A Comparative Analysis of Augmented Reality and Virtual Reality

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Abstract

Comparative analysis of Virtual as well as the augmented reality has become crucial as it seems like both of them functions similar. This research has been aimed to provide a brief discussion about the technological comparison of both the technology. In the modern day era both the technology has been exclusively used in the area like the manufacturing industries, gaming industries and 3D animation and many more. The next section had talked about the material and method where the research method that will be used and it had been discussed in four distinct sections. For this research the qualitative research type has been used and the research design that has been used is secondary research design. The data have been collected on the basis of secondary data collection method and then it had been analysed with the help of thematic data analysis. In the results section the themes have been prepared and her are on the basis of the uses of the AR and virtual reality, comparison between both the technology and finally the future scope of these technologies. Finally, this discussion has been concluded with the discussion part which is about the thorough analysis of results section of this research.

Keywords

Augmented reality, Virtual reality, technology.

INTRODUCTION

Technological revolution has been drastically changed in the past few decades with the invention of technologies like machine learning and Artificial Intelligence. Both the technologies have given rise to the other technological inventions and among them the augmented reality and virtual reality has been the most significant. The *technology* of augmented reality was first invented in the year 1990 and it was developed by the US Air force Armstrong laboratory in the year 1992. *Augmented reality* can be explained as the *technology* that uses the information on a real time basis in the form of text, graphics, and other to get a proper real world experience [1]. Some of the popular examples of augmented reality are Pokémon Go, IKEA and social media filters. Whereas, the *technology* of *virtual reality* can be explained as the type of environment which is basically generated by the computers to make the user feel that they are immersed into their surroundings with the help of the real scenes and objects which are often created [2]. Some of the popular examples of virtual reality are Google cardboard, Samsung gear VR and oculus rift. At the same time the *technology* of virtual reality in the year 1956. Both the technologies had been discovered very early but in the recent decade the technological progress in both the areas has been improved a lot. Today the *technology* of virtual reality has been used exclusively in the gaming industry, fashion industry, manufacturing sector, cyber security, training of new surgeons, team building from remote locations, and training of the athletes.

Both of these technologies have been used to enhance human capabilities and help to reduce distance between two persons. In the social media platforms the *technology* of augmented reality has helped people to customize their picture. In the gaming industry the virtual *technology* has changed the overall gaming experience of the users. The best example is the Pokémon go which was launched in the year 2016 is truly based on Augmented reality technology. Some of the popular virtual reality games are Ironman VR, Red Room, The Forest and Resident Evil 7 and more. These were for the purpose of entertainment both the *technology* have been used but except these it had also been used in the construction and medical sector. Virtual reality provides a full 3D animation where people get the real life experience. In the construction it has been treated as a risky job and high cost therefore the *technology* of VR can be used [3]. With the inclusion of the VR the cost of the construction company can be minimized and a 3D prototype can be presented to the client. The client has the leverage to explore the interior of the buildings that would be constructed. If the client likes the presentation then only the company can start work on the project and in this way it can be said that it is cost efficient. These are some of the popular uses of both the *technology* Virtual reality and augmented reality, more about their discrepancies will be provided in the later section.

MATERIALS AND METHODS

Research design

The research design is the type of design that provides research methods that sharpen the research for the subject that matters and set up their studies for the success of the research. A research can be done with the help of any of the research designs but here in this the research design that has been used is the qualitative research designing [4]. The research topic is based on a comparative analysis of the virtual as well as the augmented reality and for that the data will be collected both the theories as well the quantitative

data have been provided in the websites. Qualitative research design comprises the similar things that will be used for this research along with the structure of this research is pretty much similar to the qualitative research design hence the research design that has been used here is qualitative.

Research type

In a particular research a research type can be explained as the type of research which basically refers to the different types of methodologies that have been used for preparing a research paper. In other words it can be explained as the types whether a particular study is based on deceased goals, timelines, and purposes [5]. There are various types of research type but if the research topic is analyzed critically it the best possible research types will be secondary research type and hence the secondary research types have been taken for this research. A secondary research type is the type of research that has already been gathered, organized and published in sources available.

Data collection techniques and analysis

The data collection can be explained as the process by which the data will be collected for the research. There are two different types of data collection techniques and they are primary data collection and secondary data collection method. In this research, the data collection method that has been used is the secondary data collection. Secondary data collection method is the type of data collection method which basically includes the theoretical data of the journals, books and websites. Along with all these the data collection method also includes the quantitative data in the form of graphs and pie charts that has been collected well before. The data that have been collected have been further analyzed with the help of data analysis method and the data analysis method that has been used here is the thematic analysis [6]. Thematic data analysis is the type of data analysis method where the secondary data is analyzed with the help of themes which are prepared on the given research topic.

Inclusion and exclusion criteria

Table 1: Inclusion and exclusion criteria

| Inclusion criterion	Exclusion criteria
- Collected data that has been used here is on the basis of the secondary data analysis. - The authenticity of the articles have been taken care of along with those journals have been taken which are of recent times - The research type that has been used here is the secondary data research.	- The data collection method primary has been excluded from this research. - Self-prepared survey and interview by which the quantitative data is generated has been excluded. - Primary data have not been included in this research paper.

RESULTS

Augmented reality and virtual reality: their importance and uses in solving complex problems

Augmented reality, it is a type of ***technology*** that has completely changed gaming ***technology*** as well as movie animation. It is basically an interactive experience that enhances the real world with the help of perpetual information that is generated by the computer. It can be experienced with the AR glasses, software and applications that are designed for augmented reality. Augmented reality comprises three items namely a combination of digital and physical world, interactions are made in real time and precise 3D identification of virtual and real objects [7]. Among Augmented reality and virtual reality the key difference is that AR uses the real world setting whereas VR is completely a virtual world experience. The ***technology*** of AR can be used in solving complex problems and other problems and they are like managing the expenditure of the prototyping, customer comeliness, and lack of the product customizability.

Prototype expenses; in the manufacturing sector the most significant thing that is required initially is the prototype right and structure of the product that had been aimed to produce. The best example is, if the manufacturing industry is owned

by any of the car companies they first have to draw a prototype design of the car they will be going to manufacture and before its production each and every aspect of the car needs to be explored. Making and testing on real prototype ace is a highly expensive and time consuming process. Therefore, here the ***technology*** of AR can be used to develop a virtual car and explore each and every aspect of the research. The given data that have been provided below have been giving a clear picture about the cost distribution of the manufacturing process of cars. The highest expenditure goes towards the material and the labour which is 47% and 21% respectively [8]. Whereas, the administration and the research and development cost are 10% and 6% respectively but it is the cost of research and development that is 6% is crucial as it provides a direction to the company. If the research and development is being carried out with fewer expenses and in the most effective future, unnecessary expenses can be minimized. Therefore, it can be said that with the help of augmented reality ***technology*** the complex problem for prototyping of the vehicles can be solved.

Customer complaints; in the sales business the complaints from the customer have never been reduced and for that it has been an exclusive reality. If the AR ***technology*** is used the customer will understand better about the pros and cons of the products also they will have less query regarding this.
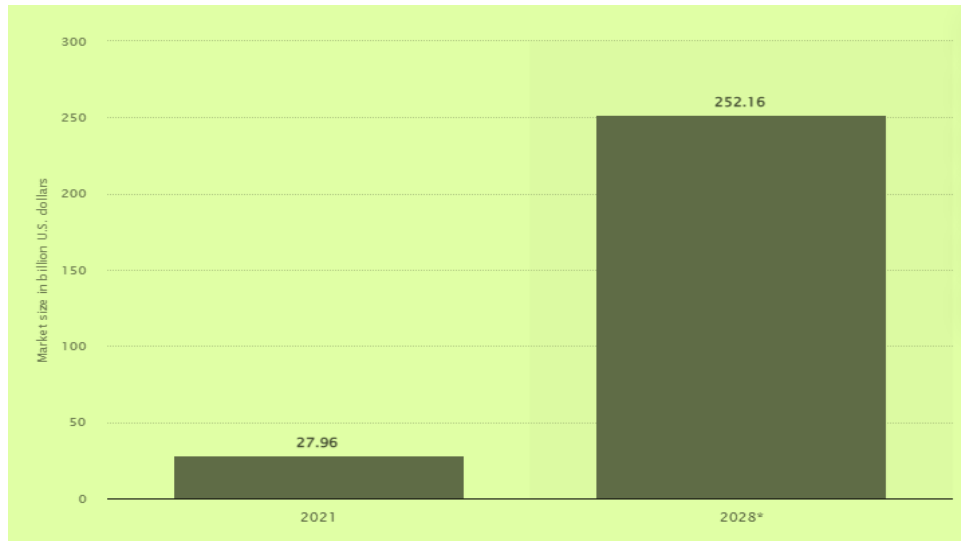
Figure 1: Market size of AR globally

A figure has been provided above which basically deals with the market size of AR and VR globally and in the year the overall market size being $27.96 billion US dollars and it has been estimated that in the year 2028 the overall market size will become $252.16 billion US dollars [9]. The progress has been phenomenal and it can be included in any of the sectors whether it is the industry of the animation or it is manufacturing industry or sales business for the resolving the complaints of the customers.

Virtual Reality is yet another *technology* that comes under machine learning and AI technology. Today the virtual reality *technology* is watching videos and movies with real life experience. It provides a total virtual world where a person can create their own world as it has nothing to do with the real world. Met averse is the best example of virtual reality technology. As of the year 2022 the market size of virtual reality will be $12 billion US dollars and its total market size in terms of gaming is around 1.9 billion US dollars [10]. Virtual reality can be experienced by using the VRheadsets and VR adoption.
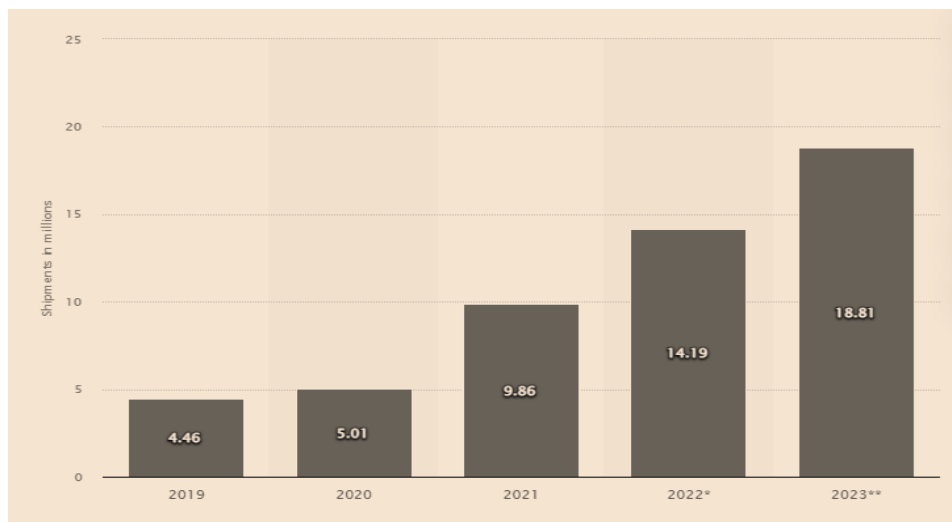
Figure 2: Headset for VR shipments had been given globally

The graph provided above depicts the global shipment of the VR headset and in the year 2019 the total shipments globally was around 4.46 million. In the year 2020 it had risen and it had become 5.01 million which will further increase in the year 2021 [11]. As of the year 2022 the total shipments has been 14.19 million and it had been predicted by many of the experts that it will rise further in future and in the year 2023 it will be around 18.81 million [11]. As the *technology* has been progressing day by day in the future it has been estimated that more and more people are going to explore the *technology* of VR. They want to explore and experience the virtual world in the real world and it can only be experienced by the VR headset of the VR. It can be used for enjoying movies and playing games like Resident evil. Along with this the *technology* of VR is now being used in training of the new employees as well as the surgeons. It has also been used for digital marketing and giving practical knowledge in a virtual world.

Difference between Augmented reality and the Virtual reality

Instead of having so many similarities both virtual reality and augmented reality are different in many ways and those ways are explained. The system through which augmented reality is performed generally provides a real world scene whereas the system that is used for experiencing the virtual reality provides an immersive virtual world. If a person is exploring the *technology* of augmented reality the person will have some connection with the real world but when it comes to the virtual reality a person gets total control of the system which they are using [12]. In short it can be said that with the virtual reality *technology* person loses its full control from the real world and they become dependent on the visuals and surroundings that are provided and designed in the virtual world. The internet connection for operation of both the *technology* is required also with high speed internet but augmented reality *technology* requires more data as compared to the virtual reality. The internet speed that is required for augmented reality is around 100 mbps whereas the internet speed that is required for virtual reality is around 50 mbps.

Augmented reality *technology* does not use the head gear but virtual reality does require the head gear and the market for headgear keeps on increasing day by day. Famous multinational social media giant Facebook had explored virtual reality *technology* from the year 2014 and the innovation is still going on. With the help of this virtual reality *technology* people will be able to meet virtually in a 3d animated world which will be created by the user with their own imagination [13]. It is a good *technology* but critics say that with this *technology* people will be less connected with the real world as the *technology* has nothing to do with the real world. Further, augmented reality *technology* is 25% virtual and around 75% real whereas the *technology* of virtual reality is 75 % virtual and only 25% real. With the

help of this *technology* one can enhance both the real as well as the virtual world but at the same time with the help of this *technology* only the fictional world can be enhanced that are basically artificially created. For getting a super gaming experience the best *technology* will be virtual reality rather than augmented reality.

Now using both the *technology* has its own pros and cons and those advantages and disadvantages of both the *technology* will be discussed here in this part. For boosting the knowledge of the user the *technology* of augmented reality is remarkable. With the help of the AR *technology* one can foster innovation and improve continuously along with maintaining the preciseness. Exploring AR *technology* is quite expensive and it can be treated as the disadvantages of augmented reality. Other disadvantages are like it has a privacy concern, it causes mental health issues like problems with the eyes and many more [14]. These are some of the disadvantages as well as the advantages of using augmented reality technology. Virtual reality on the other hand provides an immersive learning experience to the user and it also increases the working capabilities of an individual. In the field of education, virtual reality can act as a way to teach the students in an easier as well as comfortable way. With the use of VR glasses or the head set one can easily use the *technology* to make their surroundings completely different by creating their own world. Some of the disadvantages of virtual reality like the *technology* have become more and more common and people will become more used to the virtual and will ignore the real life problems. Also any things that are performed have nothing to do with the real world issues as well as the problems.

Future of augmented reality and virtual reality

Augmented reality and virtual reality *technology* has been used in various sectors as well in various industries and for that reason it can be said that the market of AR and VR in the future is bright.
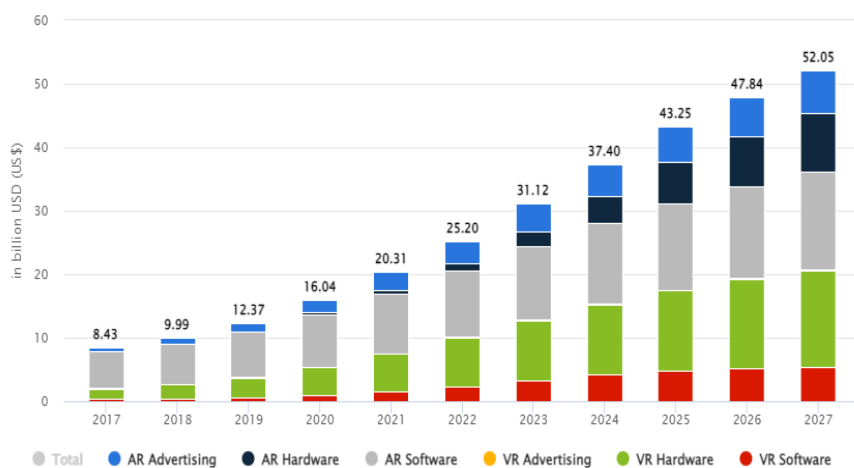

Figure 3: Revenue generated by segment from the year 2017 to the year 2027

The graph that has been provided above deals with the current and future projection of how the market will be

generating revenue using the VR and AR technology. According to the projection it can be said that by the year

2017 the total revenue that will be generated by both the AR and VR *technology* will be $ 52 billion US dollars. In the year 2017 it was around $8.43 billion US dollars and in the next the figure had changed drastically and it had become $9.99 billion US dollars [15]. According to the graph the prediction for the generation of the revenue for the year 2023 is 31.12 billion US dollars. It can also be said that the *technology* of AR software, hardware, and its advertising has become a significant part as compared to virtual technology.

In future the *technology* like the AR headsets and glasses will be explored along with the application that will be launched in the iPhone and Android devices. Studying these figures carefully it can be figured out from the market and future perspective both the *technology* is good and it will develop in future. Between virtual reality and augmented reality in future both of them had the potential but according to the projection that had been provided the augmented reality seems to rise more than the virtual reality.
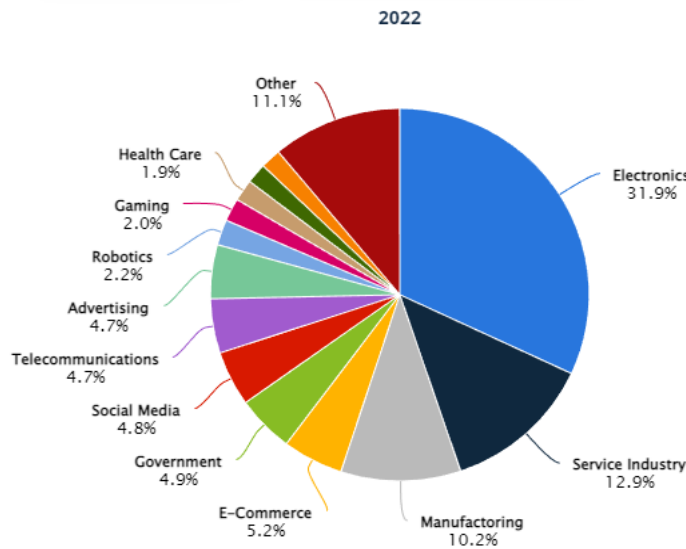
Figure 4: Share of the AR and VR *technology* in the various sectors in future

In figure 4 there has been a pie chart on the basis of percentage share of various sectors that will be using the VR and AR *technology* in future. According to the future the sector which is going to use the *technology* of VR and AR in future is electronics which is around 31.9% [15]. After the electronic sector the service industry is going to use this *technology* then the manufacturing sector. The share of manufacturing is also quite significant which is around 10.2% [15]. This is going to rise further in future as in future the sector that will be benefited most importantly will be the manufacturing sector. These are some of the future projections about the VR and AR *technology* and it can be said that in future many of the sectors as well as the industries are going to use the *technology* and it will become an integral part of their process and by the year 2027 the market size will reach a significant height.

DISCUSSION

Technological development is going across the world on a daily basis and among all the technological development the augmented reality and virtual reality are the result of this innovation and technological development. The themes that have been prepared are aimed to answer the research topic which is about the comparison betwneen augmented reality and virtual reality. In the first theme AR and VR uses in solving the complex problems have been discussed. Today the augmented has been used in the prototype making of the

vehicles, training of the surgeons, addressing the customer complaints and solving the problems of the customers has been described. In term prototype development the *technology* of AR can save much of the time and money of the company and it will enable us to explore more about the product. Hence, the complex problem of car manufacturing can be solved with the help of AR technology. In the sales business the complaints will seem to come hence for addressing their concerns it has been significant the AR and VR can be helpful. This can be done with the virtual animation which makes each and every customer understand the proper use of the product and that is offered by the company. Using the *technology* of VR as well as AR both of them uses virtual *technology* but augmented reality is less than the Virtual reality technology. It is a comparison and other comparisons have been discussed in the next section which is about their comparative analysis. AR is much more expensive as compared to VR *technology* and therefore in future more innovation is required in AR *technology* to somehow decrease its expenses.

Virtual reality on the other hand is quite different as it creates a totally virtual world for the users and provides a marvellous experience of the world that had been created artificially. Due to this the *technology* will create a barrier between real life and the virtual artificial world. The VR *technology* can be used by many of the manufacturing industries and teaching of the products without actually

making it. Augmented reality provides a virtual world but along with the real life connection and experiences. The final theme had discussed the future perspective of both the AR and VR and it had been discussed with the help of graphs about the future share of the sector that will be using the *technology* and the future revenue estimation with the help of these technologies.

CONCLUSION

Augmented reality has become an integral part of the modern gaming industry which uses high quality graphics to give a phenomenal experience for the customer. These days the *technology* has been used in the making of building projects virtually before actual construction as it is cost efficient and time efficient. Big construction projects like the bridges, high sky capers need a very careful analysis as the other costs are very high in terms and if the projects the company may go into debt. Therefore, it can be said that the *technology* of Virtual reality and augmented reality can act as a useful tool to plan the project before actual construction. In the introduction the importance of both the technologies has been explained with the help of examples like in the education sector, health sector, manufacturing sector as well as the construction businesses. At the same time there have been some of the cons of this technology, especially the *technology* of virtual reality as it has nothing to do with the real world. Each and every activity that is performed in the virtual world will be sorted to that world only and it will never make an impact on the real world problems.

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