

# Augmented Reality: A Looming Technology

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## Abstract:

Augmented Reality or AR technology is fairly old technology which in recent years is gaining more and more attention. It is the technology that spread and enhance our physical world by adding layers of digital information onto it. AR appears in direct view of an existing environment and adds graphics, video or sound to it. The computer-generated graphics are projected on top of the real world in such a way that is supposed to help us with our different tasks by adding more information to the real world. The main aim of AR technology is to how it brings the digital components into the person real world perspective.

In this research paper we will highlight a brief history, various types of Augmented Realities, current trends, future scope and some tools for developing the AR applications.

## Keywords:

Augmented Reality, Vuforia, Kudan, Wikitude, ARKit

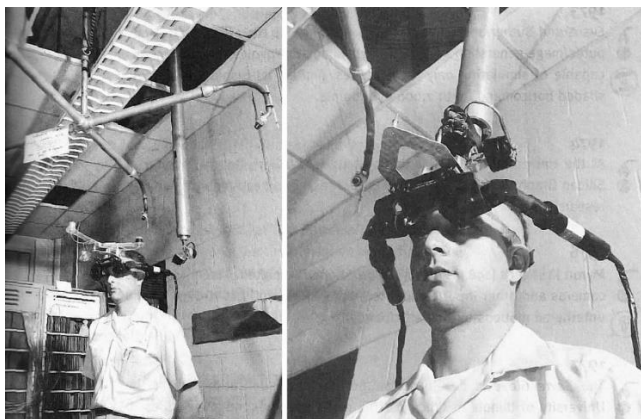
## A) Introduction:

It is a technology that works based on the inputs from the real world objects using various sensors like camera, gyro meter, accelerometer etc. Computer vision based recognition algorithms, sound, video, graphics and other sensor, these are the things that Augmented Tecnology uses for its operation It is a good way to render real world information and present it in an interactive way so that virtual elements become part of the real world.

Augmented reality displays superimpose information in your real world and can take you into a whole new world where the real and virtual worlds are seemed to exit together. Google Glass, a wearable computer with optical head-mounted display, is a perfect example. Its a simple augmented reality device : a user captures the image of a real-world object, and the platform detects a marker, which triggers it to add a virtual object on top of the real-world and displays on your Google Glass screen.

## B) History of Augumented Reality Technology:

In 1968, The first AR technology was known to developed by computer scientist Ivan Sutherland (named the “father of computer graphics”) at Harvard. He created an AR head-mounted display system caeled it as “The Sword of Damocles. The Sword of Damocles featured a head-mounted display that hung from the ceiling and the user would experience computer graphics, which made him or her feel as though they were in some other reality. This device was close to VR more than the



AR though.

*Sword of Damocles, by Ivan Sutherland 1968*

In 1974, Myron Krueger brings the next big development is AR .His project was called “Videoplace”. It combined a projection system and video cameras that produced shadows on the screen. This setup made the user feel as they were in an interactive environment.

In 1990, a Boeing researcher named Tom Caudell coined the term “Augmented Reality”.

In 1992, Louis Rosenburg at USAF Armstrong’s Research Lab created the first real operational augmented reality system and called it as “Virtual Fixtures”. It is a A robotic system that places information on top the workers work environment.

In 1994, Julie Martin created the AR in the theater and called it as “ Dancing in Cyberspace”. In this the acrobats danced around the virtuala objects on the stage.

In 1998, Sportsvision uses the 1st and Ten line computer system. This system showed the original virtual yellow first down marker during a live NFL game. A variation of this virtual first down marker is now a norm in all televised football games today and is a big part of the augmented reality history.

In 1999, NASA uses a hybrid synthetic vision system that integrated augmented reality in their X-38 spacecraft. The augmented reality technology was used to help improve navigation during their test flights.

In 2000 when Hirokazu Kato from the Nara Institute of Science and Technology in Japan created and released software called ARToolKit. Through this software, one could capture real-world actions and combine it with interactions of virtual objects.

In 2009, Esquire magazine, in collaboration with Robert Downey Jr., uses augmented reality in their print media.

In this same year, ARToolKit makes augmented reality available to Internet browsers.

## **D) Modern Day Augumented Reality**

Volkswagen is using augmented reality in their car manuals. The MARTA APP helps users to view the internal workings of the vehicle which is helpful for service mechanics.

The MARTA application can also show successive instructions to help mechanics with the projects they are working on. It can even help with replacing parts. It can even be as specific as which direction the parts should be facing. The MARTA app can be used for more cosmetic projects as well, including seeing how different color paint jobs can look on your vehicle.

In 2014, the Google Glass is revealed and is made available for consumers. The Google Glass wasn’t as successful as developers hoped it would be, but it did show the potential of what wearable augmented reality could be. The second iteration already seems to be more promising and more useful.

Instead of using the Glass to scroll through social media and other applications, factory workers are using the technology to help with everyday work. It helps walk the workers through their daily tasks and be more productive and efficient.

In 2016, Microsoft introduces the next iteration of wearable augmented reality. The HoloLens seems to be everything that the Google glass wanted to be, but certainly not as discreet and wearable in everyday life and is undoubtedly more expensive. The technology advancement between the two is unquestionable, but the price range of \$3000 and \$5000 are out of most people’s budgets

Augmented reality has also infiltrated the gaming world as well. The Nintendo 3DS comes with AR Cards that trigger integrated AR games. Just like Pokémon Go, users will see your favorite characters in the same room as them.

Snapchat has even created its own AR games that are built right into the app. The use of facial gestures controls all your movements in each game.

In the Netherlands, cell phone owners can download an application called Layar that uses the phone's camera and GPS capabilities to gather information about the surrounding area. Layar then shows information about restaurants or other sites in the area, overlaying this information on the phone's screen. You can even point the phone at a building, and Layar will tell you if any companies in that building are hiring

## C) How does Augmented Reality work

For AR a certain range of data which include animations, images, 3D models ,videos may be used and people will see the result in both natural and synthetic light. Users are aware of being in the real world which is enhanced by computer vision,

AR can be displayed on various devices like screens, glasses, head-mounted displays, mobile phones, handheld devices. It involves technologies like, depth tracking (briefly, a sensor data calculating the distance to the objects), S.L.A.M. (simultaneous localization and mapping), and the following components:

- **Cameras and sensors.** They collect data about user's interactions and send it for processing. Cameras on devices scan the surroundings and with this info, a device locates physical objects and generates 3D models accordingly. These may be special cameras, like in Microsoft HoloLens, or common smartphone cameras to take videos and pictures.
- **Processing.** AR devices eventually are like little computers, for example modern smartphones. They need a CPU, a GPU, RAM, Bluetooth, WiFi, a GPS, flash memory, etc. to be able to measure angle, speed, direction, orientation in space, and so on.
- **Projection.** It is a miniature projector on AR headsets, which takes data from sensors and projects digital content onto a surface. The use of projections in AR has not been fully invented yet to be used in commercial products or services.
- **Reflection.** Some of the AR devices have mirrors to assist human eyes to view virtual images. Some have an array of small curved mirrors and some have double-sided mirror to reflect light to a camera and to a user's eye. These all are used to perform a proper image alignment.

## G) Types of Augmented Reality

**Marker-based AR :** It is also called as image recognition, as it requires a special visual object and a camera to scan. It may be anything, from a printed QR code to special signs. In some cases, the AR device also calculates the position and orientation of a marker to position the content. Hence, a marker initiates digital animations for users to view, and so images in a magazine may turn into 3D models.

**Markerless AR:** It is also known as location-based or position-based augmented reality. It utilizes a GPS, a gyroscope, a compass, and an accelerometer to provide data based on user's location. This data then determines what AR content you find or get in that specified area. With the availability of smartphones this type of AR typically produces maps and directions, nearby businesses info. Applications include events and information, business ads pop-ups, navigation support etc.

**Projection-based AR:** This is projecting synthetic light to physical surfaces and also in some cases allows to interact with the projection. These are the holograms we have all seen in sci-fi movies like Star Wars, Iron man etc. It detects user interaction with a projection by its alterations.

**Superimposition-based AR:** This replaces the original view with an augmented, partially or fully. Object recognition plays a key role here. Without it the whole concept is simply impossible. The example of superimposed augmented reality is in IKEA Catalog app, that allows users to place virtual items of their furniture catalog in their rooms.

## H).Tools for Augmented Reality

### 1. Vuforia:

Vuforia is a prominent player in augmented reality development. It supports all the major platforms including Android, iOS, UWP and Unity Editor. It comes with a range of impressive functions which include:

- It has capability to recognize both 2D and 3D objects like cylinders, boxes, planes and consumer products using Vuforia Object Scanner.
- Text recognition that comes with over 100,000 words of English Language. Also we can use our own custom vocabulary if needed.
- It can play videos based on the specifications provided like target surfaces or images.
- Vuforia has its own barcodes called VuMarks that can do both encode data and act as markers.
- It can easily be integrated with cloud solutions for faster processing.

Though Vuforia SDK is available for free, there are limitations in functionality and watermarks in that version.

### 2. Kudan:

Kudan is the main competitor of Vuforia in augmented reality development market. It supports both Android and iOS platforms. It is a very competent tool at the disposal of marketers. Below are some of its features:

- It supports both marker-based and marker-less tracking.
- It supports high-quality 3D graphics along with tools map.shader and real-time texture morphing.
- It supports camera sensors like depth to cast virtual content more specifically on a targeted location.
- It is agile enough to be used in multiple ways like using in a head-mounted display or being embedded in the chipset.

Despite of all these features, Kudan has some drawbacks like the inefficiency of Crash Editor, sometimes leading to apps crashes, issues with test license key installation etc. The free version is available only for app testing. Though Kudan is easy to integrate, the problems with Unity Editor complicate the development process.

### 3. Wikitude:

Wikitude is another great tool for augmented reality development. It can be used for Android, iOS and even for smart glasses. Like the above two SDKs, it also comes with SLAM technology to render 3D images. Here are some of its features:

- It comes with top-notch image recognition and tracking (SLAM-based)
- It is efficiently backend for working with geo-referenced data.
- It allows saving the image databases in the cloud for identification and faster processing.

With its new Wikitude SDK 7, it also provides advanced camera options, improved extended tracking, and better positioning. Wikitude offers a free trial with all features just with one limitation of a watermark.. It doesn't support the Unity Editor, which complicates the augmented reality development.

#### 4. ARKit:

This year Apple announced its own framework for augmented reality development which is called as ARKit. The major selling point of ARKit is its wide reach and scalability. Being an independent platform for Apple devices, ARKit promises greater scope and functionality. Here are some of its features:

- TrueDepth camera to detect the position, structure, and expression of the user's face, all with high accuracy, making it easy to apply effects in real-time.
- Efficient scene understanding and lighting estimation. It works exceptionally well on plane surfaces.
- Visual Inertial Odometry (VIO) to fuse camera sensor data with Core Motion data to track movements without any additional calibration.

Since Apple devices are now powered by Apple A9, A10, and A11 processors, ARKit comes out as an effective tool for development. Augmented reality execution depends on heavy computing power which Apple took care of. Overall it comes with all the necessary features and it is free! This would lead to more experimentation and development in the AR space. It is overall a great tool at the disposal of developers.

#### I). The Future of Augmented Reality

Augmented reality technology has been incorporated into many different aspects of our lives. But AR has more potential than it is given credit for. The use of AR in games such as Pokémon Go have been huge success stories, but the reality of AR and the potential it has to impact our lives can't be ignored.

AR can transform our lives for the better. There are cars that have displays that project your speed, GPS routes, and other information that one may need or merely want onto the windshield of the car more easily visible.

Google glass is already being used in the work environment in factories as a means of efficiency. Augmented reality is also helping automobile mechanics as they service cars, and it's also helping train medical professionals and future medical professionals as well.

The reality is, as augmented, as it may be, the advances in technology are heading in the right direction and will revolutionize the way we live for the better.

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