Augmented Reality (AR)

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Abstract

Technology has advanced to the point here realism in virtual reality is very achievable. However, in our obsession to reproduce the world and human experience in virtual space, we overlook the most important aspects of what makes us who we are—our reality. On the spectrum between virtual reality, which creates immersible, computer-generated environments, and the real world, augmented reality is closer to the real world. Augmented reality adds graphics, sounds, haptics and smell to the natural world as it exists .Augmented reality will truly change the way we view the world. Picture yourself walking or driving down the street. With augmented-reality displays, which will eventually look much like a normal pair of glasses, informative graphics will appear in your field of view and audio will coincide with whatever you see. These enhancements will be refreshed continually to reflect the movements of your head. In this article, we will take a look at this future technology, its components and how it will be used. Augmented reality (AR) refers to computer displays that add virtual information to a user's sensory perceptions. Most AR research focuses on see-through devices, usually worn on the head that overlay graphics and text on the user's view of his or her surroundings. In general it superimposes graphics over a real world environment in real time.Augmented reality is far more advanced than any technology you've seen in television broadcasts, although early versions of augmented reality are starting to appear in televised races and football games. These systems display graphics for only one point of view. Next-generation augmented-reality systems will display graphics for each viewer's perspective.

1. INTRODUCTION

1.1. DEFINITION

Augmented reality (AR) is a field of computer research which deals with the combination of real world and computer generated data. Augmented reality (AR) refers to computer displays that add virtual information to a user's sensory perceptions. It is a method for visual improvement or enrichment of the surrounding environment by overlaying spatially aligned computer-generated information onto a human's view (eyes)

Augmented Reality (AR) was introduced as the opposite of virtual reality: instead of immersing the user into a synthesized, purely informational environment, the goal of AR is to augment the real world with information handling capabilities.

AR research focuses on see-through devices, usually worn on the head that overlay graphics and text on the user's view of his or her surroundings. In general it superimposes graphics over a real world environment in real time.

An AR system adds virtual computer-generated objects, audio and other sense enhancements to a real-world environment in real-time. These enhancements are added in a way that the viewer cannot tell the difference between the real and augmented world.

1.2 PROPERTIES

AR system to have the following properties:

1. Combines real and virtual objects in a real environment;
2. Runs interactively, and in real time; and
3. Registers (aligns) real and virtual objects with each other.

Definition of AR to particular display technologies, such as a head mounted display (HMD). Nor do we limit it to our sense of sight. AR can potentially apply to all senses, including hearing, touch, and smell.

2. AUGMENTED REALITY Vs VIRTUAL REALITY

The term Virtual Reality was defined as "a computer generated, interactive, three-dimensional environment in which a person is immersed." There are three key points in this definition. First, this virtual environment is a computer generated three-

dimensional scene which requires high performance computer graphics to provide an adequate level of realism. The second point is that the virtual world is interactive. A user requires real-time response from the system to be able to interact with it in an effective manner. The last point is that the user is immersed in this virtual environment

One of the identifying marks of a virtual reality system is the head mounted display worn by users. These displays block out all the external world and present to the wearer a view that is under the complete control of the computer. The user is completely immersed in an artificial world and becomes divorced from the real environment.

A very visible difference between these two types of systems is the immersiveness of the system. Virtual reality strives for a totally immersive environment. The visual, and in some systems aural and proprioceptive, senses are under control of the system.

In contrast, an augmented reality system is augmenting the real world scene necessitating that the user maintains a sense of presence in that world. The virtual images are merged with the real view to create the augmented display. There must be a mechanism to combine the real and virtual that is not present in other virtual reality work. Developing the technology for merging the real and virtual image streams is an active research topic .

3. Different AR Techniques

There are two basic techniques for combining real and virtual objects; optical and video techniques. While optical technique uses an optical combiner, video technique uses a computer for combining the video of the real world (from video cameras) with virtual images (computer generated). AR systems use either Head Mounted Display (HMD), which can be closed-view or see-through HMDs, or use monitor-based configuration. While closed-view HMDs do not allow real world direct view, see-through HMDs allow it, with virtual objects added via optical or video techniques

4. What Makes AR Work?

The main components that make an AR system works are,

1. **Display**

This corresponds to head mounted devices where images are formed. Many objects that do not exist in the real world can be put into this environment and users can view and exam on these objects. The properties such as complexity, physical properties etc. are just parameters in simulation.

2. **Tracking**

Getting the right information at the right time and the right place is the key in all these applications. Personal digital assistants such as the Palm and the Pocket PC can provide timely information using wireless networking and Global Positioning System (GPS) receivers that constantly track the handheld devices

3. **Environment Sensing**

It is the process of viewing or sensing the real world scenes or even physical environment which can be done either by using an optical combiner, a video combiner or simply retinal view.

4. **Visualization and Rendering**

Some emerging trends in the recent development of human-computer interaction (HCI) can be observed. The trends are augmented reality, computer supported cooperative work, ubiquitous computing, and heterogeneous user interface. AR is a method for visual improvement or enrichment of the surrounding environment by overlaying spatially aligned computer-generated information onto a human's view (eyes).

This is how AR works.

- **Pick A Real World Scene**

  Real world. User's view through the see-through head-worn display of the real world, showing two struts and a node without any overlaid graphics.
- **Add your Virtual Objects in it**

  User's view of the virtual world intended to overlay the view of the real world.
- **Delete Real World Objects**
- **Not Virtual Reality since Environment Real**

5.Augmented Reality Application Domains

Only recently have the capabilities of real-time video image processing, computer graphic systems and new display technologies converged to make possible the display of a virtual graphical image correctly registered with registered with a view of the 3D environment surrounding the user. Researchers working with augmented reality systems have proposed them as solutions in many domains. The areas that have been discussed range from entertainment to military training. Many of the domains, such as medical are also proposed for traditional virtual reality systems.

5.1. Medical

This domain is viewed as one of the more important for augmented reality systems. Most of the medical applications deal with image guided surgery. Pre-operative imaging studies, such as CT or MRI scans, of the patient provide the surgeon with the necessary view of the internal anatomy. From these images the surgery is planned. Visualization of the path through the anatomy to the affected area where, for example, a tumor must be removed is done by first creating a 3D model from the multiple views and slices in the preoperative study. Being able to accurately register the images at this point will enhance the performance of the surgical team and eliminate the need for the painful and cumbersome stereo tactic frames. Simulated AR medical image of a brain

5.2 Entertainment

A simple form of augmented reality has been in use in the entertainment and news business for quite some time. Whenever we are watching the evening weather report the weather reporter is shown standing in front of changing weather maps. In the studio the reporter is actually standing in front of a blue or green screen. This real image is augmented with computer generated maps using a technique called chroma-keying. It is also possible to create a virtual studio environment so that the actors can appear to be positioned in a studio with computer generated decorating

In this the environments are carefully modeled ahead of time, and the cameras are calibrated and precisely tracked. For some applications, augmentations are added solely through real-time video tracking. Delaying the video broadcast by a few video frames eliminates the registration problems caused by system latency. Furthermore, the predictable environment (uniformed players on a green, white, and brown field) lets the system use custom chroma-keying techniques to draw the yellow line only on

the field rather than over the players. With similar approaches, advertisers can embellish broadcast video with virtual ads and product placements

5.3 Military Training

The military has been using displays in cockpits that present information to the pilot on the windshield of the cockpit or the visor of their flight helmet. This is a form of augmented reality display.

By equipping military personnel with helmet mounted visor displays or a special purpose rangefinder the activities of other units participating in the exercise can be imaged. In wartime, the display of the real battlefield scene could be augmented with annotation information or highlighting to emphasize hidden enemy units.

5.4. Engineering Design

Imagine that a group of designers are working on the model of a complex device for their clients. The designers and clients want to do a joint design review even though they are physically separated. If each of them had a conference room that was equipped with an augmented reality display this could be accomplished. The physical prototype that the designers have mocked up is imaged and displayed in the client's conference room in 3D. The clients can walk around the display looking at different aspects of it

5.5. Robotics and Telerobotics

In the domain of robotics and telerobotics an augmented display can assist the user of the system. A telerobotic operator uses a visual image of the remote workspace to guide the robot. Annotation of the view would still be useful just as it is when the scene is in front of the operator. There is an added potential benefit. The

robot motion could then be executed directly which in a telerobotics application would eliminate any oscillations caused by long delays to the remote site.

5.6.Manufacturing,Maintenance and Repair

Recent advances in computer interface design, and the ever increasing power and miniaturization of computer hardware, have combined to make the use of augmented reality possible in demonstration test beds for building construction, maintenance and renovation. When the maintenance technician approaches a new or unfamiliar piece of equipment instead of opening several repair manuals they could put on an augmented reality display. In this display the image of the equipment would be augmented with annotations and information pertinent to the repair. The military has developed a wireless vest worn by personnel that is attached to an optical see-through display. The wireless connection allows the soldier to access repair manuals and images of the equipment. Future versions might register those images on the live scene and provide animation to show the procedures that must be performed.

5.7. Consumer Design

Virtual reality systems are already used for consumer design. Using perhaps more of a graphics

system than virtual reality, when you go to the typical home store wanting to add a new deck to your house, they will show you a graphical picture of what the deck will look like

When we head into some high-tech beauty shops today you can see what a new hair style would look like on a digitized image of yourself. But with an advanced augmented reality system you would be able to see the view as you moved. If the dynamics of hair are included in the description of the virtual object you would also see the motion of your hair as your head moved.

5.8. Augmented mapping

Paper maps can be brought to life using hardware that adds up-to-the-minute information, photography and even video footage. Using AR technique the system, which augments an ordinary tabletop map with additional information by projecting it onto the map's surface. can be implemented.

It would help emergency workers and have developed a simulation that projects live information about flooding and other natural calamities. The system makes use of an overhead camera and image recognition software on a connected computer to identify the region from the map's topographical features. An overhead projector then overlays relevant information - like the location of a traffic accident or even the position of a moving helicopter - onto the map

5. Challenges

Technological limitations

Although there is much progress in the basic enabling technologies, they still primarily prevent the deployment of many AR applications. Displays, trackers, and AR systems in general need to become more accurate, lighter, cheaper, and less power consuming. Since the user must wear the PC, sensors, display, batteries, and everything else required, the end result is a heavy backpack. Laptops today have only one CPU, limiting the amount of visual and hybrid tracking that we can do.

User interface limitation

We need a better understanding of how to display data to a user and how the user should interact with the data. AR introduces many high-level tasks, such as the need to identify what information should be provided, what's the appropriate representation for that data, and how the user should make queries and reports. Recent work suggests that the creation and presentation of narrative performances and structures may lead to more realistic and richer AR experience.

Social acceptance

The final challenge is social acceptance. Given a system with ideal hardware and an intuitive interface, how AR can become an accepted part of a user's everyday life, just like a mobile phone or a personal digital assistant. Through films and television, many people are familiar with images of simulated AR. However, persuading a user to wear a system means addressing a number of issues. These range from fashion to privacy concerns. To date, little attention has been placed on these fundamental issues. However, these must be addressed before AR becomes widely accepted

7. Conclusion

The research topic "Augmented Reality" (AR) is receiving significant attention due to striking progress in many subfields triggered by the advances in computer miniaturization, speed, and capabilities and fascinating live demonstrations. AR, by its very nature, is a highly inter-disciplinary field, and AR researchers work in areas such as signal processing, computer vision, graphics, user interfaces, human factors, wearable computing, mobile computing, computer networks, distributed computing, information access, information visualization, and hardware design for new displays.

Augmented reality is a term created to identify systems which are mostly synthetic with some real world imagery added such as texture mapping video onto virtual objects. This is a distinction that will fade as the technology improves and the virtual elements in the scene become less distinguishable from the real ones.

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