

# A REVIEW: AUGMENTED REALITY AND ITS WORKING

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**Abstract** - Augmented reality (AR) is a technology that has taken the world by storm in the past few decades. Its applications are now found in almost all the fields possible. It is a technology that puts graphics, images, and other computer generated augmentations upon a reality that already exists, in order to improve the experience of the user by enabling different interactions between the user and his environment. In this review paper, we basically present how AR actually works and what are the different technologies that are involved in its implementation. These technologies help to project or augment that virtual object onto the real world.

**Key Words:** Augmented reality, displays, location based, marker-based, virtual reality

## 1. INTRODUCTION

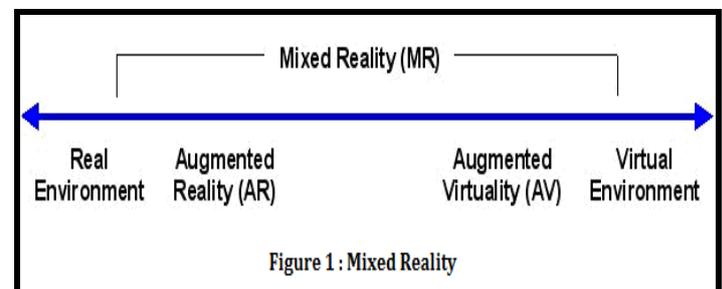
The basic idea of augmented reality is to overlay images, graphics, and audio and other intelligence enhancements over a real environment in real time. The system is to grow the user's idea of and interaction with the real world by augmenting the real world with 3D virtual objects that appear to exist in the same space as the real environment. [1] Various technologies like virtual reality, augmented reality, sixth sense technology, computer graphics and different sensors work together, to create a world where virtual objects are superimposed upon the real life environment. AR or virtual reality (VR) technologies have grabbed the eyes of researchers for quite some time now. AR and virtual reality are often confused with one another, where as in reality, they overlap each other and somewhere work together.

### 1.1 Augmented Reality versus Virtual Reality

Virtual reality means generating such an environment within the computer that the user can interact with and get immersed in. This world exists only in the digital land, i.e. we cannot really feel or touch the things. Whereas, Augmented reality (also called AR), enhances the reality we would ordinarily see rather than replacing it. It takes the real time environment of the present world and projects or displays digital images and sounds into it. [2,3,4]

Virtual reality (VR) artificially replicates or recreates the real time world environment by using computer generated

graphics. The hearing and vision are enhanced in such a manner that the user feels he is actually experiencing the computer generated or recreated environment. Whereas, Augmented Reality places the virtual objects in the real environment in real time which we can see through the different display objects and turns the environment around us into a digital interface. Augmented and Virtual Reality both fall in the range of mediated reality.



## 2. HOW AR WORKS?

### 2.1 Augmented Reality Components

A highly efficient AR device is made by combining the basic components used in AR technology. These include the different display units, tracking module, computer or other portable devices, different scanning algorithms, etc. Other than these, various devices like high resolution cameras, accelerometers, high speed multi-processors, different sensors like gyroscope, pressure sensors, and rotation sensors are also used to increase the reliability and performance of the AR device.

In AR, additional information is presented to the user as virtual objects whose main aim is to enhance his/her experience by widen his senses of hearing, feel and vision. So, one need is to have an engine or some mechanism which is capable of depicting or interpreting virtual objects over an existing real time environment. Various types of displays are used in AR technology like Head Mounted Displays [HMD], handheld displays, spatial displays etc. [5] Both the images of the real physical world and the virtual graphical world are kept by the HMDs over the user's world view. These devices can be either video transparent or optically transparent. They use mirrors that are partially silvered which pass the real world views and images through a lens. This mechanism

is used in optically transparent display device. During this period, the virtual images are passed into the eyes of the user. To track the HMD device, a 6-degree of freedom sensor is used.

The second important component in AR technology is a positional tracking module. The 3D geometry of the virtual image has to be studied upon and well understood, for the virtual object to appear as flawlessly incorporated in the real environment. Tracking and position or orientation don't only include the user's exact location as compared to his surrounding environment but also, the tracking of his head and exact eye movements. [2] The computation of the orientation of the originating camera, its exact position and its internal parameters such as focal length, aspect ratio etc. must be known or calculated from the virtual image requirements. Also there is a need of some previous information about the original environment and to model it correctly in order to position the virtual objects accurately. For example, to place the virtual objects at their correct positions, we need to define the level of the ground plane. [2] For this technology to prolong, the computers used must have high speed processors. Work is still being done to improve the efficiency of the computers used for this purpose. A high end configuration is needed for using 3-D graphics in these systems.

## 2.2 Augmented Reality Types:

When we want broad, background detail about some place like a near by hotel or petrol pump or any local street map, we can use devices like GPS or some other such navigation system to find our location. This is the simplest form of tracking. It's easy to use tracking data from Wi-Fi hotspots as well. But accurate and exact locations and positions are needed by the AR devices. They use any of the two tracking methods: location based or marker based.

**2.2.1 Marker less or location based tracking:** This tracking method works by using scanning algorithms and feature detection systems.[6] Say, we want to find the information about some object, we can simply point our phone at it and have some kind of feature-detection or pattern identification systems try to recognize it. Specific scanning algorithms are used to identify it. It creates or projects a virtual grid on the image caught by our camera. The GPS already locates the approximate location of our phone or the device we are using. And to pinpoint the exact location, the automatic scan finds several anchor points and binds a virtual model to it. The marker less technology has

many advantages including that the real life object can serve as a marker by itself and there is no overhead of making or creating markers on the objects. We don't have to make distinctive optical identifiers. The physical objects have the digital images projected directly upon them. This is known as projection mapping and can be used to quite remarkable effects.



Figure 2 : Location Based Tracking

**2.2.2 Marker based tracking:** In this method, a particular target is looked for by the device.[7] Usually these are small, two-dimensional barcodes known as data-matrix codes or it's a 2D image printed on something like a poster. The target is recognized via the camera by the augmented reality application device, the image is processed, the barcode is turned into a web address, and an appropriate web page is called up by the browser with further information. All kinds of other markers or fiducial markers, as these "added reference points" are called, can be read by the AR systems by designing them suitably. The benefit of using this tracking method is that it's more convenient to use as the markers or targets can be recognized easily by the camera. Also, a more stable, accurate, tied to a particular point, image is obtained using the markers. Due to its simplicity of implementation, it is the more popular option currently.



Figure 3 : Marker Based Tracking

### 3. THE FUTURE OF AUGMENTED REALITY

This technology has its limitations which are likely to be overcome at some point in the future. But it is important to have knowledge about them. These include limitations regarding accuracy of GPS and other tracking and positioning methods, information overload and privacy concerns. There is a danger of someone obtaining sensitive or private information about other people without their consent. But work is being done upon to reduce these factors to the bare minimum.

But AR apps have found a place in many fields. Also phones and tablets will not be the only devices where AR technology is used. For example, work is being done on augmented reality ear buds, which will allow us to adjust the sounds that come in from the surroundings. Research continues on including AR functionality in contact lenses and other wearable devices that would operate by themselves. The ultimate goal of augmented reality is to create a fitting and accepted concentration and to ease the human work.

### 4. CONCLUSION

We reviewed the area of augmented reality and the different technologies used to implement it. The review contributes the information about the AR components such as the display, tracking and orientation, software systems and different algorithms used; the study of different types of AR applications. Augmented reality is likely to worm its way into our daily lives more and more in the 21st century. Thanks to technologies such as augmented reality, the way we work with computing devices and think about the partition between digital and analogue realism is expected to transform vitally.

The review concludes that there is a lot more to research upon and implement in this technology and it has a long way to go.

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