Using Fiber Image Bundles in Microdisplay Design for Dermal-Adhered Eyetap

Ryerson University – Faculty of Communication and Design – New Media
John Morgan

Introduction

The wearcomp paradigm is rapidly accelerating the way social institutions function.
In this experiment a spatial light modulator (SLM) by Microvision is combined with a fiber image guide (FIG) to create a wearable display with a minimized footprint. These two novel systems combine to form a unique method for accomplishing virtual retinal display (VRT) in a package small enough for transdermal adhesion.
A PicoP ® display engine projects a focused image exceeding the dimensions of the distal face of the FIG. A platform consisting of an optical reduction arrangement and eyepiece was produced for this experiment. This platform allows a simple DSLR camera system to capture the magnified proximal face.

Method

A testing platform was built from laser cut medium density fiberboard. The assembled components formed a precise bench in which to study how elements interact. Lens holders were positioned in slots, so they could be moved along the optical axis.
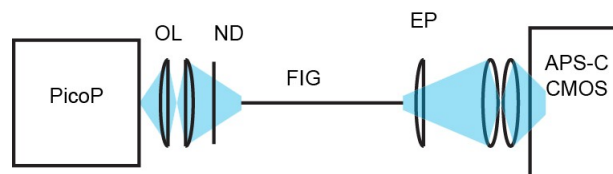

Fig. 1. Light formed by the SLM is refocused by an objective consisting of two 12.5mm plano-convex lenses (OL). Image brightness is reduced by a neutral density filter (ND). FIGH-50-1100 image fiber FIG translates the image to a 13mm plano-concave doublet eyepiece (EP). The translated image is recorded by a camera system focused on the proximal end.

The test images projecting from the proximal face of the FIG were recorded using an APS-C sensor inside of a Nikon D-60 body. A 60mm macro lens was stopped all the way down to f22. Underexposed images would clearly show the progress of the scanning mirror, cutting off the image abruptly partway though the scan.
After determining the appropriate exposure settings, the default Microvision test image was used as a benchmark in the experiment.

Results

The lines on the proximal face of the image fiber bundle represent only about a tenth of the total scanned image – you are looking at four vertical lines that make up a large-font text element spelling the word 'WOW'.
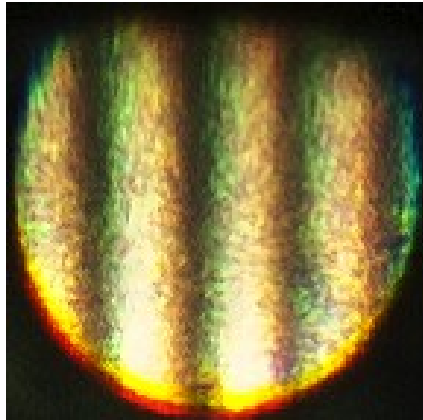

Fig. 2. The proximal face of the coherent FIG. The limited resolution of the CMOS camera senor creates pixelation over the ~250 pixel diameter FIG.

This experiment has successfully demonstrated that a FIG VRT can be achieved, but does require a more substantive lens design.