ISSN: 2278-0181
V-IMPACT - 2016_2 Conference Proceedings

A Review Paper on Holographic Technology Three-Dimensional Visualization

Nakshatra Sharma
B. Tech Scholar
Department of Electronics & Communication
Vivekananda Institute of Technology, Jaipur

Kausar Ali
Associate Professor
Department of Electronics & Communication
Vivekananda Institute of Technology, Jaipur

***Abstract*: This paper examines the new technology "Holographic Projection". It represents the new wave in the future of technology and communication, the different application of the technology, fields of life it will dramatically affect including business, education, telecommunication and healthcare. This paper also discusses the future of the technology and how it will prevail in the coming years highlighting and how it will affect and reshape many other fields of life, technologies and businesses.**

INTRODUCTION

Holographic projection is the new wave of technology that will change how we view things in the new era. It will have tremendous effect on all fields of life including business, education, science, art and healthcare. To understand how holographic projector work we need to know what a hologram is. Holography is the method we use to record different patterns of light. These patterns are reproduced as a three dimensional image called a hologram. Typically, a hologram is the photographic recording of light, rather than the image formation by lens, and it is used to display a fully three-dimensional image of the subject, which is seen without the aid of special glasses or other optics. The hologram itself is not an image but it is usually unintelligible when viewed under diffused atmospheric light. It is an encoding of light field as interference patterns of seemingly random variations in the opacity, density or surface profile of the photographic medium.

The Hungarian-British physicist Dennis Gabor was awarded for the Nobel Prize in Physics in 1971 for his invention of the holographic method. His work, done in the late 1940s, was built on pioneering work in the field of theX-ray microscopy by other scientists including Mieczyslaw Wolfke in 1920 and William Lawrence Bragg in 1939. Early holograms used silver halide photographic emulsions as the recording medium. They were not much efficient as produced grating absorbed much of the incident light. Various methods of converting the variations in transmission to a variation in the refractive index were developed which enabled to produce more efficient holograms.

TYPES OF HOLOGRAM

Several types of holograms can be made area follows:

1. *Amplitude and phase modulation holograms* **–** The amplitude modulation hologram, where the amplitude of light diffracted by the hologram is proportional to the intensity of the recorded light. A straightforward example of this is photographic emulsion on a transparent substrate. This emulsion is exposed to the interference pattern, that subsequently developed giving a transmittance which varies with the intensity of the pattern, the higher light intensity that fell on the plate at a given point, the darker the developed plate at that point.

Phase hologram is formed by changing either the thickness or the refractive index of material in proportion to the intensity of holographic interference pattern. This is a phase grating and it can be shown that when such a plate is lightened up by the original reference beam, it reconstructs the original object wave front. The efficiency (i.e. the fraction of illuminated beam which is converted to reconstructed object beam) is greater for phase than for amplitude modulated holograms.

2. *Transmission and reflection holograms* **-** A transmission hologram is one where the object and reference beams are incident on recording medium from the same side. In practice, several more mirrors may be used to direct the beams in required directions.

Normally, transmission holograms can only be reconstructed using a laser or quasi-monochromatic source, but a particular type of transmission hologram, known as a rainbow hologram, could be view with white light.

In a reflection hologram, the object and reference beam are incident on the plate from opposite sides of plate. The reconstructed object is then viewed from the same side of the plate as that where the re-constructing beam is incident.

HOLOGRAPHY WORKS

A hologram can be made by shining parts of the light beam directly into the recording medium, and the other parts onto the object in such a way that some of the scattered light fall onto the recording medium.

Apparatus - A more flexible arrangement for recording a hologram require the laser beam to be aimed through a series of element that change it in different ways. The first element is a beam splitter which divides the beam into two identical beams, each aimed to different directions:

- One beam (known as the object beam) is spread using lenses and directed to the scene using mirrors. Some of the light scattered from the scene then fall onto the recording medium.
- The second beam (known as reference beam) is also spread through the use of lenses, but is directed so that it does not come in contact with the scene, and instead travels directly onto the recording medium.
- Several different materials can be used as recording medium. One of the most common is a film very similar to the photographic film (silver halide photographic emulsion), but with the much higher concentration of light-reactive grain, making it capable of the much higher resolution that a hologram requires. A layer of this recording medium (e.g. - silver halide) attached to the transparent substrates, which are commonly glass.

Process - When the two laser beams reach the recording medium, their light waves interfere and intersect with each other. It is this interference pattern that is imprinted on recording medium. The pattern itself seemingly random, as it represents the way in which the scene's light interfered with original light source, but not with the original light source itself. The interference pattern can be considered as an encoded version of the scene, requires a particular key — the original light source — in order to view its contents.

The missing key is provided by shining a laser, identical to the one used to record the hologram, onto the developed films. When this beam illuminates the hologram, it diffracted by the hologram's surface pattern. This produces a light field which is identical to the one originally produced by the scene and scattered onto the hologram.

APPLICATIONS

1. Art - Early on, artists saw the potential of the holography as a medium and gained access to science laboratories to do their work. Holographic art is often the result of collaboration between scientists and artists, although some holographer would regard themselves as both a scientist and an artist. Salvador Dalí claimed to have been the first to employ the holography artistically.

2. **Data storage -** Holography can be put to a variety of uses other than recording of images. Holographic data storage is the technique that can store information at high density inside the crystals or photopolymers. The ability to store large amount of information in some kind of medium is of great importance, as many electronics product incorporate storage devices. As the current storage techniques such as Blu-ray Disc reaches the limit of possible data density (due to the diffractions-limited size of the writing beams), holographic storages have the potential to become the next generations of popular storage media. The advantage of this type of data storages is that the volume of the recording media is used instead of the surface. Currently available SLMs can produce about 1000 different images a second at 1024×1024-bit resolution. Using the right type of medium (probably polymers rather than $LiNbO_3$), this would result in about one-gigabits-per-second writing speed. Read speed can surpass this, and experts believe that one-terabits-per-second readout is possible.

3. **Holographic Interferometry -** Holographic interferometry is a technique that enables the static and dynamic displacements of object with optically rough surfaces to be measured to optical interferometric precision (means to fractions of a wavelength of light). It can also be used to detect optical-path-length variation in transparent media, which enables, e.g., fluid flows to be visualized and analyzed. It can also be used to generate contour representing the forms of the surface.

4. Holographic Microscopy - The hologram keeps the information on the phase and amplitude of the field. Several holograms may keep information about the same distributions of light, emitted to various direction. The numerical analysis of such holograms allows one to emulates large numerical aperture, which in turn, enables enhancement of resolution of optical microscopy. The corresponding technique is called interferometric microscopy. Achievements of the interferometric microscopy allow one to approach the quarter-wavelength limit of resolution.

5. Security - Security holograms are very difficult to forge(or copy), because they are replicated from master hologram that requires expensive, specialized and technically advanced equipment. They are used widely in many currencies, examples are British 5, 10, and 20 pound notes; South Korean 5000, 10,000, and 50,000 won notes; Japanese 5000 and 10,000 yen notes, India 50,100, 500 and 1000 rupee notes. They can also be found in credit , debitand bank cards as well as passports, ID cards, books, and sports equipment.

Covertly storing information within a full color image hologram was achieved in Canada, in 2008, at the UHR lab. The method used the fourth wavelength, aside from the RGB components of the object and reference beam, to record additional data, which could be retrieved only with the correct key combinations of wavelength and angle. This technique is for prototype stage and was never developed for commercial applications.

FUTURE OF HOLOGRAPHIC PROJECTION

3D holographic projection technology clearly has a big future ahead. The holographic projectors that are under development will be much smaller and portable than image projectors that rely on conventional, incoherent light beam. Ultimately, holographic projector may become sufficiently small to be incorporated into future generation smartphones. Holographic techniques are being used for three dimensional (3-D) rendering of medical pictures such as MRI and CT pictures. Medical holo-technology imaging can enable doctorsto test the insertion of medical instrument into an artificially constructed, 3-dimensional version of the surgical field before the operation. An array of micro-mirrors, whose movement are controlled by computer, may be used to divide and focus the array of laser beams to make moving, 3-dimensional holographic pictures of internal anatomic features.

In the areas of telecommunication and instruction, distance education and remote conferencing technologies featuring 2-D screen pictures will evolve into 3-D, engaging holographic projection systems. Holographic applied science is, even now, being used for "Holo-Cells" (holographic cell phones that record and play 3-D, real time pictures of the communicating parties that maybe viewed from different angles). The site three dimensional medical imaging also provides information on these topics.

REFERENCES

[1] Illustrations Medical. Medical and Scientific Animation. Copyright 2008 Medical Animation Studio5105 Route 33 http://medical-animationstudio.com/MedicalIllustrationMOAAnimation.html
[2] Newest Technology: 360Brandvision™ Offer 3D Video Holograms in 360 Degree. Las Vegas, NV (PRWEB) November 10, 2008. PR WEB Press Release. (www.prweb.com)
[3] https://www.researchgate.net/publication/45921701_Holographic_Projection_Technology.html