

VIRTUAL RETINAL DISPLAY

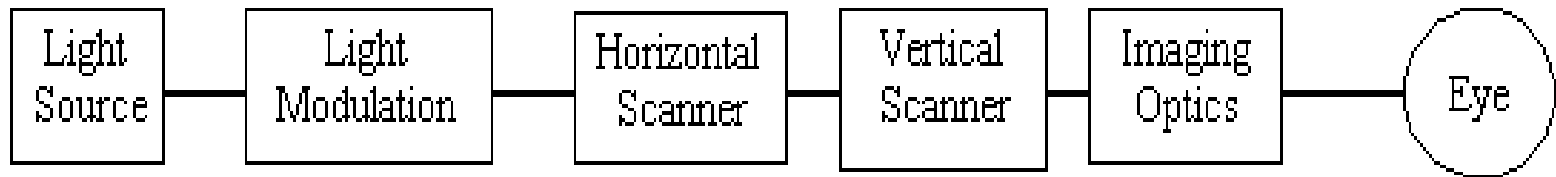
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INTRODUCTION

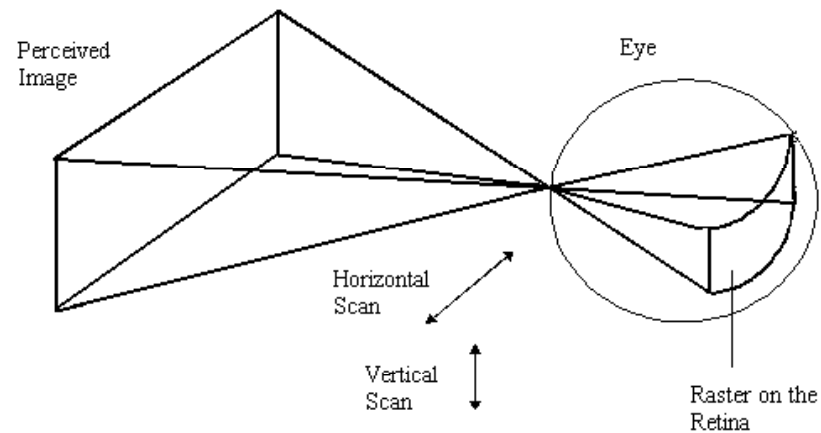
- ❑ **PDD under development in HIT lab, University of Washington.**
- ❑ **Not a screen based technology.**
- ❑ **Scans light directly on to retina of eye.
(Hence the name)**
- ❑ **Full colour, high resolution, high brightness, wide field of view virtual display without flickering.**
- ❑ **Potential applications include HMDs for military, aerospace, engineering, medical fields.**

VRD Basics

- ❑ **Substitute to conventional bulky and power hungry VDUs.**
- ❑ **Light is focused to a miniscule image(frame) on retina.**
- ❑ **SLD or LED triads of R,G&B emits light. Mixing in proportions can produce any colour.**
- ❑ **As light scans the retina, it is intensity modulated by the video signal.**
- ❑ **Scanning is performed directly onto retina in a raster pattern through collimating optics.**



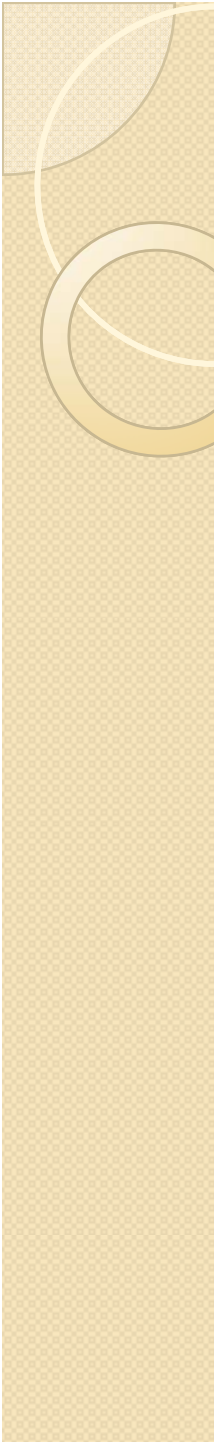
Above figure is the basic block diagram of VRD



As shown, the viewer perceives a wide field of view image as if from a screen placed some distance away.

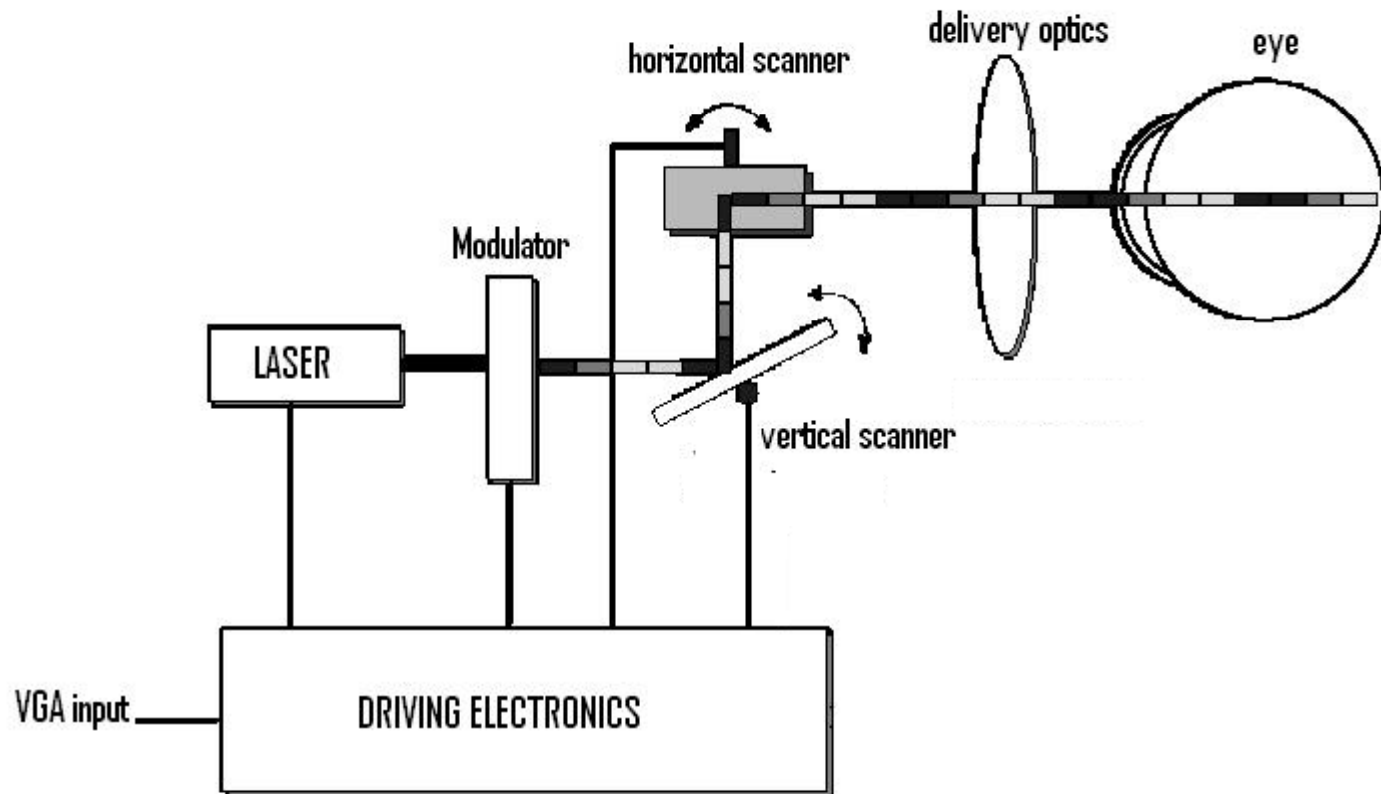
Key features of VRD

- ❑ **Size and Weight:** Small size as no intermediate screen is present. All components are small and light making it highly portable. Appropriate for Hand held and Head mount displays.
- ❑ **Power consumption:** Light sources consume very less power in order of milli watts. Scanning is done with a resonant device (MRS) with high figure of merit. Exit pupil of VRD has very small aperture allowing generated light to enter eyes almost completely. Hence high power efficiency.
- ❑ **Resolution:** Limited only by diffraction and optical aberration in the optical components, limits in scanning frequency and modulation b/w of photon source. SLD is a coherent source and offer high modulation b/w to give resolutions well over a million pixels. State of the art scanners can scan over a 1000 lines per frame which is comparable to HDTV.

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- ❑ **Brightness:** Perceived brightness is only limited by power of the light source. SLD sources can provide very good brightness levels even for see through mode in day light.
 - ❑ **Field of view:** Inclusive systems provide horizontal field of view b/w 60-100 degrees. See through mode systems have it slightly over 40 degrees. These figures are far better than existing HMD systems.
 - ❑ **Stereoscopic display:** Supports stereoscopic display as both eyes can be separately addressed. Thus provides a good approximation to natural vision.
 - ❑ **Inclusive & See through:** See through works very well even at very high illumination conditions of about 10000 candella per meter squared.

VRD System Overview

A block diagram of a VRD system is shown below



Applications

VRDs can reduce the read-time and can act as always-present guides for many tasks.

The various fields of application of VRD technology are listed.

- Radiology**
- Surgery**
- Therapeutics (Scanning Laser Ophthalmoscope)**
- Production**
- Communication**
- Augmented \ Virtual reality**
- Aerospace**
- Military**

Future scope

- ❑ When cost of production falls further, we will see VRDs fulfilling many functions and applications, and may perhaps see a time where they become ubiquitous in the more distant future.
- ❑ Future systems will be even more compact with the advent of MEMS(Micro Electro Mechanical System) scanners, miniature laser diodes and application specific IC technology.
- ❑ Another key development to come is the advent of Augmented Reality display systems to assist people in their various tasks.

Conclusion

VRD provides an unprecedented way to stream photons to the receptors of the eye; affording higher resolution, increased luminance, and potentially a wider field-of-view than all previous displays. Virtual retinal display is a breakthrough in imaging technology that will optimally couple human vision to the computer. Cost is currently acting as a blocker of the technology in most industries. If this continues to fall, we will see VRDs fulfill many functions and applications, and may perhaps watch them becoming ubiquitous in near future.