AUGMENTED REALITY

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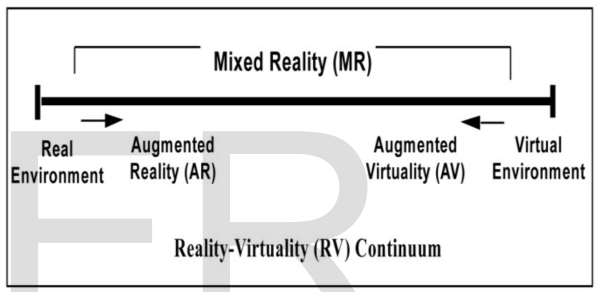
Abstract— This paper aims to provide design on augmented reality (AR) based system to encourage user participation. Augmented reality is a technology that merges visual perception of real world environments and objects with virtual, computer-generated content. Augmented reality is changing the way we view the world. Picture ourself walking or driving down the street. This history of augmented reality can be traced to work done at MIT in the late 1960s.In the ensuing decades, a growing cadre of researchers in university, medical, industrial and military settings built upon the early breakthroughs. Diverse applications of augmented reality followed, and today we are witnessing a dazzling array of innovations across a wide spectrum of industries and disciplines. Augmentation is conventionally in real time and in semantic context with environmental elements, such as sports scores on TV during a match. Augmented reality brings virtual reality into the real world and in process enhances what we can do in real-world scenarios. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable.

1 INTRODUCTION

Augmented reality (AR) refers to computer dislplays that add virtual information to a user's sensory perception. It is a growing area in virtual reality research. It is the outcome of late 1990s. The basic ideology is it is a technology through which the view of real world environment is supplemented by computer generated elements/objects. An augmented reality system generates a composite view of the user. It is a combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information. The ultimate goal is to create a system such that the user cannot tell the difference between the real world and virtual augmentation of it. To the user of this ultimate scene, it would appear that he is looking at a single real scene. By contrast, virtual reality replaces the real world with a simulated one. In the reality- virtuality continuum by Milgram et al in the year 1994, augmented reality lies between the virtual world and real world.



Tracking and registration are the most critical issues for AR applications. The proper alignment of virtual objects to real world environment is called registration. Tracking is the main issue for out door augmented reality applications. Calibration is another challenge for augmented reality system. Intraction techniques and user interfaces are problems for AR system that need to be address. Portability of AR system is also a challenge as a wearable system needs to be carried out a whole set of heavy equipment for a long time. The virtual objects and real world environment are required to be of same illumination. Another issue is occlusion, that is a process to determine which surface or its parts are not visible from a certain view point.

2 HISTORY

The term "augmented reality" has been around since 1990 but that doesn't mean that it was never there before. The moment that man-made gadgets that could relate to their environment and supply their users with information based on that, AR was there but nobody thought to call it that. From 1957, a gentleman known by the name of Morton Helig began building a machine called the Sensorama. It was designed as a cinematic experience to take in all our senses and, shaped, rather like arcade machine from the 80s, it blew wind at us, vibrated the seat we sat on, played sounds to our eyes and projected a form of a stereoscopic 3D environment to the front and sides of our head.

In 1966 Professor Ivan Sutherland of Electrical Engineering at Harvard University invented the first model of one of the most

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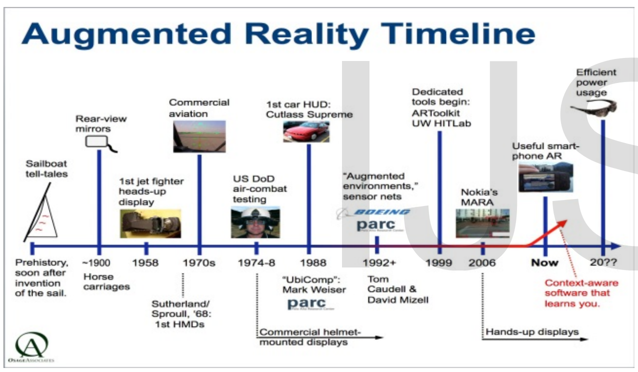
important devices used in both AR and VR today - the head-mounted display or HMD. It was a monumental piece of kit that was too heavy for the human head to actually bear and so hung suspended from the ceiling of the lab instead which was how it got its nickname as The Sword of Damocles. Being early in the scale of computer technology, its graphical powers was fairly limited and provided just simple wireframe models of generated environments. Nonetheless, it was the first step in making AR a usable possibility. While it might have been around for a few years in one shape or other, the phrase Augmented Reality is supposed to have been coined by Professor Tom Caudell while working in Boeing's Computer Services' Adaptive Neural Systems Research and Development project in Seattle.

At the same time, in 1992, two other teams were made big steps into this new world. LB Rosenberg creates what's widely recognized as the first functioning AR system for the US Air Force known as VIRTUAL FIXTURES where fixtures were what he described as cues to help guide the user in their task and did so in very big letters. A second group, also fond of capping things up, made up of Steven Feiner, Blair Macintyre and Doree Seligmann - all of whom now lead in the field of AR - submitted a paper on a prototype system they called KARMA (Knowledge-based Augmented Reality for Maintenance Assistance).



3 WORKING

Augmented reality system tracks the position and orientation of the user's head so that the overlaid material can be aligned with the user's view of the world. Throught this process, known as reagistration, graphics software can place a 3dimensional image of a tea cup, for example on top of a real saucer and keep the virtual cup fixed in that position as the user moves about the room. AR systems employ some of the same hardware technologies used in virtual reality research but there's a crucial differences; whereas virtual reality brashly aims to replace the real world, augmented reality respectfully supplement it.Eventually, possible by the end of this decade, we will see first mass- marketed augmented reality system, which one researcher calls "THE WALKMAN OF THE 21ST CENTURY". Just as the innovation of video technology enabled the medium of film and television, a breakthrough in computer vision in the last decade has enabled what we now consider to be the fundamentals of AR. What augmented reality attempts to do is not only super impose graphics to accomodate a user's head and eye movements, so that the graphics always fit and perspective

The basic idea of augmented reality is to superimpose graphics, audio and other sense enhancements over a real-world environment in real-time. Augmented reality is far more advanced than any technology we've seen in television broadcasts, although early versions of augmented reality are starting to appear in televised races and football games, such as Racef/x and the super-imposed first down line, both created by sporTVision. Next-generation augmented reality systems will display graphics for each viewer's perspective. There are the three components needed to make an augmented-reality system work:

- Head mounted display
- Tracking system
- Mobile computing power

3.1 HEAD MOUNTED DISPLAY

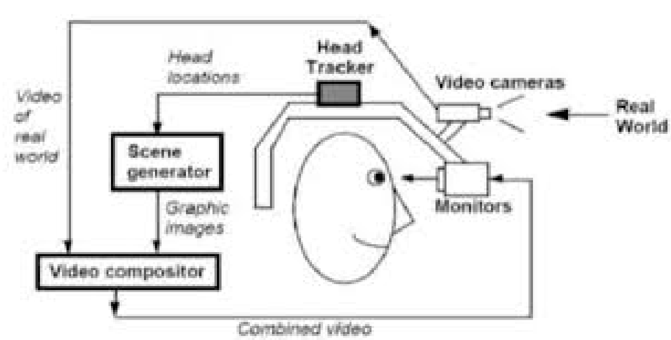
Just as monitors allow us to see text and graphics generated by computers, head-mounted displays (HMDs) will enable us to view graphics and text created by augmented-reality systems. So far, there haven't been many HMDs created specifically with augmented reality in mind. Most of the displays, which resemble some type of skiing goggles, were originally created for virtual reality. There are two basic types of HMDs:

- Video see-through
- Optical see-through

3.1.1 Video see-through

In contrast,a video see through display uses video mixing technology, originally developed for television special effects, to comibe the image from a head worn camara with syncrosized graphics. The merged image is typically presented on an apaque head worn display. With careful design the camera can be positioned so that its optical path is closed to that of the users eye; the video image thus approximates what the user would normally see. As with optical see through displays, a separate system can be provided for each eye to support stereo vision. Video composition can be done in more than one way. A simple way is to use chroma-keying: atechnique used to many video special effects.

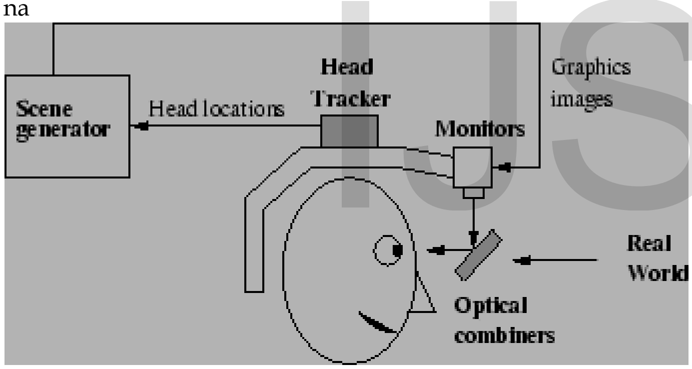
Video see-through displays block out the wearer's surrounding environment, using small video cameras attached to the outside of the goggles to capture images. On the inside of the display, the video image is played in real-time and the graphics are superimposed on the video. One problem with the use of video cameras is that there is more lag, meaning that there is a delay in image-adjustment when the viewer moves his or her head.



3.1.2 OPTICAL SEE-THROUGH

A simple approach to optical see-through display employs a a mirror beam splitter-a half silvered mirror that both reflects and transmits light. If properly oriented in front of the user's eye, the beam splitter can reflect the image of the computer display into the user's line of sight yet still allow light form the sirrounding world to pass through. Such beam splitters, which are called combiners, have long been used in head up displays for fighter-jet-pilots. Lenses can be placed between the beam splitter and the computer and display to focus the image so that it appears at a comfortable viewing distance.

If a display and optics are provided for each eye, the view can be in stereo.Most companies who have made optical see-through displays have gone out of business. Sony makes a see-through display that some researches use, called the "Glasstron". Blain MacIntyre, director of the Augmented Environments Lab at Georgia Teach, believes that Micro visions Virtual Retinal Display holds the most promise for an augmented-reality system. This device actually usues light to paint images onto the retina by rapidly moving the light source across and down the retina. The problem with the Microvision display is that it currently costs about $10,000. MacIntyre says that the retinal-scanning display is promising because it has the potential to be small. He imagines an ordinary-looking pair of glasses that will have a light source on the side to project images on to retina



3.2 TRACKING AND ORIENTATION

The biggest challenge facing developers of augmented reality is the need to know where the user is located in reference to his or her surroundings. There's also the additional problem of tracking the movements of users eyes and heads. A tracking system has to recognize these movements and project the graphics related to the real-world environment the user is seeing at any given moment. Currently, both video see-through and optical see-through displays typically have lag in the overlaid material due to the tracking technologies currently available.

Tracking is easier in small spaces than in large spaces. Researchers at the University of North Carolina-Chapel Hill have developed a very precise system that works within 500 square feet. The HiBall Tracking System is an optoelectronic tracking system made of two parts:

- Six user-mounted, optical sensors
- Infrared-light-emitting diodes (LEDs) embedded in special celling panels

3.3 MOBILE COMPUTING POWER

For a wearable augmented reality system, there is still not enough computing power to create stereo 3-D graphics. So researchers are using whatever they can get out of laptops and personal computers, for now. Laptops are just now starting to be equipped with graphics processing units (GPUs)

Once researchers overcome the challenges that face them, augmented reality will likely pervade every corner of our lives. It has the potential to be used in almost every industry, including:

- **Maintenance and construction** – This will likely be one of the first uses for augmented reality. Markers can be attached to a particular object that a person is working on, and the augmented- reality system can draw graphics on top of it
- **Military**- The military has been devising uses for augmented reality for decades. The idea here is that an augmented-reality system could providetroops with vital information about their surroundings, such as showing where entrances are on the opposite end of a building, somewhat like x-ray vision. Augmented reality displays could also highlight troop movements, and give soldiers the ability to move to where the enemy can't see them.
- **Instant information**- Tourists and students could use these systems to learn more about a certain historical event. Imagine walking onto a civil war battlefield and seeing a re-creation of historical events on a head-mounted, augmented- reality display. It would immerse us in the event, and the view would be panoramic
- **Gaming**- The game could be projected onto the real world around you, and you could, literally, be in it as one of the characters. One Australian researcher has created a prototype game that combines quake, a popular video game, with augmented reality. He put a model of a university campus into the game's software. Now, when he uses this system, the game surrounds him as he walks across campus

4 APPLICATIONS

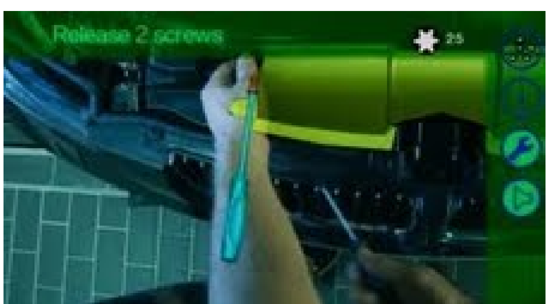
4.1 MEDICAL

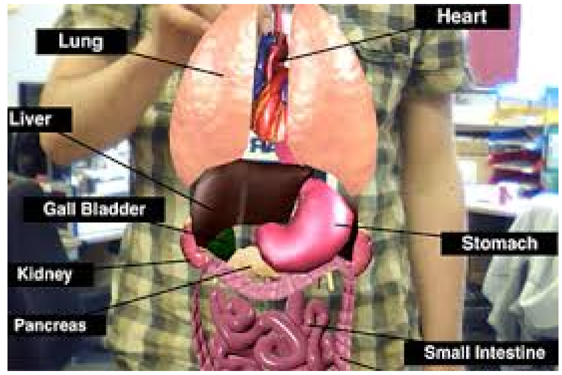
Augmented reality can be applied to give the surgical team a better sensory perception of the patients body during an operation. E.g, the surgical team can see the CT or MRI data correctly registered on the patient in the operation theatre.Being able to accurately register the image during the operationcan act as a very effective life server.

AR may even enable surgeons to detect key medical data with a naked eye. Image infor-for-maion about exact location to drill a hole into the skull while performing precision tasks such brain surgery or information about heart blockage in AR

4.2 SPORTS

A form of augmented reality is widely used in sports broadcasting. For example,the yellow "first down" line in American Football, or the colored trail showing location ordirection of the puck in TV broadcasts of hockey ga[...]rm of lane numbers overlai[...]wimming competition, or eve[...]om the ball to the flag in a gol[...]





4.3 MECHANICAL

An annotated display that continuously assists the enginer in identifying the parts to work on & reminds him about the specific task to be performed is absolutely possible with AR

4.4 EDUCATION

AR can be used to have a deeper understanding about science,biology,etc. E.g. Formatin of rain based on real time cloud formation or say,functioning of heart through AR could give students a much clearer picture about the process. AR can be utilized in millions of ways through easily understandable AR simulations.

4.5 ARCHITECTURE

AR can be used to simulate planned construction. It can also be used to erect historic monuments or even provide enhanced virtual information about any existing construction

4.6 ENTERTAINMENT

A simple form of AR has been in use in the entertainment and news business for quite some time. Weather reports are another classic example where real image is augmented with computer generated maps using a technique called chroma-keying. Programming during the presidential elections also attracted many news networks,more precisely CNN to use similar technique

4.7 TOURISM

A device that can provide computer generated information augmented on the real geographic location. AR can enable

hassl free navigation for any tourist while in a foreign environment

5 FUTURE

While AR has come long way in past couple of years, mobile technology still causes some degradation in experience because of limited band width, Storage space and processor capabilities. Film makers and animators, for instance have to suppress a tendency to control the camera angle, since AR gives users a 360-degree 3D view.

With multiple players in the space, the future of augmented reality is still up for grabs, but if DAQRI has its way, that future's going to be a fun one.

Google glass today, smart contact lenses tomorrow?

It might take a decade or more, but projects from imec and others could eventually bring augmented- reality contact lenses to life

Though it may be hard to imagine now, we may eventually be able to ditch head- worn devices like google glass and simply see images projected floating in front of us using contact lenses.
Researchers at Belgian nonelectronics research and development center Imec and Belgium's Ghent University are in the very early stages of developing such a device, which would bring augmented reality- the insertion of digital imagery such as virtual signs and historical markers with the real world- right to our eyeballs. It's just one of several such projects and while the idea is nowhere near the point where we could ask our eye doctor for a pair, it could become more realistic as the cost and size of electronic components continue to fall and wearable gadgets gain popularity.
In the future, we will see our environments become augmented to display information based on our own interests through built-in RFID tags and 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; our environment will facilitate our interactions seamlessly. We will no longer be able to discern what is real and what is virtual, our world will become a convergence of digital and physical media

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The future of augmented reality is clearly bright even as it already has found its way into our cellphones and video game system.

6 Conclusion

Augmented reality solutions have to appeal through simplicity agelessness, ergonomic factors. It will provide customized – mood-and location-based information. Augmented reality is another step further into the digital age as well soon sees our environments change dynamically either through a smartphone, glasses, car windshields and even windows in the near future to display enhanced content and media right in front of us. This has amazing applications that can very well allow us to live our lives more productively, more safely, and more informatively

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