REPORTING

OF

AUGMENTED REALITY

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INTRODUCTION

DEFINITION

Unlike Virtual Reality (VR), which immerses users in a completely simulated environment, AR enhances the real world by supplementing it with digital content. This technology achieves its effects through the use of various display devices, such as headsets, smart glasses, or mobile devices, which render the virtual elements and present them in a way that integrates seamlessly with the user's surroundings.

AR applications rely on advanced computer vision, image recognition, and sensor technologies to track the user's position and orientation in real-time, enabling the proper alignment and interaction between virtual and physical objects. This synchronization allows users to perceive the digital content as if it exists in the real world, enhancing their perception, understanding, and engagement with the environment.

AR has found applications across numerous industries, including gaming, entertainment, education, healthcare, retail, and more. Its potential lies in providing users with context-specific information, visualization of data, immersive storytelling, interactive training experiences, and enhanced decision-making support.

Overall, AR merges the virtual and physical worlds, offering users a blended reality that augments their perception and interaction with their surroundings, unlocking new possibilities for communication, productivity, and entertainment.

BRIEF HISTORY

1. 1968: "Sword of Damocles" Prototype
    - Ivan Sutherland creates the first head-mounted display (HMD) system called the "Sword of Damocles." It uses a large, heavy apparatus suspended from the ceiling to display simple wireframe graphics over the user's field of view.
2. 1990: The term ‘AR’ was born
    - Boeing Computer Service researchers Tom Caudell and David Mizell coins the term "Augmented Reality" to describe a digital overlay on physical objects.

- The two researchers came up with a head-mounted display for aircraft construction workers named 'Augmented Reality'. This display overlaid the position of cables through the eyewear and projected them onto the boards.

3. 1992: Virtual Fixtures
    - Louis Rosenberg develops the Virtual Fixtures system, which enables the projection of virtual objects onto real-world scenes, enhancing the user's perception and interaction with their environment.
4. Late 1990s: ARToolKit and Wearable Computers
    - Hirokazu Kato develops ARToolKit, an open-source software library that enables the detection of markers and tracking of physical objects in real-time.
    - Steve Mann pioneers the concept of wearable computing, combining HMDs and portable computing devices to create a more mobile AR experience.
5. Early 2000s: Mobile AR and Gaming
    - ARQuake, an AR version of the game Quake, is developed by Ron Azuma, demonstrating the potential of AR for gaming.
    - Mobile AR applications begin to emerge, with the release of ARToolkitPlus and the ARhrrrr! game, allowing users to experience AR using smartphones and webcams.
6. 2010: Introduction of Mobile AR Platforms
    - Layar, one of the first mobile AR platforms, is released, allowing developers to create AR experiences on smartphones.
    - Qualcomm introduces the Vuforia platform, offering computer vision capabilities for marker-based and markerless AR applications.
7. 2013: Google Glass and HoloLens
    - Google unveils Google Glass, a wearable AR device resembling eyeglasses, capable of displaying information in a hands-free manner.

- Microsoft announces the development of HoloLens, a head-mounted display that combines AR and virtual reality (VR) capabilities, allowing users to interact with virtual objects in the real world.

8. 2016: Pokémon Go

    - Pokémon Go, a massively popular mobile AR game, is released, demonstrating the mainstream potential of AR and its ability to blend digital content with the real world.

9. 2017: ARKit and ARCore

    - Apple introduces ARKit, a framework for developing AR applications on iOS devices, enabling developers to create immersive AR experiences.
    - Google releases ARCore, a platform for building AR experiences on Android devices, expanding the reach of AR technology.

10. 2020: Advancements in AR Hardware and Applications

    - Improved HMDs, such as the Magic Leap One and Microsoft HoloLens 2, offer more immersive and realistic AR experiences.
    - AR applications find use in various industries, including healthcare, education, architecture, and retail, enhancing productivity and user experiences.

11. Present and Future Developments

    - AR technology continues to advance, with ongoing research in areas like spatial mapping, gesture recognition, and real-time object tracking.
    - Integration of AR with 5G technology promises enhanced connectivity and faster data transfer, enabling more complex and seamless AR experiences.
    - Augmented Reality glasses, contact lenses, and other wearable devices are being explored, aiming for lightweight, unobtrusive AR displays.

AR TECHNOLOGIES AND DEVICES

Augmented reality, or AR, is a technology that enhances interactive user experiences by fusing virtual and real-world aspects. Users can interact with both real and virtual items concurrently since it superimposes digital information including graphics, audio, and haptic feedback onto the real world.

There are various AR technologies and devices available, each with its own unique features and applications. Here are some notable examples:

1. **Smartphones and Tablets**: The ability to use augmented reality is built into many current smartphones and tablets. They track the user's surroundings using the camera and sensors on the device, then overlay virtual items on the screen.
2. **AR Glasses**: Smart glasses, commonly referred to as augmented reality (AR) glasses, are wearable gadgets that project virtual content into the user's field of vision. In order to project the augmented reality onto the lenses or transparent screens, they frequently come with a camera, sensors, and a display system.
3. **Headsets**: AR headsets are like AR glasses but typically provide a more immersive experience. They often consist of a headset that covers the user's entire field of view, enabling a wider range of applications, such as gaming, training, and industrial design.
4. **HUDs (Heads-Up Displays)**: In order to give enhanced information without impeding the user's vision, HUDs are frequently employed in transportation, aviation, and athletics. They enable users to see both the real environment and supplementary information at once by projecting data onto a transparent surface.
5. **AR Contact Lenses**: While still in the early stages of development, AR contact lenses aim to provide a more natural and seamless AR experience. These lenses would overlay virtual information directly onto the user's vision, eliminating the need for external devices.
6. **Projection-based AR**: This approach involves projecting virtual content onto real-world surfaces. It can be achieved using projectors or specialized systems that create interactive experiences on walls, floors, or objects.

For developing AR experiences, there are numerous software platforms and development tools accessible. These platforms and tools give programmers the resources, libraries, and frameworks they need to create augmented reality apps. Here are a few that are frequently used:

1. **ARKit (iOS) and ARCore (Android)**: For building AR applications for iOS devices, Apple offers the ARKit development framework. Like this, Google's ARCore technology is used to create AR applications for Android smartphones. For motion tracking, environmental awareness, and displaying virtual content, these platforms provide a wide range of tools and APIs.
2. **Unity**: Popular game development platform Unity supports the creation of AR content. It offers a comprehensive collection of features and tools made especially for building AR experiences. Developers may create AR applications for both iOS and Android using Unity's AR Foundation.
3. **Unreal Engine**: Another well-known game production engine, Unreal Engine, offers support for AR creation. Using the C++ programming language and Blueprint visual

scripting framework, developers can build engaging AR experiences. The ARKit and ARCore plugins for Unreal Engine enable cross-platform AR development.

4. **Vuforia**: PTC owns the augmented reality platform Vuforia. It offers resources for both marker-based and marker less augmented reality experiences. The object detection, tracking, and virtual content insertion capabilities of Vuforia are made possible by computer vision algorithms.
5. **Wikitude**: A platform for augmented reality called Wikitude enables both marker-based and marker less tracking. It includes a variety of functions, including 3D model rendering, geolocation-based AR, and image recognition. To create AR applications for iOS, Android, and other platforms, developers can use Wikitude's SDK.
6. **AR.js**: An open-source JavaScript package called AR.js is used to build web-based AR experiences. Without the need to download special apps, it exploits web technologies like WebGL and WebRTC to offer AR features right in the browser. Marker-based and location-based AR are supported by AR.js.
7. **Spark AR**: Facebook developed the Spark AR platform, which focuses on developing augmented reality (AR) experiences for social media networks. It enables creators to create interactive AR content for Facebook, Instagram, and Messenger as well as filters and effects.

Various technologies are utilized to track user movements and the environment in order to enable AR interactions. Understanding the user's position, orientation, and surrounding environment is vital thanks to these technologies. These tracking methods are frequently used in augmented reality:

1. **Visual Tracking**: Visual tracking involves following and analyzing the user's surroundings using cameras and computer vision techniques. This can be accomplished using techniques like marker-based tracking, in which the camera recognizes particular markers or patterns to establish the position and orientation of the user or objects. Markerless tracking, on the other hand, uses elements of the environment to follow movement, such as natural landmarks or objects.
2. **Inertial Measurement Units (IMUs)**: IMUs are motion sensors that frequently have magnetometers, accelerometers, and gyroscopes. These sensors track the user's movements by measuring changes in velocity, rotation, and magnetic fields. In order to provide more precise and responsive tracking, IMUs are frequently employed in conjunction with other tracking techniques.
3. **Global Positioning System (GPS)**: Satellites are used by GPS technology to determine the user's location. Although GPS is frequently used for outdoor tracking, it has accuracy issues and is not appropriate for accurate AR interactions. However, it can be combined with other tracking techniques to offer location-based augmented reality experiences.
4. **Depth Sensing**: Time-of-Flight (ToF) sensors and structured light systems are examples of depth sensing technologies that allow for the detection and measuring of distances to objects in the environment. These sensors offer depth data, which is useful for detecting the user's position in relation to the environment and for addressing occlusion in AR applications.
5. **SLAM (Simultaneous Localization and Mapping)**: The goal of the SLAM technique is to simultaneously map the environment and track the user's position inside it by

combining sensor data from cameras, IMUs, and other sensors. Real-time tracking and reconstruction of the user's surroundings are made possible by SLAM algorithms, which examine visual features, depth information, and motion data.

6. **Beacon-based Tracking**: Radio signals broadcast by Bluetooth Low Energy (BLE) beacons are used in beacon-based tracking to determine the user's location. For indoor locating and tracking, beacons that have been put in the environment emit signals that a user's device can pick up.

CORE CONCEPTS & TECHNIQUES

3.1 Marker-based AR

Maker-based AR works by scanning a marker which triggers an augmented experience (whether an object, text, video or animation) to appear on the device. It usually requires software in the form of an app, which enables users to scan markers from their device using its camera feed.

Marker-based Augmented Reality

Marker-based Augmented Reality uses a designated marker to activate the experience. Popular markers include Augmented Reality QR codes, logos, or product packaging. The shapes or images must be distinctive and recognizable for the camera to properly identify it in various surroundings.

There is another important factor of marker-based Augmented Reality. The marker-based AR experience is tied to the marker. This means that the placement of digital elements depends on the location of the marker. In most cases, the experience will display on top of the marker and move along with the marker as it is turned or rotated. You'll see exactly what we mean in the following two examples.

1. **Marker-Based AR Example: Augmented Reality QR Code**

-An Augmented Reality QR code is a QR code with a marker for AR.js that redirects the user to the AR web app or mobile app. AR codes lets you add an extra dimension to the product by creating interactive content to the real world around you.

- Position detection markers are used to help the scanner identify where the QR code begins and ends. These square markers are always placed in the corners of the code, and there are typically three of them. An alignment marker helps the scanner correctly line up the QR code to read it properly.

2. **Marker-Based AR Example: Product Packaging**

- The Jack Daniel's AR Experience, from the Brown-Forman spirits and wine company, takes consumers on a virtual journey of the Jack Daniel Distillery through a series of pop-up book-style dioramas. The Jack Daniel Distillery's AR

app offers a virtual tour of the distillery, allowing users to take a closer look at the whiskey-making process, and learn stories about the man himself—Mr. Jack Daniel.

Pros	Cons
The marker-based AR ensures impeccable quality AR experiences.	The marker-based AR works only when the camera is near the marker image. Moreover, if the marker image reflects light then it causes trouble in overlaying the 3D object.
If we create the marker image with enough unique marker points then the tracking is extremely stable and effortless.	In case we move the scanner away from the marker image, the AR overlay disappears and the marker is usually scanned again. We can always go for extended tracking; however, it isn't very smooth and creates issues.
The AR overlay does not move a lot and remains stable.	The marker image must have a sharp contrast between the shades of various colors. Smooth color transition makes the recognition process more challenging.
The marker-based AR is way easier to use from an end-user perspective as we simply scan the marker	

3.2 Markerless Augmented Reality

Markerless Augmented Reality scans the real environment and places digital elements on a recognizable feature, like a flat surface. So, instead of being tied to a marker, the digital elements are placed based on geometry. Markerless Augmented Reality is very popular in gaming, like Pokémon Go, where characters can move around the environment. It is also often utilized for live events and virtual product placement.

The impeccable markerless AR enables digital transformation via scanning the scenario or environment without the necessity of a trigger picture to load the AR content. Thus, we can try various combinations of objects and styles and locations.

Markerless AR Example: Gaming

- Markerless Augmented Reality (AR) in gaming refers to the integration of virtual objects or characters into the real-world environment without the need for physical markers or triggers. It allows players to interact with virtual elements seamlessly in their surroundings, enhancing the gaming experience

and blurring the line between the real and virtual worlds.

Markerless AR Example: Live Event

- Markerless Augmented Reality (AR) in live events refers to the use of AR technology to enhance the audience's experience during a real-time event, such as a concert, sports game, or conference. It allows for the integration of virtual elements into the live environment without the need for physical markers or triggers, creating an immersive and interactive atmosphere.
- Imagine attending a music concert that incorporates markerless AR technology. As you enter the venue, you receive a smartphone app or a pair of AR glasses that allow you to see virtual elements overlaid on the stage and throughout the venue. Instead of relying solely on the physical set design and performers, the AR technology enhances the visual and auditory experience, making it more captivating.

Markerless AR Example: Product Placement

- Markerless Augmented Reality (AR) can also be used for product placement, which involves integrating virtual products seamlessly into real-world environments without the need for physical markers. This approach allows advertisers to showcase their products within various contexts, such as movies, TV shows, or interactive AR experiences, providing a more immersive and engaging form of marketing.

Pros	Cons
Markerless AR applications can move digital objects freely in the physical space. There is no need to scan a trigger/marker image.	In markerless AR, the AR object may not make sense always floating in mid-air in any specific setting. For an impeccable immersive experience, markerless AR needs a surface with texture for computer vision to recognize it. In case the flat surface is not distinct from the surrounding area, the rendering of the AR overlay might be affected.
Markerless AR does not require an efficient object-tracking system and provides a stable AR experience. A rich markerless AR experience can now be created because of a lot of advancements in cameras, algorithms, sensors, and processors of mobile phones and tablets.	

3.3 Location-based Augmented Reality

Location-based Augmented Reality (AR) is a type of AR experience that uses the user's real-world location as a foundation for the virtual content overlay. It involves integrating virtual elements into the user's surroundings based on their specific geographic location, offering a unique and contextually relevant AR experience.

Location-based AR isn't as common as marker-based and markerless AR but is particularly relevant in the travel and tourist industries. Location-based AR is also known as GPS-based or Geo-based Augmented Reality. You can derive from the name that the digital elements depend on physical locations. Obvious uses for Location-based AR include directional guidance, such as Google maps. However, people have come up with more creative uses, such as art installations scattered around cities.

Location-Based AR Example: Directional Guidance
- Location-based Augmented Reality (AR) can be utilized for directional guidance, providing users with real-time navigation instructions overlaid on their surroundings. This feature enhances traditional navigation methods by superimposing virtual arrows, markers, or visual cues onto the user's real-world environment, making it easier to navigate and reach their desired destination.

Here's an example to illustrate location-based AR for directional guidance:

Imagine you're exploring a new city and need to find your way to a specific restaurant. You launch a location-based AR navigation app on your smartphone, and it uses your GPS location and camera feed to determine your position and orientation accurately.

3.4 AR: object recognition

AR object recognition refers to the technology that enables augmented reality systems to identify and track real-world objects in order to overlay virtual content onto them. It involves using computer vision algorithms and machine learning techniques to recognize and understand objects based on their visual characteristics.

Here's an example to illustrate AR object recognition:

Imagine you're using an AR app on your smartphone to explore a museum. The app is designed to provide additional information about the artworks on display. As you point your phone's camera at a painting, the AR object recognition technology kicks in.

The app analyzes the visual features of the painting, such as colors, shapes, textures, and patterns, to identify the artwork. It compares these features to a database of known artworks or uses machine learning algorithms to recognize the specific painting based on its visual cues. Once the painting is recognized, the app can overlay virtual content, such as text, images, or animations, onto the painting in real-time.

4. AR in Various Industries

Industrial Augmented Reality (AR) is a technology that complements existing manufacturing processes and enables companies to improve efficiency and increase quality. AR enables companies to cut costs, reduce time to market, and build safer products.

AR technology allows manufacturers to access manual process and automated data at the same time. It continues to collect cycle times and defects but adds more minute points of reference. For example, augmented work instructions track step times, the exact actions that led to a defect, and real-time operational metrics.

Five benefits of augmented reality in manufacturing

- Improving the quality of production processes. ...
- Reducing production and service costs in the field. ...
- Refining training and skills sharing. ...
- Improve industrial safety standards. ...
- Optimising the product assembly process.

12 Examples of Augmented Reality in Different Industries

What's the use of new tech if you can't apply it to solving real-world problems? Augmented reality (AR) is finding use in manufacturing, healthcare, education, and a wide range of industries.

The growth of use goes hand-in-hand with the release of new AR hardware. The applications are ranging from entertainment (think about ar filters with Snap Spectacles from Snapchat), e-commerce (mostly mobile AR through your smartphone or tablet) or enterprise solutions (think HoloLens 2!).

Comparing to virtual reality (VR), AR is a lot easier to adapt and in most cases more comfortable to use because the user still sees the physical world around here. The AR superimposes the additional information on top of it. With VR - you are 'stuck' in the virtual world.

Let's explore some real-life applications of this technology.

1. Manufacturing

Augmented Reality manufacturing is an advanced form of automation that incorporates digital technology into the production line. It combines the physical world with computer-generated graphics, data, and interactive elements to create an enhanced reality.

AR in manufacturing improves productivity, efficiency, and worker safety by providing real-time guidance, training, and data visualization. It enhances assembly processes, quality control, and collaboration among teams, leading to reduced errors, streamlined operations, and improved overall performance in the manufacturing industry. AR has wide applications in manufacturing. The technology lets workers visualize and use data in real-time, enabling them to make timely data-driven decisions.

It also promotes virtues like

- Cross-team collaboration
- Paperless workforce
- Simplified manufacturing workflows

2. Healthcare

Augmented Reality (AR) technology has the potential to transform various aspects of healthcare, ranging from medical training and education to patient care and surgical procedures.

AR in healthcare offers innovative solutions to improve medical training, surgical procedures, patient care, and overall healthcare outcomes. It enhances visualization, education, and patient engagement, enabling healthcare professionals to provide more accurate diagnoses, personalized treatments, and improved patient experiences.

It helps improve healthcare-delivery accuracy and supports safer healthcare services by allowing health professionals to:

- Work hands-free
- Access training videos
- Use images or annotated instructions
- Run quality assurance checklists

These healthcare professionals can also:

- Record and share voice communications
- Connect with coworkers through live video streams
- Collaborate and troubleshoot issues in real-time

3. In-Store Shopping Experience

AR in-store shopping experiences enhance customer engagement, interactivity, and personalization. By leveraging virtual try-on, product visualization, interactive information, navigation assistance, and gamification, retailers can create unique and memorable shopping experiences that bridge the gap between the physical and digital realms, ultimately improving customer satisfaction and driving sales.

Leading retailer brands like IKEA, Amazon, and Sephora provide e-commerce shopping experiences over augmented reality mobile or wearable glasses interfaces.

These brands' apps support shoppers in real-time as they make buying decisions.

For example, the IKEA AR mobile app takes pictures of a living room, measures the space, and recommends the furniture that fits the space.

4. Logistics

AR in logistics enhances operational efficiency, accuracy, and productivity by providing real-time information, guidance, and visualization. By leveraging AR in warehouse management, order picking, inventory management, last-mile delivery, training, and maintenance, logistics companies can optimize processes, reduce errors, and improve customer satisfaction.

Augmented Reality (AR) has the potential to revolutionize logistics operations by improving efficiency, accuracy, and productivity. Here are some examples of how AR is being used in the logistics industry:

1. Warehouse Management: AR can enhance warehouse operations by providing real-time information and guidance to workers.
2. Order Picking and Fulfillment: AR can streamline order picking and fulfillment processes. By using AR-enabled devices, warehouse workers can visualize pick lists, optimized routes, and virtual markers guiding them to the correct locations. AR can also overlay barcode scanning instructions onto items, ensuring accurate identification and reducing manual errors. This technology improves order accuracy, speeds up fulfillment, and enhances overall productivity.
3. Inventory Management: AR can assist in inventory management tasks by providing real-time visibility and tracking.

5. Athletics

AR in athletics offers opportunities for enhanced training, performance analysis, fan engagement, and injury rehabilitation. By leveraging virtual coaching, interactive experiences, and real-time data visualization, AR technology contributes to improving athlete performance, fan enjoyment, and the overall experience of sports.

6. Advertising

AR advertising, or Augmented Reality advertising, refers to the use of augmented reality technology in promotional and marketing campaigns to create interactive and immersive experiences for consumers. It allows brands to engage with their target audience in new and creative ways, leveraging the capabilities of AR technology to deliver memorable and engaging advertising content.

AR advertising offers exciting possibilities for brands to create unique, interactive, and memorable experiences for consumers. By leveraging virtual try-ons, interactive demonstrations, location-based experiences, gamification, storytelling, and social media filters, brands can enhance their advertising campaigns and establish deeper connections with their target audience.

7. Remote Collaboration

AR remote collaboration refers to the use of Augmented Reality technology to facilitate collaboration and communication among remote teams or individuals in different locations. It enables people to work together virtually, share information, and collaborate on projects as if they were in the same physical space.

AR remote collaboration empowers teams and individuals to work together effectively, regardless of their physical location. By leveraging virtual meetings, remote assistance, virtual collaboration spaces, remote training, and remote product development, AR technology enhances communication, collaboration, and productivity for remote teams.

8. Live Language Translation

AR live language translation refers to the use of Augmented Reality technology to provide real-time translation of spoken or written language, overlaying translated text or audio onto the user's view of the physical world. It enables users to understand and communicate with people who speak different languages, facilitating cross-cultural communication and breaking down language barriers.

AR live language translation technology enhances cross-cultural communication, facilitates understanding, and promotes global collaboration. By leveraging real-time speech translation, text translation, visual translation, augmented interpretation, and language learning applications, AR technology helps bridge language barriers and enables individuals to communicate effectively across different languages.

9. Gaming

AR gaming, or Augmented Reality gaming, refers to the use of augmented reality technology to create interactive and immersive gaming experiences that blend virtual elements with the real world. In AR games, players can interact with virtual objects, characters, and environments overlaid onto their physical surroundings, enhancing their gaming experience.

AR gaming offers a unique and interactive way for players to engage with virtual worlds and characters within their real-life environments. By blending virtual and physical elements, AR games provide players with immersive gameplay experiences, social interactions, and the opportunity to explore and interact with their surroundings in exciting new ways.

10. Education

AR education, or Augmented Reality education, refers to the integration of augmented reality technology into educational settings to enhance the learning experience and provide interactive and immersive learning opportunities. AR enables students to engage with virtual content overlaid onto the real world, creating dynamic and interactive educational experiences.

AR education offers innovative and interactive learning experiences that engage students, enhance understanding, and promote active participation. By leveraging AR to visualize concepts, provide virtual field trips, offer interactive learning materials, facilitate science experiments, support language learning, and enable collaborative learning, educators can create dynamic and immersive educational environments that foster curiosity, critical thinking, and knowledge acquisition.

11. Architecture and Design

AR (Augmented Reality) is playing a significant role in architecture and design by providing innovative tools and visualization capabilities that enhance the design process, communication with clients, and the overall user experience.

AR technology is transforming the architecture and design industry by enabling more immersive visualization, real-time design modifications, effective communication with clients, and enhanced collaboration throughout the design and construction process. By leveraging AR tools and applications, architects and designers can create more efficient, sustainable, and user-centric designs.

12. Aerospace and Defense

AR (Augmented Reality) technology is finding applications in the aerospace and defense industries, enhancing training, maintenance, and situational awareness.

AR technology in aerospace and defense enhances efficiency, safety, and effectiveness by providing real-time information, visual guidance, and immersive training experiences. By leveraging AR for maintenance, training, situational awareness, design, mission support, and remote communication, the aerospace and defense industries can benefit from improved capabilities and enhanced operational performance.

CHALLENGES AND FUTURE DIRECTIONS

***Technical challenges**: discuss the limitations and technical hurdles faced in AR development*

***User experience**: address the importance of designing intuitive and seamless AR experiences for users*

***Ethical and privacy considerations**: explore the potential ethical implications and privacy concerns associated with AR*

***Future prospect** :discuss emerging trends such as AR in social media ,AR cloud and advancement in AR hardware*

1. Lack of Proven Business Models

The mysterious aspect of augmented reality is that even though it has a large-scale adoption and acceptance, it is not doing that well as per the business. It isn't that the industry is not doing fine - there is a steady flow of investment in the augmented reality market, and its general perception is also positive. The reason behind it is that the **market still lacks a particular AR business model that works in the long term.**

Startups are popping out like mushrooms after rain and coming up with more outlandish concepts, whereas large enterprises are experimenting with AR solutions. The common thing among users by both startups and enterprises is **adding it to their business models that may work with or without augmented reality.** What I mean is that augmented reality needs its approach and is not used just as an accessory.

The major AR products are Pokemon Go, IKEA, and Amazon AR applications. In Pokemon Go, the brand power made it a hit, and the retention rate followed even after the hype died out. These real-life applications also illustrate the same fact that these ventures could also have survived without AR use.

Still, there is a **viable possibility for augmented reality development in the form of industrial companies**. They have many fields to use AR technology and adequate financial resources to invest in. To name a few, here are some projects for which they can use AR:

- Visualization of hidden infrastructure
- Checking discrepancy
- Proof of concept for construction projects
- Maintenance instructions
- Monitoring construction progress

Such applications have the capability to establish an augmented reality technology not just a visual treat but a viable tool to help improve complete end-product quality.

How AR Will Change The Way Businesses Operate?

2. Lack Of Standards For AR App Design & Development

It is essential to have standards as it is like a universal language. It sets parameters that work on a universal level when developing a software application or planning a marketing campaign. It helps guarantee contribution and compatibility to the entire technology development. And this is something that is still under progress for augmented reality.

If you are wondering why standardization is essential? You must know it is a vital aspect that has worked for every technology that brings stability and compatibility to the chaos that comes without standard parameters. Augmented reality is a new technology, and it's no wonder that we still have to figure out the standards in terms of software and hardware.

Without standards, you cannot unify solutions to help create the bigger picture. Due to lack of standardization, technology development is slow, and there are issues to keep everyone on the same page.

Moreover, technical standard implementation needs time, and its use will mean that the final stage to define the technology is the real deal.

3. Security & Privacy Issues with Augmented Reality

One of the significant challenges that the AR industry has to face is security and privacy concerns. There is a legitimate chance you can get into trouble without intending to do so because of the inconsistencies in the AR programming, negligence, and oversight.

The significant issue is that no regulation defines what is allowed and what should not be allowed in an Augmented reality environment. It is like a free pass that may cause a grave security issue. Some may use it with malicious intent as much as this technology can help you with entertainment.

For instance, a feature that is a real hit in retail and online shopping, try before you buy option helping you overlay the chosen apparel on your body. Just in case someone can use it to damage your reputation or blackmail you. It is one of the possible misuses of this technology. Other potential misuses involve hijacking accounts through data mining and surveillance by manipulating or overlaying AR content like it's done in ad stacking and fraud schemes.

Lack of awareness is also an issue that's part of this issue. People take this very lightly and do not deal with it more sensitively. Another aspect of this issue is the reluctance on the developer's part to take action before something like this happens. It is not something to be scared of, but

something that every emerging technology has similar issues without proper standardization.

AR Is Still Raging On!

Even though these challenges still need to be defined and sorted, AR use is raging among top brands and businesses. This complication of the lack of a particular business model is being overcome by the short-scale use of AR to attract consumer attention and encourage them to invest more time in their planned campaign to boost brand awareness.

This small-scale version might not seem much, but it helps businesses understand the hoops and complications they may have o face when creating an extensive campaign around augmented reality.

There is definitely a lack of adequate standards to develop augmented reality development in both design and applications. Still, there is no shortage of businesses venturing into AR-based app development. It encourages them to invest more time due to the attractive visuals and helps improve consumer participation in the campaigns.

ImagineAR offers a platform for businesses of all sizes to implement AR campaigns without any programming or technology experience. So whether you're looking at professional sports teams, small retailers, or restaurants - everyone can create interactive AR campaigns that blend the real world with digital content in an instant.

5 Key UI UX Pillars for Augmented Reality Design

The success of an interface defines how discreetly users can interact with it without distractions that arise from the other elements in the interface. This holds true in the context of augmented reality as well. However, given AR's immersive and attention-grabbing nature, designers need to be more aware of how users interact with their product or platform. They can do this by paying attention to the following 5 critical pillars of UI UX in AR:

Environment:

Surroundings in which users will be interacting with the product must be considered for augmented reality design. It Includes everything from the lighting conditions to the physical space where users are situated.

Movement:

How users will be moving around in the virtual or physical space and what needs to be considered while designing for movement.

Onboarding:

How users will be introduced to the product and get started with it; how augmented reality design can help.

Interaction:

How users will be interacting with the product, both physically and virtually.

Feedback:

How users will be notified of their actions, as well as the consequences or results of those actions.

By paying attention to these critical pillars, UX and UI designers can create more seamless and intuitive augmented reality designs.

Ethical Considerations

There are many ethical considerations to take into account in terms of AR. Currently, there is no regulatory infrastructure in place to moderate the development and deployment of AR technology. What is even more worrying is that the speed at which technology is advancing is too fast for the traditional legislative system to account for. Blockchain technology is an example of this. As soon as a bill is passed new features have been added and created rendering the bill more or less obsolete.
The control over AR software should be in the hands of customers so they can make the decisions with regard to what they want to see and what data is made accessible. Like all technology, AR is a two-edged sword and needs to be correctly wielded in order to be effective.

the augmented reality (AR) market is expected to reach over $97bn by 2028, bringing with it a dizzying change in the way we interact with the world and tech.

Unlike virtual reality, which creates a completely artificial environment, augmented reality refers to an interactive experience that combines the real world and computer-generated content.

"In terms of potential, augmented reality is the next version of the internet," Richard Godfrey, CEO of software company Rocketmakers, tells Sifted. "Everybody that has a website or an app today will be involved in some kind of immersive experience in the future."

In terms of potential, augmented reality is the next version of the internet

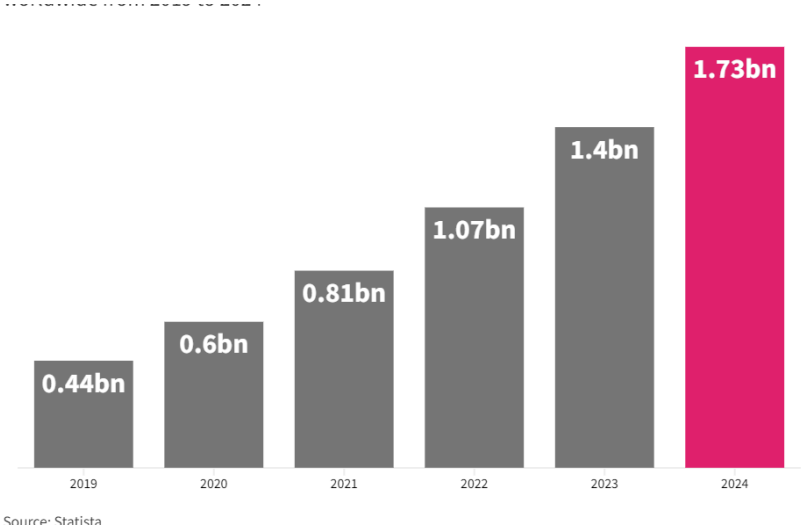
Sectors such as entertainment, healthcare and retail are predicted to integrate the technology the quickest. But challenges such as consumer adoption, technical skill and ethical concerns remain.

Sifted dug into the data on augmented reality and spoke to the experts to see how AR is revolutionising the tech ecosystem and startups — and the exciting places it could be going next.

There will be an estimated 1.73bn active AR user devices by 2024

There will be an estimated 1.73bn active devices (smartphone apps and other devices) using AR by 2024.

While phones are the key to augmented reality in the immediate future, creating headsets which are light, cost-effective and unobtrusive is essential for widespread consumer adoption. By next year, Statista anticipates that global AR headset shipments will reach over 30m units — over twelve times the number shipped in 2020. BY SIFTED.EU



Example and Success Stories:

These prominent augmented reality (AR) applications, games, or experiences have become well-known and had an impact on their respective industries.

1. **Pokémon Go**: Niantic's Pokémon Go, which was created, went viral after its debut in 2016. The game combines GPS technology and location-based augmented reality to let players capture virtual Pokémon characters in actual places. Since it drew millions of players and demonstrated the potential of augmented reality gaming, Pokémon Go has significantly increased social engagement and physical exploration.
2. **Snapchat Filters**: The "Lenses," or augmented reality filters, introduced by Snapchat have had a big impact on self-expression and social networking. Users can add interactive and dynamic effects to their faces or the background of their images and videos to add fun and creativity. The popularity of Snapchat's AR filters has sparked the development of related functionality in other apps.
3. **IKEA Place**: IKEA Place is an AR app that allows users to virtually place furniture and home decor items in their own spaces. By leveraging AR technology, users can see how items would look and fit in their homes before making a purchase. IKEA Place revolutionized the furniture shopping experience, providing convenience and enhancing customer confidence in their buying decisions.
4. **Snapchat's Landmarkers**: The "Landmarkers" tool that Snapchat introduced lets users add augmented reality effects to well-known structures and landmarks. This feature adds a new level of interaction and pleasure to famous locations like the Eiffel Tower or the Flatiron Building by transforming them into interactive and animated experiences.
5. **Microsoft HoloLens**: Microsoft HoloLens is a mixed reality headset developed and produced by Microsoft. It was first announced in January 2015 and has since undergone several iterations, with the latest version being the HoloLens 2, released in 2019.

   The HoloLens is intended to create an augmented reality experience by superimposing computer-generated images, movies, and 3D holograms onto the actual world. To do this, it combines sensors, cameras, and customized holographic displays. The headset is self-contained, thus connecting it to a computer or gaming console or using external wires is not necessary.
6. **Wayfinding and Navigation**: The use of augmented reality (AR) has improved navigational experiences and provided real-time information in a variety of wayfinding and navigation applications. For instance, route directions, places of interest, and real-time data are superimposed on the actual scene to improve navigation in AR-based navigation apps like Google Maps and AR-based heads-up displays in vehicles.
7. **Medical Training and Visualization**: In the medical industry, AR has been widely used for teaching and visualization reasons. During operations, surgeons can overlay real-time patient data, anatomical features, and instructions using augmented reality (AR) headsets or smart glasses, improving precision and lowering risks. By viewing intricate anatomical components and learning through interactive simulations, augmented reality can also aid medical students.

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