International Journal of Scientific Research & Engineering Trends
Volume 9, Issue 6, Nov-Dec-2023, ISSN (Online): 2395-566X

Leading the World towards the 4th Industrial Revolution through Virtual Reality

Geofrey Mwamba Nyabuto, Professor Franklin Wabwoba
Information Technology, Kibabii University

Abstract- The fourth industrial revolution is characterized by the convergence of various technologies including the Internet of Things, Artificial intelligence, virtual reality, and augmented reality among others. This revolution is shaping how people live, interact, and share information. Virtual Reality (VR) is one of these technologies that are revolutionizing the world. VR technology enables individuals to immerse themselves in a virtual world using special headsets, gloves and computers and has seen its application in several sectors hence improving productivity and do things that could have proven difficult or impossible. This paper explores the evolution of VR technology, its current state, and its application in real life. Through its application, the paper reviews how it has already been applied in industries like entertainment, medicine, education, automotive and others to change how things are done. By using VR, organizations can increase their productivity and give customers a better user experience, increasing sales and profits. Health and safety issues, ethical considerations and costs are also reviewed in this paper. There is a need for collaboration between content creators, developers, policymakers, and researchers to come together and utilize the full potential of this technology while addressing the current challenges.

Index Terms- Virtual reality, customer experience, headset, virtual environment, Immersion

I. INTRODUCTION

Virtual Reality (VR) is a technology that has been used to simulate the real-world environment through computer-simulated screens. With this technology, people wear special goggles that allow them to traverse the virtual world and interact with it freely (Zheng, Chan, & Gibson, 1989). The term virtual reality was coined around 1986 by Jaron Lanier founder of VPL Research, a company that was developing goggles, gloves and all the necessary needed equipment to help experience virtual reality. This was made possible with accelerated development in computer processing speeds, and high-resolution computer graphics among others.

Cyberspace is a term coined by William Gibson in 1982 to refer to the ultimate virtual environment. People in the virtual environment can move and interact freely. VR as an artificial world allows the immersion of people into the virtual world and helps them have an experience as if they were in the real world. The virtual world is created with the great help of computer technologies through sensors.

Virtual reality has three key building blocks i.e., real-time 3-D graphics, response to user actions and a sense of immersion in the virtual world (Delgado, Oleas, & Laura Ortega Ponce, 2022). With this technology, users wear special gloves or headsets that have sensors. These sensors can capture finger movements (in the case of gloves) or head movements (in the case of a headset) and transmit this signal to the computer for further processing. The computer will process this information in real time and send a signal to the headset to visualize. Capturing and transmission of these signals are done in real-time. The special screens can capture these, analyze them, and generate new virtual worlds in real time. This gives users a feeling of immersion in the virtual world.

II. HISTORY OF VIRTUAL REALITY

Developments in the field of virtual reality root back to the 1960s when Ivan Sutherland first presented the idea of making the virtual world in the window sound and look real as well as feel and respond in a realistic way to viewers (Sutherland I. , 1968). Before this, Writer Stanley G. Weinbaum in the 1930s a story of science fiction described how a wearer of special goggles can experience a fictional world through touch, smell, and holography. As described in this story, the experience of those wearing these goggles is like those of participants of VR. In the 1950s, Morton Heilig developed Sensorama which featured stereoscopic 3-D displays, smell generators, vibrating chairs, stereo speakers, and fans that were able to simulate all senses. The main intention was to immerse the participant in a virtual world in the film. First forward, in 1985, VPL Research was developed as the first VR company and its founder came

up with the word virtual reality to describe the technology. The company produced and sold Head Mounted Displays (HDMs).

1. Components and Architecture of VR

The concept behind VR is to place the user in a virtual environment that replicates the real world and makes them feel like being there. For this to be possible 3 items are key, i.e., sensors, effectors, and reality simulators. The sensors are attached to the headsets or gloves won by the user and can detect all user movements through the head or fingers allowing the simulator to generate real-time 3-D effects. The 3 components work in unison to give a user real effect in the virtual world.

Virtual World

They are also called metaverse, virtual environments or immersive virtual worlds. In this case, computers are used to create virtual environments that make virtual reality look real. These are computer-generated environments that allow people to interact as if they are in the real world (Bainbridge, 2010). This environment simulates the real physical world that we live in and now computing technology allows these users to interact with the virtual world in real-time. The Virtual World has virtual objects that emulate the ones in the real world. Users in the virtual world can freely interact with them.

Immersion

This is making the experience as close to the real world as possible. This is made possible through immersive graphics and sounds that use VR headsets and Audio where users can fully immerse themselves and feel all the effects just like the real world. This allows them to play games, watch movies and do other things in the virtual world.

Sensory Feedback

VR can play with someone's senses like smell and taste just like it does with audio and video. This is what provides an immersive experience. The VR equipment is fitted with sensors that can collect information from people and share it with the VR device. Based on these, VR can create a virtual world with an immersive experience that enables users to feel as if they are in the real world. There is two-way communication, and the device can send some effects that can be felt by the person immersed in the virtual world.

Interactivity

People in the VR environment can feel a real-time VR experience. This gives them a sense of inclusion and being in the virtual world. There is real-time interaction on the screen with the user.

This is made possible with the sensors highlighted above. For example, in VR, a user can interact with monsters, kill them, pick things on the screen and many other sorts of interactions.

2. Devices Used in a VR System

VR Headset/Gear

They are also called VR goggles. These are wearable devices that users wear on their faces to help them interact with the virtual environment/world (Siriborvornratanakul, 2016). They provide an immersive experience using 3D graphics and visual content. They usually cover the whole face of an individual and have a screen through which users can see the virtual world. They are made of different devices including sensors to help them detect and transmit any motion enabling users to have real-time experience.

Host Computing Devices

Due to the real-time nature of VR, a user needs high-performance computers that quickly run and process information to help give the best VR experience. A high-performance personal computer, laptop, and gaming equipment can be used to carry out this function.

Input and output Devices

These are other devices that help users interact with virtual environments and convince users that indeed they are in the real world. These devices include a 3D mouse that controls movements in virtual space, optical trackers which monitor users' position, and wired gloves that are won in the hands and help in capturing and tracking physical movements through sensors attached to them (Bamodu & Ye, 2013). Other devices are motion controllers that allow users to act in mixed reality hence fine interactions, and omnidirectional treadmills that allow users to move in any direction physically hence giving a fully immersive experience. Lastly, a smelling device also called an olfactometer is part of the most recent VR devices that allows users to smell in VR environments. With the smelling functionality, users can get a better immersive experience than ever.

III. METHODOLOGY

This paper uses a systematic literature review to explore related work to VR systems. Some of the items covered by the paper include a high-level overview of the components and architecture of the VR system, devices used in the VR system, and a review of how the VR system is revolutionizing the world.

IV. RESULTS AND DISCUSSION

In this section we will look at the different sectors and industries where VR has been applied and how it is transforming those industries. This will clearly outline how this is already driving the world to the story of the fourth industrial revolution. With the help of VR, it is possible to create a computer-generated virtual environment that simulates the real world. This allows for the inclusion and creation of activities

that can be used for experimental purposes, and the reproduction of complex scenarios among others (Herpich, Voss, Nunes, Jardim, & Medina, 2014). This also comes with an opportunity for collaboration and sharing a situation rarely experienced in other situations.

1. HealthCare

The very first application of VR in healthcare goes back to the 90s and this was necessitated by the need to have medical staff being able to visualize medical data during surgery or planning for the same.

VR has been intensively applied in the medical education and training setup to equip learners with skills and knowledge of these organs. Through VR, learners can view organs, walk around these organs, and even enter the organs. This gives them a better view and understanding of the organs making it easier for them to know the internal workings of the organs. VR has been used to do medical procedures and operations such as surgery (Ajmera & Gonen, 2020). Through VR, learners can acquire the necessary practical skills needed to undertake these procedures. In some instances, virtual environments have been used to give healthcare information and to educate and improve healthcare knowledge.

There are cases where VR has been used to provide knowledge about sexually transmitted infections, and the prevention of unexpected pregnancies among teens among others (Vermund, Geller, & Crowley, 2021). Some of these projects have been carried out at the University of Plymouth to provide several educational experiences. VR has been used in nursing training and disaster simulation.

Carrying out a surgical operation is a risky venture that sometimes can lead to loss of life. Using VR, it is possible to simulate a surgical operation before the actual operation is carried out. Nowadays powerful computers have a lot of surgical information that can be used in VR to give surgeons an opportunity to carry out a mock surgical operation in a Virtual World (VW) before the same is replicated in the real world (Sutherland, et al., 2006). Simulation of surgeries is possible, as manipulation of virtual organs in the VW and through this, surgeons can get valuable experience before they carry out real operations.

In some cases, VR has been applied as a distraction method to reduce pain during medical procedures. In this case, the patient is fully immersed in a virtual world where their attention is diverted off the painful operation hence achieving the overall goal of reducing the pain and anxiety (Ahmadpour, Randall, Choksi, & Gao, 2019). Also, for patients with burns, this method can be used as a distraction to help keep them off their pain. VR will distract such patients during wound treatment and care.

There is a lot of promise with VR in treating people with mental health issues like post-traumatic stress disorder (PSTN), anxiety and depression. In this case, the therapist creates a virtual environment that exposes patients to traumatic or feared areas but in a controlled virtual environment (Bell, Nicholas, Alvarez-Jimenez, Thompson, & Valmaggia, 2020). This helps patients get accustomed and used to such environments hence reducing fear and anxiety.

VR has been used to support patient rehabilitation and boost physical therapy. VR is used to provide an interactive environment that gives patients a chance to move and exercise within a controlled virtual environment. This makes the therapy session interesting and enjoyable for the patient.

VR has been applied in telemedicine to support remote medical consultations. Through this, a virtual environment is created that allows doctors and patients to freely consult and interact. Healthcare providers can assess their patients, do medical examinations, and support the patients with remote care virtually. This is very useful where physical presence is expensive or difficult.

It is possible to use VR to promote the healing and training of amputees. Once a patient has been amputated, one of the difficult tasks is to adapt to the new norm of doing things. In this case, VR can be deployed to support simulations of how the patients can control the new prosthetic devices.

2. Entertainment

VR has extensively been applied in the field of entertainment right from gaming, museum, and music. In gaming, VR has provided players with a virtual environment where they fully immerse themselves hence being able to interact freely. Specialized headsets and gears are used by players to interact and engage in the virtual world. Users/players are put right in the middle of the game (Cruz-Neira, Fernández, & Portalés, 2018). Popular ones include Superhot VR and Beat Saber among others. Creators can fully immerse themselves in the virtual environment, make stories that affect outcomes, and explore various storylines, hence having a personalized experience.

VR has been applied in the movie industry allowing users to watch movies in a completely immersive way where they are immersed in the virtual world and are surrounded by several actions. Since users can visualize, it gives them an opportunity to memorize and remember all their interactions (Zhang, Zhu, & Tian, 2020). This makes storytelling easier and possible.

Events and concerts have made use of VR to enhance the user experience by providing 360-degree live streaming of events and concerts. Events can be watched in real time which gives users an illusion of being at the event. People can freely attend events from all over the world without being physically at the

event. Users can also have rides within the VR environment where they are able to adventure and walk around giving them a fantastic life experience.

The creation of virtual museums and art galleries has been made possible with AR technology. Users from all over the world now have an opportunity to interact freely. This fosters and improves culture by giving people from all over the world a chance to share their diverse cultures (Shehade & Stylianou-Lambert, 2020). VR users also have a chance to view sports in a 3-D manner and users can watch any sport from within the virtual environment.

VR arcades are also coming up courtesy of VR technology. They provide users with a virtual environment where they can get a VR experience without necessarily purchasing very expensive VR equipment. In these places, users have an opportunity to explore various VR entertainment options without owning VR devices.

3. Automotive Industry

Within the automotive industry, there has been mass adoption and use of VR technology to improve production and end-user experience. Its application ranges from design, manufacturing, sales, and customer experience. Designing and development of automotive is an expensive venture especially if changes are required after the designs are done. VR comes in handy to help designers visualize the vehicle in a virtual environment before the physical design is done (Lawson, Salanitri, & Waterfield, 2015). Within the virtual environment, designers can immerse themselves there, do virtual designs, explore both the interior and exterior of the vehicle, test the usage of different materials and colors, and assess aesthetics before starting the actual design of the vehicle. Adopting the usage of VR makes it cheaper to do the actual physical prototyping as it is possible to have several design iterations in the virtual world before the actual design.

VR technology can be used to create virtual showrooms and configs where customers can view and re-configure vehicles in an immersive way. Here users can walk around the vehicle, open the vehicle, enter the vehicle, do virtual test drives, and change the vehicle configurations including colors. Through this, users can make more informed decisions. VR can also be used to create great marketing experiences and arouse interest in users. The test drives give users a great experience as they can drive around without leaving the showroom (Sportillo, Paljica, & Ojedab, 2018). Users virtually sit in the driver's seat, explore the vehicle's interior, and virtually simulate driving through different terrains.

VR has been employed as a tool to help in training new automotive employees including technicians, assembly line workers and sales staff. Simulation provides real-life experiences and training scenarios. This makes it better for employees since they are training in a virtual environment near a real-world scenario. When these employees get to the real world, they can easily cope since the environment looks similar, reducing errors and increasing efficiency. VR helps engineers simulate and visualize production lines and through this, they can note areas of improvement. VR also improves collaboration among engineers as they carry out several design considerations. Engineers can use shared virtual spaces to achieve this. Feedback sharing can also be done virtually.

With the increased adoption of robotics and AI, VR is being used to support the development of autonomous vehicles. Self-driving cars can be deployed and monitored in the virtual environment as they navigate (Nascimento, et al., 2019). Through this, engineers can easily detect errors and make necessary adjustments before the actual deployment of such vehicles. In the VE, the vehicle can navigate through roads with several obstacles including people, other vehicles, and non-moving objects like broken-down vehicles. An environment that simulates the real world is essential since it gives designers and developers of such vehicles an opportunity to re-work on any anomaly that might arise and revise the driving algorithm. Simulation of such environments makes it possible for the automotive industry to design and ensure the safety of their vehicles.

VR enhances marketing and advertising by allowing customers to navigate through the vehicles before committing to purchase them. This gives them an opportunity to request any reconfiguration before they make an actual purchase. With free virtual rides, users can make an informed decision about the performance, experience and other features that come with the vehicle.

4. Education

Just like other industries, the educational sector has not been left behind in the adoption of VR technology. VR is being used and deployed to support learners by allowing the creation of virtual learning environments. This gives a personalized learning experience to each learner. VR creates interactive and immersive learning experiences that give learners hands-on skills. Learners can explore distant places like planets, historical landmarks, and other virtual environments. This practical experience improves knowledge retention and understanding of complex things for learners (Lee, Wonga, & Fung, 2010).

In the fields of study, there is a need for field trips to help learners visualize what they have been taught in class. VR comes in handy with virtual field trips that allow learners to visualize and relate what they have learnt in class without leaving the classroom. Students can visit museums, cultural landmarks, historical places, and laboratories to view and conceptualize what they have learnt in class. Actual visits to the field may be very expensive and many learners may not afford

to go on those trips hence VR comes in as a cheaper option that gives learners a similar experience.

Within the education setup, VR can be used as a simulation tool to help learners undertake several activities in a controlled environment (Antón-Sancho, Fernández-Arias, & Vergara, 2022). This is a safer environment where learners can put into practice what they have learnt in class. The field of science involves students undertaking various virtual experiments whose intention is to equip learners with world experience. For example, pilots use a simulation to train their students and only expose them to real planes once they fully understand what is needed. Engineers can build structures in the virtual world. This enhances students' problem-solving skills, bridges their skills to the real world and their ability to apply practical concepts to the real world. Students can learn and improve their language skills by interacting with different virtual devices through conversations.

Through VR, students can reconstruct world histories. They can get first-hand world historical information. This is possible as they can witness virtual important events and interact with historical figures, and this helps them to better understand the past.

There is hope for special need people and children to learn more and better through VR technology. It is possible for VR technology to provide personalized learning experiences and appreciation of different challenges faced by special needs children and people hence customized learning content through the virtual world (Lányi, Geiszt, Károlyi, Tilinger, & Magyar, 2006). Visualization of complex scientific concepts is possible through VR technology hence fostering concept understanding among STEM students. VR will enable students to visualize different chemical reactions and physics experiment simulations among others.

In the education set-up, VR will be used to foster collaboration among learners. This is possible as VR enables students, learners, and teachers from different parts of the world to collaborate and share knowledge. They can work on projects together and engage in discussions and this promotes teamwork among learners, global connectivity and enhance communication. Teachers as well can learn and practice classwork management techniques virtually, firefighters can simulate their firefighting skills virtually among others.

5. Retail Industry

The retail industry has used VR technology to enhance user experience and increase overall sales for companies. Through VR, users can undertake virtual shopping just from the comfort of where they are. VR has created virtual stores where these users can browse different products and make online purchases through integrated e-commerce platforms. Through these, users have immersive virtual shopping experiences that improve the customer experience of different products. Through VR, users can virtually try different products like clothes, accessories, and cosmetics. Customers using VR Headsets can see how products look like and this is important for the customers as they make decisions on which product to buy.

One of the key items for retailers is the design and the layout of their shops to make it easier for customers to locate any item they want to buy and at the same time save customers time when shopping. Different layouts will affect how customers get to and shop within the shops. VR comes in handy to support this by providing virtual layouts and designs that retailers can try as they come up with the best layout for their shops for better customer engagement and increased sales.

VR allows customers to visualize and customize their desired products in the virtual world. Customers can change product colors, configurations and materials to allow them to get a realistic view of the product. This improves customer experience and saves the customer shopping time and reduces physical sampling with personalized personal experience (Moorhouse, Dieck, & Jung, 2017). This can also be used in showrooms and exhibitions where retailers can showcase their products. This allows customers to try different products before making informed choices. VR enhances global exhibitions without physical logistics. It can also provide virtual assistants who can take users across the products offering personalized recommendations, provide support in real-time and answer customer questions.

Employee training and orientation in the retail industry can be made possible through VR. Simulation of the physical world makes employees able to learn new products and refresh on other existing products with the retail. VR replicates the real products in the retail and users can easily be trained on handling and management of these products in the virtual world. This equips employees with practical skills hence positively translating to increased employee productivity and uniform training across several employees.

VR is being used to support market research and give consumer insights. While being able to simulate shopping scenarios, virtual environments can be used to track customer preferences and shopping behaviors and reactions (Boardman, Henninger, & Zhu, 2020). With this information, retailers can make data-driven decisions that can drive and improve sales and customer experiences. Some items are difficult to display in a real shop and VR comes in handy to allow displaying such items.

6. Space and Military

VR as a technology can be used in the space industry to support the military with new ways to train and explore the world. VR allows astronauts to experience simulated space operations, critical mission instances and spacewalks. This builds confidence and fosters skills within astronauts and enhances

their problem-solving skills. In space, people can virtually plan and simulate complex space missions (Kot & Novak, 2017). It helps space agencies to simulate spacecraft manoeuvres, and risk assessment among others.

VR creates a virtual space with replicated physical landscapes and other bodies thus allowing researchers and scientists to virtually explore space. It can also be used in training in space by allowing students and people to explore the universe, go to different planets and learn about celestial bodies and objects. This lowers curiosity about how space looks like and astronomy.

In the military, VR has been used to support training and simulations. Soldiers can simulate real combat scenarios and mission-critical operations. Such training makes it possible for the military to develop and nurture their problem-solving skills especially when handling such mission-critical operations by simulation of virtual battlefields (Lele, 2011). With the different terrains in the virtual world, soldiers can study the enemy, and make strategic plans on attacking the enemy. In the same setup, soldiers can train on how to drive virtual tankers and attack the enemy among other things. Adoption of this technology in the military will improve soldiers' performance.
During military exercises, it is possible that some soldiers will be hurt and will need medical attention. VR comes in handy to support medical officers in military environments to get off safely. Such simulations like mission-critical operations are risky operations that can be simulated for better learning experiences. Autonomous systems in warfare are highly being adopted in the current time by different countries. The use of such systems is often very difficult in the real world. VR provides an opportunity to use these devices before they are deployed in the real environment. This improves the safety of users as it reduces accidents during training in the real world.

7. Architecture

VR is revolutionizing how designs and visualizations are done in the architectural world. It enables architects and their clients to immerse themselves in the virtual world and check different designs before the final output. Clients can walk through buildings, explore the interior of the buildings, and experience the dimensions of buildings before actual construction (Delgado, Oyedele, Demian, & Beach, 2020). This allows architects and clients to have a common understanding and agreement before actual construction. Clients can have a virtual walkthrough of buildings, enabling them to make informed decisions.

VR enables collaborative review of architectural designs. This allows multiple stakeholders to actively participate in meetings and discussions about designs. Buildings need several professions including architects, engineers, clients, project managers and other members. All of them can collaboratively work in a virtual environment. Design concepts can be tested and piloted with a virtual space enabling architectures to explore multiple prototypes. VR can be used to explore interior house designs to help users and designers try different furniture placement options in the virtual world.
VR can also be used in urban planning to visualize cities. Better management of cities starts with better designs. VR enables virtually exploring different design samples for the city allowing managers to choose the best design. The impact of new developments can be analyzed, and alternative designs drafted to minimize negative impacts. VR enables the historical reconstruction of ancient structures.

8. Digital Marketing and Advertisement

As discussed in previous topics, there is an aspect of improved user experience with the adoption and use of VR in exploring new items by allowing users to have a look and feel of these items. Through VR, customers can have virtual product demonstrations by fully immersing them in the virtual world and allowing them to explore different variants of the product without purchasing it. Through this, users can test product functionality, features, and benefits.
Virtual showrooms have already been discussed above as they come in handy in improving customer retention. Brands can hold virtual events and market campaigns. Customers can actively participate in brand activities, trade shows, presentations, and networking amongst themselves (Harz, Hohenberg, & Homburg, 2022). Customers can make virtual tours and reach their desired destinations, hotels, and resorts virtually. This provides customers with a quick glimpse of what they can expect if they visit those hotels.

VR has been integrated into interactive advertising to give users interactive content. Users can participate in virtual games, and brand exploration to increase brand awareness. VR has made it possible for users to have personalized user experiences by analyzing their data and allowing brands to create customized products for their target markets. Already social media is integrating VR capabilities into social media networks.

9. Occupational Safety

VR technology can be deployed to identify hazardous areas and create awareness. By having a trip in the virtual world, users can have an opportunity to identify hazardous machinery, and environments and be used to train users on how to navigate through the hazardous environment to reduce their exposure risk (Zhao & Lucas, 2015). Through this, users will have skills and experience in how to identify hazardous items and be able to mitigate them.

VR can be used to carry out emergency training and evacuation efforts in a virtual environment. Workers will be able to learn different evacuation strategies, and this also can help the organization come up with proper evacuation policies. Workers in dangerous places can get hands-on skills and knowledge on how to navigate such environments. Workers can be trained in

the operation of these machines, improving users' confidence and safety awareness. Workers lose life daily to the machines they operate. Sometimes this happens because the workers are not well trained in machinery handling and enough mechanisms have not been put in place to curb this. Workers can virtually be trained to handle different machines in industries. This reduces risky exposure for the workers. VR can be used to carry out safety refresher training.

10. Social Science and Psychology
VR enables the creation of a controlled virtual environment to be able to study human beings. Within these virtual environments, individuals can be monitored to see how they react to the environment. VR can be used to carry out training for social skills like communication, public speaking, and dating, where they are able to talk to objects as a simulation for interviews among other things.

VR has been applied to patients with autism spectrum disorder to support therapies. VR has been used to improve clients' social skills, communication, and navigation of the social workspace.

11. Tourism
VR enables users to travel to virtual destinations in areas far away from their physical location. They can interact with different virtual destination facilities. This gives them the experience of experimenting with what the real place looks like. Virtual places that can be traversed include cultural sites, and landmarks among others. VR can be used to provide an immersive travel experience, one of its kind. Using the VR headset, one can dive underwater, and climb mountains among others.

VR users can explore rooms virtually, dining rooms and other amenities. Have virtual tour guides to take you through virtual destinations.

V. CHALLENGES WITH THE ADOPTION OF VIRTUAL REALITY

1. Health Concerns
In the recent past, we have seen increased uptake and use of virtual reality in different domains to improve services and human life. Just like other technologies, VR has its fair share of challenges that should be addressed to make the technology more useful. Health concerns are some of the key issues raised as to whether VR is safe for human use. They include side effects like nausea, headache blurred vision among others (Kirsch, 2019). Using VR technology can make users experience motion sickness where there is a discrepancy between what users see on the VR screens and the motion. Motion sickness can lead to dizziness, disorientation, and nausea.

VR can strain users' eyes and fatigue due to its extended use. This is possible with the proximity between the headset and the user's eyes. This may lead to dry eyes and discomfort. Users fully immersed in VR can lose their sense of balance and body coordination, leading to accidents. VR experiences are usually very realistic and immersive, hence making users have strong emotional responses hence leading to anxiety and stress.

VR systems isolate users from the real world and take them to a virtual environment hence leading to the social isolation of individuals. Users who often use the VR system may end up isolating themselves from the real world. This has serious negative effects on the mental health of individuals. There is a need for research to find out how VR affects human brain development in children.

2. Cost
It is very expensive to buy and use a VR system as it requires specialized hardware, headsets, controllers, and sensors. Getting these quality components may be very expensive, especially for high brands. With real-time simulation, VR systems require high-performance computers to effectively perform. This increases the cost of the items. For enhanced VR systems, a lot more peripheral devices are needed to enhance the experience like extra sensors, and specialized controllers among others.

The development and purchase of software and content used in VR are very expensive. Subscriptions for this software are very expensive as well. Upgrades and maintenance are also as expensive as the software and hardware itself. Replacing worn-out components may also require additional costs apart from the initial purchasing cost. Training users to effectively use VR items is expensive, especially for developing countries.

3. Ethical Considerations
Privacy in the VR environment comes as an ethical concern as the VR system collects and stores a lot of personal data. This includes user movements, interactions, and preferences. Companies can use this data to do numerous things including targeted testing and better customer experiences. However, it is good if there can be a clear cut-off on the level to which users should be involved in the use of their personal information and if proper consent is given.

On another note, it is possible for the VR system to be used to manipulate and misuse people through emotions and perception (Kaimara, Oikonomou, & Deliyannis, 2022). The creation of immersive experiences including fear and trauma can be harmful to individuals. Developers and content creators of VR systems should incorporate good ethical considerations in the design of their products.

With immersive VR technology, there is a tendency to have increased dependency and addiction to this technology. This

may end up leading to social isolation, and mental health issues among others. This calls for the promotion of healthy VR usage. Physical safety is also a concern among users as the VR system involves the movement of the equipment. This can lead to accidents among other things.

4. Acceptance

Using the VR system can be isolating since users are fully immersed in the VR environment, leading to social isolation. Due to this, it can lead to low acceptance as users are afraid of being isolated from the real world. There is a stigma as many people feel that VR is used for just gaming and entertainment. However, this technology as discussed above can be used in many other setups to undertake several things.

The high cost of the technology reduces its acceptance as it requires high-performance devices that are expensive to acquire. There are also health and safety concerns with the VR system including motion sickness, eye-straining and related accidents. As discussed above there are ethical considerations that could be making acceptance of this system low. Few users know how to use the VR system and it has limited content since it is a new technology. All this lowers its acceptance levels.

IV. CONCLUSION

This paper has reviewed the various applications of virtual reality technology and outlined how the different sectors are already benefiting from this technology. With the development of high-performing computers, virtual reality is meant to change how several things are done. This provides a golden opportunity for companies to increase their productivity, increase sales and improve service provision.

The fourth industrial revolution is with us here and a lot is changing in how we do things. Though there are few concerns in adopting VR technology, the advantages outdo these challenges. Since it is a new technology, more sectors will find a way of incorporating and taking advantage of this technology to improve service delivery.

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