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A STUDY OF 3D AUGMENTATION APPLICATION TO PRESERVE THE HERITAGE

KULDEEP KUMAR & MANAS MANBHAV

TYBCA, Ashoka Center for Business and Computer Studies, India

ABSTRACT

We all know how the homosapiens according to Darwin (scientist), how our ancestors cultivated the communications through writings & painting's about their historical times and how our great Indus civilisation, other civilisation's progressed. As we entered in to so called millennium we progress with giant feet's but how do we need to know what and where but Who performed and Why?

Absolute answer would be a very rare but the existing monuments had given many answers about history. For example, Shah Jahan the great Mugal ruler was good engineer by his works of monuments. Basically we know everything about our past by inscriptions, scriptures, books and past monumental work. We know that population of India is increasing day by day and at the same time we have to protect our Indian monuments for the future generation population and also for other people who wanted to visit India but cannot afford to come to India and appreciate the Indian culture as well as Indian heritage. Sometimes it is difficult to allow to show these monuments because of their geographical presence and also sometimes because of security problems. This may be possible through 3D augmentation. This paper is an initiation to introduce a technical aspect of heritage sites augmentation.

KEYWORDS: Augmentation, Be Matron, Head-Attached Displays, Projected AR Displays, Spatial Display

INTRODUCTION

In the following paper the greatest gift of past is preserved, through the technology is augment reality, that is we can just make augmentations of heritage sites and preserve them, by doing so we are able to not only preserve but, also could show our generations what are ancestor have done in past and what was good as well as morally bad about them.

What seem to impossible are now possible nowadays, only matter of initiative by governments and private operations. In order to be hold this initiative we have good example of PLACE–HAMPI augmented stereographic panoramas of the Vijayanagara, India [12].

What's there is just 2D more or less is not quite fully 3D you are seeing the 3D and it is there but not fully what is expected is something that could be touch felt and understood from your own emotions so that you could understand them feel them, only eyes could feel and display emotions.

Country like India is not limited to its borders when it comes to culture, it is beyond boundaries such as Combodia, Guyana, U.S.A, South Africa, Korea, etc what significant about them is our past colonise such as combodia and Indonesia, that contains our past architecture that have fabulously built our past architecture which is now dying(Hindu and Buddhist specially), example of would be Mohan-ja-Daro sites, Angokar, Burodumbdore etc. We need to see them preserve them and touch feel there trueness.

If Augmentation is present we could see and feel them at our place in, our homeland and show them to our kids in classroom's, universities and study them, time will come, when there real image would fade away but, don't worry we have augmentation of these sites and we could feel them forever and see them always.

Augmented and Mixed Reality

The goal of Augmented Reality (AR) is to improve and enhance our perception of the Surroundings by combining sensing, computing and display technologies.

Most AR research addresses human vision, as it is generally considered to be our most Important sense. Visual systems are also the focus in this overview, but it is worth noting that other stimuli, such as feedback from auditory, tactile or olfactory displays, may be equally or even more important, depending on the specific scenario and individual. The characteristics of these systems can be further understood from three classical and widely used criteria for AR systems [Azuma 1997]:

"Combines Virtual and Real"

AR requires display technology that allows the user to simultaneously see virtual and real information in a combined view. Traditional displays can show only computer-generated images and are thus insufficient for AR

"Registered in 3-D"

AR relies on an intimate coupling between the virtual and the real that is based on their geometrical relationship. This makes it possible to render the virtual content with the right placement and 3D perspective with respect to the real.

"Interactive in Real Time"

The AR system must run at interactive frame rates, such that it can superimpose information in real-time and allow user interaction.

Definition

"Advanced human-computer interface that simulates a realistic environment and allows participants to interact with it." [1]

Milgram defined a continuum of real-to-virtual environments, in which AR is one part of the general area of mixed reality (Figure 1). In both *augmented virtuality*, in which real objects are added to virtual ones, and *virtual environments* (or virtual reality), the surrounding environment is virtual, while in AR the surrounding environment is real. [2]

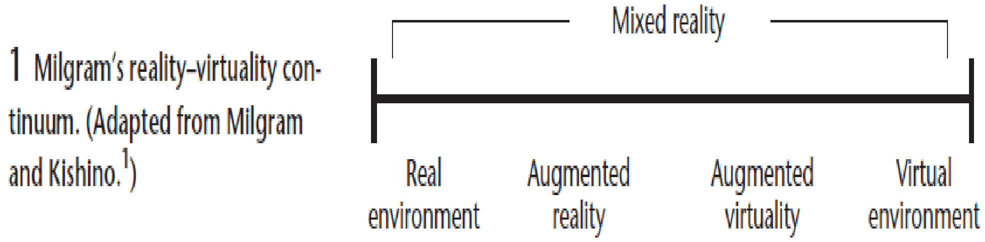

Figure 1: Showing Meaning of Mixed Reality

DISCUSSIONS

Virtual Reality is a term used for computer generated 3D environments that allow the user to enter and interact with synthetic environments [3][4][5]. The users are able to “immerse” themselves to varying degrees in the computers artificial world which may either. Be a simulation of some form of reality[6] or the simulation of a complex phenomenon

[7][3].

In telepresence, the fundamental purpose into extend operator’s sensory-motor facilities and problem solving abilities to a remote environment. In this sense, telepresence can be defined as a human/machine system in which the human operator receives sufficient information about the teleoperator and the task environment, displayed in a sufficiently natural way, that the operator feels physically present at the remote site [8]. Very similar to virtual reality, in which we aim to achieve the illusion of presence within a computer simulation, telepresence aims to achieve the illusion of presence at a remote location.

AR can be considered a technology between and telepresence. While in VR the environment is completely synthetic and in telepresence it is completely real, in AR the user sees the real world augmented with virtual objects. When designing an AR system, and three aspects must be in mind:

- Combination of real and virtual worlds;
- Interactivity in real time;
- Registration in 3D.

Classification

The following classification is based on [9], figure 2.

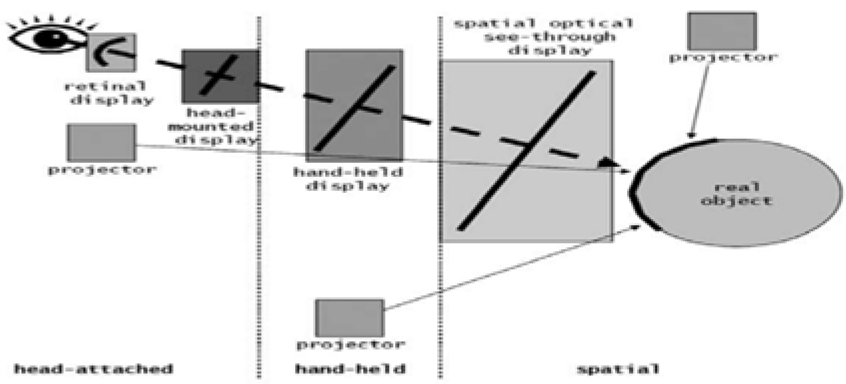

Figure 2: Image Generation of Different AR Displays

In order to provide a classification first the term see-through display must be explained. The basic idea behind this is to have a display, which can overlay virtual information over a real environment. Therefore, if the display does not show information at a certain location, one can see through it. There are two basic approaches to realize such a display:

- **Video-Mixing:** Here the real environment is filmed by a camera, then combined with virtual information and finally displayed.
- **Optical:** Here an optical combiner (e.g.: a half-silvered mirror or a transparent monitor) is used, such that one can

observe the real environment, while it is overlaid with virtual information [10]

Head-attached displays: As implied by the name the user has to wear the display on his or her head. Two of the depicted displays are:

- Retinal displays, which use a low-powered laser to project an image directly onto the retina of the user.
- Head-mounted displays (HUDs) were traditionally the displays of choice. Despite that, they were replaced in recent years by hand-held displays. Similar to them they are also see-through displays.

Please note that for the rest of this report head-attached displays are ignored and I refer to [9] for an analysis of these displays and also there is much importance had been given on this.

Hand-held displays: Almost all hand-held displays come nowadays in the form of tablets or smart phones, which can be classified as video see-through displays.

The following list of advantages and disadvantages of smart phones is based upon [11]:

Advantages:

- Relatively cheap
- Common and available
- Have a range of sensors already built in: GPS, accelerometer …
- Unlimited field of view through moving the smart phone around

Disadvantages

- Small display, therefore, if one does not want to move the phone all the time, the field of view is limited.
- User might need to hold / move the device over an extended period of time
- The resolution, in which the reality is displayed, is limited by the resolution of the camera and/or the display screen. This is a general problem of the video mixing technique. However, it must be noted that the resolution of the camera and screen of smart phones has drastically increased over the recent years.

Spatial Displays: The main difference between spatial and body-attached displays is that the former free the user from all or most of the needed technology and instead directly integrate it into the environment. They, therefore, allow for larger displays and a better control over environmental factors, while sacrificing mobility.

Projected AR Displays: As one can see from figure 1 it is possible to make use of projectors in every domain. In addition, the following advantages become apparent:

- Projectors can directly project onto the object; there-fore, the projector and its image must not necessarily be located in the same domain.
- The eye of the observer does not need to switch focus between the image plane and the real environment, thus, projected AR allows for an easy eye accommodation.
- The image plane of projectors does not need to be a rectangular plane. It can have various shapes and might be

non-planar.

- A projector can be much smaller than the image it projects.

Two disadvantages of projectors are:

- Low light-intensity. While this is normally not a problem for stationary projectors, it can be a major challenge for mobile projectors. Depending on the application a trade-off between battery life, light intensity and projector size must be found.
- The image is always projected into the scene. While this is normally seen as an advantage, it might be a problem if one wants to display information in mid-air.

Augmented Reality and Heritage Sites

Augmented Reality can play a crucial role in protecting the heritage sites, because it have very important aspect which other computing really lacks, which is interaction and ability to intract with real world .Which of course other technology lacks much.

People who played the games such as Prince of Persia have seen beautiful virtual reality of history work, War of God and many more are very much good example of this that is much reason many love to play them, But a new step has came into market was movies in 3D and 4D, as obvious they also have very much Virtual world came into real world, as if you were really into the world of movie so, real enjoyment and real tech magic of showing you real what really doesn't exist too.

We are living in 21^{st} century, a century of mass development as already discussed on augment reality that has been cleared, but what needs is what is application.

Our focus would be at its greatest gift it could offer that is, i.e, why can't we augment the our heritage sites so that we could preserve them by augmenting them keep in disks and hard drive and just feel there reality at any time so, that we could be more realistic in our approach.

Figure 3: Microsoft Document Effect of Augment Reality

Consequences

- See and feel them forever. Time would never trouble us, we are able to see there decay in there original form.
- Technology new aspect would make unfortunate Archeologist, to study ancient site without moving.
- No borders to study.

- Time would come when Mohan-ja-daro would fade away, but its Mystery would come to true meaning showing its cryptography.
- The scope of knowledge would increase too.
- Ancient Heritage would always be there to study.
- Pune University Students could study Agartala only in there university.

Technology Possibility

This could be possible only through technology, possibility of it is discussed below, over here we have just discussed only on technical device this possibility through Be matron:

Be Matron: A Steerable Displays

The field of view of an AR device was already discussed for hand-held displays, namely, the movement of the display. To successfully apply this idea to a projector, it must solve the following problems:

- The projection should stable during the movement of the device.
- It must be able to project images ‘correctly’ on arbitrary surface.

To solve these problems geometric-awareness is required.

An example for a projector, which solves these problems, is the Be matron. It was presented in

Build: To allow for a steerable display, a video projector was mounted on a light platform. Furthermore, a Kinect sensor was attached to it.

Figure 4: The be Matron

Stabilizing Projected Graphics During Movement: When a moveable projector is moved, while it projects an image, this movement must be taken into account in order to stabilize the projection. For example, if a real object is augmented, the virtual information should remain attached to this object, even when the projector is moving. To solve this problem the authors of [13] built a circuit board, which directly connects to the built-in pan and tilt sensors of the platform. They were, therefore, able to accommodate for any movement of the projector.

Understanding the Geometry of the Display Surface: Through the use of the Kinect sensor, in combination with Kinect Fusion [15], the unit is able to obtain smoothed depth images of its environment (see Figure 6 [13]). These depth images can then be used to project images ‘correctly’ onto arbitrary surfaces as described in the next section.

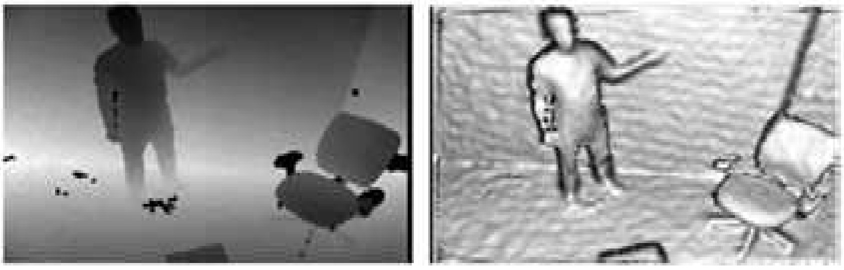

Figure 6: Multiple Depth Images are Combined into One Smooth Estimate of the Room Geometry

Projecting Images 'Correctly' onto Arbitrary Surfaces: It was already discussed how an image can be projected onto a real object, such that its distortion is minimized for a number of observers with different viewpoints. For the Beamatron the authors wanted that the projection creates the illusion of a real 3D object for a single observer (see Figure 7 [13]). To achieve this two rendering passes are required:

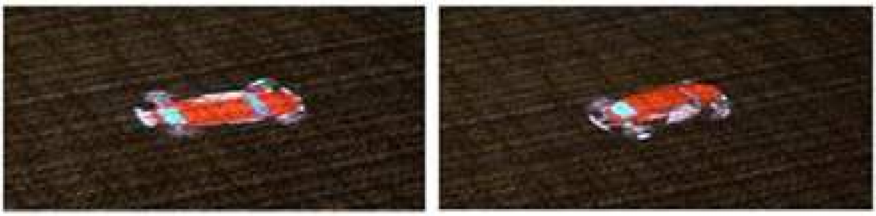

Figure 7: Rendering of a Toy Car. Left: without Projective Texturing; Right: with Projective Texturing

- Render the real objects along with the virtual objects from the point of view of the user.
- Use the result as a texture map while rendering the real geometry.

Keeping Track of the User Position: Often the sensing capability of an easily transportable projector is limited by the condition of being self-contained. For example, the Beamatron as described so far can only sense activities, which happen in the field of view of the Kinect sensor. To overcome this problem the authors decided to extend the sensing abilities of the Beamatron by adding infrastructure in the form of three Kinect sensors. These sensors were mounted – two horizontally and one vertically - in the corners of the room. By using their array microphone it was possible to localize the user while he or she speaks (see Figure 8 [13]). Furthermore, he or she could give commands, which were recognized by the Beamatron.

Application: An application given by the authors is the Beam buggy. A user controls a toy car with a steering wheel. Because of the geometric-awareness of the Beama-tron, the virtual car is rendered correctly from the view-point of the user, where this viewpoint was determined through the sound localization described above. Further-more, the car realistically reacts to the real environment, e.g. it is possible to jump over a ramp (see Figure 9 [13]).

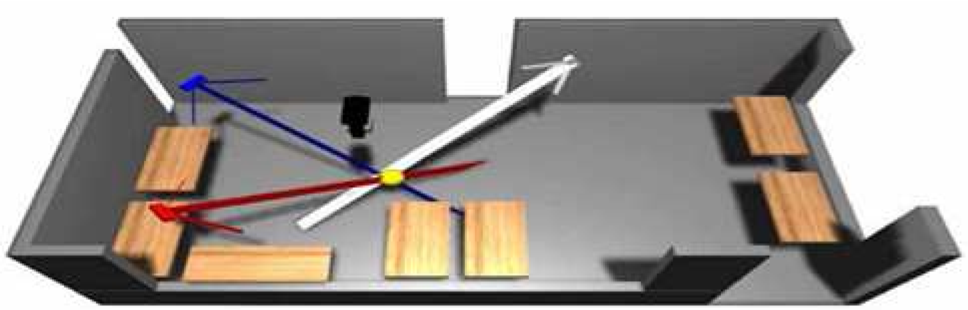

Figure 8: Illustration of How the Array Micro-Phones are Used to Localize a User

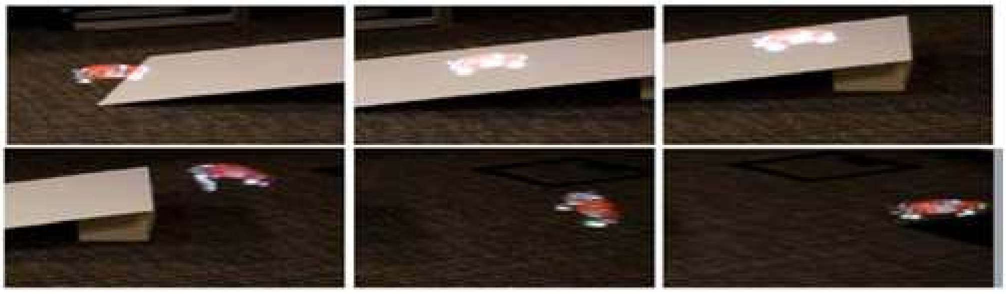

Figure 9: Because of Geometric-Awareness a Virtual Object Can React Realistically to the Real Environment

DISCUSSIONS

Because projectors can create large displays, without being large themselves, they are well-suited for creating AR de-vices, which can be transported easily and still retain some of the advantages of a fully stationary display.

Three important requirements were identified in [14], which must be considered in order to create such an easy-to-transport device. From my point of view, the most important one is the geometric-awareness. Through it important problems, like:

- Projecting an image, such that it appears 'wall-papered' (means well in real form) onto a real object or to be 3D.(the most important and futuristic aspect)
- stabilizing the projection during movement(means auto correction).

Through the solution it became apparent that there exists a trade-off between how self-contained or independent a unit can be and how much it can sense.

CONCLUSIONS

we could now conclude our discussion with the some important statements such as what does the direction we require in our field of protecting and teaching(how) in future, what we try to emphasize was that we need 3D full interaction Hardware + software solution, so that we could make our heritage more closer to people and politics and especially our on self's.

What we try to explain with only a fragment of technology is that we need a touch and sensing solution of augmentation that could not only improve the understanding of tech with heritage, what know lacks is initiative by government and private mergers to augment them and earn profit but should make these augmentation much more open and free as time passes away these would be available to more people, and students and one day university of Pune or

Ashoka University see agartala at there university only.

There were initiative's as an Indian, I must say that new Indian government as well as quick to it much in same as sloth, but initiative such as HRIDAY [16] have revived the possibilities of better and clean heritage sites but what about, which are, inaccessible to us such as Pakistan's Mohan –jo-Daro sites which mite replenish or get destroyed in those native nation's we could never know what its symbols of these sites which remain mystery to us the videos, photos remain but the power of sense always haunt as this, would be possible by future much improved devices after iLamp, Room Projector, SLAM Projector**.**

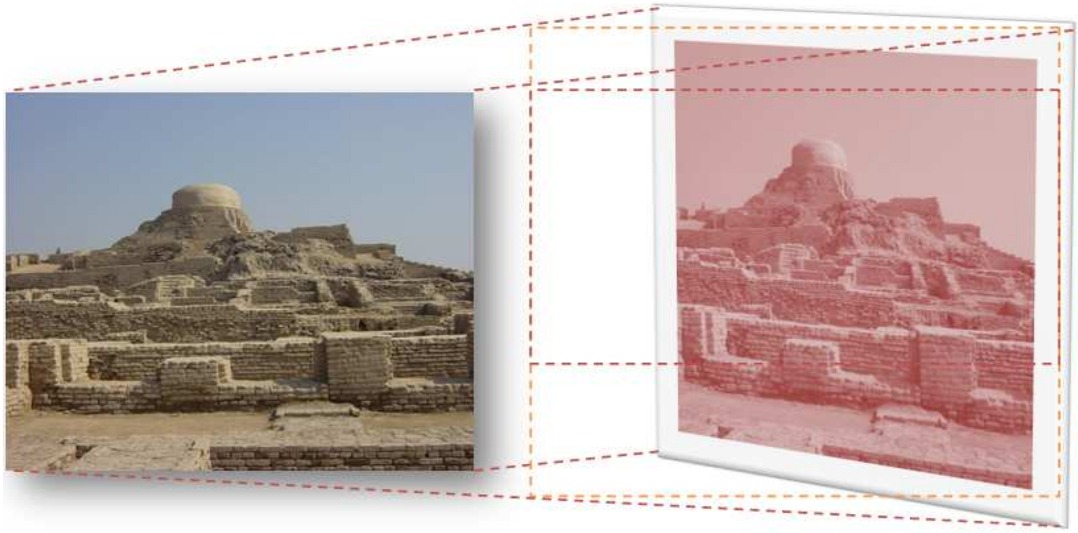

Figure 10: A Future Agumentation of Mohan – j a -Daro

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