A Glimpse Into The World Of Augmented Reality

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Abstract— **Immersive technology is a fast-growing, fascinating, and groundbreaking domain that interests the majority of people. Concisely, immersive technologies widen reality to a greater extent. VR transports the user into a totally different virtual simulator environment. This innovative and fascinating technology is growing at a very fast pace giving hopes for a more digitalized future. Virtual Reality creates a simulator environment, by wearing a headset, so the user can experience an entirely different reality. Augmented Reality is the laying of digital elements into the real physical world. Mixed Reality merges real and virtual environments to produce new visualizations and experiences in real-time. Our major concern is Augmented Reality AR.**

Keywords— Immersive technology, Augmented Reality, Virtual Reality, Digital elements, Gyroscope, Mixed Reality, Real and Virtual world, Simulator environment.

I. INTRODUCTION

Augmented Reality and Virtual reality are identified as one of the top cutting-edge technologies. It is the overlay of visual, auditory, and sensory data onto the real physical world. It is a fast-growing domain that takes up the industry in the coming few years. Augmented Reality is not a new term or technology, people have already started using it in their real day-to-day lives. VR differs widely from AR in many aspects, but the experience provided is quite similar. Augmented Reality, AR is an augmented version of the physical world inclusive of digital objects that are placed virtually with sound and sensory elements. Users will be able to experience virtually placed digital elements through their electrical devices. It has the potential to create a new world experience standing by the doorstep. Immersive technology is revolutionizing the present and the future. Creating a visually different atmosphere, entirely different from what we see is obviously fascinating and triggers interest for further research and knowledge gaining.

II. HISTORY OF IMMERSIVE TECHNOLOGY

Immersive Technology has come into existence even before the introduction of mobile phones or smart devices. Virtual reality showed up way long back in the 1800s. This groundbreaking innovation has been evolving through practical photography till now. Morton Highlake invented a device called "sensorama" in 1957 which is the first VR device of its kind. The multimedia device "sensorama" is the earliest VR device system. However, the term "Virtual Reality" was coined in the year 1987 by Jaron Lanier when he was researching on the evolving technologies. VR is not only confined to gaming, its potential is transfiguring many other industries including education, hospitals, and sports to name a few. The term "Augmented Reality" was first coined by Boeing engineers, Thomas Caudell and David Mizell in 1992. They were working on a simple transparent system that helped aeronautical engineers in complex wiring illustrations. Their attestation stated that the aim of augmented reality, also shortly referred to as AR, was to reduce financial pressure and improve efficiency in many of the manual works in the aircraft industry. AR has always been a dream among people for a long time, and its history states back even before it was named. In fact, AR and VR share a bond between them, typically they are technological cousins. Both VR and AR being related have a common forefather "The Sword of Damocles". Created in 1968, "The Sword of Damocles" was developed by Ivan Sutherland, a computer expert, and researcher. He wanted to develop the supreme and very complex virtual display. A virtual interface that could totally transform the real world. The prototype was complicated as it had to be dangle from the ceiling with some support of a mechanical arm.
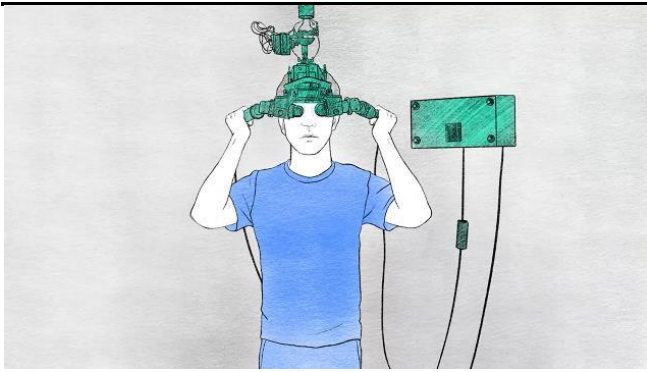
Fig. 1 VR Setup

Even after constructing the complicated hardware, it displayed only the rudimentary wireframe rooms that were not pleasant to the visuals. But it was the first step toward replacing the physical world with digital elements. Since

1992, Many scientists and researchers have worked on the vision of Sutherland's work which was written half a century ago. The final goal was to create a display so that a room under a computer's control can manipulate the real-world entities. For example, a table in the virtual reality room can be used to place objects, a knife in such a room can cut things and a firing gun in the VR room can shoot people. A Standalone headset or a Head-Mounted Display, HMD, is hardware that is worn independently on the head such as glasses, a visor, or a helmet. Most people would have experienced AR for the first time through their mobile phones. AR is delivered to the audience through Standalone or Smartphone. The fast-paced development of smartphones is directly proportional to the development of the VR and AR projects as the components used in the manufacture of smartphones are similar to that of AR, VR required hardware. It includes gyroscopes, accelerometers, miniaturized, high-resolution displays etc.
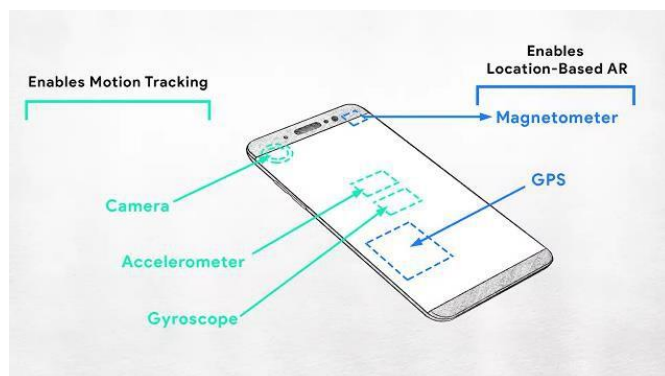

Fig. 2 VR Hardware

AR does not use any new hardware apart from the basic features of a smartphone. In simple words, AR is created using the cameras in the smartphone, the front, and the rear-facing. It would display virtual elements integrated with the real world.

Smartphones act as a portal to an entirely new world or different environment experience.

III. GOOGLE AR

Google first developed a head-mounted display that was in the form of glasses as its first attempt towards AR space. It is a small, easily wearable, lightweight, see-through display that acts as a smart lens. It hasn't still lost its market value in the industries and in AR applications.
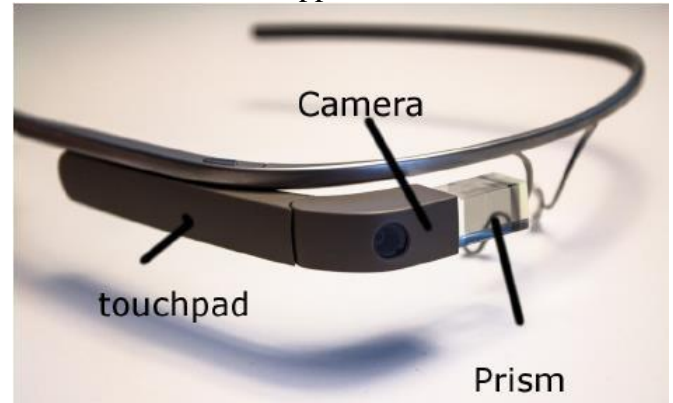

Fig. 3 Google AR

After glasses, Google's next attempt was project Tango in the field of AR. Tango combined both software that was customizable and additional hardware for depth-sensing devices. Phones that had Tango-enabled in them could understand the whole world around them and they were able to display or overlay the digital elements onto the real world.
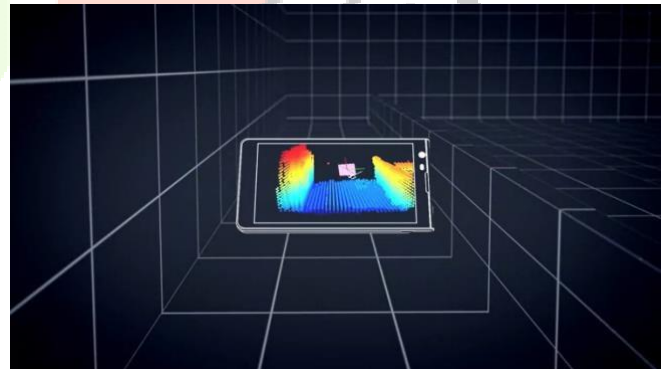

Fig. 4 Google Modified AR

In 2017, Google introduced "ARCore". A great leap towards the AR Space. It was an enhanced version of the Tango platform. It acts as an interface or API (Application Programming Interface) for building mobile AR experience.

Fig. 5 AR Core

Fig. 7 AR for Business

IV. SIMILARITIES BETWEEN AR AND VR

The major difference between Virtual and Augmented Reality is the hardware itself. VR creates a simulator environment that can be experienced only through headsets connected to an external device like mobile phones or high-end PC. It requires a powerful, low-latency display that is capable of projecting the entire digital world without missing a single frame. VR creates a totally new experience and environment whereas AR places digital elements in the physical world. It is computer-generated perceptual data. AR is just a 3D image placement in the real world with visual, and sound elements.

V. APPLICATIONS OF AR

Augmented Reality has already been put into use in various fields. Our first AR application is always using smartphones. The various sectors where AR is used are listed below.

1) AR for Shopping and retail:-

AR for shopping fuses with the real world very seamlessly. It is very useful for the shopping and retail sectors. AR enables users to try on the products like a watch, dress, or a new shade of lipstick, without ever leaving our doorstep. The most used application of AR is furniture shopping. AR makes it easy to imagine and visualize the digital versions of furniture right where you want to place it in your house, with the exact measurements and size of real life. Major companies have already started using this idea.
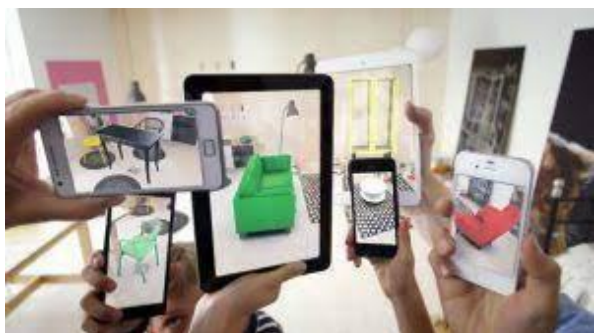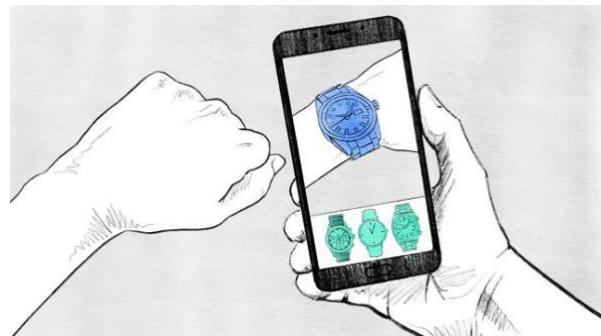

Fig. 6 AR for Shopping

2) AR for business:-

AR creates the best user experiences in many professional organizations for better sales.

✓ Easy navigation for laborers inside warehouses.

✓ Visualizing the architecture plan and design in 3D space.

Fig. 8 AR for 3D Visualization

✓ Advertising and marketing can reach its peaks with the use of AR. Retailers can attract customers in a novel way.

This is just the peripheral application of AR. It allows users to better experience the products

rather than seeing them behind the screens.

3) AR for social media:-

Social Media is one of the best users of AR.

✓ Snapchat was the first Social Media platform to bring lightweight AR into use among common people. The filters and lenses used in Snapchat fully embrace AR.

✓ Facebook also had its AR camera interface.

✓ Google introduced AR Stickers that can be imported. They are 3D animated stickers for creating social content.

Fig. 8 AR Sticker

4) AR in gaming:-

The best of AR and VR can be experienced through gaming. They can pull off a truly entertaining environment. It transforms and transports the user

into an entirely different world. In 2016, Pokemon Go was the first-ever AR game. Following that many companies launched mainstream characters

like Harry Potter, The Walking Dead, Ghost Busters, etc. AR can also create a platform for games like arcades to tabletop games. Even though AR produces a wonderful experience in this domain, its functionality and application aren't fully explored.

Fig. 9 AR Gaming

5) AR for education:-

Students tend to grasp concepts easily when it is taught visually. AR space allows students to visualize and understand the concept completely. Demonstration of difficult topics can be done using AR for faster and wider reach. "Expeditions AR" is designed by Google to help teachers show students concepts with simple

demonstrations and engaging AR visuals for educational purpose. AR can also be used to conduct experiments and measure real-time value accurately. It can be widely used to spread education effectively.

Fig. 9 AR in Education

Fig. 10 AR in Healthcare

6) AR in healthcare:-

AR has already shown up in most of the domains. It will only keep increasing as the technology matures. Medical assistants use AR's enhanced virtual/digital visualization to diagnose and treat patients, plan procedures and treatments effectively. Someday in the future AR can replace the charts and guide surgeons step by step to perform a complex operation successfully. The medical industry is always the most exciting arena for the development of new technologies. It always hopes for new and better AR technology.

VI. WHAT MAKES AR FEEL REAL

Augmented Reality provides an experience where digital elements including audio, visual, and sensors are present in the real world. There are many factors that make it seem real and create a visual effect as if the object is present in front of us. There are some key points to follow to provide a seemingly real visual effect:-

i) Placing and Positioning assets:-

The 3D digital object on our mobile screen needs to be placed at a certain position such that it doesn't move even when the user moves

around. The object should be placed to some wall, ceiling, floor or it could be floating in

mid-air. These 3D stationery objects must stick to their place.

ii) Scale and size of the assets:-

Most of us would have observed how the object orientation, lighting, shape and size of the object would change with respect to the distance between and our perspective of view. Similarly, the digital elements should change according to all these factors to provide a realistic effect. This is called scaling.

iii) Occlusion:-

When we move our hand in front of us,
we hide certain things from our view. This is called occlusion. It refers to the effect of hiding objects behind other objects to create a realistic view and experience. It is one of the trickiest factors to achieve AR Space.

iv) Lighting for increased realism:-

The shade or the colour density of the
3D object should change according to the factors like light direction, change in lighting, etc. For example, the object
shade changes to a darker shade when the lights are turned off. There should be a difference between the initial and changed lighting effect.

v) Solid augmented assets:-

AR objects should be opaque and solid. It should be placed on top of real-world objects and not suspended in mid-air. It should not overlap with physical world objects.

VII. TRACKING IN AR

Whereas in inside-out tracking,the cameras and sensors are fixed inside the AR device. The power supply is also in-built. Our mobile phones are the best examples of this kind.

Inside-Out Tracking   Outside-In Tracking

VIII.CURRENT CHALLENGES FACED

• New technologies are always hard to understand and work with. It takes a lot of effort and studying to understand the emerging technology. People aren't always sure of how to interact with the emerging technology.

• The power consumed is high and proportionally it produces a large amount of heat. The size of the hardware is large. It takes some more time to develop a more efficient AR system.

• Developing and creating 3D designs is not that easy. It requires much practice and professionalism. People with no experience will definitely face issues in this area. This calls for the help of animators, graphical
designers, engineers, and video game creators.AR observes the real world around it through computer vision and recognizes the objects. It scans, recognizes, segments and breaks the environment for better analysis. This process is called tracking. AR Tracking can be done in two different ways inside-out tracking and outside-in tracking.

OUTSIDE-IN TRACKING:-

In this type of tracking, the sensors, front, and rear-faced cameras are present outside the device i.e they are mounted around the room. Hence its flexibility is less.

IX. CONCLUSION

We have entered the age of new realities virtual and augmented. The world is advancing faster than it has ever before and it is hard to keep up with the day-to-day technological advancement. One of the major domains in which the investors are heavily investing is in virtual and augmented reality. We are surely spending most of our time looking at screens, they have become a big part of our lives. VR and AR create a totally new and exciting way to use screens and enhance the experience. The market for AR and VR products in 2022 is expected to go as high as 150 billion dollars. So at any given time, there is a plethora of new technologies to keep your eye on. In the future, there might be a scenario where we have VR and AR in the same device. The gap between these two is going to end very soon or some new device is developed where we have such a high definition graphics that it looks almost like reality. The future is full of surprises and it is unpredictable.

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