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Screenless Display: The Future of Virtual Visual Communication

[1]Dr. Suraj R. Nalawade, [2]H. O. Tapase, [3]Riya Pradeep Kumbhar, [4]Nidhi Jayant Pawar
Department of Artificial Intelligence and Data Science Engineering, YSPM's Yashoda Technical Campus, Satara-415001, Affiliated to DBATU University Lonare, Maharashtra, India.)
Email: dr.surajsir@gmail.com, gouribarge.8@gmail.com, riyakumbhar1187@gmail.com, nidhipawar2023@gmail.com

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Abstract

Screenless display which is an emerging new technology, has become a good prospect in the near future for a wide range of applications. There are several new emerging ways for the technological development of the working principle of the screen less displays[4]. Several software's are merging for the GEN-X wonder view.

Any computer system that can run the mudoc software can present text that has been set in interactive movable type. Most of the mudocs that are consumed in the next few years will be consumed with conventional personal computers, e-book readers, and other kinds of display and projection devices that are now in use. Very soon it appears to be a new kind of input/output system will facilitate communication and interaction between the computer and the computer user. This new human/computer interface is the telereader terminal.

Visual Image is a bitmap manipulation and composition product. A virtual retinal display (VRD), also known as a retinal scan display (RSD), is a new display technology that draws a raster display (like a television) directly onto the retina of the eye.

The user sees what appears to be a conventional display floating in space in front of them. Similar systems have been made by projecting a defocused image directly in front of the user's eye on a small "screen", normally in the form of large sunglasses.

The user focuses their eyes on the background, where the screen appeared to be floating. The disadvantage of these systems was the limited area covered by the "screen", the high weight of the small televisions used to project the display, and the fact that the image would appear focused only if the user was focusing at a particular "depth".

It involves the following 3 different working principle

1.The Visual image 2. Virtual retinal display 3. Synaptic interface

Screen-lessdisplay technology represents a paradigm shift in how visual information is presented, removing the need for traditional physical screens. By utilizing techniques like holography, retinal projection, and augmented reality, this innovative approach delivers visual content directly to the user's eyes or onto other surfaces. The technology enhances portability, reduces device footprint, and improves accessibility, offering a futuristic solution for diverse applications such as entertainment, healthcare, military, and education. It eliminates the challenges of screen fragility and size constraints while delivering immersive and interactive experiences. Despite its potential, challenges remain in terms of cost, resolution,

power consumption, and user adaptation. Advancements in optics, miniaturization, and artificial intelligence continue to drive the evolution of screen-less displays, paving the way for their integration into smart environments and wearable devices. This technology holds the promise of redefining visual communication, making it more intuitive, engaging, and seamlessly integrated into daily life.This technology would bring about the revolution in the field of displays and monitors that are costly, huge and are proven difficult to manage the power requirements and constraints . It is also the futuristic technological innovation.

Introduction

Screenless display is a present envolving technology in the eld of the computer enhanced and technologies. Is is going to be one of greatest technological development in coming future years.

Visual Image

Fig. 1. Reference: LinkedIn Article on Global Screenless Display Market

Hologram

Fig 2. Reference: https://ashutoshviramgama.com/visual- image-display/amp/

Holograms were used mostly in telecommunications as an alternative to screens. Holograms could be transmitted directly, or they could be stored in various storage devices (such as holodiscs) the storage device can be hooked up with a holoprojector in order for the stored image to be accessed virtual reality goggles (which consist of two small screens but are nonetheless sufficiently different from traditional computer screens to be considered screen less)and heads-up display in jet fighters (which display images on the clear cockpit window) also are included in Visual Image category. In all of these case light it reflected off some intermediate object (hologram, LCD panel, or cockpit window)before it reaches the retina.

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Hologram

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Retinal Display

Virtual retinal display system are a class of screenless disply in which image are projected directly onto the retinas shown in fig 3. They are distinguished from the visual image system because light is not reflected from somr intermidate object on the retina,it is instied projrcted directly on to the retina.

Fig 3. Reference: https://images.app.goo.gl/4U4EfJQu2iDR YCDV8

Retinal Direct system once marked, hold out the promise of extrem privacy when computing work is done who is legitimately viewing the screen and retinal direct system send light only in to the pupils of their intended viewer

How Virtual Retinal Display Works:

The VRD creates images by scanning low power laser light directly onto the retina. This special method results in images that are bright, high contrast and high resolution. In this paper, we describe how the VRD functions, the special consequences of its mechanism of action and potential medical applications of the VRD, including surgical displays and displays for people with low vision. A description of its safety analysis will also be included. In one set of tests we had a number of patients with partial loss of vision view images with the VRD. There were two groups of subjects: patients with macular degeneration, a degenerative disease of the retina and patients with keratoconus. Typical VRD images are on the order of 300 nanowatts. VRD images are also readily viewed superimposed on ambient room light. In our low vision test subjects, 5 out of 8 subjects with macular degeneration felt the VRD images were better and brighter than the CRT or paper images and they were able to reach the same or better level of resolution. All patients with Keratoconus were able to resolve lines of test several lines smaller with the VRD than with their own correction. Further, they all felt that the VRD images were sharper and easier to view. The VRD is a safe new display technology. The power levels recorded from the system are several orders below the power levels prescribed by the American National Standard. The VRD readily creates images that can be easily seen in ambient room light and it can create images that can be seen in ambient daylight.

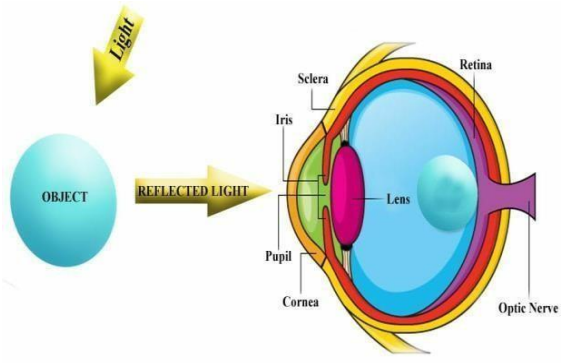

Fig 4. Reference: https://images.app.goo.gl/XYUzQ66utRo KthR3A

Synaptic Interface

Synaptic Display Synaptic Interface screen less video does not use light at all. Visual information completely bypasses the eye and is transmitted

directly to the brain.
This technology is already tested on humans and most of the companies started using this technology for active communication, education, business and security system. This technology was successfully developed by sampling the video signals from horse crab eyes through their nerves, and the other video signals are sampled from the electronic cameras into the brains of creatures.

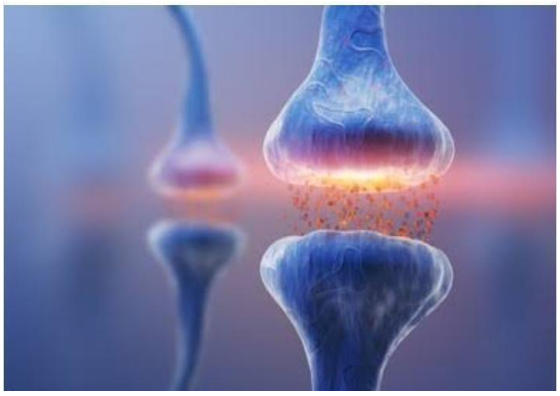

Fig 5. Reference: Reviews in Veterinary Neurology and Neurosurgery | Frontiers https://images.app.goo.gl/1rrJSCeMv7PXF

Literature Review
In 2013 screenless display market has witnessed factual growth and according to the MIT latest technology review, it has become a new rage of development for the next GEN-X Screenless display was first introduced by the mobile phone named OWASYS 2CC [8]. Google, Microsoft, Apple, Kapsys, Displair and Avegant are the key players in the global market, hence several researches renowned IT sector companies are being driven for the future development of this emerging new technology such as mobile phones for elderly, blind people, bionic contact lenses, virtual reality headsets and holograms [4]. Google is researching more on screenless tablet computers and smart phones, Google Glass and Cardboard Virtual Reality use the concept of screenless display. In cardboard, two polarized lenses show two images, which helps the brain combines to create a 3D image. Given the illusion of depth the brain offers a type of virtual reality. Goggle offers another wearable way to interact with screenless display which is named Google glass and anyone can wear it [9]. Therefore, using virtual retinal display several companies had already raised with the aim of commercializing personal gaming and cinema devices. In the field of the hologram projection screenless displays are also broadly applicable because holographic images can be generated in three dimensions [6]. Recently researchers at Swinburne University of Technology have discovered nanoscale pixels of refractive index through a photonotic process and found the capacity of a technique using graphene oxide [5] and complex laser physics to create a pop-up tiny floating 3D holographic image which is visible to the opened eye. Graphene enabled floating display is based on the principle of holography because it is a two dimensional carbon material with extraordinary electronic and optical properties. Though there is no limitation for the up scalability of graphene 3D display it can allow images up to 1cm only.[10]

Methodology
screenless display technology is used to transfer or display information without using a screen. The advancement in the old of screenless displays would lead the replacement of touch screen displays by screenless ones in the near future. Screenless displays are a part of an emerging technology in the old of displays that are likely to be a game changer and would change the way displays are used. In due course of time, hardware component is expected to become economical. This technology is not developed fully till now and is available in a limited range of products.

The Working Principle
There are several new emerging ways for the technological development of the working principle of the screen less displays. Several software's are merging for the GEN-X wonder view. Any computer system that can run the mudoc software can present text that has been set in interactive movable type. Most of the mudocs that are consumed in the next few years will be consumed with conventional personal computers, e-book readers, and other kinds of display and projection devices that are now in use. Very soon it appears to be a new kind of input/output system will facilitate communication and interaction between the computer and the computer user. This new human/computer interface is the tele reader terminal. Visual Image is a bitmap manipulation and composition product. Bitmaps can be manipulated independently, in the Image Mode or multiple bitmaps can be composited Together in the Object Mode to create a "collage". Visual Image can create and Manipulate images of any size: the only limitation is the amount of memory resources your system has. These EYE files can be used to create catalogs of images in logical sub groupings: for example, you can create a catalog file in the EYE format that lists all images of building materials (brick, concrete, stone, etc.). The File, Export Project

command creates an EYE file that refers to all of the images that are currently loaded into Visual Image. When you select this command, you are prompted to enter a filename for the EYE file that is to be created. If you have created any image in Visual Image that are not yet saved to disk those you will be asked if you wish to include those images in the EYE file and if so, you are prompted to store images as bitmaps. The File, Exports Editor Command in Visual Image allows you to pack and choose those image files on disk that you wish to include in a catalog EYE file [5]. When you select File in Export Editor, a file browser appears from which you can choose the image files to include. Use this browser to select images to add to a project file for use in Visual Catalog.

Additional Software and Hardware Requirements

To facilitate the interacivity.

To optimize the user's perceptual and cognitive capabilities To provide the most healthful visual environment for the user.

Responding to a variety of user commands (using voice, hand, foot, or other signal methods) Providing blink cues or blinks responses Modifying output to compensate for changes in user's physiology or reaction time, etc. The new software and hardware will enable the user and the system to better exploit each other's capabilities and to function as a fully integrated team those you will be asked if you wish to include those images in the EYE file and if so, you are prompted to store images as bitmaps. The File, Exports Editor Command in Visual Image allows you to pack and choose those image files on disk that you wish to include in a catalog EYE file [5]. When you select File in Export Editor, a file browser appears from which you can choose the image files to include. Use this browser to select images to add to a project file for use in Visual. A Virtual Retinal Display (VRD) is a type of display technology that projects images directly onto the retina of the eye, creating a highly immersive and direct viewing experience. It differs from conventional displays, such as LCDs or OLEDs, which rely on emitting light toward the eye that gets focused by the eye's lens onto the retina.

Implementation of Virtual Retinal Display Image Creation:

The image is created by combining the modulated colors into the desired pixel configurations. Each point of light is directed individually by the scanning mechanism to specific points on the retina, creating the image.

Retinal Scanning

The scanning system, often working at a high refresh rate, continuously "draws" the image directly onto the retina. This requires precise calibration and control to ensure that the image is clear, stable, and aligned with the viewer's vision.

In practical implementations, VRD systems are incorporated into wearable devices like augmented reality (AR) headsets or smart glasses. The VRD device must be lightweight and compact, ideally fitting into everyday wearable form factors. Additionally, synchronization with external devices and content sources, such as mobile phones or computers, allows for interactive AR or VR experiences.

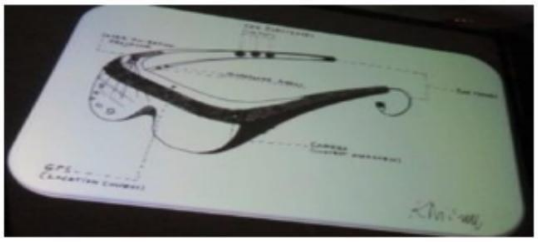

Fig 6. Reference: https//www.ijraset.com/images/text_version_uploads/imag%201_12540.png

Virtual Retinal Displays

Results in Virtual retinal displays (VRDs) project light directly onto the retina,effectively creating the perception of an image. This method can produce high-contrast images that are viewable in various lighting conditions.

Experimentation in user comfort and readability has shown VRDs to be effective in augmented reality settings where hands-free information access is essential, such as in aviation or healthcare. VRDs bypass traditional screens, reducing the bulk of display devices. However, challenges arise in aligning the light precisely to the user's retina, especially for users with vision impairments.

Experiments indicate potential issues with eye strain, and prolonged use needs further study to assess long-term effects.

Air-Based and Volumetric Displays

Results in Air-based displays create floating images in the air, often using ionized air or water vapor as the medium. Volumetric displays achieve a similar effect by projecting 3D images that appear to occupy a volume of space. Studies have demonstrated their appeal for public installations, where users can view information or art interactively without touching a physical screen. While captivating, air-based displays face limitations in resolution, stability, and

durability. Environmental factors like airflow can disrupt the display, and their visibility may be compromised in brightly lit spaces. Experiments suggest that while practical for short-term or artistic installations, these displays are less suited for precise data presentation.

Future Scope

The future of screenless display is promising, with the potential to transform user interface, improve accessibility, and create immersive experiences. Screenless display are experiences. Screenless display are expected to grow in popularity due to a number of factors, including:
Increasing demand for immersive experience: Consumer are seeking more engaging and interactive, experiences, and screenless display can provide these.
Growing adoption of AR and VR: The rising popularity of AR and VR applications across industries like gaming, healthcare, education, and automotive is driving demand for screenless display. Advancements in display technologies: Improve resolution, brightness, and field of view are portable and can be used in many places

Conclusion

The paper has elaborately discussed screenless displays which is one of the most emerging computer technologies and has become a new exciting rage for the up coming generations as a field of the futuristic technology. Due to the ability of having several advantages which are involved in the making, designing, coding of the screenless , this needs plenty of knowledge and process for the development is still under the improvement. May be in the future the world may be dominated with the screen less display technologies and this enriches the world of technological Screenless displays promises the cost effective aspect and also brighter future in the computer technology.

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