

# AUGMENTED REALITY'S LATEST TRENDS: A SYSTEMATIC REVIEW OF RESEARCH AND APPLICATIONS

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**Abstract**—Augmented reality is a concept in which virtual content is impeccably combined with displays of real-world scenes, it is a growing area of interactive design in all aspects, today. With the increasing use of personal mobile devices begins to explore the use of Augmented Reality in all the fields. This paper presents the concept and working of Augmented Reality (AR), basis difference between virtual and augmented reality and It also explore the major fields in which Augmented Reality is applied nowadays.

**Keywords**— Augmented Reality, Virtual Reality, Head mounted devices, smartphones, GPS - Global Positioning System, GPU - Graphics Processing Unit.

## I. INTRODUCTION

The origin of the word augmented is augment, which means to add something. Similarly, in this case graphics, sounds, and touch feedback are added into real world. Augmented Reality, abbreviated as AR is a new technology that enables virtual content to be seamlessly merged with the real world. It blurs the line between real and computer generated artifacts. It changes the way we see the world around us by adding a layer of graphics and other sensory enrichments on the real world as it exists in real time. Researchers are drawing graphic out of the computer screen and integrating them into the real world by assertive the barriers of photorealism.

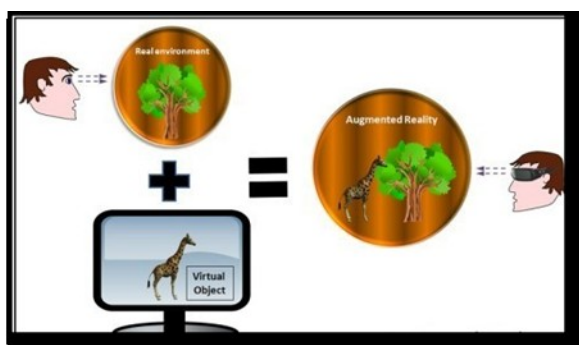


Figure 1: Augmented Reality, Blends virtual object with real world.

Although initially requiring custom hardware and software, in the last few years AR experiences have become widely available on mobile and handheld devices. One reason for this is the emergence of smart

phones that combine fast CPUs with displays, cameras, graphics acceleration, compass, GPS sensors, and even gyroscopes. Now, people have a powerful AR hardware platform in their pockets at is their mobile phone[3].

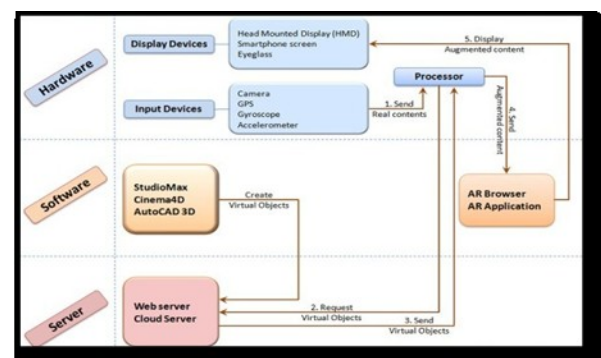


Figure 2: Augmented Reality Layout.

Many recent papers have elaborating the definition of AR beyond this vision, by defining the following properties: 1.) Blends real and virtual, in a real environment. 2.) Real-time interactive 3.) Registered in 3D Registration refers to the accurate alignment of real and virtual objects. Without accurate registration, the artifice that the virtual objects exist in the real environment is severely compromised. Registration is a challenging problem .

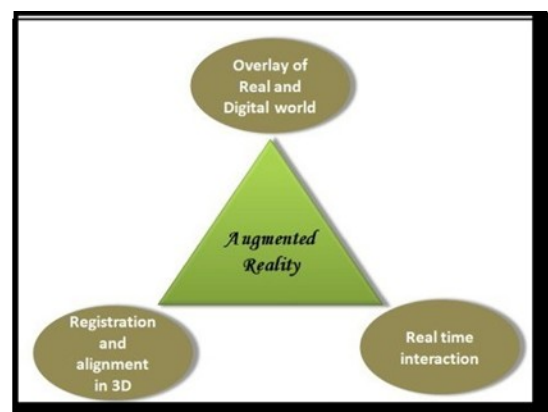


Figure 3: Augmented Reality Characteristics

Applications of augmented reality can be as simple as a text-notification or as complicated as an instruction on how to perform a life-threatening surgery.

Milgram defined a continuum of Real to Virtual environments, where Augmented Reality is one part of the general area of Mixed Reality (Figure 4). In virtual environments, the surrounding environment is virtual, while in AR the surrounding environment is real. This survey focuses only on Augmented Reality not virtual reality [2].

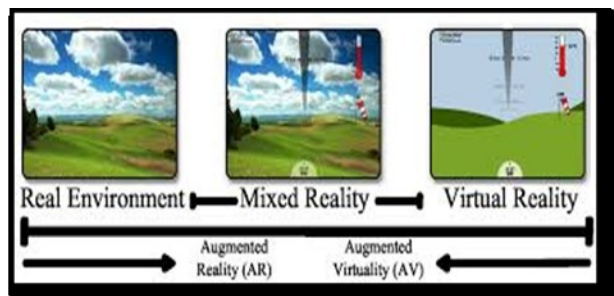


Figure 4: Augmented Reality Milgram

## II. HOW DOES IT WORK?

By using a mobile application, a mobile phone's camera identifies marker, often a black and white barcode image. The software analyses the marker and creates a virtual image overlay on the mobile phone's screen, tied to the position of the camera. The app works with the camera by interpreting the angles and distance the mobile phone is away from the marker. Due to the number of calculations a phone must do to render the image or model over the marker, often only Smartphone's are capable of supporting augmented reality with any success. Phones need a camera, and if the data for the AR is not stored within the app, a good 3G Internet connection[5].



Figure 5: Augmented Reality Working

## III. DIFFERENCES BETWEEN AUGMENTED AND VIRTUAL REALITY

Augmented reality add something to the existing environment to enhance the real world, whereas virtual reality actually create an entirely new artificial world. Augmented reality needs the environment so just use a camera integrated in our devices such as Smartphone, tablets, PCs,. Virtual reality needs a device which can fully isolate us in virtual world, this is, specific devices.[11] Augmented reality is having more acceptance in formation and marketing field, whereas Virtual reality is better for videogames and other leisure options[2].



Figure 6: Virtual Reality vs Augmented Reality

### 3.1 ADVANTAGES OF AR:

- Now days augmented reality can be used for increase user knowledge and information.
- People can share experiences with each other in real time over long distances.
- Games that provide an even more "real" experience to the user.

### 3.2 DISADVANTAGES OF AR:

- Openness: Other people can develop their own layers of content to display. That could cause information overload and augmenting without permission.
- Interoperability: The lack of data portability between AR environments.
- Regarding user experience, socially using Augmented Reality may be inappropriate in some situations.
- Spam as it is easy to imagine that spam could overwhelm the augmented world with unwanted advertising or unwanted information of any kind.
- Price – as the technology is still developing it may be quiet expensive to use it in everyday life and it might be less accessible for small businesses[7].

### 3.3 BARRIERS WHICH WE NEED TO CROSS:

- 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:
- Public Awareness and reach of Mobile AR
- Technological Limitations
- Addressing Privacy Issues
- Mobile Internet Connectivity in Emerging Markets[7]

## IV. EXISTING APPLICATIONS OF AR

There has been considerable amount of research and development in the following fields of applications for AR[8,9].

### 4.1 AR in Medical Fields:

Augmented reality has the potential to play a big role in improving the healthcare industry. Only a few years since the first implementations of augmented reality in medicine, it has already filled an important place in doctors' routine, as well as patients' lives.

This new technology is enhancing medicine and healthcare towards more safety and efficiency. For now, augmented reality has already made significant changes in the following medical areas:

- Surgery (Minimal Invasive Surgery);
- Education of Future Doctors;
- Diagnostics;
- Disease Detection.



Figure 7: AR in Medical

#### 4.2 AR in the Education:

Augmented reality in education will soon affect the conventional learning process. AR has the potential to introduce new and additional ways and methods. Abilities of Augmented Reality technology may make classes more engaging and information more apprehendable.

Nowadays 80% of young people own smartphones. Most of them are active smartphone users that use these devices to access social sites and playing games. In the meantime, much lesser part of young adults use phones for studying purposes, to do the homework, dig information about a subject, etc. by adding creative and interactive AR Apps we can create a creative and interactive environment by adding elements such as text, images, video and audio can be superimposed into a student's real time view of the environment. Educational material such as textbooks, flashcards and other reading material can contain embedded "markers" that produce supplementary information to the student in a multimedia format, when they are scanned by an AR device.



Figure 8: AR in Education

#### 4.3 AR in the sports industry:

AR in the sports industry, you'll see how naturally and gradually it has been entering sportsmen's routine and sport competitions. Augmented reality in sports is capable to improve the skills of athletes, reduce the risk of failures and injuries, as well as enhance the viewing experiences for the fans.



Figure 9: AR in Sports

You can apply augmented reality to different sports competitions to secure the more fair game. The technology provides a three-dimensional representation of the ball's trajectory and is used in cricket, tennis, Gaelic football, badminton, hurling, Rugby Union, association football and volleyball.

4.4 AR in tourism: tourism is one of the largest industries in their domestic economies, today. New AR mobile apps provide useful information, navigation, guides and translations by providing real time information on displays regarding a location and its attributes, including reviews and comments made by previous visitors of the site which might be helpful to tourists.

4.5 AR in e-commerce: Growth of consumers' demands, evolution of mobile devices and market capabilities lead to strong trends that make AR one of the major tools and platforms in tech world.

- Magic Leap has got from Google \$800 million alone and 1.4 billion from others.
- Facebook advanced Oculus which has cost them almost \$2 billion.
- Alibaba also announced that they are working on creating the Virtual and Augmented Reality services for e-commerce.
- Other major players in this field are Microsoft, HTC/Valve, Sony, Samsung and many more.

All of that makes AR slowly capturing interest of consumers and takes over mobile devices by creating connection between real and digital world. Meantime ecommerce companies may take their own role in all of this and rise up on tide of new tech, like Amazon using internet overgrown Walmart 20 years ago.



Figure 10: AR in e-commerce

## V. CONCLUSION

This paper presents the concept of Augmented Reality which is a novel technique to interact with the virtual world by giving us a better

way to expose our views to other, through this paper we discuss the increasing application of this technology in each and every zones by giving a better user experience. But it is still in its initial phases; and thus the forthcoming possible apps are boundless.

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