# AMITY SCHOOL OF ENGINEERING AND TECHNOLOGY

**WEEKLY PROGRESS REPORT 2**

**Enrollment No.** – A2305222498

**Program** – B.Tech C.S.E

**Batch** – 2022-2026

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**Faculty Guide’s Name** –Dr NEHA TYAGI

# Project Title:

Analysis of Augmented and Virtual Reality

**Target set for the week:**

History of AR and VR

Milestone and significant advantages of AR Milestone and significant advantages of VR

User experience and design challenges of AR and VR

**Progress/Achievements of the week:**

Successfully Researched and made report on the history of AR and VR. Also studied their milestones, advantages and user experiences.

**Future work plans**:

Key contributors in the field of AR and VR Hardware and software for AR and VR

Regards

**Atia Naim**

**3-CSE 8X**

### WPR-2

**History Of Augmented Reality (AR) and Virtual Reality (VR)**

Augmented Reality (AR) and Virtual Reality (VR) have a rich history that spans several decades. In recent years, both AR and VR have continued to evolve and find applications in numerous fields, such as gaming, entertainment, training, healthcare, and architecture. The advancement of technology and the growing interest in immersive experiences suggest a promising future for AR and VR technologies.

*Virtual Reality (VR)*

**1960s:**

* Ivan Sutherland, a computer scientist, develops the "Sword of Damocles," considered one of the earliest VR head-mounted display (HMD) systems. It used a head-mounted display and a suspended arm mechanism to track head movements.

**1970s:**

* Myron Krueger develops "Videoplace," an interactive environment that allowed users to interact with projected computer graphics using their bodies.

**1980s:**

* Jaron Lanier, a computer scientist and artist, coins the term "Virtual Reality" and founds VPL Research, a company dedicated to developing and selling VR-related products.
* VPL Research introduces devices like the DataGlove, which tracks hand movements, and the EyePhone, a head-mounted display with integrated stereo speakers.
* NASA starts using VR in their training programs, including the VIEW system for training astronauts in simulated environments.

### 1990s:

* Sega releases the Sega VR headset for arcade gaming, which provides a stereoscopic 3D experience.
* The Virtuality Group introduces a series of VR arcade machines, such as the "Virtuality 1000CS," enabling multiplayer VR gaming experiences.
* Nintendo releases the Virtual Boy console, a VR headset that displays red monochrome graphics. Despite its limited success, it paves the way for future developments in the gaming industry.
* VR research and development continue in various academic and industrial settings, but interest and funding decline towards the late 1990s.

**2000s:**

* The gaming industry continues to explore VR concepts, but technological limitations, high costs, and limited market demand prevent widespread adoption.
* Various universities and research institutions work on advancing VR technology, focusing on areas such as immersive displays, tracking systems, and haptic feedback.

**2010s:**

* The Oculus Rift, a high-quality VR headset, is introduced via a Kickstarter campaign, capturing significant attention and reinvigorating interest in VR.
* The Oculus Rift's success leads to a resurgence of VR development, with other companies, such as HTC (Vive) and Sony (PlayStation VR), entering the market with their own headsets.
* VR gains traction beyond gaming, finding applications in healthcare, education, architecture, and training simulations.
* Mobile VR becomes accessible with the introduction of smartphone-based VR headsets like Google Cardboard and Samsung Gear VR.
* Mixed Reality (MR) headsets, such as Microsoft's HoloLens, blend virtual elements with the real world, further expanding the possibilities of immersive experiences.

**2020s:**

* VR technology continues to evolve with advancements in display resolutions, field of view, and tracking systems.
* Companies and developers create a wide range of VR experiences, including games, virtual tours, social interactions, and training programs.
* VR finds applications in therapeutic treatments, architectural visualization, remote collaboration, and more.
* Standalone VR headsets gain popularity, eliminating the need for external devices or a powerful PC, making VR more accessible to a broader audience.

The history of VR has seen significant advancements and periods of both enthusiasm and stagnation. However, with the ongoing development of technology and the increasing interest in immersive experiences, VR is poised to continue evolving and finding new applications in various industries.

## Augmented Reality (AR)

**1960s:**

* Ivan Sutherland, a computer scientist, develops the "Sword of Damocles," an early head-mounted display (HMD) system that had both VR and AR elements. It superimposed simple wireframe graphics onto the user's view.

**1970s:**

* Myron Krueger creates "Videoplace," an interactive system that allows users to interact with computer-generated graphics projected onto physical space. Although not strictly AR, it laid the groundwork for interactive digital overlays on the real world.

### 1980s:

* Steve Mann develops the "WearComp," a wearable computing system that used a camera to capture the user's view and overlay digital information on top of it, essentially creating an early form of AR. o Thomas Caudell, a researcher at Boeing, coins the term "Augmented Reality" to describe a digital display system that assists in aircraft assembly.

**1990s:**

* Louis Rosenberg founds the Virtual Fixtures company, which explores AR concepts for industrial and military applications. They develop AR systems that enhance human performance in various tasks.
* Hirokazu Kato develops ARToolKit, an open-source software library that enables the tracking of markers and the overlay of digital information onto live camera feeds.

### 2000s:

* AR applications begin to emerge in the entertainment industry. ARQuake, a project by Bruce Thomas, Mark Billinghurst, and others, allows users to play a real-world version of the popular game Quake, overlaying virtual enemies onto the user's surroundings.
* In 2009, Layar releases the first AR mobile app, which allows users to view digital information overlaid on their smartphone's camera view. This marks the beginning of AR on mobile devices.

**2010s:**

* Google introduces Google Glass, a wearable AR device that resembles a pair of glasses. It displays digital information in the user's field of view, allowing for handsfree interaction with the digital world.
* Microsoft develops the HoloLens, a mixed reality headset that combines AR and VR elements. It enables users to interact with holographic digital content in the real world.
* Pokémon Go, a mobile AR game, becomes a global phenomenon, introducing AR to a wide audience and showcasing its potential for gaming and interactive experiences.
* AR finds applications in various industries, including architecture, healthcare, education, and marketing. Companies like IKEA use AR to allow customers to visualize furniture in their homes, while surgeons use AR to enhance surgical procedures.

**2020s:**

* AR technology continues to advance, with improvements in hardware, software, and computer vision algorithms. Smartphones and tablets become common platforms for AR experiences.
* Apple introduces ARKit, a framework for developing AR apps on iOS devices, which drives further adoption and innovation in the AR space.
* AR glasses and headsets, like the Microsoft HoloLens 2 and the Magic Leap One, offer more immersive and hands-free AR experiences.
* AR becomes increasingly integrated into everyday life, with applications ranging from navigation and shopping to social media filters and remote collaboration.

The history of AR showcases its evolution from early experimental systems to mainstream applications. As technology continues to progress, AR is expected to become even more prevalent, offering new ways to interact with digital information and enhancing our perception of the real world.

# User Experience and Design Challenges for AR

Augmented Reality has emerged as a transformative technology with the potential to revolutionize various industries and enhance user experiences. However, implementing effective AR experiences presents several challenges that need to be addressed to ensure seamless user interactions and optimal design.

### User Experience Challenges:

* Spatial Understanding: AR requires users to perceive and interact with virtual entities overlaid in the real world. One of the primary challenges is achieving accurate spatial understanding, it includes depth perception, object placement, and occlusion. Incomplete or inaccurate spatial mapping can result in confounded experiences and difficulty interacting with virtual objects.
* User Interface Design: Designing intuitive and user-friendly interfaces for AR applications is indispensable. Striking a balance between displaying relevant information and avoiding visual clutter poses a challenge. Determining optimal placement, size, and format of AR elements while considering user context and preferences is essential to provide smooth and consistent experiences.
* Interaction and Input: AR offers unique interaction possibilities, such as gestures, voice commands, and haptic feedback. However, designing intuitive and efficient input methods without overwhelming users can be challenging. Balancing simplicity and complexity while providing clear instructions for interaction is vital for an optimal user experience.
* Performance and Latency: AR experiences heavily rely on real-time tracking, rendering, and processing of virtual content. Poor performance and delay issues can negatively impact the user experience by causing lag, jitter, or inaccurate object placement. Maintaining smooth and responsive interactions is essential for a compelling AR experience.

### Design Challenges:

* Contextual Relevance: Designing AR applications that seamlessly integrate with the user's environment and context is vital. Ensuring that virtual objects are contextually relevant, meaningful, and aligned and anchored with the user's goals is a challenge. Designers must consider factors such as the user's location, task, and preferences to provide valuable AR experiences.
* Visual Realism and Aesthetics: Achieving realistic and visually appealing virtual objects in AR can be challenging. Maintaining consistency in lighting, shading, and object integration with the real world requires advanced rendering techniques. Striking a balance between realism and visual aesthetics while considering performance limitations is crucial.
* Privacy and Ethical Considerations: AR applications often collect user data, including location and visual information. Protecting user privacy, ensuring data security, and addressing ethical concerns related to data usage and potential misuse present significant design challenges. Striking the right balance between personalized experiences and user privacy is essential.
* Social Acceptance and Norms: AR can introduce new social dynamics and challenges. Balancing individual user experiences with social acceptance and norms can be complex. Avoiding obtrusive or disruptive AR experiences in public spaces and considering cultural, social, and ethical implications are crucial for widespread adoption.

Augmented Reality holds immense potential to transform user experiences across various domains. However, addressing the user experience and design challenges associated with AR technology is paramount for its successful implementation. By focusing on spatial understanding, user interface design, interaction, performance, contextual relevance, visual realism, privacy, ethics, and social acceptance, designers can create immersive, intuitive, and meaningful AR experiences that delight users and drive widespread adoption.

# User Experience and Design Challenges for VR

Virtual Reality (VR) has gained significant attention as an immersive technology that transports users into virtual worlds. While VR offers exciting possibilities, it also presents unique user experience (UX) and design challenges. This report aims to explore the key UX and design challenges associated with VR technology.

### User Experience Challenges:

* Motion Sickness: VR experiences can induce motion sickness or discomfort due to a mismatch between the user's visual perception and the physical sensations they experience. Minimizing motion sickness through optimized movement, field of view, and frame rates is crucial for a comfortable and enjoyable user experience.
* Presence and Immersion: Achieving a sense of presence and immersion in VR is essential for creating compelling experiences. Challenges include creating realistic virtual environments, accurate tracking of head and body movements, and providing convincing haptic feedback to enhance the feeling of being present in the virtual world.
* User Interface Design: Designing intuitive and effective user interfaces in VR presents unique challenges. Navigating menus and interacting with virtual objects require careful consideration of spatial and gestural interactions. Striking a balance between providing necessary information and avoiding visual clutter is crucial for an immersive and user-friendly interface.
* Interaction and Input: VR offers various input methods, including handheld controllers, motion tracking, voice commands, and even eye tracking. Designing intuitive and natural interaction methods that align with user expectations is essential for an optimal UX. Ensuring that interactions are responsive and accurate is crucial for maintaining user engagement.

### Design Challenges:

* Comfort and Ergonomics: VR hardware design must prioritize user comfort and ergonomics to ensure extended periods of use without physical discomfort or fatigue. Designing lightweight and adjustable headsets, ergonomic controllers, and optimizing weight distribution are critical factors in creating a comfortable VR experience.
* Visual Realism and Performance: VR demands high-quality graphics and smooth performance to maintain a sense of realism and prevent distractions. Striking a balance between visual fidelity, rendering performance, and minimizing latency is crucial. Optimizing graphical assets and leveraging advanced rendering techniques are key considerations for creating immersive and visually appealing VR experiences.
* Content Creation and Adaptation: Creating compelling and engaging VR content presents unique challenges. Adapting traditional forms of media, such as films and games, to the VR medium requires reimagining storytelling techniques, camera perspectives, and user interactions. Designers need to explore new creative approaches and understand the affordances and limitations of VR as a medium.
* Accessibility and Inclusivity: Ensuring that VR experiences are accessible and inclusive to a wide range of users is vital. Challenges include addressing physical limitations, providing customization options for different abilities, and considering the needs of users with visual, auditory, or cognitive impairments. Designing for a diverse user base help create inclusive VR experiences.

Virtual Reality presents exciting opportunities for immersive and engaging experiences, but it also brings several UX and design challenges. By addressing challenges related to motion sickness, presence and immersion, UI design, interaction and input, comfort and ergonomics, visual realism and performance, content creation and adaptation, and accessibility and inclusivity, designers can create compelling and user-friendly VR experiences. Overcoming these challenges will contribute to the widespread adoption and advancement of VR technology.

### Significant advancements in VR

As we all are already aware, technology around us is far different than the one present a decade or even half a decade ago. The need for more innovation pushes us into developing fresh things on a frequent basis.

The technology of virtual reality has been around since the 1960s and has undergone numerous developments.

### Hardware:

From basic headsets made according simple mechanics we have now shifted to more complicated ones such as the HTC Vivo Pro which offer the consumer an immersive experience with their wider and better displays and better tracking making the whole setup more realistic.

The gear available today allows the user to feel the true essence of the virtual world and creating a sense of oneness with it.

### Size:

The equipment size has halved and many are now standalone (require no connection to the PC)

### Improved Graphics:

Brands like AMD have improved graphics card creating a more realistic experience.

### Availability:

Due to drastic change in technology, the once available on big theatre styled cabinets like the

Sensorama is now available one click away on our smartphones



Sensorama

[https://vr.linde.com/2021/12/27/the-evolution-of-modern-virtual-reality](https://vr.linde.com/2021/12/27/the-evolution-of-modern-virtual-reality/)/

<https://www.vrs.org.uk/virtual-reality/history.html>

### Significant advancements of Augmented reality

Augmented reality has experienced significant advancements in recent years, redefining the way in which we engage with digital realm and thus enhancing our experiences in various fields.

Some of the major advancements in AR are

* Enhanced hardware: Over the years, AR devices have evolved to be more lightweight, compact and powerful. AR devices have also encountered developments in display technology, enabling superior resolution and wider visual scope, resulting in more authentic and captivating AR interactions.

Smart glasses, such as Microsoft HoloLens and Magic Leap One, offer immersive AR experiences.

* Interactive mapping and tracking: AR have witnessed advancements in form of improved computer vision algorithms and advanced sensors, enabling real-time tracking and mapping of the physical surroundings This allows AR systems to accurately connect digital content with precise positions and objects in real-time, producing a seamless and captivating encounter.
* Object detection and engagement: AR has developed to demonstrate superior skill in identifying and understanding objects in real world. Machine learning algorithms and computer vision techniques empower AR systems to recognize objects, including buildings, products, or landmarks, and provide relevant information for an interactive experience.
* Audio:Spatial audio techniques produce an illusion of 3D sound, enabling users to perceive sound sources originating from specific direction adding to the realism of AR environments.
* Training and Education:AR has evolved into a valuable tool in training and education. By superimposing digital content onto real-world scenarios, AR enables interactive and captivating learning experiences. This includes medical simulations, virtual laboratories, historical recreations, and language learning.
* Gesture tracking and voice sensing: AR systems have grown more adept at recognizing and comprehending gestures and voice commands. This empowers users to interact with digital content and control AR applications using natural and intuitive gestures or voice instructions. Hand tracking technology, combined with machine learning algorithms, facilitates precise gesture recognition, enriching the user experience.
* Multi user and multi device experience:AR has developed to support multi-user and multi- device experiences, encouraging collaboration and interaction among multiple users within the same augmented environment
* Advanced visual quality**:** Developments in rendering techniques, graphics processing, and display technologies have brought about enhanced visual realism in AR.