

A Survey on 3D Video Calling: Implementation of Holographic Video Calls

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Abstract: Implementation of holographic video calls in mobile devices using of hologram projectors further to TFT displays. Here we tend to use hologram projectors for video calls by storing video as holographic pictures through the technique of computer device Generated holography. Downside statement: hologram video calls aren't in usage they're merely in research condition. Hologram makes Video Calls in 3D virtual screen. So as to bring hologram usage in mobile phones by suggests that of hologram projectors within the manner of computer device generated holography. A holographic image will be generated e.g. by digitally computing a holographic interference pattern and printing it onto a mask or film for subsequent illumination by appropriate coherent source of illumination. Or else, the holographic image will be delivered to life by a holographic 3D display (a display that operates on the idea of interference of coherent light), bypassing the requirement of getting to fabricate a "hardcopy" of the holographic interference pattern every time. Holographic laptop displays for a large range of applications from CAD to gaming, holographic video and television programs, automotive and communication applications (cell phone displays) and plenty of a lot of. Results: 3D hologram pictures are set within the video frames by hologram projectors whereas we have a tendency to build a video calls. Whereas creating the video call 3D photograph video are going to be displayed through Hologram Micro projector. Voices are transmitted through microphones and speakers.

Keywords: 3D video technology, Computer Generated holography (CGH) and holograms.

1. Introduction

3D video technology is used to make a hologram on a telephone set. "We see 3D [video] technology getting into the mobile phone, which is able to have the power to transmit data off the mobile phone to make a 3D hologram, a user would be ready to walk next to a hologram of a friend, and software system must be written to for receiving input from those cameras, several of the innovations on cell phones and alternative mobile devices. For instance, IBM predicts that commuters can get personalized travelling data, probably on a mobile phone or personal computer that combines somebody's calendar for a given day with recent traffic reports from multiple sources. The data may return from tracking the speed of cars on a highway, supported the time it takes for a cell phone to move from one cell tower to following one.

2. Materials and methods

A. Computer generated holography (CGH)

Computer Generated holography (CGH) is that the methodology of digitally generating holographic interference patterns. A holographic image are often generated e.g. by digitally computing a holographic interference pattern and printing it onto a mask or film for resulting illumination by appropriate coherent source of illumination. Instead, the holographic image are often brought to life by a holographic 3D display (a display that operates on the idea of interference of coherent light), bypassing the necessity of getting to fabricate a "hardcopy" of the holographic interference pattern on every occasion. Consequently, in recent times the term "computer generated holography" is progressively being employed to denote the full method chain of synthetically making ready holographic lightweight wave fronts appropriate for observation. Computer generated exposures have the advantage that the objects that one desires to point out don't have to possess any physical reality in any respect (completely artificial hologram generation). On the opposite hand, if holographic information of existing objects is generated optically, however digitally recorded and processed, and delivered to display afterwards, this can be termed CGH moreover. Ultimately, computer generated holography would possibly serve all the roles of current computer device generated imagery: holographic pc displays for a large vary of applications from CAD to recreation, holographic video and television programs, automotive and communication applications (cell phone displays) and many more which can be like Fig. 1.

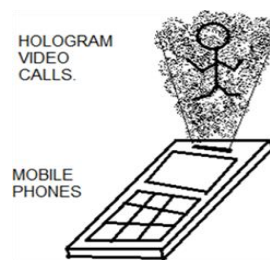


Fig. 1. Hologram video calls

Holography is a technique originally invented by Hungarian scientist Dennis Gabor (1900-1979) to boost the physical

phenomenon on electron microscopes. Associate in nursing object is light with a coherent (usually monochromatic) lightweight beam; the scattered lightweight is delivered to interference with a reference beam of constant supply, recording the interference pattern. CGH as defined within the introduction has generally 3 tasks:

- Computation of the virtual scattered wave front.
- Encoding wave front knowledge, getting ready it for display.
- *Reconstruction*: Modulating the interference pattern onto a coherent beam by technological means that, to move it to the user observant the hologram.

Note that it's not always even to create a strict distinction between these steps but it helps the discussion to structure it.

B. Wave front computation

Computer generated holograms provide necessary benefits over the optical holograms since there's no want for true object. As a result of this a breakthrough in three dimensional display was expected once the primary algorithms were according to 1966. Unfortunately, the researchers shortly realized that there are noticeable lower and higher bounds in terms of procedure speed and image quality and fidelity severally Wave front calculations area unit computationally terribly intensive; even with trendy mathematical techniques and high-end computing instrumentality, time period computation is tough. There are many alternative ways for convincing the interference pattern for a CGH within the next twenty five years loads of ways for CGHs are planned within the fields of holographic data and procedure reduction moreover as in procedure and quantization techniques. Within the field of procedure technique, the algorithm will be classified in 2 main ideas.

C. Fourier transforms method

In the 1st one the Fourier transformation is employed to simulate the propagation of every plane of depth of the thing to the display plane. The Fourier transformation construct was 1st introduced by Brown and Lowman with the detour section technique resulting in cell headed holograms. A secret writing technique advised by Burch replaced the cell headed holograms by purpose holograms and created this type of laptop generated holograms a lot of engaging. During a Fourier remodel hologram the reconstruction of the image happens within the way field. This can be sometimes achieved by victimization the Fourier reworking properties of a positive lens for reconstruction. Thus there are a unit 2 steps during this process: computing the sunshine field within the way observer plane, then Fourier reworking this field back to the lens plane. These holograms area unit known as Fourier primarily based Holograms. 1st CGHs supported the Fourier remodel might reconstruct solely second pictures. Brown and Lohmann introduced a method to calculate laptop generated holograms of 3D objects. Calculation of the sunshine propagation from three-dimensional objects is performed in keeping with the same old parabolic approximation to the Fresnel- Gustav Robert

Kirchhoff optical phenomenon integral. The surface to be reconstructed by the Hologram is, therefore, the superposition of the Fourier transforms of every object plane thorough, changed by a quadratic phase factor.

D. Point source holograms

The second procedure strategy is predicated on the purpose supply conception, wherever the article is broken down in self-luminous points. An elementary hologram is calculated for each source and therefore the final hologram is synthesized by superimposing all the elementary holograms. This idea has been initial rumored by Waters whose major assumption originated with Rogers who recognized that a Fresnel zone plate could be thought-about a special case of the hologram projected by Dennis Gabor. But, as far} as most of the article points were non-zero the procedure complexness of the point- supply conception was much above within the Fourier transformation conception. Some researchers tried to beat this disadvantage by predefining and storing all the attainable elementary holograms exploitation on prime special knowledge storage techniques attributable to the massive capability that's required during this case, others by exploitation special hardware within the point-source conception the major downside that should be circumvented is that the competition among knowledge storage capability and procedure speed. In explicit, algorithms that rise the procedure speed want typically terribly high knowledge storage capabilities whereas on the opposite facet algorithms that lower the necessity of knowledge storage capability cause high procedure complexness the' some optimizations may well be achieved. Another conception that results in source CGHs is that the Ray tracing methodology. Ray tracing is probably the only methodology of computer generated optics to visualize. Basically, the path length difference between the distance a virtual "reference beam" and a virtual "object beam" have to travel is calculated; this will give the relative phase of the scattered object beam.

E. Interference pattern encoding

Once it's renowned what the scattered wave front of the article seems like or however it's going to be computed, it should be fastened on a spatial light-weight modulator (SLM), abusing this term to incorporate not solely alphanumeric display displays or similar devices, however additionally films and masks. Basically, there square measure differing kinds of SLMs available: Pure section modulators (retarding the illuminating wave), pure amplitude modulators (blocking the illumination light), and SLMs that have the aptitude of combined phase/amplitude modulation .In the case of pure section or AM, clearly quality losses square measure ineluctable. Early styles of pure amplitude holograms were merely written in black and white, that means that the amplitude had to be encoded with one little bit of depth solely. Similarly, no form may be a pure-phase coding fictional at IBM within the time period of CGH. Although a completely advanced phase/amplitude modulation would be ideal, a pure section or

pure amplitude resolution is generally most well-liked as a result of it's a lot of easier to implement technologically.

F. Reconstruction

The third (technical) issue is beam modulation and actual wave front reconstruction. Masks could also be written, resulting typically during a) grained pattern structure since most printers will build only dots (although very little ones). Films could also be developed by optical device exposure. Holographic displays are presently yet a challenge (as of 2008), though made prototypes are engineered. a perfect display for laptop generated holograms would accommodate pixels smaller than a wavelength of sunshine with adjustable part and brightness. Such displays are referred to as phased array optics. Additional progress in nanotechnology is needed to create them.

3. Three dimensional limitations

Not only discretionary mutual intensity functions impossible for coherent fields, arbitrary band restricted three-dimensional wave function are not realizable. It is standard that the Fourier remodel of a coherent 3 – dimensional scalar field far-off from any evast sources yields a 3 – dimensional function. That's a wavelength of the optical field in question. In alternative words, a 2 dimensional manifold will describe any reliable coherent three-dimensional field. Therefore, there are several of three-dimensional field that can't be complete. E.g. A “plane wave” whose wavelength is doubly a long because the wavelength of a field.

$$U(x,y,z) = ef2\int t / 2t$$

Therefore, through the conditional theorem, any physically valid field should also be on the surface of the sphere. In alternative words, imposing that the 3 – dimensional field could be a correct answer to the Helmholtz equation ends up in the loss of one dimension. However, in several application areas, solely the intensity and not the part of the coherent field is vital. Since the intensity is solely the field increased by the complex conjugate. This implies that the potential extent of the Fourier remodel of the intensity is corresponding to the automotive vehicle correlation of the hollow sphere. This operation will “fill” the 3 – dimensional area, creating it tougher to see an easy pattern that will be not possible to generate employing a totally coherent field. However, recall that this automotive vehicle correlation operation remains a function from a 2-D manifold to a 3dimensional pattern. Therefore, the set of doable three-dimensional intensity patterns should have size but or capable the set of doable three-dimensional field patterns and there a similar limitations still apply. Though the liberty to settle on the part might yield potential gains. With the discussion to date, limitations of coherent fields are the results of obvious dimension a couple problems, however within the following section, we'll demonstrate that not all band restricted two-dimensional intensity patterns will be generated by a coherent

field, either this conclusion can build it obvious that not all band restricted intensity pattern containing a impossible 2 – dimensional intensity also will be not possible to get employing a coherent field

A. Available CGH devices

Currently, several companies and university departments are researching on the field of CGH devices:

- MIT Lab has developed the "Hologvideo" CGH display
- Real Technologies have prototyped a CGH display
- Cortical CGH Kit is a CGH related hobbyist site with instructions, source code, and a web-application for CGH creation.

4. Hologram projector

A holograph projector could be a video projector which will show a two-dimensional (2D) image. Light is routed to a particular location, creating the device economical, and also the projector has the capability to provide video frame rates for a practical exposure. It's a little device and may be integrated into laptops or mobile phones. The technology is principally employed in 2d applications, however models which will turn out three-dimensional (3D) pictures are in development. Calculations created by a silicon chip process exposure patterns. The light created by the device undergoes optical phenomenon, which might be controlled to make a high-quality image, all without a large lens. A liquid display is made on prime of the chip, on that the pattern seems like a cluster of dots, whereas optical device light provides the illumination to project the image onto a wall or screen. Various applications will enjoy a hologram projector, like home recreation and advertising. It additionally has potential for several businesses, automotive firms, yet as within the region trade. The device may be mass created inexpensively as a result of the circuitry is made into a typical style of field-programmable gate array, thus a comparatively new technology may be enforced using parts that are already offered. 3D devices square measure being designed, and one model even creates a touch once somebody puts their finger out to touch the exposure. Ultrasound waves within the air permit a somaesthesia to be felt once the photo is touched. The visual quality of the exposure isn't affected. Video games may incorporate such technology, and there square measure a colossal range of current applications of holographs within the game trade. The idea of a hologram projector isn't new, however the construct has been tough to develop as a result of incorporating holograms into video needs quick processing power. Such a large amount of mathematical calculations happen that even powerful computers would take a protracted time to make individual video frames. Pictures projected this manner are low in quality, and therefore the lasers needed for the application are terribly high-cost.

Several firms have caught onto technologies that may support the process speed required. The dynamics of a holograph projector give little components, thus it is to be incorporated

into small natural philosophy like laptops or personal digital assistants (PDA). Video pictures is created that, until recently, sounded like one thing seen solely in science fiction.

A. Holographic Display

Generally Holograms are 2d canvas which might show 3D objects. You'll realize them in several places in reality like your MasterCard and driver's license. There you'll see 3D object in 2d sticker and looking on the angle you consider it you'll get completely different views, same as in real 3D object. Those holographic stickers are troublesome to breed and accustomed indicate originality of product. Using identical underlying elementary thought laser devices will produce 3D pictures in nullity. This is often a latest expertise to United States. When we tend to see a reproduced image its 2d and there's a screen. Although you expertise Wi-Max 3D, still there's a screen. However with optical maser photo there's no physical screen. It just seem 3D objects in air. Normally in a very Smartphone we tend to see pictures in 2d show and bit responsiveness is additionally restricted to 2d surface. Yes, some applications are capable of displaying 3D pictures, however still they're virtual 3D and displayed on 2nd surface. The day engineers equipped a Smartphone with a Holographic show, the photographs stuck in 2d show can come out of the phone as real 3D objects. Smartphone home screen can spread out in air and menu item can begin floating close to them. Once this becomes reality it'll be following huge factor in Mobile French telephone evolution. Display real 3D pictures in air won't be capable deliver a good user expertise. There must be motion detector which might perceive hand gestures and management the UI consequently. Once you mix this sort of motion detector to a Holographic show, you'll be able to truly bit a 3D object that popped out from your phone and switch it around together with your fingers. Same thought can work even higher with massive screens in tablets.

B. Technical challenges

Smartphone displays area unit primarily used for data presentation like net browsing, multimedia system application and Games. In those case color copy ought to be correct and frame refresh rate have to be compelled to be bigger and also the holographic show ought to be able to show 2d pictures whenever necessary. Current optical device holograph technology desires to travel a protracted way to meet the on top of demand. Current state is color copy quality is extremely low and refresh rate is average. Once it involves hardware, it's not able to sleep in small Smartphone body. If you think about the ability consumption optical device holograph can kill the foremost powerful Smartphone inside seconds. Thus we want to shine up holograph show technology before it's blocked in to a Smartphone. When it involves 3D motion sensors, the case is far higher than holographic display. Technology already made few 3D motions sensors and a few of them are already within the market like Microsoft Kinect. Still the technology desires numerous sharpening up to shrink the hardware to put them in

Smartphone body. In our life we've got full-fledged speed of technology persistently. Back in Nineties we tend to were exploitation 2G mobile phones for sending text messages. After ten years we tend to have Smartphone with multi-touch displays, high speed knowledge property, GPS and HD displays. these days it'd sounds sort of a day dream to introduce holographic displays and 3D motions sensors in Smartphone, however technology can surprise United States of America inside few years with means advanced technology evidently. Component for synthetically generating a holograph we tend to describe a way of crucial associate aberration correction for a holographic image show system employing a special lightweight modulator (SLM) to show a holograph. Embodiments of the invention live the corrections required for a selected projection system, using a similar system SLM as wont to generate the pictures to produce wave front-sensing holograms.

C. Holographic laser projection technology

LBO's technology represents a revolutionary approach to the projection and show of knowledge. Not like different commercially-available projection technologies, LBO's projection engine image F_{xy} on a small display that is typically consecutive lit by red, green and blue light-weight to create color. During this case, the small show merely acts to by selection block (or amplitude modulate) the incident light; when passing through some magnification optics, the projected image F_{xy} appears. Conversely, holographic optical device projection forms the image F_{xy} by illuminating a optical phenomenon (or hologram) pattern huv by optical device light-weight of wavelength. If the exposure pattern is delineate by a show part with picture element size then the image F_{xy} shaped within the focal plane of the lens is expounded to the pixel lated exposure pattern h_{uv} by the separate Fourier remodel $F[\bullet]$, and is written as x

$$F_{xy} = F[h_{uv}]$$

The relationship between hologram h_{uv} and image F_{xy} present at the rear focal plane of a lens of distance f , once lighted by coherent monochromatic lightweight of wavelength. The crucial potency advantage of LBO's system happens as a result of the exposure h_{uv} is quantized to set of part solely values uv , where

$$h_{uv} = \exp(juv)$$

So that the incident light is steered into the required image pixels – while not blocking – by the method of coherent interference, and also the resultant instantaneous projected image seems as an immediate consequence of Fourier optics. to attain video- rate holographic show, a dynamically- addressable display part is needed to show the exposure patterns; LBO's system uses a custom-manufactured ferroelectric liquid on element (LCOS) small show factory-made by show school, Inc. to attain high image quality a quick small show is employed to show N holograms per video frame among the 40ms temporal information measure of the attention, every of that produces a

picture F_{xy} exhibiting quantization noise. If the intensity of the i th displayed image exploits the physical method of 2 dimensional optical phenomenon to create video pictures. A typical imaging projection system works by displaying a desired

$$I = N \quad i=1$$

Uniquely, the key to holographic optical device projection technology lies not within the optical style however in the algorithms accustomed calculate the exposure patterns h_{uv} from the specified image F_{xy} . LBO has developed and proprietary algorithms for the needs of scheming N sets of holograms each with efficiency and in real time, as 1st incontestable in 2004. Crucially, such algorithms will be with efficiency enforced during a custom microchip. A sensible realization is very easy and is shown within the schematic of Figure four. A desired image is born-again into sets of holograms by LBO's proprietary algorithms and showed on a phase- modulating small display that is time- consecutive lit by red, inexperienced and blue optical device lightweight severally. The next optical phenomenon pattern passes through a demagnification lens try $L1$ and $L2$, which might be chosen to produce ultra- wide projection angles in more than 100° . Thanks to the nature of Fraunhofer optical phenomenon, the image Remains focused in the least distances from the lens $L2$.

5. Results

The optics video calls will be enforced through implementing a small holograph projectors within the mobile show through LBO projector models within the method of pc generated optics. The image are unreal in 3D model. Their originality are viewed by peaks and depths of every holographic pictures set into the video frames. The relationship between photograph h_{uv} , sub frame F_{xy} and frame V_{xy} in LBO's holographic projection technology .Normally in an exceedingly mobile we have a tendency to see pictures in 2nd display and bit responsiveness is additionally restricted to 2nd surface. Yes, some applications are capable of displaying 3D pictures, however still they're virtual 3D and displayed on 2nd surface as shown in fig five.3. The day engineers equipped a mobile with a Holographic show, the photographs stuck in 2nd show can initiate of the phone as real 3D objects. Smartphone home screen can detached in air and menu item can begin floating close to them. Once this becomes reality it'll be consequent huge issue in Mobile handset evolution. Display real 3D images in air won't be equal to deliver a good user experience. There has got to be motion detector which might understand hand gestures and management the UI consequently. Once you mix this sort of motion detector to a Holographic show, you'll be able to truly bit a 3D object that popped out from your phone and switch it around with your fingers. Same conception can work even higher with giant screens in tablets.

6. Discussion

A new ground-breaking holographic 2d projection technology might end in a brand new generation of pocket-sized digital video projectors and miniature projection displays incorporated into alternative hand-held devices. Digital video projectors manufacture massive, prime quality pictures have become progressively widespread as they grow cheaper with production, however the technology is restricted in its shrinking, preventing projectors from being incorporated mobile device markets. Holographic projection of 2d (rather than 3D) pictures represents a compelling different to traditional image projection. Video projectors supported this holographic technology may be created terribly little thus a projector may well be integrated into a laptop computer, a PDA, or perhaps a mobile. Holographic projection of 2d (rather than 3D) pictures represents a compelling different to standard image projection. Holograms efficient: they work by routing light-weight to the places wherever you wish it, and off from the places you do not. Video projectors supported this holographic technology need only a few elements, which implies they will be created terribly tiny - and therefore the smaller you create holograms, the better the image that results. Therefore a projector may well be integrated into a portable computer, a PDA, or maybe a portable. The conception of a holographic projector isn't new, however up so far technical problems have prevented development of AN actual product supported this technology. Holograms square measure very complicated objects mathematically, and scheming them quick enough for video applications is incredibly difficult; even the foremost powerful computers would take minutes to come up with a exposure to project simply one video frame. The projected pictures created by holograms tend to be sparkly and of terribly inferiority. The lasers that are needed to illuminate the holograms have, till very recently, been expensive and restricted in availableness .Hologram pattern, that to the optic appears like a group of random dots, is showed on a tiny low liquid-crystal-on-silicon (LCOS) small display - a little, in no time liquid show designed on prime of a chip. The exposure patterns square measure calculated by lightweight Blue Optics' proprietary "hologram chip" in order that once the small show is well-lighted by optical maser lightweight, the sunshine interferes with itself in an exceedingly complicated manner through the physical method of optical phenomenon that, once rigorously controlled, ends up in the formation of an outsized, top quality projected image on, for instance, a screen or a wall. Unlike a standard video projector, heavy, large lenses aren't required: optical phenomenon will all the work for you, and also the projected image is sharp and focused at any distance. There are a large variety of applications for this technology in fields together with business, home amusement, region advertising. At present, the main target is on second applications, especially small personal projectors for business and residential use. The illustration shows associate artist's impression of a possible early product - a private video projector, that you may transfer

movies to then play anyplace, employing a wall as the screen.

7. Conclusion

3D technology stepping into the telephone, which is able to have the power to transmit data off the telephone to form a 3D exposure, protruding the exposure on any surface in life size. With a telephone exposure, a user would be able to walk next to a exposure of a disciple, or an employee might project associate enlarged 3D image of a product needing repair to run within it and notice issues. IBM is already performing on the telephone exposure thought in its labs, and Bloom foretold that

a model ought to be prepared in 5 years. The cameras that are being employed to form early versions of holograms still ought to be miniaturized, and computer code has to be written to for receiving input from those cameras. Based on what quantity 3D video has caught on in recent months in gambling and different areas, we have a tendency to expect individuals can wish holograms on their cell phones. "I undoubtedly need a exposure on my telephone, to be able to say, 'Beam me up, Scotty,' despite the fact that it would be a virtual and not a true person"

References

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