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AR/VR Development Landscape

Part One

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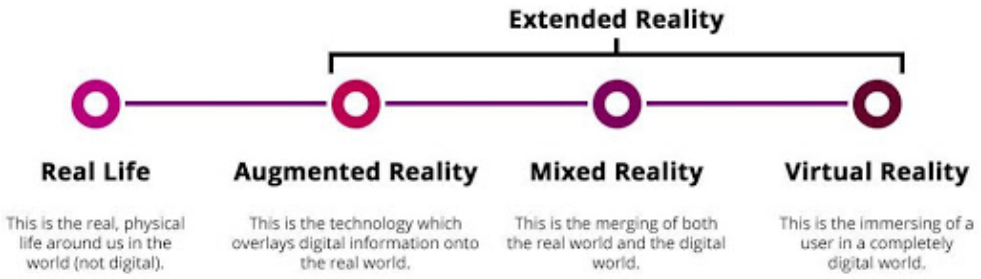


The year 2020 was an eventful one for everyone but particularly in Augmented and Virtual Reality. Businesses adapted to work from home or remote locations due to the COVID-19 pandemic, which has, in turn, promoted the use of AR technology. These immersive technologies have made their way into every aspect of life. Be it entertainment usage to business applications, the use of AR and VR has allowed individuals to work, interact and socialize with others.

In Part 1 of this 3-part series, we try to provide an insight into the ever-expanding and complex AR VR technology ecosystem, the future trends in these technologies and take a look at the different types of AR applications.

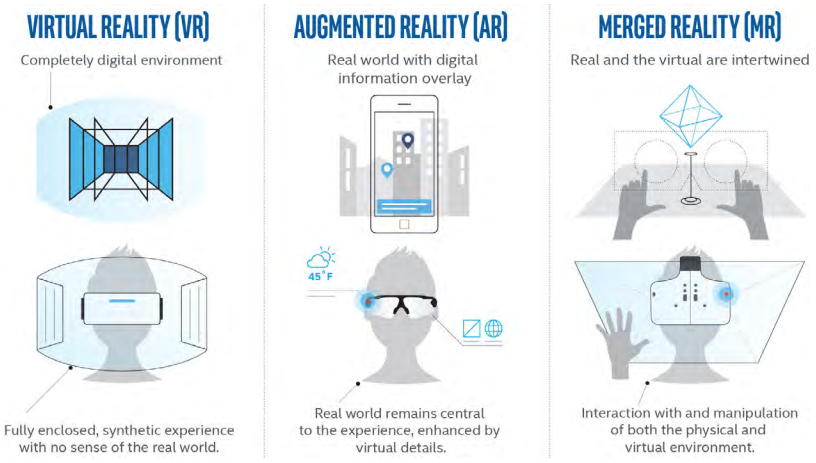
In the upcoming series, we will also talk about the available development tools for the various types of AR and VR applications and the various technical jargons associated with these technologies.

What Are AR, VR, MR, and XR?

Augmented Reality (AR)

Augmented Reality (AR) involves a real environment with the addition of digital elements. Users can engage in AR-based applications with their smartphones or smart glasses.

The digital content can be added onto a live camera feed and made to look as if it is part of the physical world. AR technology can be applied to healthcare, education, tourism, navigation systems, entertainment, and many others.



(Image Source: applied art)

Virtual Reality (VR)

Virtual Reality is the use of computer technology to create a simulation environment. VR places the user inside an artificial experience.

Users are completely immersed in the synthetic 3D experience and can interact with it using devices, such as special goggles with a screen or gloves fitted with sensors.

VR technology can be applied to advanced fields of medicine, engineering, education, design, training, entertainment, and many others. The most important piece of a virtual reality kit is the headset. The higher quality headsets need to be connected to a computer to run apps and games.

Mixed Reality (MR)

Mixed Reality (MR) involves a mix of aspects from both virtual and real environments with the involvement of digital elements.

The virtual objects can be mapped to the physical environment. It differs from AR because the virtual objects are placed on a separate layer on top of the physical world.

Mixed Reality can be much more useful in AI-based training involving the mapping or interaction of digital elements with the physical world.

In the case of MR, the user can experience virtual objects wit the real world or physical view. The user needs a headset capable of MR. The HoloLens device from Microsoft can provide such an experience.

Extended Reality (XR)

Extended Reality refers to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables. Extended Reality includes all its descriptive forms like Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR).

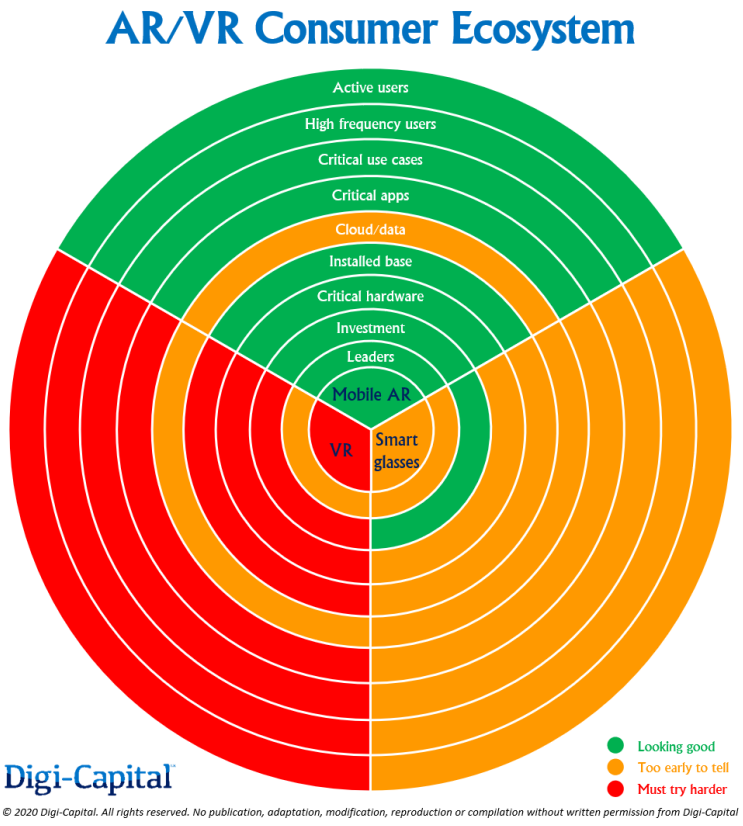
In other words, XR can be defined as an umbrella, which brings all three Realities (AR, VR, MR) together under one term, leading to less public confusion.

AR VR - Consumer Ecosystem

In spite of its many benefits, VR has yet to take off as a consumer mainstream. Many big-name adopters have abandoned their VR projects. Google recently halted sales of Daydream, its VR headset, for example.

A significant issue that has impeded mass adoption is that the price of hardware required to run VR apps has remained very expensive.

Take video games, for example. These need a powerful computer with a good amount of RAM, special sensors to detect spatial coordinates, and the VR headset itself. The total cost of the setup goes up very high, very fast, which is impractical for most just to run a game.



With most new phones supporting AR, the consumer market for Mobile AR has steadily increased, with over a billion active installations across messaging-based, OS-based, and web-based mobile AR platforms in 2020.

Smart glasses still have a lot to overcome to expand their current ground. Although companies are finding great workflow solutions through smart glass technology, the general public will still have to wait for the benefits of mass-accessibility and usage to trickle down to them. Smart glasses producers have realized that to reach mass-market usage, they must first overcome the challenge of balancing functionality and wearability at an affordable cost.

Image Source: VentureBeat

AR VR Domains

Marketing	Designing	Publications	eCommerce	Education
Enterprise	Games	Health/Fitness	Lifestyle	Medical
Location-Based	Navigation	Productivity	Media	Solution Services
Technology	Military	Travel	Headsets	Utilities

The AR/VR ecosystem is complex, cutting across multiple domains such as lifestyle, medical, education, eCommerce, entertainment, solution services, sports, travel, utilities, etc. There are many content creation and platform solutions/applications to wade through.

The current AR/VR landscape consists of more than 1,000 companies representing more than $45 billion on paper.

Future Trends in AR

Augmented by AI & ML

AR, VR, and MR can be augmented with machine learning and artificial intelligence (AI). This has been somewhat basic over the past few years, although it's expected that these will become increasingly sophisticated over the coming years. A shopper can walk around the store and have their questions answered by an NLP chatbot while having AI recommendations for new products based on their previous purchase history.

Google's machine learning-enabled microscope is one such example that is becoming increasingly capable and is able to identify cancer cells in tissue samples. Coupled with VR and AR, this could make medical technologies increasingly more accurate and allow for more complex treatment and diagnostic tools.

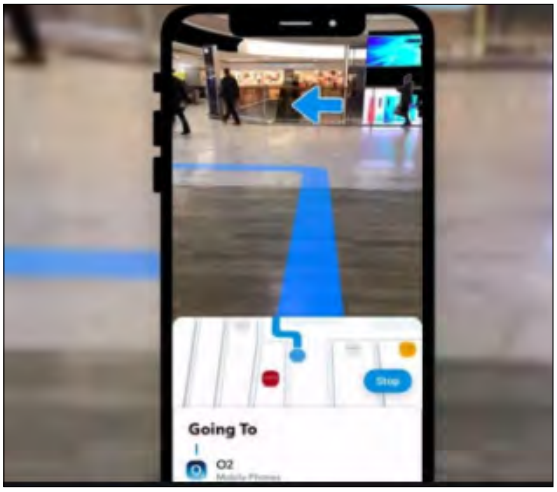
Augmented Reality in Retail

AR-enabled shopping is the hottest thing in the retail industry today. Retailers now have cool ways to provide shoppers with an augmented reality shopping experience. Brands are using AR apps to transform the way customers look at, try, buy and use their products. Retail stores are coming up with virtual fitting rooms and showrooms that allow users to try items virtually before buying them as customers continue to become more and more comfortable using AR as part of their daily experience.

Smart mirrors can scan for Radio Frequency ID tags and offer recommendations to the traditional shopping experience. IKEA has an AR app that customers can use to place virtual furniture and products to see how they would look in their own homes. The future of smart malls is all about enhancing customer experience by using mobile phones integrated with Augmented Reality.

In-Store Navigation Solutions

Maps services, such as from Google and Apple, allow people to get to their destinations on the outside. However, one of the most promising use cases for AR technologies is indoor navigation.

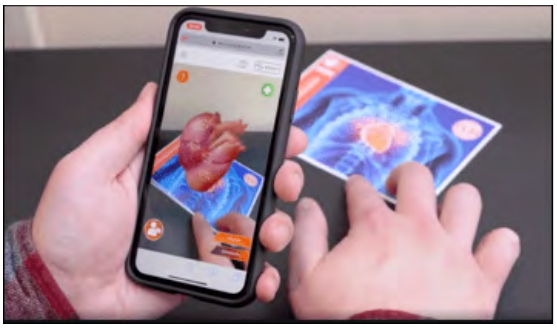


Augmented maps for indoor navigation can be useful in places such as hospitals, large office campuses, airports, hospitals, and malls. Using the AR app, customers can navigate the store by themselves and at the same time get relevant information for the items they are looking for. Based on their tickets, Gatwick Airport's AR solution app provides users with the best routes to get to their terminals and gates.

The augmented reality feature for Google Maps is already available to all AR-compatible iOS and Android mobile devices as of August 2019. People can use it to get walking instructions with their phones. Google will soon be looking beyond smartphones and include integration with smart glasses, which would give users a degree of flexibility never seen before with such apps.

WebAR

Instead of specialized AR apps for different platforms like Android and iOS, users can log on to WebAR-enabled websites and get the same level of functionality.



Mozilla is engaged in bringing WebAR to Firefox, with the goal to make AR adoption easier by the use of web-based browsers, Safari, Chrome, and other browsers also rapidly adopting the WebAR standards.

Augmented Reality Remote Assistance

Global Workplace Analytics predicts that by the end of 2021, as much as 30% of the workforce will work from home, multiple days a week. Augmented Reality remote assistance enables technicians and experts to visually guide and collaborate with customers. Remote assistance is based on the use of a remote view to control a computer or a mobile device and help solve issues.

AR remote assistance takes this concept further and uses streaming videos to connect customers and technicians with the work being performed. AR developers can create mixed-reality settings where participants in a conference call can see each other, making it more personal and direct. Microsoft HoloLens is working towards a beta of a video app that employs a holograph of the participants.

Automotive Industry and AR

There are AR solutions being developed for the automotive industry that will enhance driver experience by providing important information about the car and navigation directly on see-through displays. Examples of this are HUDs in a military fighter jet plane, windshield projectors or various wearables, which will allow the driver to concentrate on the road and not need to look down to navigate.

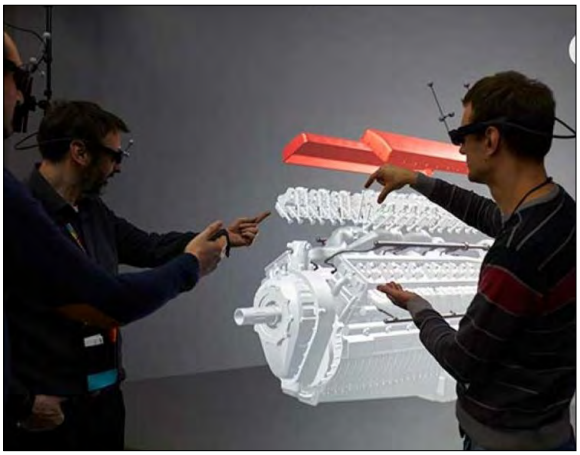
Hyundai is working on merging and creating adaptable and interactive AR instructions to replace long and complex car manuals. Trying to figure out where the fuse is? Just point the app at the car, and it will pinpoint it on the screen. Augmented Reality comes in handy for the manufacturing and maintenance of vehicles and making the training process more efficient. Users can see the internal components of machines just by looking at them through AR-enabled apps.

A major advantage with automotive AR is that cars already have built-in power supplies to generate electricity on the go, with windshields that can be used instead of headsets.

Future Trends in VR

VR in Education and Training

Education is one of the most promising sectors that is now running in VR. As innovation and change affect all areas of life, teaching and learning skills have also increased effectively per the new technologies.



Virtual Reality continues to establish itself as a good asset in an education system. Its success suggests people remember more about something through direct experience rather than reading, seeing, or hearing about it. There is also some evidence that those who explore more of the virtual space form deeper cognitive associations with the content.

VR in Industry and Work

Automotive: With VR technologies, engineers and designers can easily experiment with the look and build of a car before actually spending any money on it. BMW and Land Rover already use VR apps to review design and engineering. By reducing the number of prototypes built per vehicle, VR is helping the automotive industry save millions.

Defense: VR is also ideal for the defense sector. It can provide military personnel and defence contractors a way to gain valuable experience of dangerous or life-threatening environments from the safety of the training room.

Real Estate: VR can guide a client through a real estate portfolio with a virtual experience of touring real-life properties.

Virtual and Augmented Reality offer experiences like no other, allowing people to conceptualize and understand ideas that would be difficult to imagine using only a picture or a detailed description.

VR in Socializing

Social VR applications can be used to gather people in a simulated world. VR-based social platforms such as VR Chat, AltspaceVR, and Rec Room allow people to meet up, chat or play in virtual environments.

While we will always want to spend time with friends and loved ones in the real world, the COVID-19 pandemic has reduced in-person interactions and increased virtual interactions. As technology improves in this area, we will continue to have more meaningful ways to connect with others.

The Virtual World as a Stage for Real-World Activities: Let's say it's a holiday and you feel like playing a game of soccer. It takes a few hours for you and your buddies to get together at the nearest soccer field in the real physical world. Instead, you send a quick message through a platform like Facebook Messenger and invite your friends to join you virtually.

Live VR Streaming: We are already familiar with the impact of live video streaming in the social media world. When virtual worlds gain more popularity in social networking, we could even see live streaming of events taking place in the Virtual Reality environment.

VR in Games and Entertainment

If we think about the way gaming and entertainment developed during the last two decades, the first games were 2D, then 3D games started coming into the market. Cinemas started showing movies with 3D glasses, and that has added even more dimensions to entertainment.

Now VR has emerged. 360-degree photos and videos give you the feeling of being in another place. VR games transfer a player to a fantasy world. These kinds of trends position VR to be the future of the gaming and entertainment industry.

VR in Healthcare

Healthcare is one of the biggest adopters of VR, with trainee practices for robotic surgery, phobia treatment, surgery simulation, and skills training, to name just a few. Many healthcare organizations across the globe have started making use of VR in their operations and have realized its benefits. Some of the key applications of virtual reality in medicine are listed below.

Medical Training: VR can be used to provide virtual training for special or emergency situations or for using expensive equipment, as well as to provide students with a medium to learn about the human body without actually working on one.

Robotic Surgery: This is a recent innovation in which surgery is performed remotely with robotic devices such as robotic arms controlled by a human surgeon.

Virtual Reality in Diagnostics: VR is being used as a powerful diagnostic tool, which helps doctors and physicians get a more accurate diagnosis report. This is done with the help of a combination of methods (such as MRI/CT scans) and eliminates any mistakes, making it a pain-free experience for the patient.

Types of AR Applications

1. Projection-Based AR

Projection-based Augmented Reality uses advanced projection technology to simplify the complex manual tasks that are part of a company's manufacturing, assembly, sequencing and training operations.

Projector-based AR is one of the most used non-interactive AR techniques, where projectors are used on objects to create a deception about their position, orientation, and depth. The projection is calculated, and the projection light sequence is designed carefully to deceive the viewer's mind.

Enterprise Augmented Reality is made up of an array of systems designed to give professionals across industries the guidance necessary to complete tasks correctly, consistently, and efficiently. Projector-based AR is leading this movement in the manufacturing sector, with proven technology that delivers the highest results compared to other forms of AR.

2. Recognition-Based AR

Recognition-based AR recognizes an object that is set before it and then provides more information about it on the user's screen.

A barcode or QR code scanner is one type of recognition-based AR technology.

3. Location-Based AR (Markerless AR)

Location-based AR helps users discover places of interest near their current location.

This works by detecting the location, then adding related information on the screen about the objects that can be seen from the camera.

4. Outlining AR

Outlining AR uses object recognition to recognize various boundaries and lines to help in situations when the human eye cannot be of help.

For example, outlining AR could be helpful in driving in low-light conditions.

5. Marker-Based AR

Marker-based AR uses visual markers (such as QR or 2D code) that the software recognizes when the marker is sensed by a reader app.

Such apps then trigger additional content (such as a video, animation, 3D, or something else) to appear on top of the marker.

For example, using marker-based technology, additional content such as videos can be shown to users reading a magazine.

6. Superimposition-Based AR

Superimposition-based Augmented Reality uses object recognition to recognize an object and then either partially or fully replaces the original view with a newly augmented view of that same object.

This type of AR is commonly used in the medical field to superimpose an X-ray onto a patient's body and can also be used to enhance a historical tour or bring long-lost historical places to life.

Types of VR Applications

1. Fully-Immersive Simulations

With the fully-immersive simulator, users get the most realistic experience possible. High-resolution VR headsets provide a wide field of view, so whether you are flying through space, racing an F1 car, or fighting, you will have the most realistic experience possible.

Mostly used for gaming and other entertainment purposes in arcades, these are also starting to appear in homes.

2. Semi-Immersive Simulations

With semi-immersive experiences, users get a partially virtual environment to interact with, which is mainly used for educational and training purposes. Normally, these are made possible using large projector systems and graphical computing.

Though being semi-immersive, these VR simulations still give the user the feeling of being in a different reality by using physical environments and controls. The best example of this is a flight simulator that shows an airplane's instrumental panel and uses computer screens as virtual windows.

3. Non-Immersive Simulations

Because non-immersive simulations are the most common, we tend to forget that there are non-immersive simulations, as well. Take the average video game, for example. It is a virtual experience we interact with from our own physical space.

Summary

Immersive technologies have come a long way and have started gaining acceptance in mainstream markets. With the advancement of mobile technology, AR is now available to everyone without the need for expensive equipment. This paper tries to give an overview of the length and breadth of the ever-expanding immersive technologies and the avenues where these technologies can be used.

In part two of this series, we will take an in-depth look at the various development tools available to create immersive applications.

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What is AR, VR, MR, XR, 360?

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AR HoloLens

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AR Snapchat

- How to Use Lenses

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Research

- An Augmented Reality Microscope for Cancer Detection
- Different types of augmented reality
- Phiar raises $3 million for AR navigation to eliminate wrong turns
- AUGMENTED REALITY FOR REMOTE ASSISTANCE VIA SHARED AR & WE BRTC: VIDEO DEMO
- What Is Virtual Reality? (+3 Types of VR Experiences)

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