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A Study on Visual Image Display: A Type of Screenless Technology

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Abstract – *Advancements in technology always lead to the evolution of devices and their development process. Visual Image Display, comes under the screenless display, in which it is possible to recognize an image with the help of the human eye. Screenless display is where we eliminate the touch screen display/technology. Therefore, overcoming the problems of the touch screen and improving the quality of life of the people. In visual image display we have three important parts or entities, the light source, the reflector surface, and the observer or human. The most common examples are holographic display, virtual reality goggles and heads-up displays (HUD).*

Key Words: **Heads Up Display, Holographic displays, Light Source, Reflector Surface, Screenless Display, Visual Image Display.**

1.INTRODUCTION

Visual Image Display is a category of screenless display, in which the human eye can recognize any type of image. It usually consists of three important parts, a light source, a reflector surface, and an observer. A light source or the original image is what the user wishes to be projected on any surface that reflects light. Secondly, the reflector surface can be windows or films which reflect light, it forms the core of the Visual Image Display. Finally, we have observers or humans. The reflector surface is the actual visual image that we will be concentrating on. Some of the examples include virtual reality goggles, holographic displays, and heads-up displays, which will be discussed later.

1.1 Origin of HUD

The first use of HUD can be attributed to fighter jets. They gradually developed over the years. The first generation used a cathode ray tube (CRT) as a source and if an enemy target was in sight, it would be highlighted so that the missile can be fired. Then the fighter jets moved on to the second generation in which LED was used as the source but it was costly. The third generation introduced the light source on specially coated surfaces (windshields), whose clarity was improved to provide HD images by using lasers in the fourth generation.

2. Working of HUD

HUDs are also termed as transparent displays, widely used in the automation industry and also in computer games. The basic idea is that users can operate on the information without looking away from their screen or windshield. The basic HUD contains a projector, combiner, and a computer.

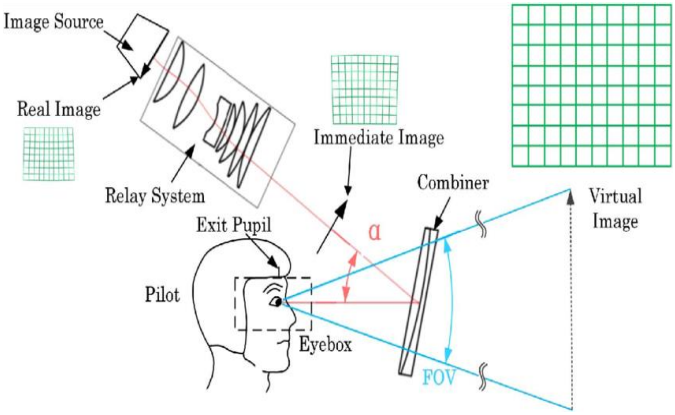

Fig -1: Schematic diagram of HUD

The image source is like a monitor which can be connected to a phone or can be inbuilt in a car or other automobile. The relay system is nothing but a bunch of mirrors used for reflection and also to eliminate distortion and altering the shape of the image, either magnify or shrink them. Combiner is the windshield or the reflector surface (specially made), here there is no distortion and multiple images are not observed, which are obvious while using normal glass. It can be adjusted suitably so that it provides a clearer picture to the user from a particular angle. Also, there is a light trap which is a black piece of plastic to trap the sunlight or light from other mediums so that the original image is not distorted.

Fig -2: Representation of HUD

Heads-up display project a floating image directly on the windshield of the car containing relevant information. For example, they will project information regarding to speed, direction, cruise control settings, and other useful information. The main advantage of heads-up display is its ability in manipulating the size of the image. In this category

of displays, multiple bitmaps can be composited together in the object mode, and image mode, manipulation takes place.

3. HOLOGRAM

The Hologram is an application of visual image display, using this a 3D image can be constructed. Hologram is made up of two Greek words "Holos" (whole) and "Gramma" (message). It is the method of recording a wavefront and later reconstructing it to produce the original image. It has a wide range of applications. The original image is reconstructed by superimposing the second wavefront (reference beam) on the initial one, creating an interference pattern on a suitable physical medium. They can also be computer-generated.

Hologram projection is a result of a technological innovation that aids for touchless interfaces. The holography technique is used to create and generate hologram, which are widely in telecommunication industry. It projects high quality 3D images which gives a feeling that it can be touched. It is possible to transmit them directly or store them in various storage devices. The hologram is first recorded and reconstructed whenever it is needed.

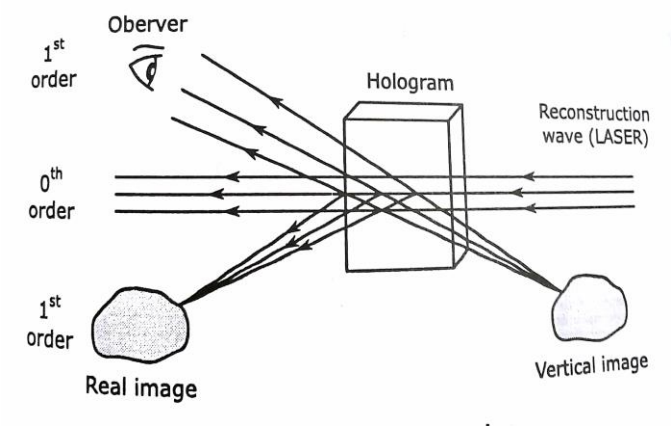

Fig -3: Construction of Hologram

Holography enables a light field (light source) to be recorded and later reconstructed when the original light field is no longer present, due to the absence of the original object. It can be thought as somewhat similar to sound recording, whereby a sound field created by vibrating matter like musical instruments or vocal cords, is encoded in such a way that it can be reproduced later, without the presence of the original vibrating matter. In laser holography, the holography is recorded using a source of laser light, which as orderly composition and is pure in its color. Various setups may be used, and several types of holograms can be made, but all basically involve the interaction of light from different directions and producing a microscopic interference pattern which a plate, film, or other medium photographically records.

Usually, lasers are used for the construction of holograms because of their monochromatic nature. It is a coherent beam of light with the same wavelength. The initial laser beam is split into two, one beam gets reflected from the target object and the other goes directly onto the screen. The reflected beam gets imposed on the screen, therefore reconstructing the target object by the interference of the two beams. The holographic films can be cut and still can reconstruct the entire image, which is not possible in photography, therefore we can say that holograms are efficient for data storage.

3.1 Photography vs Holography

The difference between a regular photo and a hologram is that a regular photo has fixed wavelengths captured so that the picture remains the same when viewed from every angle. On the other hand, the hologram shows a 3D image and changes with respect to the angle.

Photography produces a 2D image of a 3D object whereas hologram generates a 3D image. It is possible to record both intensity and phase variation in holography, but only intensity is recorded in photos. When cut into pieces, the photo is capable of providing partial information only, while the hologram recreates the entire object. There is point-to-point recording of the intensity of light in photos, on the other hand in holograms each point of the film receives light from all parts of the object.

4. CONCLUSIONS

The global market size of Screenless Displays is increasing annually. It is a part of an emerging technology in the filed of displays. This technology is looking to transmit information without the use of a projector or a screen. Mainly used in medical holography for medical imaging applications. Visual image systems are capable of projecting visual information directly onto the open space. Smart glasses, automotive HUDs, holographic systems are all applications of visual image displays. They are also expected to be used in defense, aerospace, automotive and various commercial sectors, but right now it is available to a limited range of products. Currently used in holographic displays, head mounted displays, and heads-up displays.

The demand for the industry has increased in the past few years, because of its portability and increased popularity of holographic projections. Full-sized keyboards can be projected on any flat surface for ease of interaction. Breakthroughs have been made by numerous companies in this field, including mobile phones for partially blind and elderly people, virtual reality headsets, bionic contact lenses, and many more.

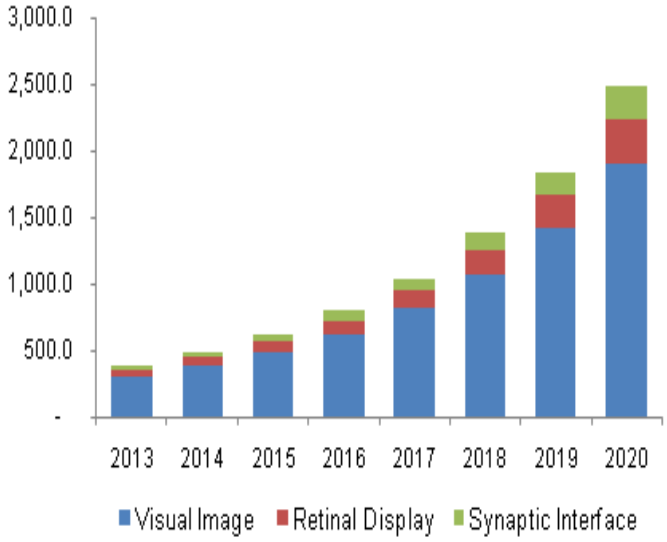

Fig -4: Industry Insights

We can see the domination of visual image display over the other types of screenless displays in the past few years. The launch of Google glass is one such step towards utilizing the technology in daily use across different industry verticals.

The ability to have several compensations which are involved in the making, designing, coding of the screenless, plenty of information and process for the development is still under consideration. The future years maybe dominated with the screenless display skills and this augments the world of technological empowerment in the field of computer technology. This technology is cost effective and also has a bright future ahead. Screenless displays look ready to start a generation in the lineage of projections, and that generation is the screenless generation.

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