

## 3D Holographic Video Using Fibre Display : A Survey

Sarode Shyamli S.<sup>1</sup>, Hankare A.P.<sup>2</sup>, Shirude Pratik V.<sup>3</sup>, Vibhute Prasad A.<sup>4</sup>

<sup>1</sup>Student of B.E, Department of E&TC, SKNCOE, SPPU, Pune

<sup>2</sup>Assistant Professor Department of E&TC, SKNCOE, SPPU, Pune

<sup>3,4</sup>Student of B.E, Department of E&TC, SKNCOE, SPPU, Pune

[<sup>1</sup>shyamliSarode@gmail.com](mailto:shyamliSarode@gmail.com)

[<sup>2</sup>aphankare.skncoe@sinhgad.edu](mailto:aphankare.skncoe@sinhgad.edu)

[<sup>3</sup>pratik.shirude.5050@gmail.com](mailto:pratik.shirude.5050@gmail.com)

[<sup>4</sup>prasadvibhute98@gmail.com](mailto:prasadvibhute98@gmail.com)

### Abstract

*In past centuries, Holographic video plotting is done using point source technology and projectors which is very costly having complex setup [1], Here we are displaying video on the pyramid shaped fibre using the python language having simple setup. Holography is nothing but upgraded level of photography and conventional film and its three-dimensional nature makes it completely new possibilities for future use. Through this project we are trying to help display products, objects, and animated sequences three-dimensionally. 3D Holography is different from conventional film on a standard screen. 3D hologram is visible from all sides, so the observer can walk around the hologram, enabling an absolutely realistic-looking image to form. A video which is to be displayed will be processed. While processing, the image will be dimensionally split in such a way that after it's reflection on the fibre, it could be seen from all sides. The dimensions of the fibre being used will be required to be aligned with that of the image for proper display. The methodology we are using in this project is Reflection Holography using Geometric Transformation [2].*

**Keywords-** Holographic Video, 3D hologram, Reflection Holography, Geometric Transformation.

### I. INTRODUCTION

We can often see the 3D holographic communication technology in science fiction movies, by using the principle of 3D computer graphics, and the distant person or thing can be projected in the air in the form of three dimensional. Due to development in science, all the equipment are reduced in size and precision increased, while the display device are not upgraded as per the requirement, so people have a demand for advanced display for projection to solve the problem. The 3D holographic projection does this role precisely. The word, hologram includes the two Greek terms, "holos" for "Complete view"; and gram means "written". A hologram is simply a 3D projection of the positive interference pattern of laser light waves.

A scientific term for holography is 'wave front reconstruction'. Dennis Gabor, the Hungarian physicist worked on advancement, research for electron microscopes and other related fields, he also discovered the basic technology of holography in 1947. However, the technique was not fully revealed and utilized until the 1960s, when laser technology was perfected. 3D Holographic Technology (3DHT) introduced in 1962. Holography means making of unique photographic image without the use of a lens or spectacles. The projection and recording of the image is called a holography, which appears to be an unrecognizable, complex pattern of stripes and whorls but which when illuminated by coherent light, as by a laser beam organizes the light into a three dimensional representation of the expected original object's image.

3D Holographic projection technology is the new sign of future technology and advanced communications. This technology first received attention worldwide in 2008 when Prince Charles addressed the World future energy summit and made his first appearance as a hologram in a bid to

reduce the royal carbon footprint. In late 1980s, American leader Al Gore launched Live Earth Tokyo in a high-tech, new virtual way – as a hologram using Holographic Projection. This technology has been used widely to launch the products in market and create fun. The 3D holographic projection technology is also known as "Musion Eyeliner." Musion Eyeliner is nothing but a variation on the Pepper's Ghost stage illusion. The images used are three-dimensional images, but projected as two-dimensional images (2D) into a 3D stage set, therefore the mind of the audience intends it as the 3D illusion [3].

## II. PROPOSED SYSTEM

### Block Diagram

Input video is pre-processed to extract the frames and de-noise it. The purpose behind the pre-processing is an improvement of the image data that suppresses and reduces the unwanted distortions and the noise created by sensors during capturing of image or enhances some image features for further processing. Pre-processing is operations with images at the very low level of abstraction, both input and output are intensity images.

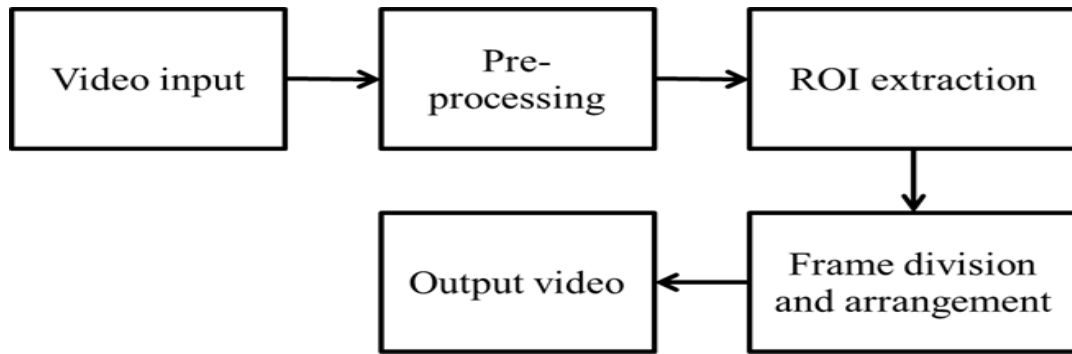


Fig 1. Block diagram of proposed system

A region of interest (ROI) is a part of an image that you want to filter or to perform some operations on it. There can be the ROI's of many shapes, using the high-level ROI functions such as circle or polygon one can create the ROI's of any shape. A common use and main purpose of an ROI is to create a binary mask image. In the Binary mask image, pixels that belong to the ROI are set to 1 i.e. required portion of image for operation and pixels outside the ROI are set to 0 i.e. background of required portion. Commonly, ROIs are groups of adjacent pixels but ROIs can be define by using intensity values, in which case the regions are not necessarily adjacent. Splitting of video is done using Geometric Transformation.

After capturing region of interest, divide the whole video frames in 4 parts arranging them in such a way that we finally get a holographic video system.

## III. WORKING

3D holographic projection is the technology that record and reproduce objects in real 3D image with using of interference and diffraction theory [4]. Holographic projection schematic is been shown in Fig 2.

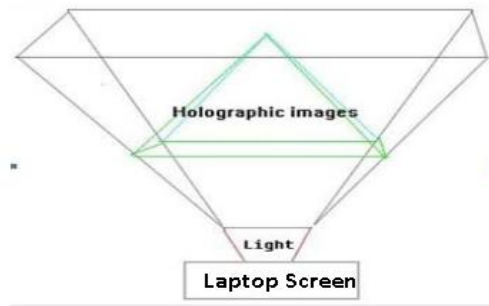


Fig 2 Holographic projection schematic

The initial step is to capture the object light wave pattern information by light interference principle, the capturing process: the object or image under source radiation forms a some diffuse pattern for object/image; another part of the source as a reference beam shines on the holographic display, and the image beam is superimposed and produce interference, converts the phase and amplitude of object's image light waves to the intensity in space changes, thus captures and record all the information of the image light waves with using of contrast and spacing in interference patterns. The film, recording the interference pattern, after developing and fixing projection display, a hologram or holographic image will form. The next step is by diffraction theory which reproduce the image light wave information, which is the imaging process, the hologram is like a complex interference pattern, in coherent source [5]. The image of reproduction has the strong three-dimensional feature and a effective visual effect. Every part of the hologram will capture the light of the image, so in principle, every part can reproduce the original image, a number of different images can be captured on a film by multiple-exposure and showed each other without disturbing.

In projection model of holography, A four sided reflective transparent fiber pyramid whose size can vary according to projection model, application and need. A screen, like mobile or laptop is used to run the desired processed video on. The actual setup shown in fig 3.



Fig 3. Holographic Proposed Setup

In the holography projections model, a particularly interesting point –different from television or Virtual Reality, a 3D hologram can be seen by everyone without 3D spectacles, which is an incredible advantage for use at exhibitions, entertainment industry and similar events. This method of using 3D holograms creates completely new, interesting way of representing products in market. It is also recommendable to use some acoustic backdrop perfectly coordinated to suit the 3D hologram to appear attractive and effective, including background sound and special sound effects. It receives the attention span and sub-consciously the product being presented even more deeply in the minds of the audience.

#### IV. ADVANCEMENT IN HOLOGRAPHY

##### A. Touchable Hologram:

The importance of interaction techniques creates much more attention with the advancement of the computer graphics technology, the physical simulation and the visual display technologies. There are a lot of interactive systems which aim to enable the users to handle 3D graphic objects and images with their hands using finger sensor. If tactile feedback is provided to the user's hands in 3D free space, the usability of those systems will be considerably improved [6].

##### B. 360-Degree 3D System:

The system was made possible by operating high-speed video on a continuous spinning mirror. As this spinning mirror changes direction, different perspectives of the projected image is captured and shown. [7].

#### V. RESULTS

In this module, the input video is pre-processed, frames are extracted from the input video for further processing and transformation as shown in fig 4. After processing, extracted frames are merged to form the splitted video which is going to display on fibre pyramid as shown below in fig 5, tab/mobile screen used as a projection source.

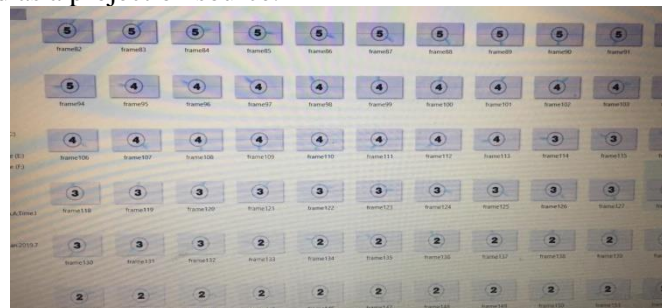


Fig 4.Extracted frames from input video

Frames are extracted from the input video using python 3. We used the OpenCV module for video Processing. Different operations are performed on this extracted frames to look like in four different spaces i.e. splitting.



Fig 5 Splitting of video using geometric transformation

## VI. CONCLUSION & FUTURE SCOPE

Through this paper, we clubbed together the century old concept of holography with Python language to display the virtual image on cheap and handable fibre display. Holographic Technology has many applications, as far as the human mind can imagine. Holography being the closest and distinct display technology to our real environment may just be the right substitute when reality fails. With holography, educational institutions can reach out to the depth of the various regions, where information and expertise are within range. Mobility and Knowledge sharing will only cost a second and learning will become more effective and interactive.

The future is interactive holography technology which makes it possible to touch and manipulate virtual object is especially important. As the field of touchable video system continues to grow and integrates with holography, interaction with holograms becomes limitless. In future, holographic displays will be replacing all present displays in all sizes, from small phone screen to large projectors, so the holographic display will become more attractive and effective.

- Future Scope:

### A. Marketing with 3D Holographic Display

This world's innovative technology can enable observers to see the images that float deep inside and project several feet above the display screen. 3D visual display solutions has recently introduced its unparalleled digital signage in the UK. This world's innovative technology can enable observers to see 3D holographic-like images that float deep inside and project several feet above the LCD or plasma display screen. Its aim is for advertising agencies and consumer products who wish to catch a huge attraction from this new break through media.

### B. Holography in Education

Recently holography is not being widely used in education. However, application of holography in education are not new. Long distance projection is possible since the images are transmitted over the internet. Holography is different from video conferencing because the teacher appears to be in the classroom. While in video conferencing users can easily notice a screen and a camera.

### C. Holography in Entertainment Industry

When one thinks about holography in the entertainment industry, the movies Avengers and Star Wars come into mind. In these movies, people relate with holograms as they would relate with real human. Although, what people see in these movies are not real holograms, they depict what a real hologram looks like and future capabilities of holography.

In the musical industry, holography is being used for concerts. In this case, the musicians can be far away in New York while performing in several cities around the world. Today, three dimensional television and cinemas are becoming common, and there is more to come. 3D movies in home theatres require chunky glasses which may be uncomfortable for some people to wear. Also experts found that viewing 3D television over a long period can cause headache and eye strain due to new sensory experience. Since holography makes beamed image look like real, it should not have any future strain on the eyes nor generate headache.

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