

Unit-5 Assignment

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1. Virtual Retinal System

**A display technology that projects images directly onto
the retina, creating a highly immersive visual experience
without the need for a screen.**



What is Virtual Retinal Display (VRD)?

Direct Projection

VRD bypasses traditional displays and projects images directly onto the retina of the eye, creating a virtual screen that appears to float in space.

Immersive Experience

This technology offers an immersive experience, as the virtual images appear to be superimposed onto the real world, blurring the lines between reality and digital content.

High Resolution

VRD has the potential for extremely high resolutions, surpassing conventional displays, providing sharp and detailed virtual images.

How Does VRD Work?

1

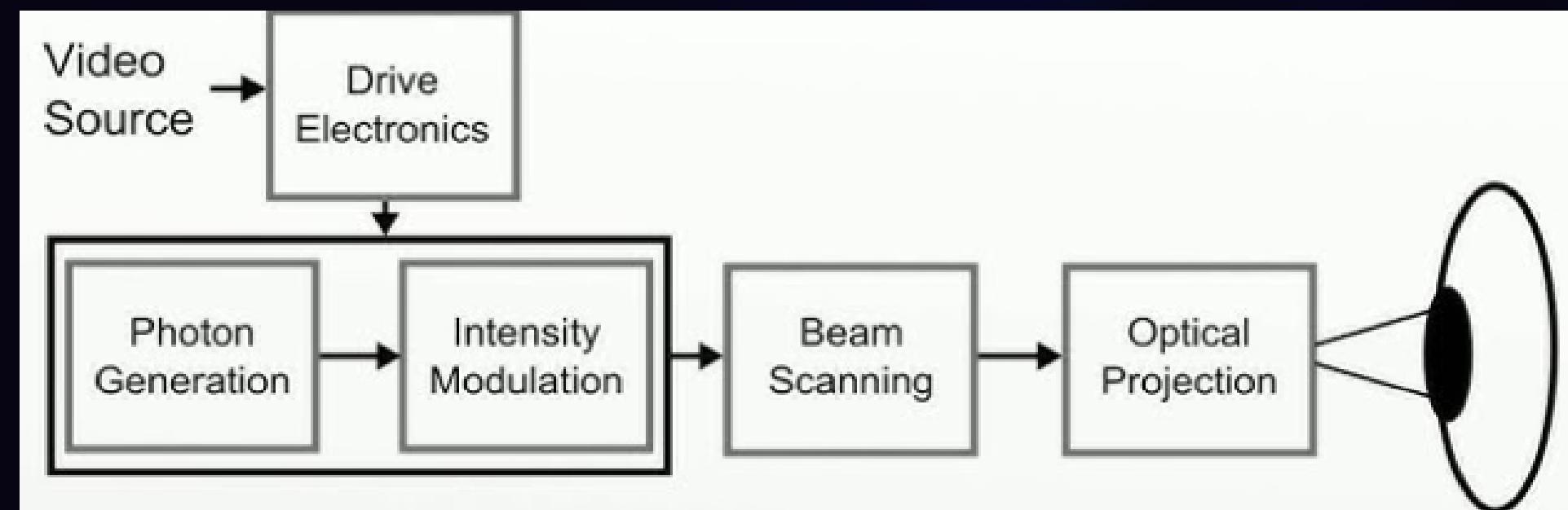
Miniature Projector
A tiny projector emits a beam of light carrying the image data.

2

Focusing System
A focusing system directs the light beam towards the user's eye.

3

Retina Projection
The focused light beam is projected onto the retina, creating a virtual



Key Components of VRD

1

Micro-Projector

The heart of the VRD system, responsible for generating and projecting the images.

2

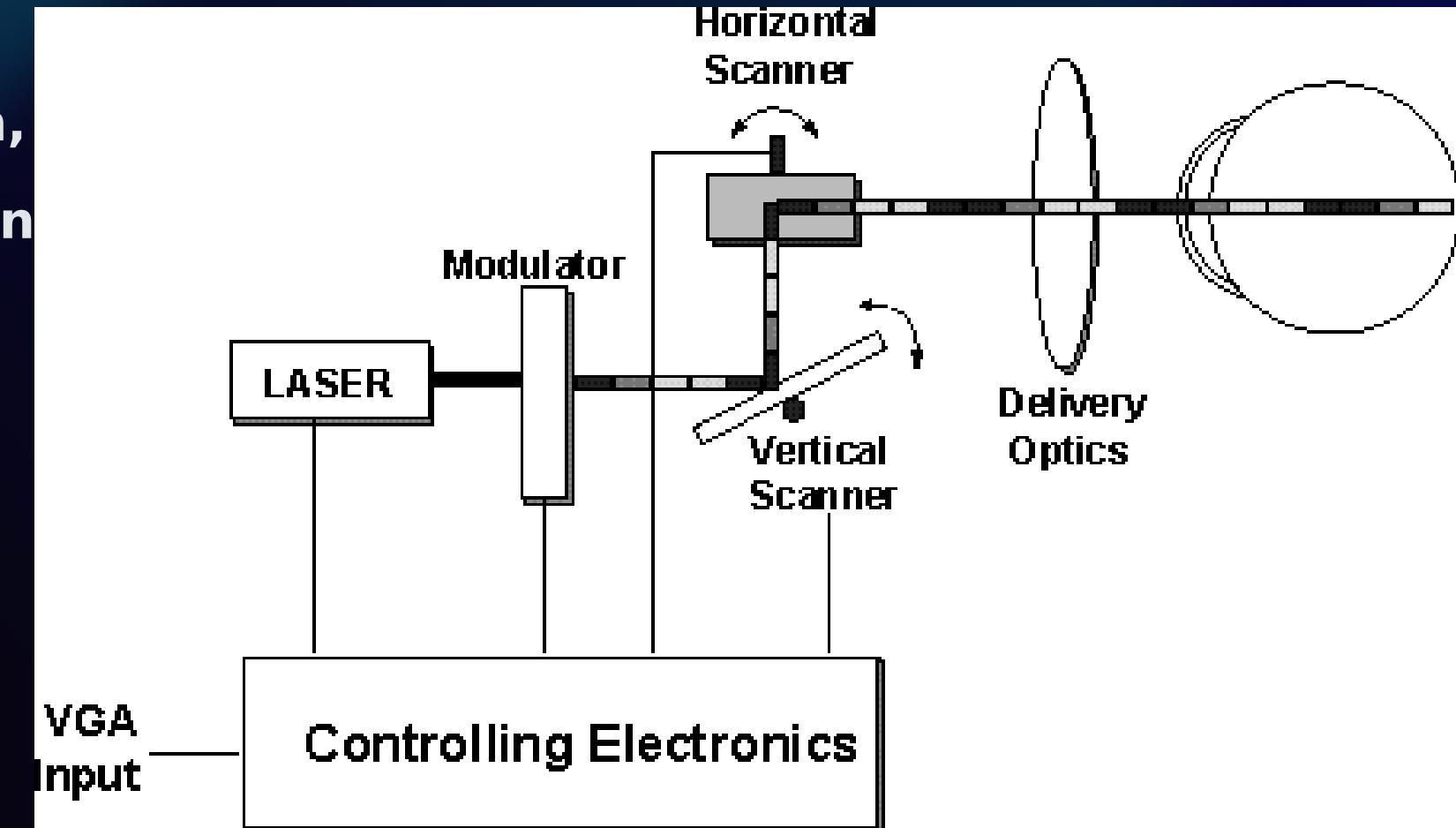
Focusing Optics

A system of lenses and mirrors precisely directs the light beam towards the retina.

3

Eye-Tracking System

Monitors the user's eye movement to dynamically adjust the image projection.



Advantages of VRD Technology

Immersive Experience

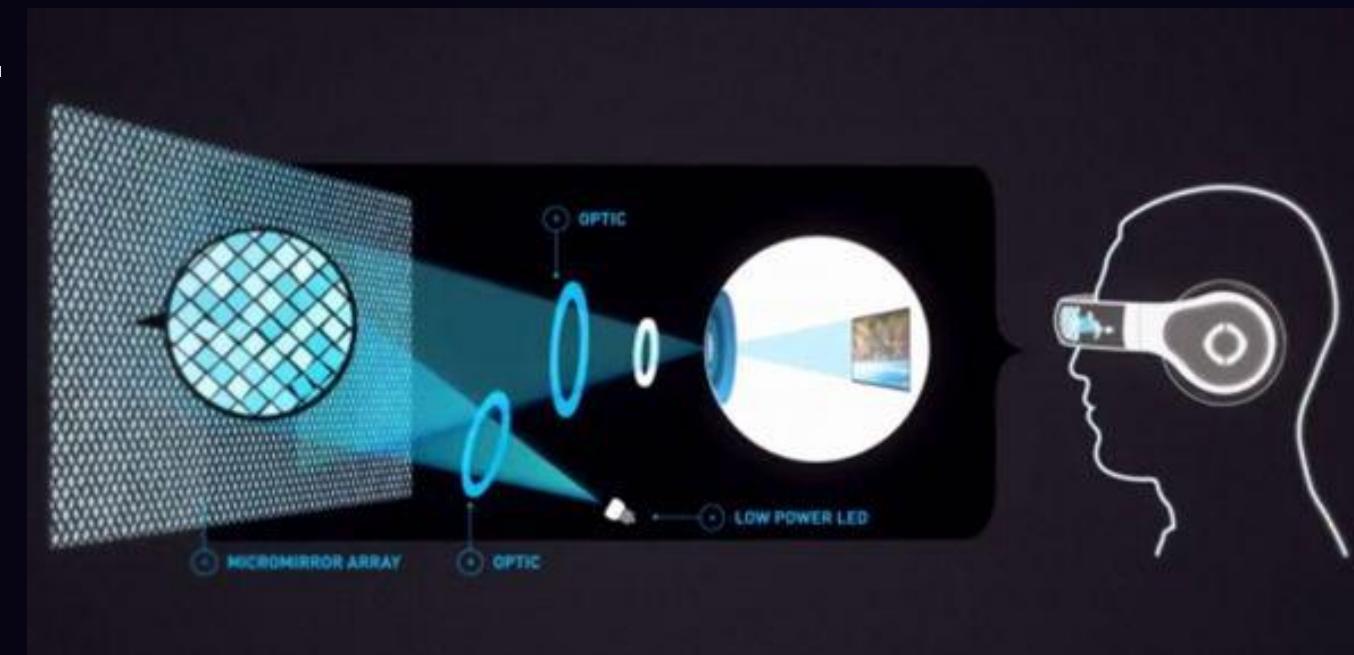
VRD provides a highly immersive experience, as the virtual images appear to be layered onto the real world.

Large Field of View

VRD offers a wide field of view, providing users with a more natural and expansive visual

High Resolution

VRD can achieve extremely high resolutions, delivering crisp and detailed virtual images.



Challenges and Limitations of VRD

High Power Consumption

VRD systems require significant power to operate, limiting their portability and practical usage.

Eye Strain

Extended use of VRD could lead to eye strain and discomfort, requiring optimization and safety measures.

Cost

The complexity and precision of VRD technology make it currently expensive to manufacture and implement.



Applications of VRD

Healthcare

VRD can assist surgeons with precise visualization during complex procedures.



Education

VRD can create immersive learning experiences by overlaying digital content onto real-world



Aviation

Pilots can benefit from VRD displays for enhanced navigation and situational awareness.



Gaming

VRD promises a highly immersive gaming experience, blurring the lines between reality and virtual worlds.



2. Monitor-Based

A conventional display setup utilizing a fixed monitor to present digital content. It supports user interaction through peripherals like a keyboard and mouse, providing a stable and stationary viewing experience commonly used in desktop or office environments.

Monitor-Based Augmented Reality Systems

Monitor-based AR systems blend digital content with the real world through a computer monitor, enhancing our perception and interaction with the environment. They enable us to see and interact with virtual objects, data, and information overlaid onto the real world, creating immersive and interactive experiences.



Hardware Requirements: Displays, Cameras, Processors

Displays

High-resolution monitors with fast refresh rates and low latency are crucial for smooth and immersive augmented reality experiences.

Cameras

Cameras capture real-world scenes, providing input for the AR system to overlay virtual elements accurately. Depth cameras enable more precise understanding of the

Processors

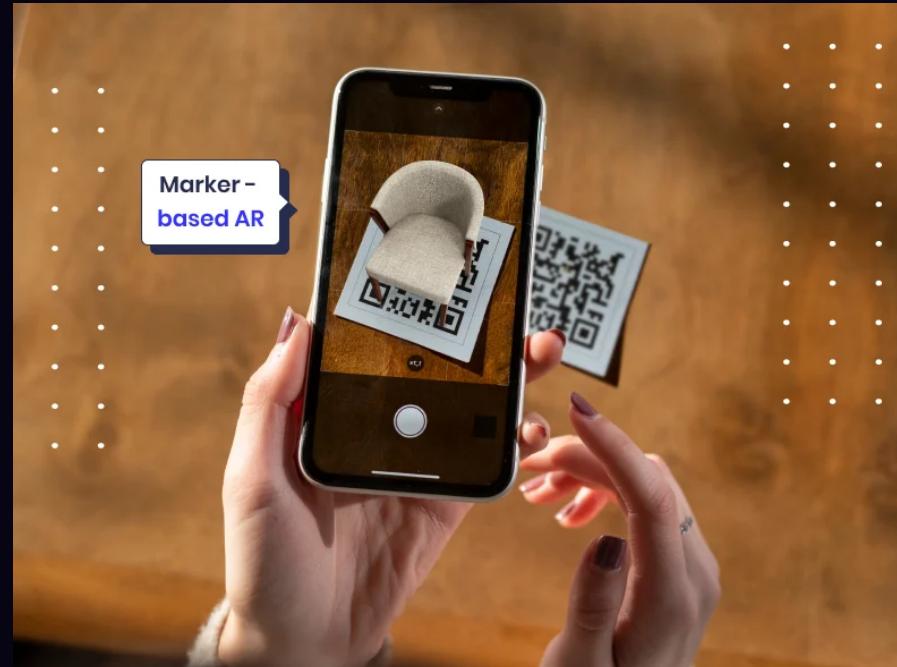
Powerful CPUs and GPUs are essential for processing real-time data, rendering graphics, and calculating the positions of virtual objects within the scene.

Tracking Techniques: Marker-based, Markerless,

H

Marker-based

These systems use specific visual markers, such as QR codes, to track the position and orientation of objects in the real world.



Hybrid

Combining marker-based and markerless techniques, these systems leverage both markers and natural features for more robust and accurate

Markerless

Markerless tracking relies on analyzing natural features in the environment, like edges, textures, and colors, to track objects and position



Interaction Methods in Monitor-based AR

Gesture Control

Using hand gestures to manipulate virtual objects and navigate the augmented environment.

Touch Screen

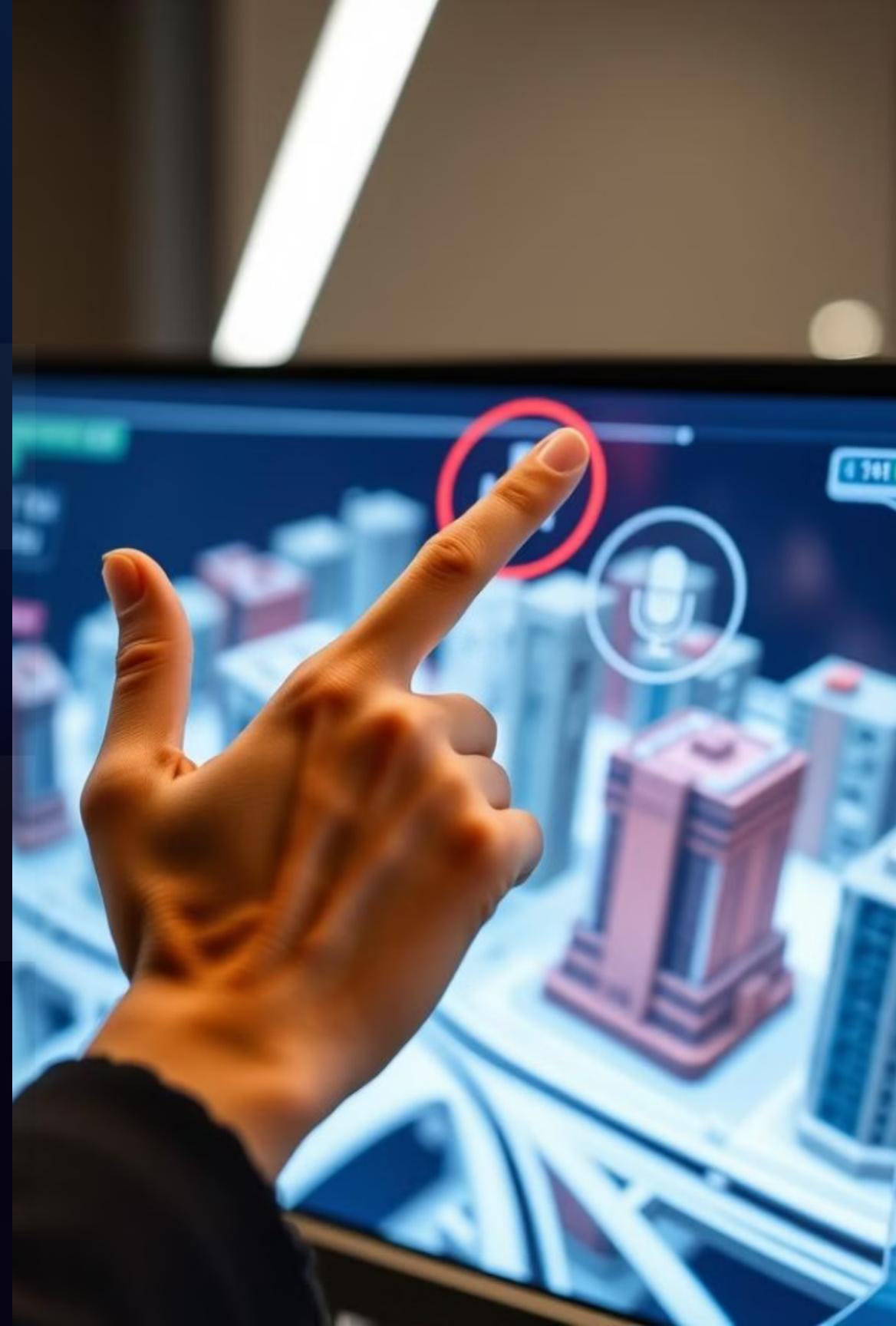
Interacting directly with the virtual objects on the screen using touch gestures.

Voice Commands

Controlling and manipulating virtual elements using spoken commands, enabling hands-free interaction.

Input Devices

Using devices like controllers, keyboards, or mice to provide input and control the augmented environment.



Applications and Use Cases



Architecture and Construction

Visualizing building designs, inspecting structures, and collaborating on construction projects.



Healthcare

Simulating surgeries, providing interactive training for medical professionals, and aiding in patient care.



Automotive

Designing and testing car models, providing virtual maintenance instructions, and enhancing the driving experience.



Retail and E-commerce
Enhancing online shopping with interactive product visualization and virtual try-on experiences.



Limitations and challenges

1

Limited Field of View

Monitor-based AR systems often have a limited field of view, restricting the user's perception of the augmented environment.

2

Accuracy and Tracking

Maintaining accurate tracking and alignment of virtual objects with the real world can be challenging, especially in dynamic environments.

3

Computational Resources

Rendering and processing the augmented reality experience require significant computational power, potentially limiting performance.

4

User Experience

Creating immersive and intuitive user experiences that seamlessly blend virtual and real can be a complex challenge.

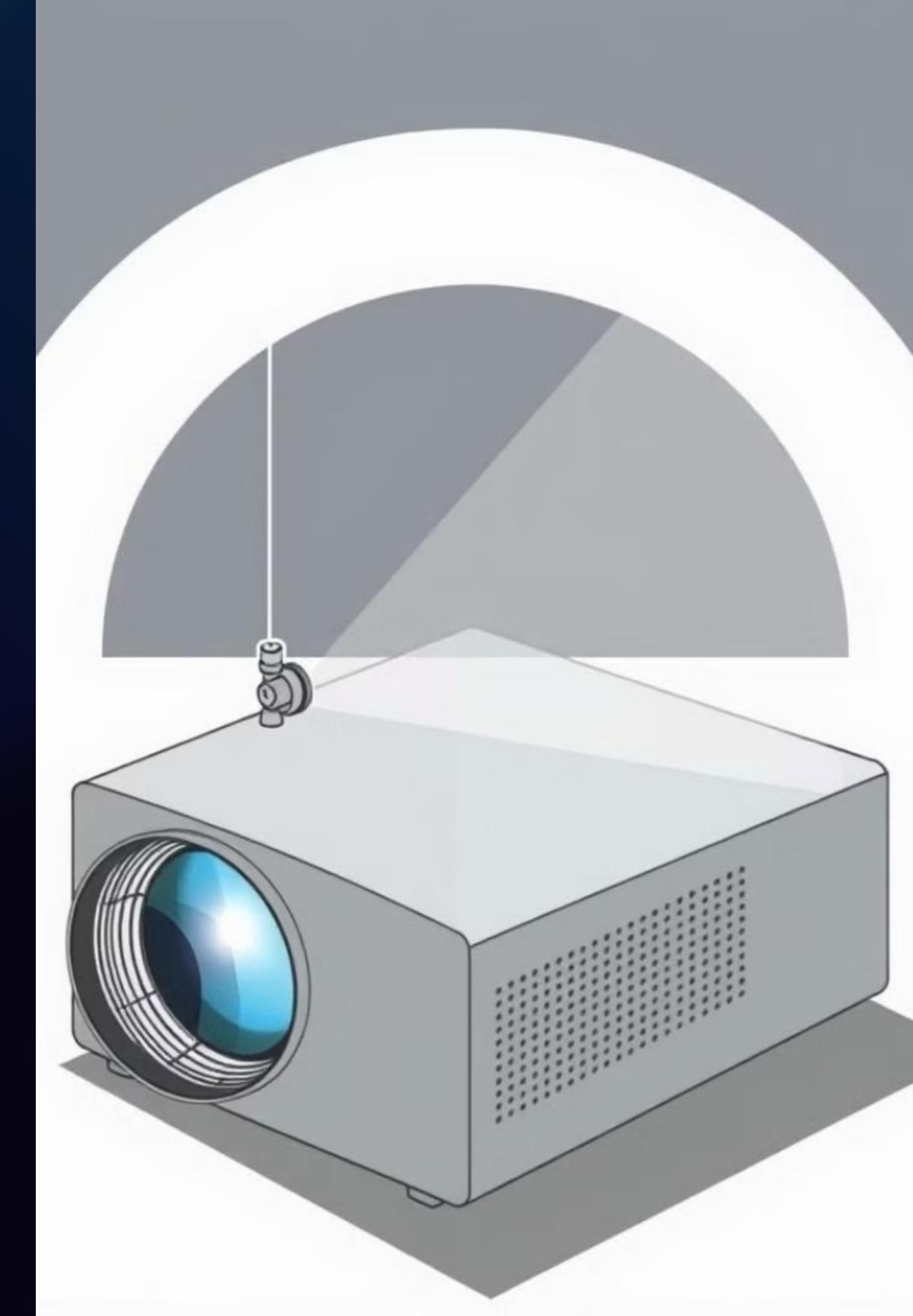


3. Projection Display

A system that projects visual content onto a large surface, like a wall or screen, enabling larger-scale viewing. Common in presentations, classrooms, and theaters, it allows for audience-wide visibility and can display digital or multimedia content from various devices.

Projection Display: A Visual Revolution

Projection display is a technology that uses a projector to display images or videos onto a surface. Projection displays have become increasingly popular in recent years, as they offer a number of advantages over traditional displays, such as large screen sizes, high brightness, and portability.



Principles of Projection Display

Light Source

Projectors use a light source, such as a lamp or LED, to illuminate the image.

Lens

The lens focuses the light from the light source onto the image, which is then projected onto the surface.

Image Formation

The image is formed by reflecting light from the light source off of a series of mirrors or prisms.

Types of Projection Display

LCD Projectors

LCD projectors use liquid crystal displays (LCDs) to create the image.

DLP Projectors

DLP projectors use digital light processing (DLP) technology to create the image.

Laser Projectors

Laser projectors use lasers as the light source, providing high brightness and color accuracy.



Advantages of Projection Display

1

Large Screen Size

Projection displays can create images that are much larger than traditional displays.

3

Projectors are generally portable, making them easy to transport and set up.

2

High Brightness

Projectors can produce very bright images, making them suitable for use in bright environments.

4

Versatility

Projection displays can be used for a wide variety of applications, including home entertainment, business presentation .

Limitations and Challenges

Resolution

Projection displays often have lower resolution than traditional displays.

Image Quality

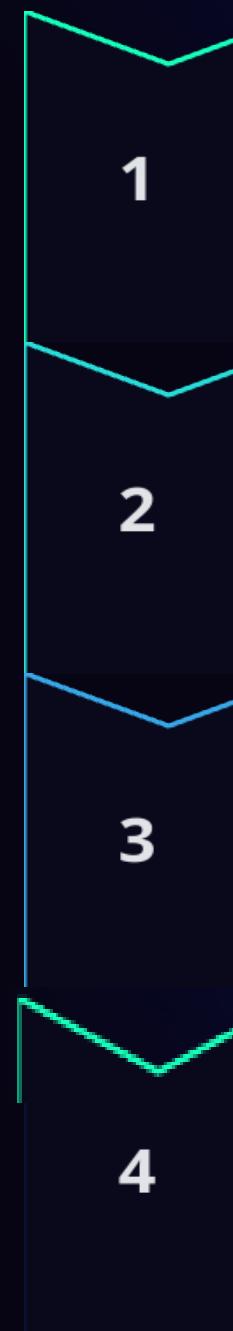
Image quality can be affected by factors such as the surface being projected onto and the distance between the projector and the surface.

Cost

Projectors can be expensive, especially high-end models with advanced features.



Applications of Projection Display



Home Entertainment

Projectors can create an immersive home theater experience.



Business

Presentations displays are used in business meetings and conferences to present information.



Education

Projectors are used in classrooms to display lessons and presentations.

Events and

Entertainment displays are used to create interactive and immersive experiences at concerts, trade shows, and other events.

Emerging Trends in Projection Display



Laser Projection

Laser projectors offer high brightness, color accuracy, and longevity.



3D Projection

3D projection is becoming increasingly popular for entertainment and education.



Interactive

Projection
Interactive projection allows users to interact with the projected image.



Portable Projection

Portable projectors are becoming more powerful and versatile.



4. Video See-Through System

An augmented reality display method where real-world views are captured via a camera, then digitally combined with virtual elements on a screen, allowing users to see a blended view of both digital and real-world content in real time.

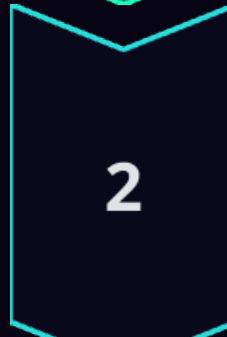
How Does Video See-Through AR Work?



1

Camera Capture

A camera captures a live video feed of the user's surroundings.



2

Digital Processing

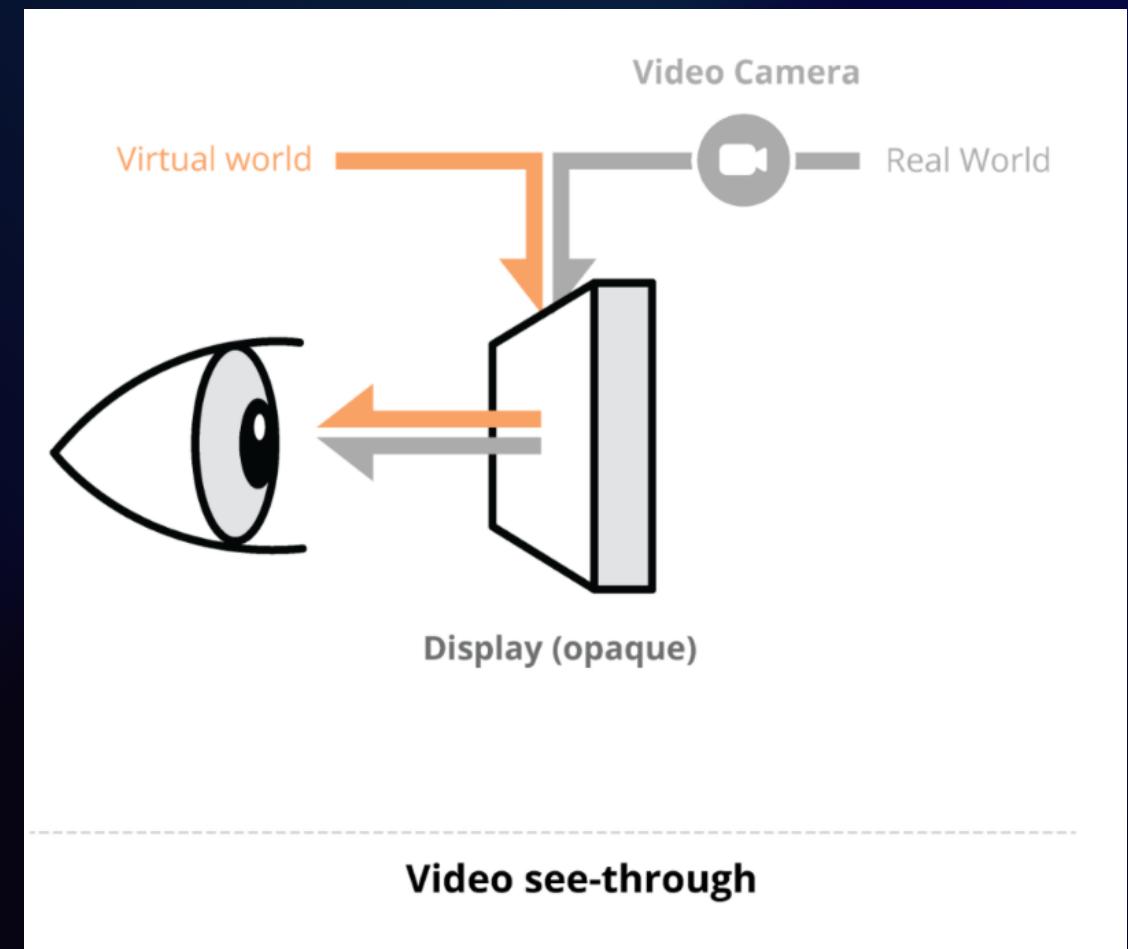
The captured video feed is processed by a computer, which adds virtual content based on user input or predefined algorithms.



3

Display Overlay

The processed video, now augmented with digital content, is displayed on a screen, usually in a transparent headset or mobile device.



Advantages of Video See-Through System

1 Immersive Experience

The ability to see both the real and virtual worlds simultaneously creates a sense of presence and immersion, enhancing the user's perception and interaction.

2 Real-Time Interaction

Video see-through AR enables real-time interaction with the virtual content, providing users with immediate feedback and responsiveness.

3 Wide Applications

Video see-through AR has vast applications in various fields, including gaming, education, healthcare, and industrial training.



Limitations of Video See-Through System

Limited Field of View
The field of view in video see-through AR devices can be limited, impacting the immersive experience and causing potential discomfort.

Performance Challenges
Rendering high-quality graphics and maintaining real-time interaction can be computationally demanding, leading to performance issues and latency.





Applications of Video See-Through System

Gaming

Interactive gameplay and immersive virtual environments.

Education

Visualization of complex concepts, interactive learning experiences, and virtual field trips.

Healthcare

Medical imaging, surgical planning, and patient education.

Industrial Training

Interactive training simulations, remote assistance, and maintenance instructions.

Comparison: Video vs Optical See-Through System

Technology

Video See-Through

Cameras and screens

Limited

Can be affected by screen resolution and latency

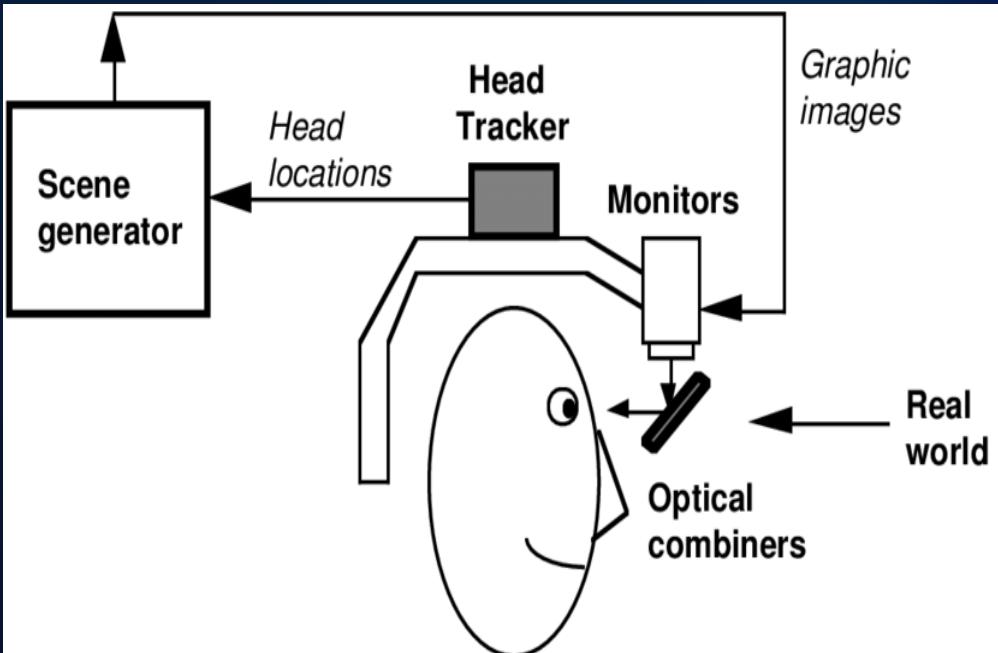
Can feel less natural

Optical See-Through Transparent displays or mirrors

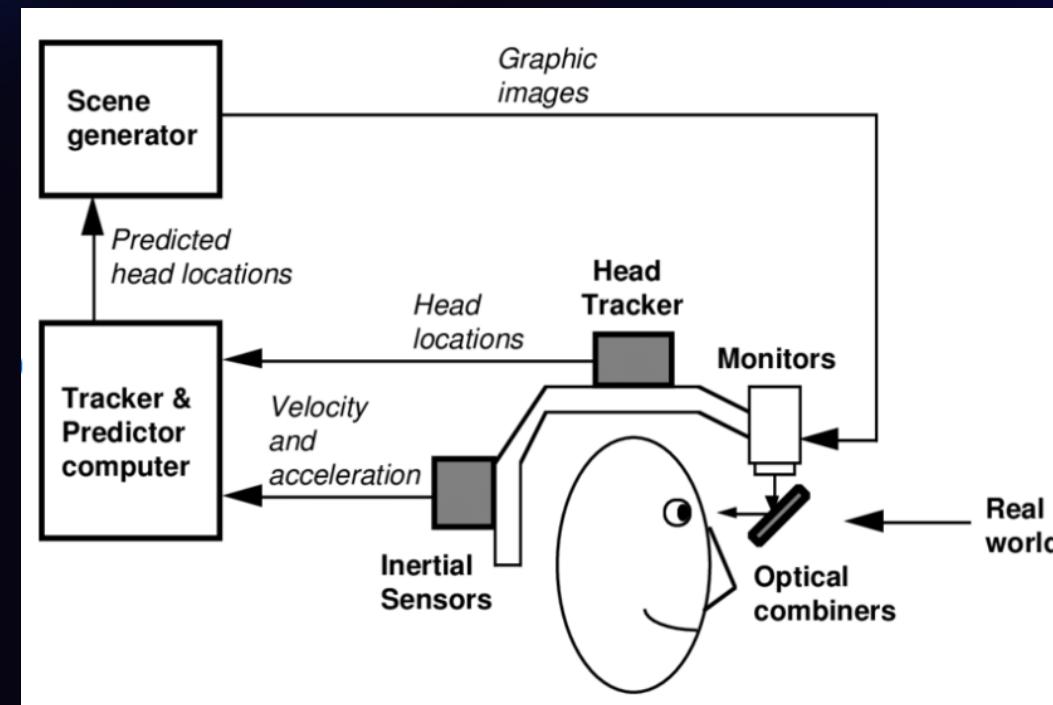
Wider

Potentially higher fidelity

More immersive and realistic



Video See-Through



Optical See-

Applications of VST in Augmented Reality

Gaming

VST allows for interactive and immersive gaming experiences, where virtual objects are seamlessly integrated into the real world.



Navigation

VST can overlay navigation instructions onto real-world scenes, providing directions, points of interest, and real-time traffic information.



Education

VST enables interactive learning experiences, where digital models, simulations, and information are displayed alongside real-world objects.



Retail

VST can enhance shopping experiences by providing virtual try-on, product information, and interactive product demonstrations.



AR Technologies: Conclusion

Virtual Retinal Systems

These systems project images directly onto the retina, offering a high field of view and immersive experience. They are ideal for applications requiring precise alignment and detailed visual information.

Monitor-Based Systems

Monitor-based AR systems use a transparent display placed in front of the user's eyes, allowing them to see both the real world and the augmented content. These systems are widely used for training and entertainment purposes.

Projection Displays

Projection displays project augmented content onto surfaces in the real world, enabling interactive experiences with real-world objects. They are well-suited for applications like gaming, navigation, and information overlays.

Video See-Through Systems

Video see-through systems capture images of the real world using cameras and overlay them with augmented content, providing a seamless blending of the virtual and real worlds. These systems are particularly advantageous for hands-free navigation and situational awareness applications.

Thank You !!

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