An overview of Augmented and Mixed Virtual Reality and current programs at the University of Central Florida

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Introduction

Fundamentally, virtual reality is an artificial environment created entirely by computers. Augmented reality adds technologically generated information to a real world scene. Mixed reality uses some artificial support to enrich an environment of virtual and augmented reality. In all cases, the atmosphere generated by the computer is recorded spatially for a user and responds to your actions in real time. For example, if the user turns his head, the system responds with an appropriate change in the scene.

Augmented reality can be divided into three classes: an augment of something which is not a part of the real world (for example, projecting an object above the head), the augment merged with the real world (For example: including or removing content that is not distinguishable by the user, such as the inclusion of furniture in a real room) , and the augment of real life (For example: using night vision goggles) . Table 1 provides a graphical view about the divisions of augmented reality.

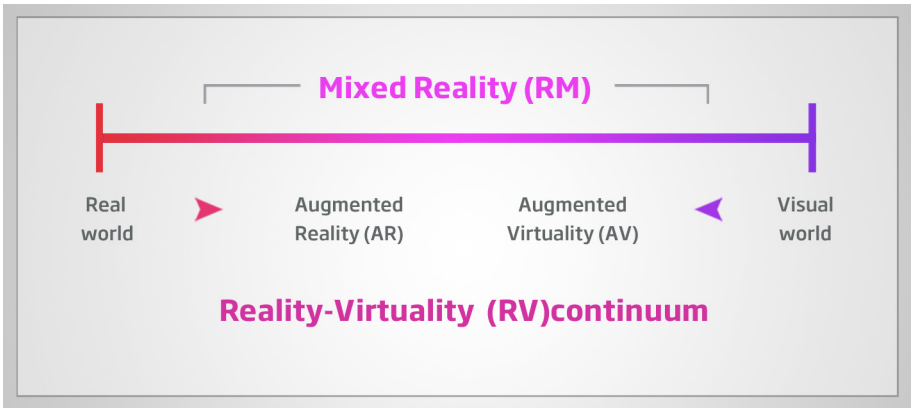

Figure 1.

The fields of mixed and augmented reality are advancing progressively in the movement of established industries, such as advertising, product display, military training and medicine. Furthermore, there is active research community that develops new technologies and who understand their impact on the user. The following images were taken from Wikipedia and are some examples of the implementation of augmented reality.

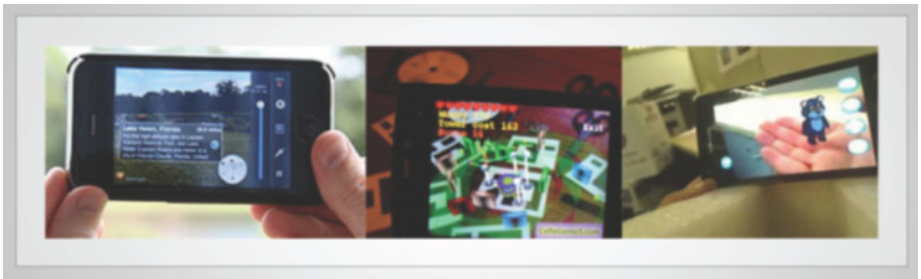

Figure 2.

This document provides a brief description of the research efforts of the Institute for Simulation and Training (IST) at the University of Central Florida (UCF) and mention some major technological changes that have been made and in some cases implemented .

IST is a multidisciplinary research unit at UCF oriented in the advancement of technology and the use of human centered modeling and simulation (www.ist.ucf.edu).

Description of Research Program selection

The investigation at the Institute is conducted on Mixed and Augmented Reality, which is generally supported by one or more of these three topics:

1. Underlying Technology
2. Development of the prototype system
3. Human use

Virtual - physical Avatar

The challenge in many augmented and mixed systems is to make them believable to those who use them. This is particularly important when the virtual part representing a person tries to interact with others. Dr. Greg Welch of IST creates virtual physical persons with the support of the U.S. Office of Naval Research and the National Science Foundation in the USA. These virtual physical people are avatars which are "inhabited" by individuals. This program seeks to incorporate characteristics

of a person in an avatar, and this avatar may have interaction or a relationship with other avatars . The person which is added is a picture of a 3D face template, its body is able to move and act with cameras and at the same time work with 2 audio channels.

A representation of this trend is shown in Illustration 1.

Currently this research represents important technological advances, including the following:

- Show the generation of CGI on a non-planar surface.
- The variation in shadows by illumination can generate algorithmic accounts that help to improve realism.
- Generate a control algorithm that allows the avatar to make a true movement, follow other movements (currently using a motorized wheelchair) ,and can continue to have a voice and a facial image.
- Increase realism in some specific facial features including its dynamic changes during the interaction.

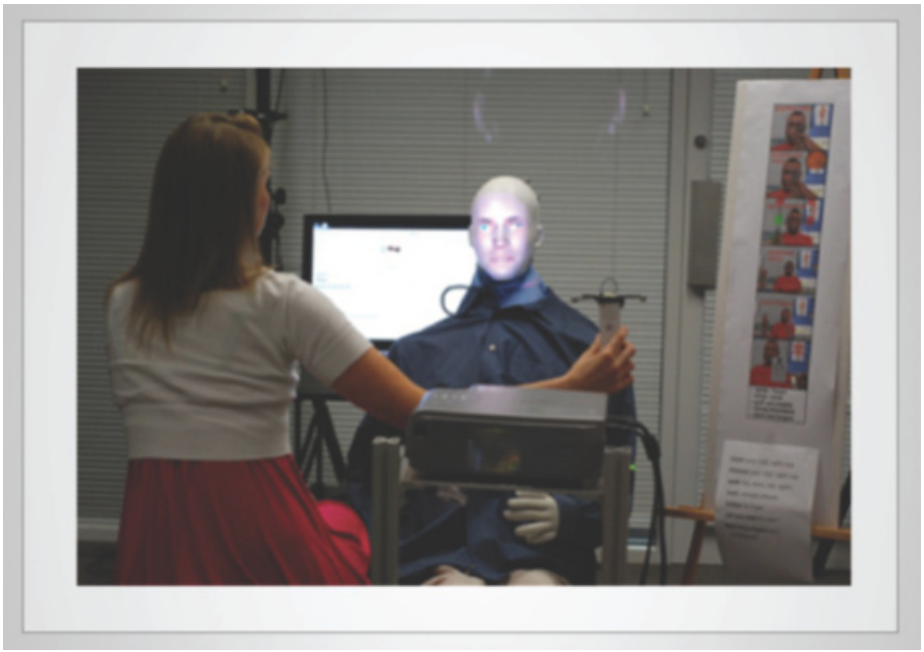

Figure 3.

Built to learn

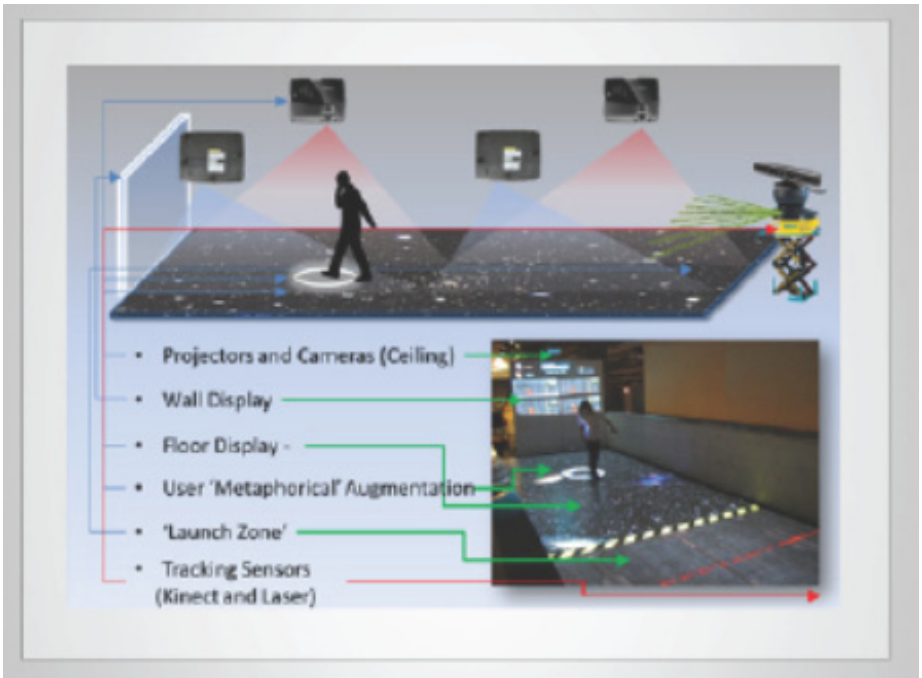

Figure 4.

This project called MEteor seeks to provide an environment where individuals can traverse space and explore various constellations physically. The person is monitored by a special system of cameras and therefore does not use specialized tracking equipment that may be damaged. The system uses a combination of Microsoft Kinect and laser tracking systems. Some important challenges are presented in the lighting, as it can minimize the projection of the participant. The National Science Foundation of the United States supports this research.

Human use

As I mentioned earlier in this paper, augmented reality systems exist today , but there are few students who can identify usefulness in specific applications. Doctors Eduardo Salas and Shirley Sonesh directed their research project to a student who interpreted the operation of a human heart using commercially available augmented reality software. The economic version of the software that is used provides an easy approach for visualization of anatomical structures that can be manipulated by the student with or without textual labels . The re-

search effort involves the evaluation of the different representations of the heart, providing an improvement in medical student training when your example is compared to a model made of fiberglass. As mentioned, medical students are prepared at UCF as target population to assess the training of students using these technologies. Future work will use augmented reality in situations that involve the direct treatment of patients, for example , to remove a phobia of a person who has arachnophobia.

Research Challenges

While the advances that are being made in augmented and mixed virtual reality are very interesting, much remains to be done. Some of the most important challenges include:

- Movements in open spaces
- Packaging
- Shutter speed (speed with which the image is captured)
- Presentation
- Publication of systems
- Presence Control

Mobility is an important aspect, but accommodating movement requires many technological advances. Many of the issues outlined above and further explained below are inclusive, yet it is pertinent to note that several unique aspects are accurately tracked through an open space and fit in a wide sphere according to the brightness, shadows , effects and radios in contrast to the natural environment.

The packaging of virtual reality systems, augmented or mixed, presents several technical challenges. It is also important to note that immersive environments,with all the details, require a special space to store a large amount of equipment and electronic sensors. This system is difficult to move and connect strategically; connecting the individual with the electronic equipment can be a challenge. Also, the equipment's clothing is typically bulky and heavy.

The shutter determines whether the individual is located in the foreground or in the background. These calculations are difficult because they have to be interpreted in real time. Often , you have to sometimes consider the bi -ocular vision of the user, it must be very accurate because the eye can be very sensitive to failures in the scene.

When the user's movements are considered,shutter speed qualifies as a big challenge.

The presentation of these projects shows technical challenges from various perspectives. There are two worlds in the display area, defined by the viewing optics and the video. For optical sight small projectors can be used and half a silver mirror will project the image a little while, allowing the user to look in the mirror and see the entire scene naturally.

These presentations can have optical complications, so you have to register geometrically close to the capture near the scene presented in the real world. This presentation assurance system provides many benefits, because if the projection system fails, the user can still see the natural scenery. The other form of presentation is in video, so the user can see the real and virtual images merged electronically and projected to an external source. While the assurance can be a problem in open environments , this approach has more advantages for the fusion of images in digital mode , which provides more flexibility than optical approach , especially since the setting is visible only through the projection system. Combining video allows control within a radius of luminosity, color adjustment, and digital image alloying .

The descriptions above, although limited in scope and depth, demonstrate that there are many advantages and disadvantages that should be considered when designing augmented and mixed virtual reality systems. Most current approaches are custom designs that offer a limited market penetration due to the difficulty in production, maintenance and cost.

The ultimate challenge is research on the Presence control (inclusion or feeling that you are somewhere different from the real environment) . If you want a fully immersive environment, the designer must consider the degree of detail required for the user to believe that the environment is real and not virtual.

For example, returning to the theme of the fear of spiders: a therapist can control a computer- mediated environment if the user is looking to overcome a phobia. In this regard ,the U.S. military sponsored research regarding the treatment of post-traumatic stress disorder , based on the Presence.

The science behind Presence is difficult due to the variation of parameters between users and the control of the scene in real time.

Classics like Heeter (1992) may provide a good explanation of the Presence and the various forms it takes .

Conclusion

Augmented and mixed virtual reality systems seem to be moving in many application environments. The research that supports its growth occurs in universities and companies that can commercialize this technology and apply it in specific fields. This paper has presented some examples of research conducted at the University of Central Florida to give the reader an idea of the use of the developed technology and its various applications. This research ecosystem is gaining momentum for the production of this technology and will continue to advance in the future.

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