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Augmented Reality[AR]: The World 2.0

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ABSTRACT- *Human has 5* ***sensory organs.*** *Eyes for vision, Nose for smell, Ear to hear, Tongue to taste, and skin to feel the touch. These are working together for the proper functioning of human body and its natural process. But many scientists tried to make these sense organs to be worked on the things which are not natural. In this process many inventions and discoveries has taken place.* ***Augmented Reality****is one of those technologies which came close to the requirements. In this paper we are going to discuss about what is Augmented Reality how it works and the pros and cons and its applications its future scope and finally conclude it. Augmented Reality is the technology which one can see hear and feel the objects which one can't in the real world. It is often termed as MIXED REALITY where one can feel the objects outside the world along with the daily routine.*

KEYWORDS: (Augmented Reality, sensory organs, Mixed Reality)

1.INTRODUCTION [5]

Augmented Reality is simple combination of real and virtual worlds, that means a real subject captured on video or camera, the technology augments that real world image with extra layers of digital information. It is a technology that works on computer vision based recognition to augment sound, video, graphics and other sensor based inputs on real world objects using the camera of device. It is good to transform real world information and present it in an interactive way. So, it helps in making the virtual elements to become part of the real world. It is a live direct or indirect view of a physical, real world environment whose elements are augmented by computer generated real-world sensory input such as sound, video, graphics or GPS data.

The first functional AR systems were invented in the early 1990s, starting with the Virtual Fixtures system developed at the U.S. Air Force's Armstrong Labs in 1992 as shown in figure 1.Early Augmented Reality experiences were used in the entertainment and gaming businesses, but now other industries are also getting interested about AR's possibilities.

Fig.1: **Early AR experience at US air force Armstrong Labs**

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Augmented Reality is potential in gathering and sharing implicit knowledge. Augmentation techniques are typically performed in real time and in semantic context with environmental elements. This combines the benefits of Augmented Reality technology and heads up display technology (HUD).

2.WORKING[1][3]

It works by executing simultaneously with the input received from the camera. It uses 3 technologies today. It can work by using anyone of these three approaches:

1. **SLAM**:Simultaneous Localization and Mapping is the most effective way. It localizes sensors with respect to their surroundings, while at the same time mapping the structure of the environment.
2. **Recognition Based**:It uses camera to identify the input such as natural feature tracking markers, to showcase an overlay only when the marker is sensed by the device. It depends upon device camera to separate a marker from other real-world objects. Not only a marker but the position and orientation can also be calculated. The recognized marker on screen is replaced with a 3D version of corresponding object.
3. **Location Based**:This is a contrary to recognition based. This depends on a GPS to provide the data about location and Augmented Reality visualizations are activated based on these inputs.

The working is shown in figure 2.

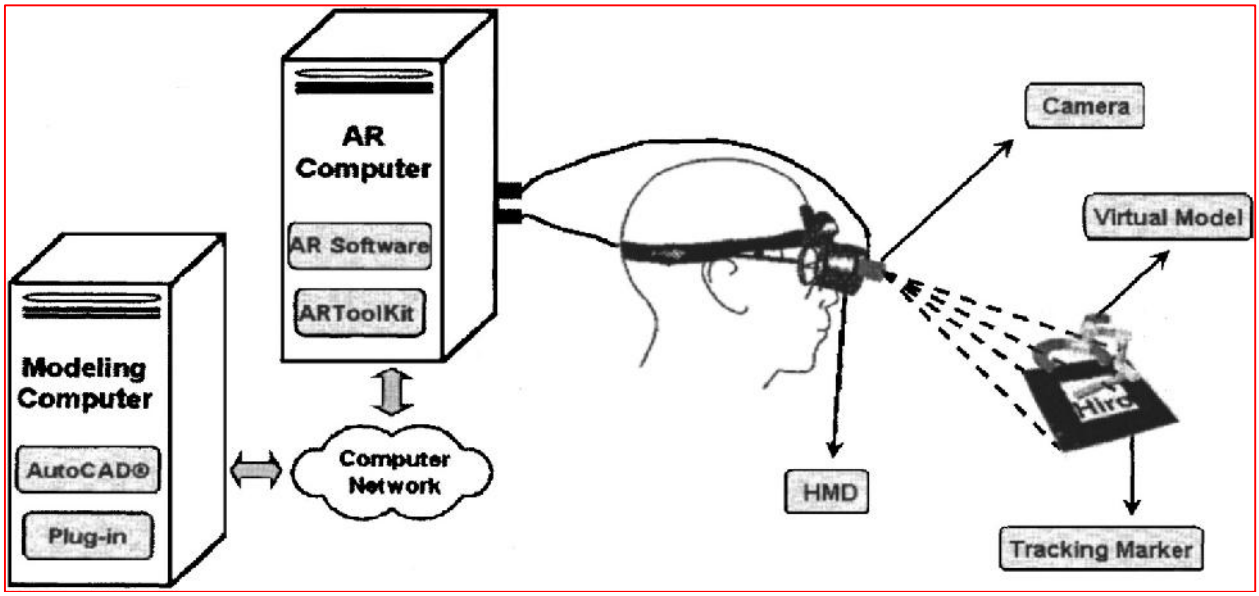

Fig 2: **Working of Augmented Reality.**

2A.HARDWARE [9]

Hardware components for Augmented Reality areprocessor, display, sensors and input devices like smartphones and tablet computers contain these elements which often include a camera and sensors such as accelerometer, GPS, and solid-state compass, making them suitable AR platforms.

1.DISPLAY

A head-mounted display (HMD) is a display device worn on the forehead, such as a harness or helmet. HMDs place images of both the physical world and virtual objects over the user's field of view. Modern HMDs often employ sensors for six degrees of freedom monitoring that allow the system to align virtual information to the physical world and adjust accordingly with the user's head movements.

J **Eyeglasses**: AR displays can be reduced on devices resembling eyeglasses as shown in figure 3. Versions include eyewear that employs cameras to interact with the real-world view and re-display its augmented view through the eyepieces or reflected off the surfaces of the eyewear's lenspieces.

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Fig.3: **Vuzix AR3000 Augmented Reality Smart Glasses**

- **HUD:** A head-up display (HUD) is a transparent display that presents data without requiring users to look away from their usual viewpoints. Near-eye Augmented Reality devices can be used as portable head-up displays as they can show data, information, and images while the user views the real world as shown in figure 4. Augmented Reality is expected to include registration and tracking between the information, data, images and some portion of the real world.

Fig.4: **Headset computer**

- **Contact lenses:** Contact lenses that display AR imaging are in development. These bionic contact lenses might contain the elements for display embedded into the lens including integrated circuitry, LEDs and an antenna for wireless communication.
- **Virtual retinal display:**A virtual retinal display (VRD) is a personal display device under development at the University of Washington's Human Interface Technology Laboratory. With this technology, a display is scanned directly onto the retina of a viewer's eye. The viewer sees what appears to be a conventional display floating in space.
- **EyeTap:** The EyeTap (also known as Generation-2 Glass) captures rays of light that would otherwise pass through the center of the lens of the eye of the wearer, and substitutes synthetic computer-controlled light for each ray of real light as shown in figure 5.The Generation-4 Glass (Laser EyeTap) is like the VRD (i.e. it uses a computer-controlled laser light source) except that it also has infinite depth of focus and causes the eye itself to, in effect, function as both a camera and a display, by way of exact alignment with the eye, and resynthesize (in laser light) of rays of light entering the eye.

Fig.5: **Eyetap model of Augmented Reality**

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- **Handheld:** A Handheld display employs a small display that fits in a user's hand. All handheld AR solutions to date opt for video see-through. Handheld display AR promises to be the first commercial success for AR technologies. The two main advantages of handheld AR are the portable nature of handheld devices and the universal nature of camera phones. The disadvantages are the physical constraints of the user having to hold the handheld device out in front of them always, as well as the distorting effect of classically wide-angled mobile phone cameras when compared to the real world as viewed through the eye.
- **Spatial:** Spatial Augmented Reality (SAR) augments real-world objects and scenes without the use of special displays such as monitors, head-mounted displays or hand-held devices. SAR makes use of digital projectors to display graphical information onto physical objectsas shown in figure 6. The key difference in SAR is that the display is separated from the users of the system. Because the displays are not associated with each user, SAR scales naturally up to groups of users, thus allowing for collocated collaboration between users.Examples include, mobile projectors, virtual tables, and smart projectors. An SAR system can display on any number of surfaces of an indoor setting at once. SAR supports both a graphical visualization and passive haptic sensation for the end users. Users can touch physical objects in a process that provides passive haptic sensation.

Fig.6: **Spatial display of Augmented Reality**

2B. TRACKING

Modern mobile augmented-reality systems use one or more of the following tracking technologies like digital cameras andother optical sensors, accelerometers, GPS, gyroscopes, solid state compassesand wireless sensors. These technologies offer varying levels of accuracy and precision. Most important is the position and orientation of the user's head. Tracking the user's hand or a handheld input device can provide an interaction technique.

2C. INPUT DEVICES

Techniques include speech recognition systems that translate a user's spoken words into computer instructions, and gesture recognition systems that interpret a user's body movements by visual detection or from sensors embedded in a peripheral device such as a wand, stylus, pointer, glove or other body wear.

3.APPLICATIONS AND ADVANTAGES [2][4]

Although Augmented Reality has been around for years, it wasn't until Android and iOS smartphones came equipped with GPS, camera and AR capability that Augmented Reality came into its own with the public. Augmented Reality is technology that combines virtual reality with the real world in the form of live video

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imagery that is digitally enhanced with computer-generated graphics. AR can be experienced through headsets that people wear and through displays on mobile devices.

- **Education**: In educational settings, AR has been used to complement a standard curriculum. Text, graphics, video, and audio may be superimposed into a student's real-time environment. Textbooks, flashcards and other educational reading material may contain embedded markersor triggers that, when scanned by an AR device, produced supplementary information to the student rendered in a multimedia format. This makes AR a good alternative method for presenting information and Multimedia Learning Theory can be applied.
- **Medical:** AR provides surgeons with patient monitoring data in the style of a fighter pilot's heads-up display, and allows patient imaging records, including functional videos, to be accessed and overlaidas shown in figure 7. AR can enhance viewing a fetus inside a mother's womb. Scientists have developed a system for laparoscopic liver surgery that uses AR to view sub-surface tumors and vessels. AR has been used for cockroach phobia treatment. Patients wearing Augmented Reality glasses can be reminded to take medications.

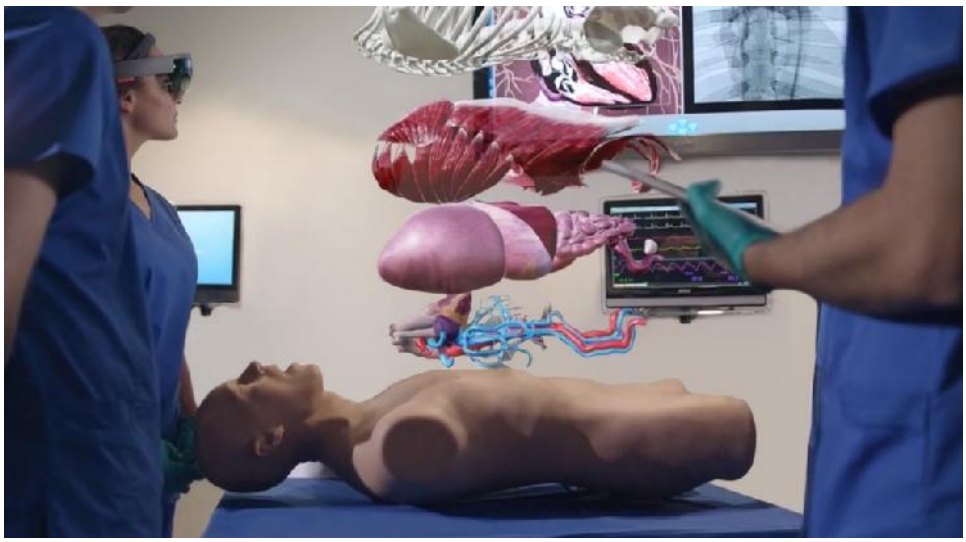

Fig.7: **Medical applications of Augmented Reality**

- **Archaeology and Architecture:** AR has been used to aid archaeological research. By augmenting archaeological features onto the modern landscape, AR allows archaeologists to formulate possible site configurations from extant structures. AR can aid in visualizing building projects. Computer-generated images of a structure can be superimposed into a real life local view of a property before the physical building is constructed there. AR can also be employed within an architect's workspace, rendering animated 3D visualizations of their 2D drawings. Architecture sight-seeing can be enhanced with AR applications, allowing users viewing a building's exterior to virtually see through its walls, viewing its interior objects and layout.
- **Military:** The Heads-Up Display (HUD) is the typical example of Augmented Reality when it comes to military applications of the technology. A transparent display is positioned directly in the fighter pilot's view. Data typically displayed to the pilot includes altitude, airspeed and the horizon line in addition to other critical data. The term heads-upname applies because the pilot doesn't have to look down at the aircraft's instrumentation to get the data he needs.The Head-Mounted Display (HMD) is used by ground troops. Critical data such as enemy location can be presented to the soldier within their line of sight. This technology is also used for simulations for training purposes.In combat, AR can serve as a networked communication system that renders useful battlefield data onto a soldier's goggles in real time. From the soldier's viewpoint, people and various objects can be marked with special indicators to warn of potential dangers. Virtual maps and 360° view camera imaging can also be rendered to aid a soldier's navigation and battlefield perspective, and this can be transmitted to military leaders at a remote command center.

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Fig.8: **Military Applications of Augmented Reality**

- **Commerce**: AR is used to integrate print and video marketing. Printed marketing material can be designed with certain "trigger" images that, when scanned by an AR-enabled device using image recognition, activate a video version of the promotional material. Traditional print-only publications are using Augmented Reality to connect many different types of media. AR can enhance product previews such as allowing a customer to view what's inside a product's packaging without opening it. AR can also be used as an aid in selecting products from a catalog or through a kiosk. Scanned images of products can activate views of additional content such as customization options and additional images of the product in its use. In 2010, virtual dressing rooms were developed for e-commerce.
- **Navigation:** AR can augment the effectiveness of navigation devices. Information can be displayed on an automobile's windshield indicating destination directions and meter, weather, terrain, road conditions and traffic information as well as alerts to potential hazards in their path. Aboard maritime vessels, AR can allow bridge watch-standers to continuously monitor important information such as a ship's heading and speed while moving throughout the bridge or performing other tasks.

Apart from these **Augmented Reality**is also used in rescue, industrial design, broadcast and live events, tourism, music, retail and snapchat.

4.DISADVANTAGES AND DRAWBACKS [8]

- **Tricky to Implement:**Augmented Reality is used in product designing. It is tricky to implement as it requires training and specific tools to be made available to designers.
- **Requires Old Values:**Designing AR is very different to traditional methods. This requires a period of adjustment and the ability for designers to reassess values.
- **Privacy Control:**This will become a bigger issue than with today's information saturation levels. Walking up to a stranger or group of people may reveal status, thoughts, or other information that usually comes with an introduction.
- **Openness**: Other people can develop their own layers of content to display
- Spam and Security
- Social and Real-Time vs. Solitary and Cached
- **UX (User Experience)**: Using AR can be inappropriate in social situations.
- **Interoperability**: The lack of data portability between AR environmentsas shown in figure 9.

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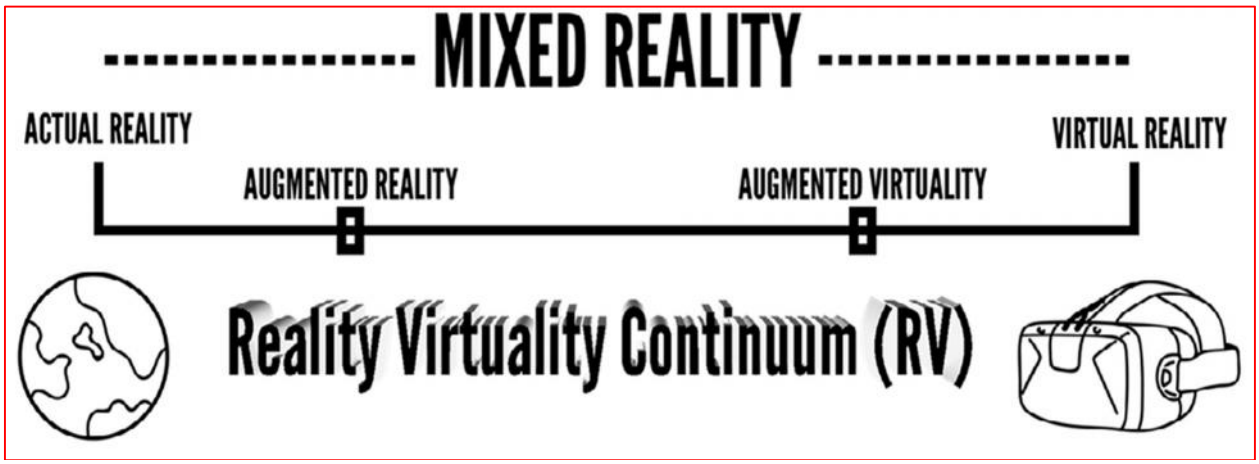

Fig.9: **Disadvantage of Augmented Reality**

- **Possible distraction**: If the AR experience takes the user off the topic, then it becomes a distraction. A good AR experience should be short with a certain Call to Action which can bring the user back to the book.
- **Addiction to the digital screen**: Most of the times one is addicted to the digital screen. Reading is one habit which takes one off it (unless oneis using Kindle). Using AR with books, will add to that addiction.

Although going forward AR seems to have a huge potential market, there are some factors which could slow down mass adoption of Augmented Reality. Some of the factors are:

- Technological Limitations
- Public Awareness and reach of Mobile AR
- Addressing Privacy Issues
- Mobile Internet Connectivity in Emerging Markets

5.FUTURE SCOPE [6][7]

- An area that might be revolutionized by AR is the retail sector, where the technology will act as a gap between online and physical shops, offer a richer experience and personalized promotions delivered right to the wearer.
- Computer games are another important area of development for AR.
- The mobile industry is also a potential scene for future of AR. From smart phones accessing GPS to wearable technologies, Augmented Reality will be expressed by specific apps. All will eventually blur the distinction between reality and virtuality.
- Some other possible future uses of Augmented Reality are in the sector of medicine, military, fine art, industry and teaching.
- **Opportunity:** It is estimated that 2.5 billion AR apps will be downloaded annually and will generate revenue of more than $1.5 billion by 2015. This is because AR apps will not be limited to conventional mobile apps. There will be new markets like Google Glass which will open more forms of development and use.

Fig.10a: **HoloLens**

Fig.10b: **Meta2**

Fig.10c: **Magic leap**

Fig.10d: **Occulus Rift**

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A marker-based AR works on concept of target recognition. The target can be 3D object, text, image, QR Code or human-face called markers. After detection of the target by AR engine, one can embed the virtual object on it and display it on one's camera screen. Qualcomm Vuforia SDK is recommended framework to develop native apps. Unity is also upgrading its quality in AR field. The big companies like Microsoft and google are taking up the challenges in Augmented Reality by upgrading their products. HoloLens [figure 10a], Meta2[figure 10b], Magic Leap [figure 10c], Occulus Rift [figure 10d]etc. are trending in the AR and looking forward for the future in field of AR. Mixing up of artificial intelligence to AR on the sets and if it happens the new revolution will be started.

6.CONCLUSION

To tap this huge market, consumers need to be educated about benefits of Augmented Reality solutions. The mobile development team has developed Augmented Reality solutions which are available for licensing to clients. With the 'product mindset' approach, one is providing robust AR solutions that are tailor-made for the customers.

Augmented Reality is another step further into the digital age as one will soon see the environments change dynamically either through a smartphone, glasses, car windshields and even windows soon to display enhanced content and media right in front of us. This has amazing applications that can very well allow one to live one's lives more productively, more safely, and more informatively.

Maybe in the future, onecan see environment become augmented to display information based on the own interests through built-in augmentations being implemented through holographic projections surrounding the environments without a use of an enabling technology. It would be incredible to no longer wonder where to eat, where to go, or what to do; environment will facilitate the interactions seamlessly.One will no longer be able to discern what is real and what is virtual, the world will become a convergence of digital and physical media.

Fig.11: **Pokémon Go based On Augmented Reality**

Anything of overdose is critical for life and hence the AR. Existing in mixed world often can give us mixed results which will be worth noted. Games like POKEMON GOas shown in figure 11 has just given the adverse effects of AR which will be warning bells to running world.

"At times we'll want to escape our polluted realitynot augment it with digital Debris"

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