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Review Paper on Holographic Memory

[1]Soumya Garg, [2]Rakesh Yadav
[1]Research Scholar, [2]Assistant professor,
[1,2]Department of Information Technology, GL Bajaj Institute of Technology & Management, Greater Noida, India
****Email:** soumyagarg060@gmail.com, rakesh.rkgit@gmail.com*
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Abstract

Being responsive to unexpectedly changing era of communication and growing call for smaller and greater capability with high bandwidth garage devices, the term holographic reminiscence got here into existence. Holographic memory is an optical information storage technology that gives each the capabilities of high information density in line with volume and excessive records transfer pace through the usage of components along with spatial mild modulator, lenses and charge coupled gadgets (CCD).This paper gives the description approximately the precept of holography and additionally with the comparisons that were observed between conventional optical gadgets and modern holographic devices. Further, it investigates at what are the reasons which are making holographic devices nonetheless unusual and it summarizes all the packages of laptop structures wherein these holographic devices can be used.

Keywords:*Holography, Photography, HVD,fibers,Optical gadgets,Communication devices*

INTRODUCTION

We know that the information storing capacity of processors and buses roughly double every three years, records storage has struggled to overcome this hole. C.P.U is having the large capability of executing commands in nanoseconds. However the information storage in magnetic disk requires six times greater than CPU execution speed. There are so many studies finished to triumph over the space between CPUs and information storage. For nearly a long time facts storage devices that were used, uses mild for storing and reading the records. Within the early 1980's revolution takes place in statistics garage field as compact disk (CD) having 12centimetres of diameter and 1.2 millimeters of thickness. These CD permit multi-megabit of information to be saved on disc. Digital flexible Disc (DVD) is a sophisticated model of CD which turned into invented in 1997.the whole-length film may be stored in an unmarried DVD. CD is having records storage capacity up to 783 megabytes at the same time as DVDs that are double sided have statistics storing ability of 15.9 GB. Modern-day desires are met by way of those conventional garage mediums however customer demand is growing so organizations are running on advance storage technology to cope up with demands of destiny era. Current innovation spare records a little bit at a time in account medium anyway predominant innovation is either optical or attractive wherein each piece is put away as particular modifications of attractive and optical chronicle medium on its floor. On the off chance that insights might be saved money on total amount of capacity material, it will build the excessive density of statistics storage. With the motive of growing storage competencies, scientists and researchers are now running on contemporary optical era known as holographic reminiscence. Holographic reminiscence is era which uses complete extent of storing material to save records

in place of only the floor vicinity. So, this 3-dimensional information storing method will boom records density according to quantity and additionally gives faster records switch price. Holographic memory is having capacity storing information up to one Terabyte in a single sugar cube sized crystal. The primary benefit of holographic reminiscence is that it's far storing data web page through web page not bit by bit and also identical for retrieving. Holographic memory gadget's potential is nearly same to one CD. To tackle the issue of data storage, advanced technologies have been proposed which attempt to curb the issue. In this research paper, we present an innovative solution which aims to serve multiple purposes as follows:

- Provides high capacity of data storage up to 1 Terabyte by storing data on whole surface instead of surface area.
- Provides a high transfer rate of 1 gigabyte/sec.
- Provides security and serves as a reason of protection on their currency notes in many of the countries.

HOLOGRAPHY

Brief History

The optical holography is exceptionally dependent on laser, so more research and invention in this became began after improvement of laser in 1960. At initial level in 1962 after invention of laser the primary optical hologram become recorded at the college of Michigan USA. Before that for recording holograms silver halide photographic emulsions became used as recording medium.

The utilization of holograms as memory stockpiling turned out to be originally proposed with the guide of Pieter Heerden in the Sixties. Sooner or later of the mid 1970s, a lot of researchers from TRCA labs prevailing with regards to putting away 500 multi dimensional image the utilization of an iron doped lithium niobate precious stone. Besides, they have possessed the capacity to keep 5 hundred fifty high-goals multi dimensional image pictures the use of the material made up of mellow delicate polymer. Presently examines for holographic memory frameworks has been reactivated in light of the fact that the added substances are wanted for one of these innovation that has end up being extensively to be had and less expensive.

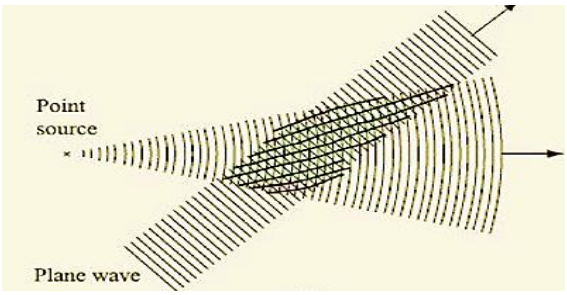
What is Holography?

The phrase "Holography" comes from Greek phrases havingwhichmeans of "complete" and "Drawing". In ordinary photography- we save handiest intensity level of photo but in holography with intensity we also save phase for photo at the same time as building a photo. So, even as reconstructing a picture we will get 3-d view of image. But here one aspect is to beobserved that we are able to get experience of 3-D picture best in the horizontal path meaning if we either move our eyes or a picture horizontally then best we can feel 3-D photo. If we move our head in vertical course then the image will look like rainbow i.e. all seven hues "Holography is a method for assembling a 3-dimensional photograph of an article by methods for account on a holographic plate or film the example of obstruction shaped by a separation laser bar after which lighting up the example either with a laser or with customary.

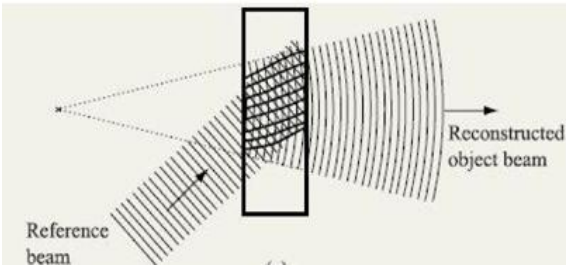
Recording and reading of Hologram

As we discussed earlier that during Holography facts is stored as page through web page. At one example whole web page is to be stored through an optical interference sample inside a thick, photosensitive optical material as shown in Figure 1.This example could be created through crossing point of laser bars which may be reasonable that are object pillar and reference bar in the carport texture. Ideal here thing pillar is having data what

is to be put away and reference shaft is for ideal period of 3D image even as contemplating. The photosensitive storing medium's chemical and physical properties could be changed in keeping with the interference pattern. In line with the interference sample, the adjustments occur in houses of the photosensitive medium like the refractive index, absorption or thickness. Either object beam or reference beam is illuminated at the interference sample and from it we will get either remake reference bar or reproduce object pillar that is appeared in Figure2.here one aspect is to be noticed that at time of reconstruction function, perspective and wavelength of laser beam should be same as time of creation, otherwise there can be possibility that we can get a unique three-D sample or say a few portion of sample which is sudden. So, those necessities make holography very complicated and high-priced due to the fact right preparations of all components are very time worthy.



(a)



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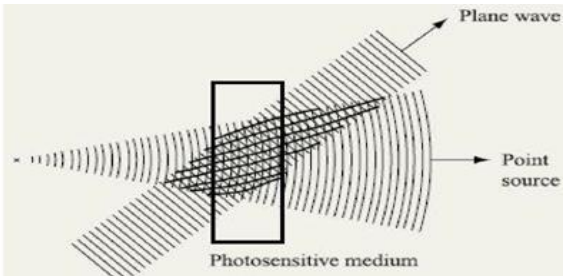
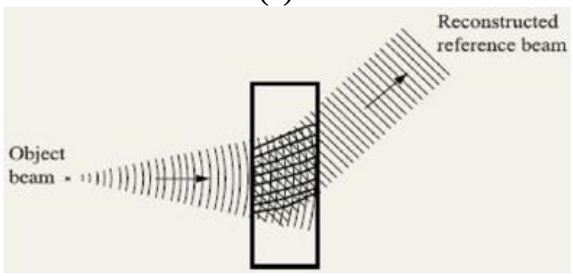


(c)



(d)

Figure 1:*(a),(b),(c) and (d) Reading of Hologram.*

Figure 2:*Recording of Hologram.*

Holography vs. Photography

- A photo may be recorded with everyday light resources like daylight or electric lights while a hologram is recorded by means of the usage of laser lighting fixtures.
- To shop a regular photolensisrequired whereas to keep a hologram, a storage medium is required on which aninterference pattern might be stored by means of scattering a mild from item.
- In a normal pictures facts is best from one route whereas in holography statistics is from exclusive path and due to which handiest it can generate a three-D view of image so that from unique route observer can look at it.

- An observer or viewer can observe photograph in any mild condition whereas hologram can be found best in very unique illumination's form.
- If a photograph is reduce from half, every piece will display half photograph whereas if hologram is cut from half, every piece will display complete hologram. Photography each point is related with the specific point of scene or image only whereas in the holography each point is having information of all points of scene or image because in this laser is scattered.

Applications of Holography

Data Storage

Holography is having capability of storing different information the usage of complete volume of storing cloth like crystals or photopolymer.

Holographic Interferometry

It's far as one of the method to discover the static and dynamic trade of item's position. In which interference styles of item are once more interfaced and offers every other interference sample which shows the displacement of item.

Security

Holograms are very useful in safety and it's far already used by many nations with a cause of protection on their currency notes. It is also utilized by banks for safety of their credit playing cards.

HOLOGRAPHIC MEMORY

There are numerous strategies for collecting the data like optical memory, streak memory, attractive memory, etc. Be that as it may, consequent might be Holographic memory. Holographic memory is an innovation that licenses multi dimensional images containing a great many bits of records to be composed or examine in an unmarried blaze of mellow. Heaps of covering multi dimensional images can be put away in a typical degree of chronicle medium which expands carport limit in venture with volume. Holography gets through the thickness furthest reaches of regular 2d carport by methods for chronicle at some phase in the entire profundity of a 3-D medium. Holography can write and study hundreds of thousands of bits of information in parallel, which allows significantly excessive records switch fees than modern-day optical garage gadgets which give excessive facts switch fee.

- Holographic reminiscence is a three – dimensional statistics garage machine which can save records at high density in the crystal or photopolymer.
- Like to other media holographic media is split into write once (wherein the garage medium undergoes some irreversible alternate), and rewritable media (wherein the change is reversible).

Holographic Versatile Disc

- The Holographic Versatile Disc (HVD) is an optical plate innovation created among April 2004 and mid-2008 as shown in Figure 3.
- These discs pursue the capacity to store 3.9 terabyte of information on an optical disc of 10cm or 12 cm.
- Its miles having about 6000 times the potential of CD-ROM, 830 instances the capacity of DVD, one hundred sixty instances the ability of unmarried layer Blu-ray discs.
- It additionally have switch price of one Gigabyte/sec.Structure of HVD disc shown in Figure 4.

Figure 3:*Holographic versatile disc.*

Structure of HVD

The holographic disc consists of:

- Green composing/perusing laser
- Red situating/tending to laser
- Hologram(data)
- Poly carbon layer
- Photo polymeric layer (information checking layer)
- Distance layers
- Dichroic layer
- Aluminum layer
- Transparent Base

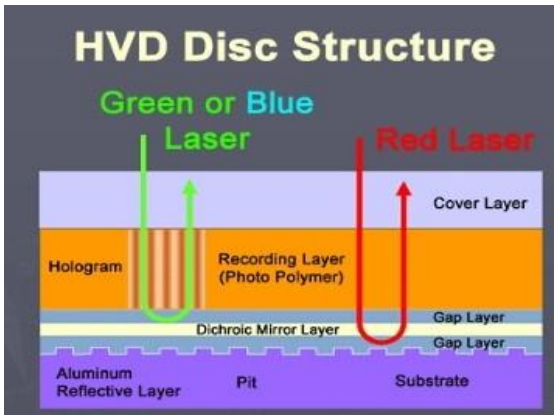


Figure 4:*Structure of HVD*

***The HVD System: Writing* Data**

- While the blue argon laser is centered a beam splitter splits into two beams a reference beam and a signal beam.
- The flag bar passes through SLM in which virtual records arranged in a page like organization of zeros, is adjusted onto flag pillar as a two-dimensional example of brilliance and obscurity.
- When two pillars meet, obstruction design that is made stores the data conveyed by the flag bar to the floor of holographic material as 3D image as shown in Figure 5.

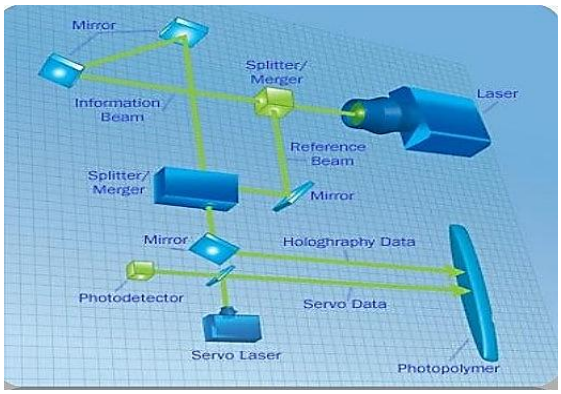


Figure 5:*HVD System: Writing Data*

HVD System: Reading Data

- The saved records are study via the reproduction of the same reference beam used to create the hologram as shown in Figure 6.
- The reference beam mild is targeted at the photosensitive cloth, illuminating interference sample; the light diffracts at the interference sample, initiatives the sample onto a detector.
- The detector is able to studying the facts, over one million bits right away, resulting within the rapid records transfer charge.

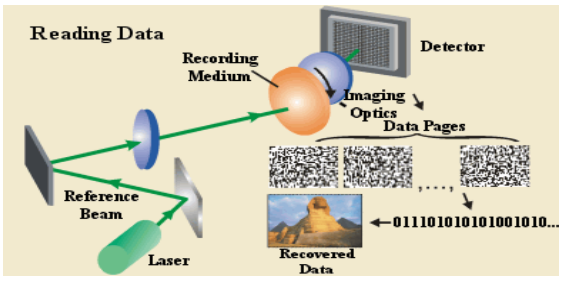


Figure 6:*HVD System: Reading Data.*

HVD System: Recording data

- Holographic facts garage carries facts the use of an optical interference sample within a thick, photosensitive optical fabric as shown in Figure 7.
- Mild from unmarried laser beam is divided into, or greater, separate

optical patterns of dark and light pixels.

- By using adjusting reference beam perspective, wavelength, or media function, multi holograms may be saved on a single extent.Technology Comparison and HVD Comparison with other storage devices is shown in Figure 8 and in Figure 9.

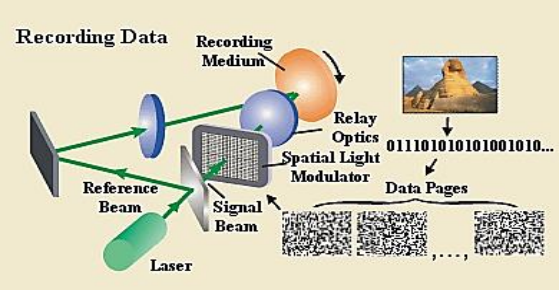


Figure 7:*HVD System: Recording Data.*

Technology Comparison

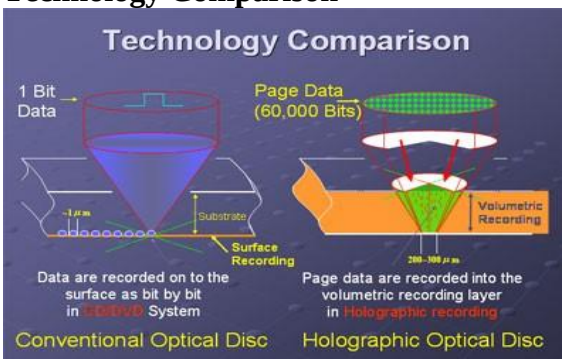


Figure 8:*Technology Comparison.*

HVD COMPARISON WITH OTHER STORAGE DEVICES

	Blu-ray	HD-DVD	HVD
Initial cost for recordable disc	Approx. $18	Approx. $10	Approx. $120
Initial cost for recorder/player	Approx. $2,000	Approx. $2,000	Approx. $3,000
Initial storage capacity	54 GB	30 GB	300 GB (max 3.9 TB)
Read/write speed	36.5 Mbps	36.5 Mbps	1 Gbps

Figure 9:*HVD Comparison with Other Storage Devices.*

Advantages

- Resistancetodamage-If a few components of the medium are damaged, yet all information can still be received from other parts.
- Efficient retrieval-All statistics may be retrieved from any medium.
- Fault and harm tolerance.
- The HVD has a transfer rate of one gigabit/s.
- 3-D recording.
- Faster recording & reading than a CD/DVD.
- Stores one TB.

Limitations and Challenges

- Its miles very tough to set up all of these additives like CCD digital, SLM arrays and beam steering devices.
- Desires properly recording touchy material to permit high information transfer fee.
- Manufacturing cost is high.

Facts

- It has been envisioned that the books in US Library of congress, biggest library in global, can be stored on six HVDs.
- The pix of each landmass on the planet like the Google Earth may be stored in HVDs.
- With MPEG4 ASP encoding, a HVD can preserve everywhere among 46900-11900 hours of video that's sufficient for non- forestall gambling in 12 months.

FUTURE SCOPE/CONCLUSION

- It gives excessive data switch rate.
- The eventual fate of holographic memory is extremely encouraging.
- However even the holographic manner of storing information continues to be at the base stage and it can take couple of years for this technique to hit computer with actual lifestyles information garage answer.
- It has precise back up than different storing medium.
- The holographic gives high thickness.

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