International Journal of Engineering Sciences & Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

IJESRT

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

AUGMENTED REALITY: A REVIEW

Vishnu Datta Kaushik, Kamal Kishor
Scientist
Technical Officer
Defence Institute of Psychological Research (DIPR)

DOI: 10.5281/zenodo.14801953

ABSTRACT

Augmented Reality (AR) is an emerging form of experience in which the Real World (RW) is enhanced by computer-generated content tied to specific locations and/or activities. Augmented reality is a technology that combines virtual reality with reality. Over the last several years, the fast development and research of augmented reality has caught people's high attention and it is available in their gadgets like mobile, i-pads etc. The paper first expands the research and current progress of augmented reality in the current scenario.

Over the last several years, AR applications have become portable and widely available on mobile de-vices. AR is becoming visible in our audio-visual media (e.g., news, entertainment, sports) and is beginning to enter other aspects of our lives (e.g., e-commerce, travel, and marketing) intangible and exciting ways. Facilitating ubiquitous learning, AR will give learners instant access to location-specific information compiled and provided by numerous sources (2009). Both the 2010 and 2011 Horizon Reports predict that AR will soon see widespread use on US college campuses [5]. In prepa¬ration, this paper offers an overview of AR, examines recent AR developments, explores the impact of AR on society, and evaluates the implications of AR for learning and education.

1. INTRODUCTION

Augmented Reality (AR) is a variation of Virtual Environments (VE), or Virtual Reality as it is more commonly called. VE technologies completely immerse a user inside a synthetic environment [17]. While immersed, the user cannot see the real world around him. In contrast, AR works through a device that films the real world and inverts live virtual objects, animations, texts, data or sounds that the user views from the screen of a computer, a smartphone, a tablet, a pair of glasses, a headset, or any other on-screen display system [2]. AR supplements reality, rather than completely replacing it [1].

Augmented reality (AR) is the technology to create a "next generation, reality-based interface" and is moving from laboratories around the world into various industries and consumer markets. AR supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world. AR was recognized as an emerging technology of 2007 [23].

Using the camera on your device, augmented reality uses computer vision-based recognition algorithms to enhance music, video, graphics, and other sensor-based inputs on actual items in the real world. It is an effective approach to represent real-world data and present it in an interactive style such that virtual components are integrated into the real-world environment.

Information is superimposed in your field by augmented reality displays, which can transport you to a new setting where real world & virtual world are closely intertwined. It extends beyond simple desktop and mobile devices. As previously indicated, a prime example is Google Glass, a wearable computer with an optical head-mounted display, HoloLens allows medical students to manipulate and visualize the human body with unprecedented

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

accuracy [4] and smart phone apps that utilize GPS data, or which display virtual images tied to real world locations [5] are the few examples of AR.

2. BACKGROUND AND HISTORY OF AR

The history of augmented reality may start since 1901. Very early in the history, in 1901, L Frank Baum, author of the Wizard of Oz, prefigured by 112 years the invention of Google Glasses and the possibilities of Augmented Reality.

In 1957–62 Morton Heilig, a cinematographer, created and patented a simulator called Sensorama with visuals, sound, vibration, and smell. In 2006, Reitmayr developed a hybrid model tracking system for outdoor AR.
Doctors used AR to show medical data inside the patient body [Navab et al., 2007, Kutter et al., 2008] [2].

In the year of 2008 Wikitude AR Travel Guide was launched with the G1 Android phone.
In 2009, Augmented Reality toolkit was ported to Adobe Flash (FLAR toolkit) by the Saqoosha, to bring augmented reality to the web browser.

Google launched Google Glass to mixed reviews in 2012. Oculus Kickstarter project also raised $2.5 million to produce the Rift in 2012.

In 2013, Google announced an open beta test of its 'Google Glass' augmented reality glasses. The glasses reach the internet through Wi-Fi or Bluetooth, which connects to the wireless service on a user's cellphone. The glasses respond when a user speaks, touches the frame, or moves the head. Next year, Google released Google Cardboard, a product of two French Google engineers in their provisioned "Innovation time-off ".

In 2014, only Facebook purchased Oculus. At the same time Samsung launched Gear VR glasses which marry VR glasses with a Samsung smartphone and associated apps.

Microsoft also launched its window mixed reality platform for windows 10 and the HoloLens device in 2015.

Unity game engine added support for VR authoring in 2016. Simultaneously, Pokemon Go captured popular imagination for AR in the year 2016 and in 2016-2017 VR impacted the public consciousness. Microsoft HoloLens, a more advanced iteration of Google Glass, Oculus Rift and HTC Vive proved pricey but it was very popular. Next year, Google released AR Core and Apple released ARKit, their proprietary VR development frameworks. In the year of 2018, the rise of standalone (untethered) VR equipment was introduced, as a result a large increase in AR and VR titles the industries was observed. In 2019, Oculus launches the self-contained, untethered Quest with six degrees of freedom. Apple also rumored to be planning camera-enabled AR/VR headset and AR glasses to follow in 2022. Microft Hololens, Apple vision pro mixed reality headset (2024) and as well as Meta quest 3 have put AR&VR. According to Skyquest, the global market value of AR & VR stood at $30 billion in 2022, but by 2031 this is expected to rise to more than $520 billion.

3. TECHNOLOGICAL USES OF AR

The core technical circle of AR, which includes 3D registration, intelligent interaction, and intelligent Display technology, is crucial to the advancement of AR. According to pertinent research, humans learn more than 65% of their knowledge through vision, which has evolved into the mainly natural-way for the people to engage with the physical world.

Augmented reality becomes a possibility with the advent technology of intelligent display technology, which is then elevated to a novel height by the numerous display devices created based on intelligent display technology. The three primary categories of display devices that play a significant role in the domain of augmented reality technology nowadays are as follows. First came the helmet display (HMD) was in the year 1968. Professor Ivan Sutherland's optical perspective helmet display makes it feasible to superimpose straightforward computer-generated visuals on actual scenes in real time. The main components of the helmet-mounted display in the subsequent evolution are the optical perspective and video perspective helmet-mounted displays.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Second, with the popularity of smartphones growing, the handheld device display relies on augmented reality technology, is very portable and small, and uses augmented reality to present information through video. Third, information about the real-world image captured by the camera is compared to a three-dimensional virtual model made by the computer, which is then displayed via the desktop display. Other display devices, including PC desktop displays, doing the same thing as usual. 3D registration technology is one of the most important components of the augmented reality system, 3D registration technology enables precise overlay of virtual images in the actual world.

Two steps make up the main 3D registration technology flow. First, ascertain how the model, the virtual picture, and the direction and position data of the camera or display device are related. Second, the rendered virtual image and model are precisely projected into the actual world, allowing them to blend with the actual environment.

There are several methods for 3D registration, including the hardware tracker-based registration technology, the computer vision-based registration technology, the wireless network-based registration technology, and the mixed registration technology, of which the first two i.e. tracker-based registration technology, the computer vision-based registration technology are the most common. It establishes the reference point to realize the determination of the direction and location of the real sight (scene) by the camera or the display for the computer vision-based three-dimensional registration technology. Intelligent display technology, 3D registration technology, ergonomics, cognitive psychology, and other fields are all strongly related to intelligent interactive technology. Intelligent interactions come in many forms in AR systems, including hardware device interactions, location interactions, tag-based interactions, and interactions based on other types of information. With the advancement of intelligent interaction technologies, augmented reality now allows for the interaction of virtual items and people in real-world settings in addition to the overlaying of virtual data onto real-world scenes. People engage with the virtual object in the sight (scene) by giving it particular instructions, and virtual object responds by providing feedback, allowing the audience of the augmented reality application to have a better experience.

1. ADVANTAGES OF AR

Improving the quality of production processes:

By ensuring superior compliance with corporate standards, safely speeding productivity, and decreasing errors, augmented reality systems enable the improvement of production process quality. When it comes to maintaining the finest possible product quality, checks and inspections, are two crucial processes, where this technology shines. For instance, hybrid smart-phone/headset applications enable the use of specialists linked remotely to support personnel doing checks and inspections in challenging and complex environments. Remote collaboration makes inspections faster, easier, and more accurate while also giving the opportunity to archive any data acquired for later use in training and analysis.

Reducing production and service costs in the field

Cost savings across a range of industries and application scenarios is one of the numerous advantages of AR technologies. This is made possible by direct cost-optimization intervention, whether because of higher productivity or better process quality. Costs associated with design, production, and maintenance can be decreased because to augmented reality.

For instance, employing augmented reality to maintain machinery enables issues to be resolved more quickly and effectively, cutting down on the amount of time needed to look for and identify defects as well as the time needed for repairs. Using AR technologies, it is also possible to maximize industrial productivity while minimizing production interruptions. The technician can troubleshoot more effectively and quickly thanks to augmented reality. If a specialized technician's intervention is required, it can be executed remotely and in real-time, which has the added benefit of saving on trip expenses.

Refining training and skills sharing

The enhancement that augmented reality may offer for training is one of its advantages and a crucial function for any business. By enabling personnel to receive detailed instructions on the job necessary remotely, as well as training that can be completed either individually or in groups, AR solutions can be used to increase the workforce's skills.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

In reality, remote expert coaching can help the entire field team and make it simple for workers to understand the complicated ideas via visual examples. A flexible e and scalable method for improving staff skills at any experience level is one of the applications of augmented reality in training.

Improve industrial safety standards

In several areas related to the industrial sector, augmented reality makes it feasible to increase safety. Operators can safeguard themselves from handling dangers in the first place by engaging with the production environment more safely. Due to the enhanced ergonomics of staff using AR solutions, it is also possible to profit physically and organizationally.

For instance, instructions given by remote specialists can prevent operators from performing hazardous operations, result in fewer errors, and lower the likelihood of accidents and injury rates.

Optimizing the product assembly process

Another benefit of augmented reality technologies is the optimization of product assembly. This type of work requires operators to be particularly meticulous, which can be challenging when hundreds of parts need to be assembled quickly and correctly following instructions in the technical document.

The use of AR allows this process to be made more interactive and simpler, making assembly information clear and supplied to the operator through an AR headset. This solution allows the employee to focus on assembling the product, saving time, and doing away with the need for them to concentrate on reading the instructions in a long and complex file.

APPLICATIONS OF AR:

Numerous industries, including tourism, archaeology, the arts, business, industrial manufacture and restoration, education, emergency management, entertainment and leisure, and healthcare have all used augmented reality technology.

By employing screen software, mobile phone cameras, and other technical tools to merge the real scenes, augmented reality technology can help repair historical places in the tourism industry. Additional information can be acquired in addition to scenes. Archaeologists frequently employ augmented reality (AR) technology to zoom in on artefacts in actual landscapes so that they can more precisely locate their position.

Customers may see every aspect of a product without ever opening the packaging thanks to AR technology. You can acquire additional product picture information by scanning the product image in addition to seeing some information about custom alternatives. Utilizing AR technology, workers may be visually guided, reminded of the time, and draw in 3D to produce things more quickly. As an illustration, consider how augmented reality (AR) technology might help designers of cars make better structural improvements and comparisons using visual displays. People can now experience and interpret reality from more perspectives thanks to the use of augmented reality (AR) technology in the world of art. This frequent blending of reality and reality has evolved into an art form. The application of augmented reality technology in public security has been beneficial. For instance, the search and rescue augmented reality system has an aerial camera that can combine the real scene with the name of the forest road and its location as determined by geography, making it easier to find the lost person. The surgeon can more precisely pinpoint the patient's surgical site by using augmented reality (AR) technology. The fetus may be seen more clearly in real time thanks to AR technology. By allowing the patient to wear the necessary equipment, augmented reality technology can also serve as a reminder for the patient to take their medication as prescribed.

2. FUTURE SCOPE:

Researchers have given augmented reality technologies a lot of attention lately. A significant amount of progress has been made in augmented reality thanks to computer vision and artificial intelligence. The effectiveness of the display equipment, tracking registration accuracy, and human-computer interface has all significantly increased. However, there are still a lot of issues with augmented reality technology that need to be resolved. The existing tracking registration technique can only employ a limited quantity of scene data, such as feature point information, which results in an insufficient knowledge of the system's relationship to the environment.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

The size and cost of augmented reality glasses that can give users a strong impression of submersion cannot keep up with public demand in terms of display technology. The more natural and multi-user augmented reality interaction technology needs additional research in terms of interaction mode. The use of augmented reality technology, particularly in the context of mobile intelligent terminals, will proliferate over the coming years.

Mobile devices are very common, despite being less waterproof than helmet-mounted displays. The simultaneous introduction of the ARKit and AR core developer platforms technically makes it possible to combine augmented reality with smart mobile devices. Smart wearable technology that can fully exploit the benefits of augmented reality technology will eventually enable the creation of a more humane integration environment. The system allows for more natural human-computer interaction from users. It seems inevitable that as science and technology advance, augmented reality technologies will significantly alter human life in the future.

REFERENCES:

1. Van Krevelen, D. W. F., & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. *International journal of virtual reality*, *9*(2), 1-20.
2. Billinghurst, M., Clark, A., & Lee, G. (2015). A survey of augmented reality. *Foundations and Trends® in Human–Computer Interaction*, *8*(2-3), 73-272.
3. Dünser, A., Grasset, R., & Billinghurst, M. (2008). *A survey of evaluation techniques used in augmented reality studies* (pp. 5-1). Christchurch, New Zealand: Human Interface Technology Laboratory New Zealand.
4. Yuen, S. C. Y., Yaoyuneyong, G., & Johnson, E. (2011). Augmented reality: An overview and five directions for AR in education. *Journal of Educational Technology Development and Exchange (JETDE)*, *4*(1), 11.
5. Carmigniani, J. (2011). Augmented Reality: An Overview. *Handbook of augmented reality/Springer*.
6. Bell, B., Feiner, S., &Höllerer, T. (2001, November). View management for virtual and augmented reality. In *Proceedings of the 14th annual ACM symposium on User interface software and technology* (pp. 101-110).
7. Dünser, A., & Billinghurst, M. (2011). Evaluating augmented reality systems. *Handbook of augmented reality*, 289-307.
8. Feiner, S. K. (2002). Augmented reality: A new way of seeing. *Scientific American*, *286*(4), 48-55.
9. Vallino, J. R. (1998). *Interactive augmented reality*. University of Rochester. book
10. Silva, R., Oliveira, J. C., & Giraldi, G. A. (2003). Introduction to augmented reality. *National laboratory for scientific computation*, *11*(1-11).
11. Fite-Georgel, P. (2011, October). Is there a reality in industrial augmented reality?. In *2011 10th ieee international symposium on mixed and augmented reality* (pp. 201-210). IEEE.
12. Bimber, O., &Raskar, R. (2006). Modern approaches to augmented reality. In *Acmsiggraph 2006 courses* (pp. 1-es).
13. Manuri, F., & Sanna, A. (2016). A survey on applications of augmented reality. *ACSIJ Advances in Computer Science: an International Journal*, *5*(1), 18-27.
14. Mekni, M., & Lemieux, A. (2014). Augmented reality: Applications, challenges and future trends. *Applied computational science*, *20*, 205-214.
15. Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019, June). An overview of augmented reality technology. In *Journal of Physics: Conference Series* (Vol. 1237, No. 2, p. 022082). IOP Publishing.
16. Azuma, R., Baillot, Y., Behringer, R., Feiner, S., Julier, S., & MacIntyre, B. (2001). Recent advances in augmented reality. *IEEE computer graphics and applications*, *21*(6), 34-47.
17. Azuma, R. T. (1997). A Survey of Augmented Reality. *Presence: Teleoperators and Virtual Environments/MIT press*.