likely to experience virtual reality in ways that are still unthinkable. Because of extreme technological advancements and achievement, VR and AR will be faster, lighter, and more affordable. Furthermore, upcoming smartphones with improved cameras and processors, as well as 5G networks, will enable us to enjoy far more sophisticated VR experience. If the use of VR increases as it has increased in past times till today the future demand if VR is likely to get increased by 48%, According to a report by Vnyz Research. Also, mobile games are launching its VR version so that the experience of virtual reality can be done through mobile phones too.

Unrealistic predictions of VR in the far future:

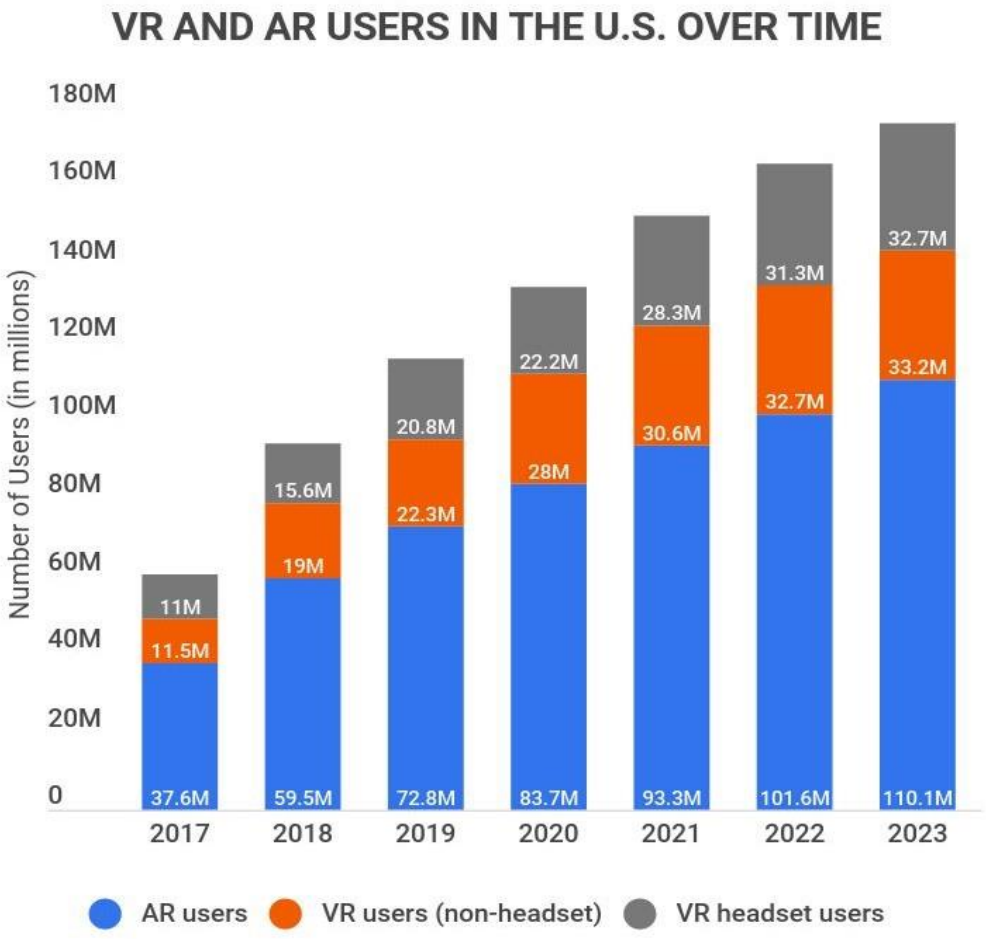
1) Brain-Computer Interface (BCI): In the future, VR may be able to directly interact with the brain, allowing users to control virtual environments and manipulate virtual objects using their thoughts alone. This is a common fiction in the gaming industry.

2) Holographic displays: VR technology may use holographic displays to create more realistic and immersive virtual environments. Holographic displays use laser technology to create 3D images that can be viewed from different angles, giving the illusion of depth and realism.

- The global AR and VR revenue is projected to reach $52.05 billion by 2027.



- As of 2023, there are 65.9 million VR users and 110.1 million AR users in the U.S.



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Conclusion

Virtual reality unlocks the future of the real and digital worlds, which is said to be the next evolution in human, computer, and environment interaction with unlimited possibilities. Virtual reality is leading the way in the future with interactive and immersive experiences, as well as an understanding of the world through a smart, connected, and network approach.

Most people associate VR with gaming, which is considerable because the VR gaming industry is worth $1.1 billion. The global VR market is currently worth $7.72 billion and is expected to grow to $26.9 billion by 2027.

VR and AR are also used in professional fields, with 80,000 jobs in the United States currently employing this technology, which is projected to increase to 2.32 million by 2030.