

THE HOLOGRAM AND ITS IMPORTANCE IN ARCHITECTURE

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ABSTRACT

Light in general and laser beams, in particular, play an essential role in the field of architecture, especially in the presence of hologram technology, as it is one of the virtual reality applications that can re-create a hologram image of objects in three dimensions in space, based on the principle of interference using laser beams.

There is no doubt that the tremendous technological developments, especially in software, have brought about a scientific revolution that has affected various architectural fields.

With the technical development in virtual reality applications and simulation, it has become possible to create a virtual environment by deluding the recipient's eye with three-dimensional models or surfaces that do not exist and are formed in a vacuum using advanced hologram techniques.

So in this research, the technology of three-dimensional holograms using laser beams, known as holograms, has been shed light on, identifying how to create virtual spaces utilizing this technology.

Thus, the designer can easily change his design ideas and present them to the recipient according to his functional needs, in addition to creating a state of renewal and continuous creativity in design.

In this research, the meaning of the Hologram was identified as one of the virtual reality applications with a brief history of the uses of this technology and the beginning of its emergence, and the idea of its work.

KEYWORDS: Hologram, Hologram photography, Virtual reality technology, 3D holographic imaging, The digital development of holographic photography.

الهولوجرام وأهميته في العمارة

عمرو المعتصم بالله الشريف

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الملخص

يلعب الضوء عامة وأشعة الليزر خاصة دوراً هاماً في مجال العمارة ولاسيما في وجود التقنية الهولوجرامية حيث أنها أحد تطبيقات الواقع الافتراضي التي لها القدرة على إعادة إنشاء صورة مجسمة للأجسام بصورة ثلاثية الأبعاد في الفضاء اعتماداً على مبدأ التداخلات باستخدام أشعة الليزر، والى الآن لم يتم الإستغلال الأقصى لإمكانات هذه التقنية ولم تنتشر بالشكل الكافي، لذا فالبحث يسعى لإبراز أهمية ودور تقنية الهولوجرام في تطوير العملية التصميمية، ومن ثم إثراء التصميم جمالياً ووظيفياً من خلال مسابرة التقنيات الحديثة ومواكبة التطور التكنولوجي.

ولاشك أن التطورات التكنولوجية الهائلة وخاصة في مجال البرمجيات أحدثت ثورة علمية أثرت في مختلف المجالات المعمارية، وكان لها دوراً فعالاً في تغيير المفاهيم الفكرية والتصميمية للكتل والفراغات الداخلية والخارجية، ومع التطور التقني في مجال تطبيقات الواقع الافتراضي والمحاكاة أصبح من الممكن خلق بيئة افتراضية عن طريق إيهام عين المتلقي. لذا في هذا البحث تم تسليط الضوء على تكنولوجيا الصور المجسمة ثلاثية الأبعاد باستخدام أشعة الليزر والتي تعرف بإسم الهولوجرام والتعرف على كيفية إنشاء فراغات افتراضية باستخدام هذه التقنية، وكذلك دراسة إمكانية تطبيقها في مجال العمارة وإعادة صياغة الفراغات الداخلية وفقاً لمتطلبات البيئة الافتراضية التي تحيط بالمستخدم وتتفاعل مع حواسه وتدخله في عالم وهمي يبدو له كأنه عالم واقعي من خلال تنفيذ صورة رقمية هولوجرامية ثلاثية الأبعاد تعطى للمستخدم حساً فنياً وحرکياً متغيراً مع عامل الزمن، وبذلك يستطيع المصمم تغيير أفكاره التصميمية وعرضها بسهولة على المتلقي حسب حاجته الوظيفية بالإضافة إلى خلق حالة من التجدد والإبداع المستمر في التصميم.

ففي هذا البحث تم التعرف على معنى الهولوجرام كأحد تطبيقات الواقع الافتراضي مع ذكر نبذة تاريخية عن استخدامات هذه التقنية وبداية ظهورها وفكرة عملها، وإمكانية استخدامها في تحسين الإضاءة الطبيعية.

الكلمات المفتاحية : الهولوجرام، التصوير الهولوجرامي، تكنولوجيا الواقع الافتراضي، التصوير المجسم ثلاثي الأبعاد، التطور الرقمي للتصوير الهولوجرافي.

1. Introduction

Recently, hologram technology has become very popular; Researchers have been working on developing it and changing the intangible nature of light to allow humans to interact with and feel light, sometimes touching it. The architectural world became more interactive as reality mixed with imagination. It resulted in difficulty in drawing a line separating them due to their overlapping in harmony, producing a unique type of space, which results in a change in architecture. This technology inserts the user into an imaginary world so that it appears as a real-world result of the interactions between the virtual environment and the user's senses and responses. With the technical development in this field, it has become possible to create a virtual environment of external and internal architectural spaces by deluding the recipient's eye of the presence of three-dimensional models or visible surfaces, but they do not actually exist and are physically intangible. They are formed in the architectural space using specific tools and equipment, and holograms are used in this field as a virtual reality application.

The hologram industry has been developed and exploited in the field of architecture on a large scale, such as its use in holographic architectural models, windows, holographic tiles, and moving wall paintings through the work of hologram artists. Hologram art is represented in the process of manipulating light and the methods of reflecting these light rays to form a three-dimensional image floating in the air; It is worth noting that with technological advancement, this technology has become available to publish explicit images, especially in the presentation of entertainment shows and concerts. It was also used in the Louvre Museum in Paris to display the famous statue of Venus de Milo with its granite base in 1981. There is no doubt that holograms have many applications, and they are constantly increasing. Therefore, it is expected that this science will be widely used and spread in the future.

2. The meaning of the Hologram

The term "hologram" is a Greek term derived from two parts, the first, holos, which means comprehensive vision, and the second, gramma, which means letter, meaning the whole picture [1], which refers to holographic imaging. This imaging is done when a collision occurs between these light waves and the object to be photographed, as the hologram device maps the data of the thing and transmits the necessary information about this object to the imaging panel. The word "hologram" refers to the process of three-dimensional recording of objects, which is called the holographic process and the medium through which it is recorded, and the Hologram is the final product of the recording process [2].

A hologram is a stereoscopic visual display in which the image of the object is recreated when light is projected onto the hologram film and displayed in three dimensions so that the stereoscopic optical image floats in the air as a three-dimensional stereotype that appears as a spectrum of colors embodied in the shape to be displayed. Fig 1. This process is carried out using laser beams, which are the purest light known to man, and when two laser beams meet, they generate a complex interference network, which can be recorded on a photographic plate, and this recording is called a hologram. Fig 2.



Fig 1: Production of 3D models using hologram technology

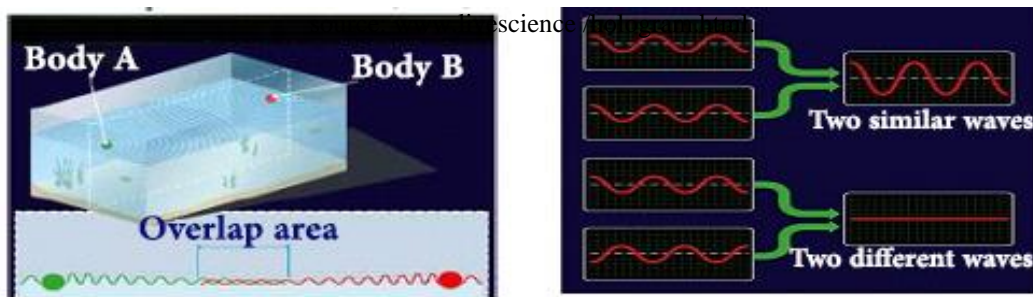


Fig 2: The idea of interference of light waves is similar to interference of water waves

source:www.euclideanholographics.com.

3. A Brief History of HoloGram Technology

The roots of this technique go back to 1947 when scientist Denis Gabor discovered holographic imaging. Because of the light resources available at that time, the emergence of holographic imaging was delayed until the appearance of the laser in 1960. In 1962, two scientists, Juris Upatnieks and Emmitt Leith of the University of Michigan in the United States of America realized that a hologram could be used as a medium for three-dimensional display. By re-applying Gabor's research using coherent monochrome lasers, they succeeded in displaying three-dimensional holograms [3].

Experiments followed that, showing the first Hologram to a person in 1967, Fig 3, and the development of hologram devices and their applications continued until 2015, which is the year of the Hologram.

Since the beginning of January 2020, the new technology has begun to impose itself on the ground significantly. Microsoft has unveiled its new HoloLens platform, an application that allows 3D rendering, which allows working with 3D models.

This technology was developed to enable the creation of optical images using holograms of virtual objects that can be touched and felt by the hand, using the femtosecond feature in releasing high-frequency laser pulses. As these pulses respond to the touches of the human hand, this makes it possible to manually manipulate those minor points (pixels) that make up the image in the air upon contact. This is a result of the possibility of an interaction with this holographic spectrum by touch, as its properties, shape, and location change when it is in contact with another object, making it easy to interact with it.

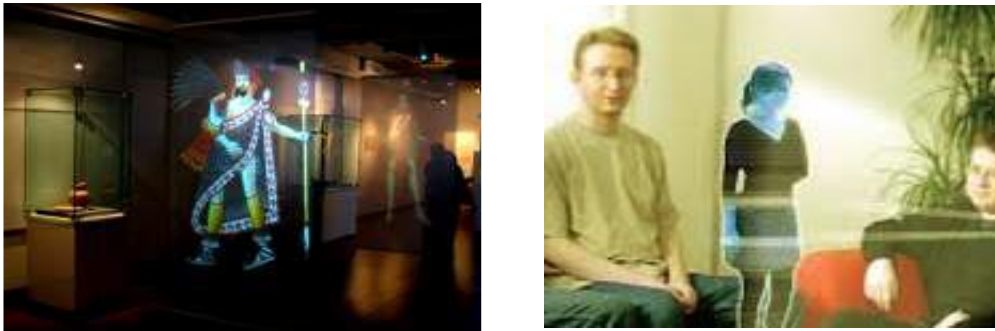


Fig 3: Hologram display of people with a hologram image
Source: www.digitalcameraworld.com/holograms

The Researchers are now seeking to create a holographic television device that embodies the inverted image as a three-dimensional spectrum that extends over a certain distance and is seen more realistically. A group of technology students at the University of Hong Kong revealed a first device that allows the user to draw in the air using hologram technology, see this drawing from different angles and interact with it. Fig 4. The Australian company Euclideon has also developed the first multi-user hologram board that allows four people to interact with images displayed on a tabletop [4] measuring 0.5* 1.5 m simultaneously. This version was available on the market in 2018. Fig 5. It is worth noting that smartphones have begun to provide hologram technology to ordinary users through some elementary applications and tools.

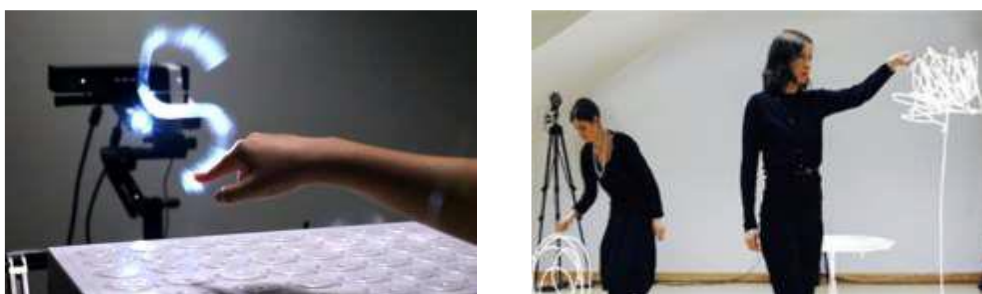


Fig 4: The ability to draw in the air, see it from different angles, and interact with it using advanced hologram technology

Source: www.newshologram/holographic and utm



Fig 5: Multi-user hologram board

Source: [www.smashingmagazine.com/virtual re](http://www.smashingmagazine.com/virtual-reality)

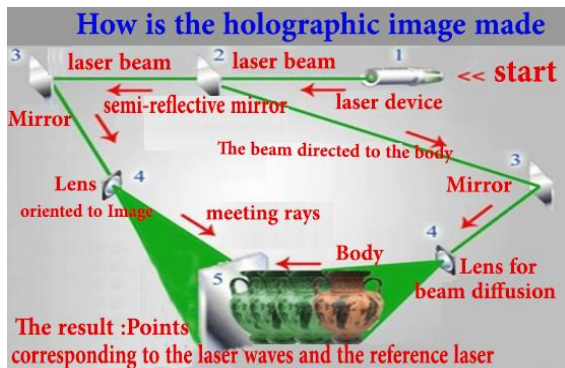


Fig 6: The idea of the work of the Hologram and the division of the laser beam

source: [www. technology review. Ae/hologram.html](http://www.technologyreview.com/hologram.html)

4. Hologram work idea

The idea of holographic imaging depends on using a laser beam that is separated into two beams and then assembled on a plate to form the holographic image, as when two laser beams meet, they generate a complex interference network. Fig 6. The interferences of this network can be recorded on an imaging plate, and this recording is called a hologram. The laser beam is divided into two beams (the reference beam and the object beam), and they meet on a medium with a high sensitivity to light, the imaging plate. Fig 7.

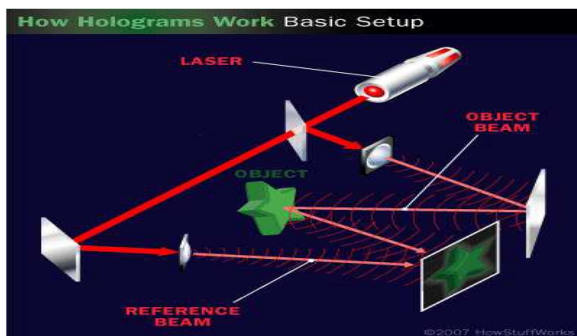


Fig 7: How does a hologram work?

source:www.euclideanholographics.com.

The laser beam is used to reconstruct the image of objects in their three dimensions because the laser is the most powerful light beam that is transmitted over long distances without being scattered (fig. 8), which enables it to record many optical details in parts characterized by opacity and transparency reflected from the object per cm³. [5]

Among the most prominent recorded three-dimensional interferences are those used in passports, residencies, personal government cards, and credit cards, where images are used on parts of them that only appear when a particular inclination tilts the card and when a laser beam similar to the one that was

used on the plate seems the imaged object at a distance from it. In a three-dimensional hologram. Fig. 8, Advantages of using laser beams in holography Source: www.euclideanholographics.com.

Older versions of holograms are simpler and are used to display the first ideas of the design and modify them by creating three-dimensional models that accurately and quickly simulate the original models, with the possibility of displaying the project details and the surrounding scenery to complete the photographic realism of the client. Fig 9.



Fig 8: Advantages of using laser beams in Holography
Source:www.euclideanholographics.com.

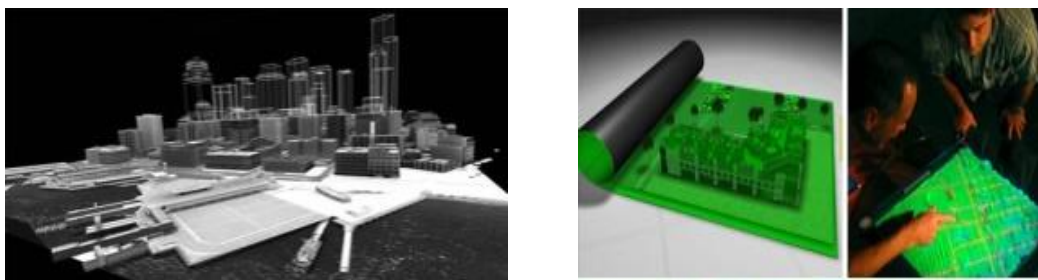


Fig 9: The use of holograms to display architectural design ideas
source: <https://gajitz.com/pop-up-buildings-incredible-3d-architectural-holograms>.

5. The essential components required to create a 3D hologram

Laser device: It produces an argon laser beam, or the laser that produces red light is a helium-neon laser; lenses: are used to direct laser beams onto an object or the imaging plate.

Splitters of light: It is a semi-reflective mirror that splits the laser beam and separates it into two parts.

Reflecting mirrors: They direct laser beams through the lenses and split the light at the specified position.

Hologram film: It consists of a layer of photosensitive materials placed on a light-permeable surface, which is a plate of liquid crystals of lithium or photopolymers used to record the Hologram to produce the Hologram.

6. How to Get a 3D Hologram

In order to create a three-dimensional stereogram, an object must be available to be a target point in the imaging. It also requires a source of laser rays for this beam to be projected onto the object to be photographed (fig. 10) and the presence of a recording medium that targets the scattered rays from the

thing through semi-reflective mirrors. That split the laser beam into two identical beams. One of these beams is directed at the object, and the beam falling on it is reflected on the recording medium.

In contrast, the other beam is directed directly to the recording medium to show a main stereo image through the Hologram. The Hologram (the plate or the interference model recorded on it) contains a complex distribution of transparent and dark areas, and when a ray similar to the original reference beam is shone on it, this beam will pass through the transparent areas and be absorbed in the dark areas to varying degrees, forming a compound penetrating wave that is the component wave of the original object, and a similar image of this object appears in space fig 11.

Therefore, obtaining the Hologram goes through two stages, the first: in which the interference patterns of the light rays are recorded, and then the Hologram is obtained; the second: in which the Hologram is illuminated in a certain way so that the incident beam is identical to the object wave, so the image appears as the original object.



Fig 10: Hologram device and laser projection on the object
source [www.sciencing.com/holographic projectors work.html](http://www.sciencing.com/holographic-projectors-work.html)

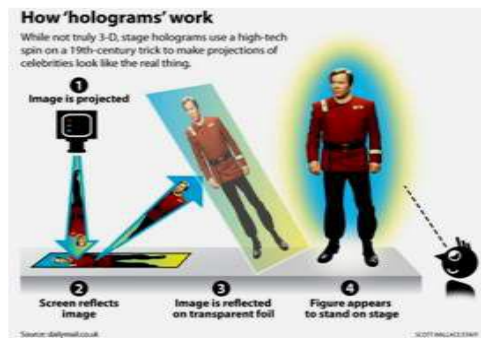
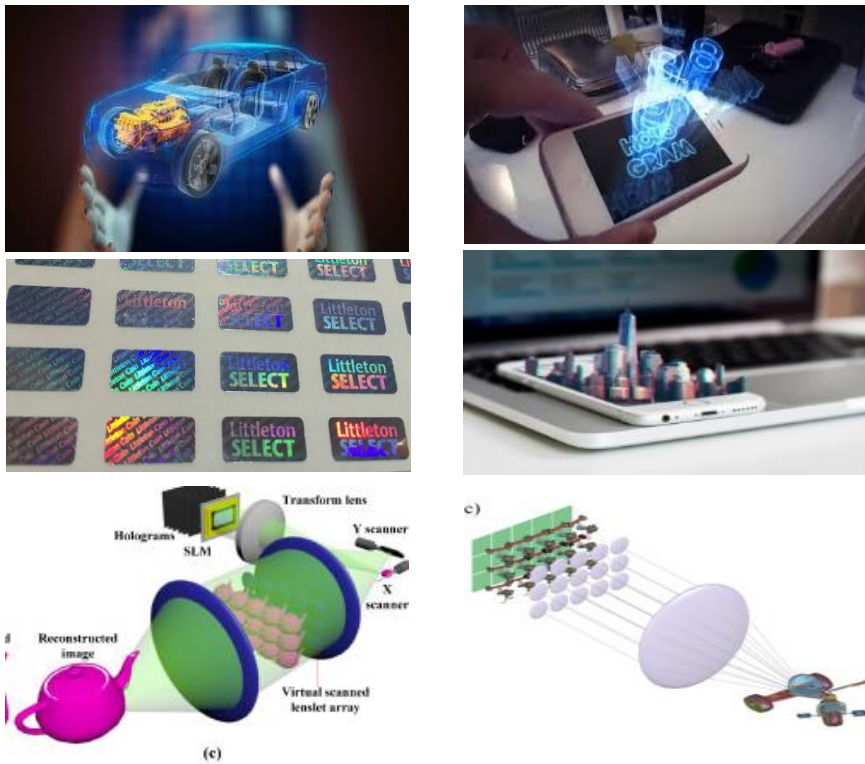


Fig 11: A simple example of how a hologram works

7. Types of Holograms

Types of holograms classified into fig. 12.

- Plane Hologram
- volume hologram
- Laser Transmission Holograms
- White Light Transmission Holograms: This type is also called a "Rainbow hologram," The colors emitted can be controlled entirely to produce hologram designs with unique colors or natural colors.
- Pulsed Holography: The laser produces a fast and powerful flowing pattern to record the shape to be photographed in a nanosecond [7].
- Integral Holography: was developed to combine Holography and cinematography to record animated scenes or designs by placing several two-dimensional sequential snapshots and converting each image into a hologram so that the holograms placed next to each other, as anything moving from movies, videos, or artistic designs of a playful nature can be converted into an integrated hologram. This type is used in the production of holographic moving life tiles as wall panels in interior design.
- Embossed Hologram: Featuring simply embossed and embossed design elements.
- An electronic hologram is one in which the Hologram is produced by a computer in real-time for the holographic process by calculating the overlapping unit and quickly reconfiguring the image on the holographic film, but this type is still limited in capabilities due to the huge amount of information required from the computer to deal with it during the holographic process.
- Digital Hologram: aims to produce traditional holograms with digital content not by using a real object but by creating a virtual scene or designs using 3D computer programs and converting them into regular holograms. The Hologram can be moved in every corner; as a result of a large amount of information that can be stored in digital holograms, the quality that can be obtained is high, so this type is suitable in architectural applications [8].



8. Hologram technology applications Fig. 12 the types of holograms.

The idea of the holographic display has captured the imagination of many researchers, as it is a technology that can be applied in many fields, such as security uses, 3D cinema applications, medical uses, the field education, games, and entertainment shows, as well as visual arts, etc. Its capabilities also allow converting the holographic image to the real scale of the building on the site that is supposed to be built or making imaginary statues in the squares before implementing it to feel its size and height and modifying it before Implementation. The following is an explanation of some of the applications of this technique:

8.1. Applications of hologram technology in improving natural lighting

In addition to the aesthetic value of the Hologram, it can be developed to be used in the architectural environment to improve the natural lighting inside the space. Holographic optical elements (HOE) can be used for shading and to reflect the direction of sunlight falling on buildings and windows at specific angles while allowing the passage of scattered rays through it and directing it into the spaces at a greater depth to obtain more natural light [9]. This is achieved by using semi-transparent holograms that can control the building's solar radiation without reducing its impact. It also achieves saving electrical energy consumption in addition to reducing the temperature inside the spaces, especially when using these elements on all facades of the building.

The Institute for Light and Building Technology (ILB), based in Cologne, Germany, is a leading organization in the field that investigates the use of holographic optical elements in architectural structures and the incorporation of holographic images to scatter daylight through windows and thus reduce lighting costs [10].

In 2003, the Cologne artist used 3D hologram technology on the roof and facade of a power substation in Media Park, Cologne, Germany, with an area of 150 m². Fig. 13.



Fig 13: The use of holograms in the ceiling and facade
Source: www.cultofmac.com/hologram-projector.

8.2. Applications of hologram technology in the formation of holographic tiles

The spectral Hologram has been developed in order to manufacture hologram tiles with moving designs that can be considered a work of art in itself, as a result of the large number of aesthetic effects that can be implemented in these tiles to achieve color and visual depth, color and light dimensions, in addition to the kinetic results.

Among these tiles are shapes that give certain effects, such as metal and glass, or give different artistic effects (Fig. 14), and some of them have been developed to interact with people through ultraviolet sensors, where they sense the presence of people and change their colors and can emit musical tones, which enables the use of this type in the directional signs, where the artist Vito Orazem was able to produce three-dimensional holographic floor tiles containing warning or guiding visual information for installation as visual barriers in metro stations (Fig.15 [11]).

It was also used in the public square of an exhibition in the Netherlands in 2001, where artist Dieter Jung combined holographic elements with three-dimensional floor tiles of 16 m2 that allowed viewers to interact with these images from all points of view (Fig. 16).



Fig14: Use hologram tiles with different effects
Source: www.google.com/digital-hologram



Fig. 15.16 The use of holographic tiles in interior design
Source: www.digital-hologram.com

8.3. Hologram technology applications in interior design

The Hologram, with its special features, was able to help break free from the traditional restrictions of interior design, as it represents a new challenge in this field. It has attracted designers for what it achieves by providing a wide area of liberation and development, which helps produce different spaces that have an impact on changing the nature of realistic interior spaces as well as achieving new formulas for these spaces.

Hologram technology can be used in internal treatments by creating variable three-dimensional backgrounds, as well as treating windows and murals and dealing with them using hologram technology, which provides a three-dimensional and irregular interior design to enrich the vision and add vitality and diversity to the internal treatments of the place. Fig. 17.



Fig.17 Using holographic effects to bring interior design to life

In 1998 it was used as part of the Beckum Bank, Germany, entrance sign, size 2 * 2.7 m2, Fig. 18. At the Bank of America Technology Center In the United States in 2001, three-dimensional images were displayed with hologram technology to enhance the impression of ultimate depth in these works by artists Ward Bos and holographer Rudie Berkhout (Fig. 19). Several three-dimensional images were installed with painted elements that combine together to form an integrated work, which achieves a delicate balance. Fig. 20. It was also used as a holographic stereo image hanging at the entrance to the building (Fig. 21, [12].

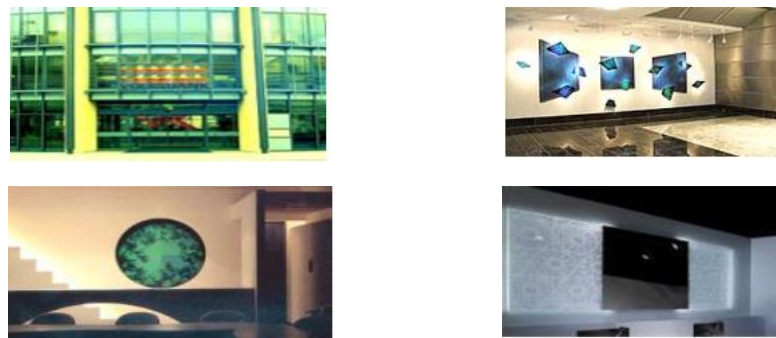


Fig. 18,19 The use of holograms in interior design and to enhance the sense of depth
Source: wwwhplustech.com/digital holography.

Digital technology has been able to achieve complete isolation of the space by using holographic visual walls to provide the most significant degree of privacy without the need for a physical partition separating the space from the rest of the spaces, thus providing suitable visual isolation. It was also used at Rome Airport by the architect Gianni Ranaulo, who designed a holographic wall with a length of 6 m. He also took advantage of the possibilities of digital movement to change the color and pattern of the wall over time. It was also used at the Hanover International Exhibition in Germany to divide the interior space using stereoscopic visual partitions (Figure 22). It is possible to change the properties of

the wall by generating particular electromagnetic waves that work to isolate the space, acoustically and thermally, and control it through digital software. One of the advantages of this holographic wall is its ease of control, flexibility in its use and removal with the push of a button, and the ability to move it from one place to another without being bound by the construction system. In addition, they are weightless, which means that the total load of the building is reduced, and they can also be used as screens for preparing holographic displays in a space.



Figure 20, 21 The use of holograms in artwork. Spaces
Source: www.mccourier.com/hologram_realfiction
metrolaser



Fig 22: The use of a holographic wall at
Hanover international Exhibition, Germany
Source: www.siptec-agri.com/new.aspx ?

9. Using Hologram Technology in Different Spaces

Holograms can be applied in many fields, including:

9.1 The use of holograms in museums

One of the types of museums in virtual reality is rooms that contain advanced display devices with special equipment that depends on the presence of a database, communication devices, and interaction devices that help convey the feeling to the recipient of the material presented to him in the form of simulation models of the unreal exhibits (Fig. 23). This is in order to preserve the antiquities, paintings, sculptures, etc., where the boundaries between the spaces and exhibitions were transformed from the traditional form into open spaces and mixed with each other, opening the field of vision and emphasizing the nature of the feeling of the nature of the exhibits. The design of the space is also in line with the techniques used in the shows.



Fig. 23 Applications of holograms in museum art exhibits
Source: www.entrprise.press/ar.

Hologram technology has been used to display three-dimensional models in art museums through transparent media that simulate the original artifacts and merge into the surrounding space, where the laser beams emitted from a laser source are separated into two beams, then the two beams are directed toward the art piece to be displayed, one of the two beams bounces off the object and passes through the other according to the set of lenses through which it is given. The beam that passes through the thing of the piece of art, which it issues to the optical film, forms a three-dimensional image [13].

It is also used in historical museums to study ancient civilizations and buildings by creating a virtual historical reality so that the holographic image can achieve the historical and temporal shift and the viewer's sense of it, as well as in water museums to imagine the world of the sea and science museums that review the latest findings such as medical sciences, watching the internal organs of humans and dealing with them directly Fig. 24.



Fig. 24 The use of holograms in medical sciences as three-dimensional paintings

9.2 The use of holograms in libraries: www.aaciaegypt.com

Hologram technology can be used in the design of libraries and its application in the field of various office tasks. It is also possible to use this technology to produce hologram books. In 2011, Media Screen Company introduced an integrated system for displaying digital books in the form of stereoscopic optical books, with the ability to browse these books Fig. 25. Experimental use of it began in museums and airports, with narrow limits in some libraries, and it was called the Monkey Book, where the light is broadcast on interactive glass surfaces that work with touch features and Retina Display technology, through which the book can be browsed in a similar way to the paper format of Fig. 26. This technology enables writers to enrich textual information with images, video clips, and audio. The application of this technology in libraries helps in their development and increases user interaction [14].

. In addition to the possibility of copying and transferring them, this technology can provide a lot of office tasks and functions and its impact on the design of library spaces.

This technology can be exploited in children's libraries or children's corners in public libraries by communicating stories and narratives without getting bored, and it is expected in the future in this field that there will be advanced formats, including an Interactive Hologram Librarian in the form of a librarian, that carries in his memory an endless amount of information to access the required information (Fig. 27).



Fig. 25 The use of hologram books in libraries and the possibility of browsing them

Source: www.drhendy.wordpress.com

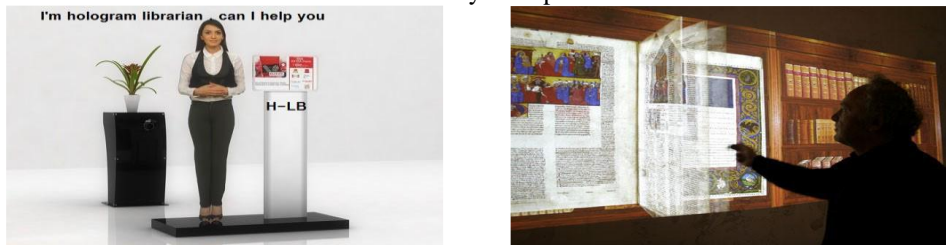


Fig. 26,27 Possibility to browse books on digital shelves as well as hologram librarian in the future

Source: www.drtazzuhairi.blogspot.com

9.3 Hologram applications in conference halls, entertainment venues, and commercial centers

Hologram technology can be applied to control screens in conference rooms and cinema screens. In one of the amusement parks in the Emirate of Dubai, hologram technology was used to create an interactive environment with a variable design and to embody realistic and dynamic three-dimensional models. Fig. 18 [15].

This technology can also be used in commercial centers through interactive displays. For example, it can be used in a clothing store to select the piece of clothing to be purchased through the display screen. Fig. 29: Hologram technology can also be applied in airports and large commercial markets in developed countries, where this technology is used in the field of flight announcements and guidance information. It can be used to promote trade, such as displaying products and artifacts [16], [17].



Fig. 28 The use of holograms in displays and entertainment shows in Dubai
Source: www.culture.ae/art/culture.

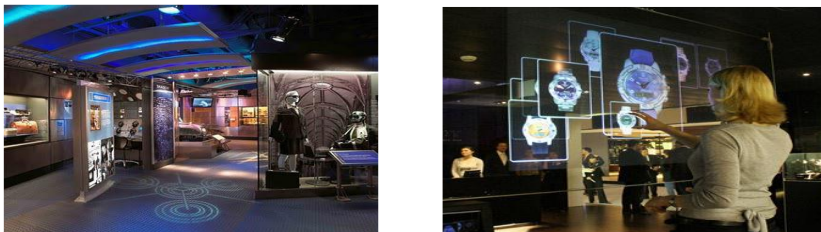


Fig. 29 The possibility of using holograms in shopping places and malls
Source: www.jdsaa.journals.ekb.eg/article

10. A Comparison of Hologram Technology and a Variety of Related Applications

A comparison was made between the hologram technology for holographic three-dimensional imaging and the most famous techniques in the specialty, such as the three-dimensional application, which is 3D Max, and the application of virtual reality, including many elements of comparison between them to identify the nature of the technology and its capabilities. A comparison has been made between the most famous techniques in the field of specialization to find out the realistic results of applying the Hologram. The following is an explanation of this comparison.

From the comparison process between a set of programs that rely on simulating the design and implementation process across a world of an imaginary reality, it is clear that the hologram technology is characterized by the direct participation of customers in the design process at the right time, with a sense of coexistence within the design, as a result of the realism that characterizes the display. But it has a relatively high cost that hinders individuals from using this technology, and it also needs specialists to deal with it to achieve a high-definition design.

SUMMARY AND CONCLUSIONS

1) The tremendous scientific development in the field of digital technologies for holograms has a significant impact on the production of stereoscopic virtual spaces that contribute to the development of architectural design by designing a miniature model of the invention, identifying its problems, and making its modifications, as there is a wide possibility to use

Table 1 : A comparison between the hologram

Comparisons	elements of comparison	hologram	3D Studio Max	ARCHICAD	Virtual Simulator
Financial cost	Regular and available cost		•	•	•
	High cost due to the novelty of technology and can be reduced by the spread and circulation of technology	•			
	very high cost				
Customer participation in the design process	The customer can participate during the design and give feedback immediately				
	The customer can participate after touring the project and identifying the problems	•		•	•
	The customer can only participate after design and presentation to it to get feedback		•		
Space available to deal with design	Dealing with design through a 2D computer screen				
	There is a specific place to deal with the design and walk through it in 3D		•	•	•
	The design can be displayed anywhere as well as roam freely in 4D	•			
Available display materials	There is a large availability of raw materials for display		•	•	
	There is limited availability				
	The materials express the nature of the design realistically	•			•
Ease of interaction of the designer with the program	The designer can handle the program himself		•	•	•
	The designer can deal with the program with the help of a specialist				
	There is a need for an assistant technician to adjust the devices	•			
nature of output	2D printing plates		•	•	
	Just watching				
	Watching and 3D printing	•			•
Availability of vision	It is available to deal with the design through the computer screen				
	Design can be manipulated and navigated		•	•	•
	It can be dealt with through the four interfaces and check the details	•			
design time	It saves a lot of design time, once you run it, the design appears			•	•
	It takes a long time and modification takes extra time		•		
	The time is proportional to the touring period and the presentation of the design	•			
clarity of design	High definition design	•	•	•	•
	Medium definition design				
	The design is limited in clarity				
Software programming	Easily available to designer		•	•	
	It can be obtained and dealt with it				•
	It can be dealt with by specialized laboratories and technicians	•			

hologram technology and adapt it in the field of architectural design in a way General and interior design in particular.

2) The use of the Hologram led to the interaction between the virtual space and the user. It provided the opportunity to create new dimensions in the development of the relationship between them, which gave the possibility for the client to participate in the design and make the required modifications, which led to a better understanding and helped both parties reach the final adjustments in a record time, which saves money and effort for post-modifications Implementation, this technology saves time and helps to live the design and allows a realistic interactive presentation between the presenter and the receiver.

3) Hologram technology is considered one of the modern applications. It is available on a small scale, so it needs specialized laboratories and technicians due to the sensitivity of the technology and that any deviation or change in the laser beam leads to a difference in the required results. It is also a high-cost technology and is more suitable for large institutions. There is no doubt

that it is the technology of the future and has an influential role in design thinking in all architectural fields.

4) Contemporary intellectual trends are a reflection of the creative and technical development in design through modern technological means that work to attract the viewer, enrich the design process, and develop the visual and sensory perception of the user.

5) The research recommends the need for designers to keep pace with modern developments and awareness of the latest technologies and to pay attention to their applications in the field of architecture to take advantage of the tremendous development in digital technologies to reach a design that keeps pace with modern technology and fits with its requirements.

6) It is necessary to work on the development of virtual laboratories for holograms through universities and specialized research centers to be used in modern applications and technologies, as well as enabling researchers and students to identify them and how to use them in various fields. The need to spread awareness of this technology through workshops and lectures, whether through universities or unions, with the need to prepare technicians and specialists for the preparation of modern technologies to reach the best results to create creative capabilities in design thought as a return to the use of these modern technologies.

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