Heads-Up Display for Microscopes
EE491: MAY1607

Prepared by:

Noah Bergman,
Garrett Hembry
Greg Kuhn,
Mike Kelly,

Submitted to:

Bob Dearth
Honeywell
bob.dearth@kcp.com

Contents

List of Figures

1 Project Statement

The objective of this project is to build and implement a heads up display in an electron microscope. A heads up display is a device that displays a virtual image on a surface. Previously, research scientists at Honeywell when performing experiment that involved the use of a microscope would be forced to continually glance between the computer where the instructions for assembly where, and the object in the microscope. We devised a mechanism which would display the instructions in the lense of the microscope itself, thereby making the process much more convenient.

2 Background

Honeywell is interested in designing a heads-up-display for a microscopes. A previous research group from Kansas State identified several alternative setups for Honeywell's microscope assembly setup. Computer monitors and tablets are the only options at this time.

Several textbooks including Bioimaging: Current Concepts in Light and Electron Microscopy by D. Chandler and R. Roberson are great resources on the application and design of microscopes.

3 Alternatives

- Surgical Microscope with HUD
  - Very Expensive
  - Tailored towards specific application
  - Tend to be bulky
- Computer Monitor at Work Station
  - Requires associate to look up from microscope at each step - Potential for Eyestrain
  - Associates can ignore instructions - potential for decreased quality
  - Large range of motion when transitioning from microscope to monitor.
- Tablet Mounted Next to Microscope
  - Reduced range of motion, compared to monitor, during transition
  - Requires mount near microscope, could clutter workspace
  - Associate can ignore instructions

4 System Description

- DLP Mini Projector Unit - Uses HDMI or VGA input to project work instructions.
  - Capable of projecting text, images, and video

- MSP432 - Main Microcontroller used to coordinate on-board systems.
- DLP3435 - DMD Display Driver
- DLPA2005 - LED Driver for DMD technology
- DLP

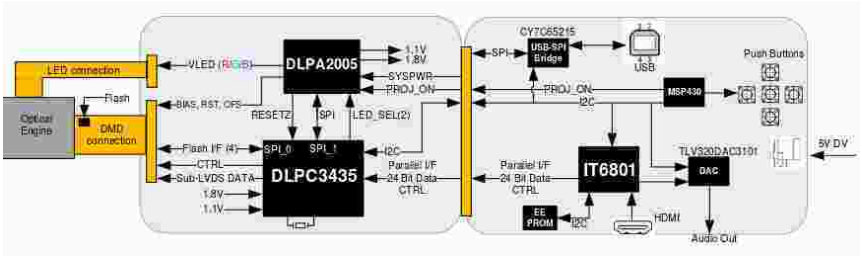

Figure 1: Block diagram for proposed mini projector

- Modified Microscope - Accepts optical input from projector and incorporates this into the field-of-view.
  - Allows original objective to pass through unaltered
  - Magnification Range: 5x - 50x
  - Goal: This will be a universal module to be attached at the lens or objective portions of a microscope.

5 Budget

The staff at Honeywell has allotted a budget of $5,000.00. We plan on allocating the budget in the following ways: Spending $117.59 on pocket projector, $1,433.00 on a Meiji microscope, $144.00 on Meiji paired eyepieces, $10.00 on Meiji eyepiece shields, and $315.00 on a Meiji microscope stand. This will give us $2,980.51 left over. This remaining money will go into the design fabrication and the PC board.

6 Feasibility

There are several feasibility concerns to be aware of. The first and most significant concern is how to successfully integrate a beam splitter inside the microscope. This could be difficult but using a beam splitter stand,which will attach the beam splitter to the microscope lens should make it easier. The second major constraint is lighting, namely will there be enough light to view the instructions. One possible solution to this problem is to use coaxial cables to generate light in the microscope lens.

7 Risks

- Blocking Field-of-View
  - Reduced visibility in the field-of-view will hinder users and could offset any help the HUD provides.
- Modifications to the Microscope
  - The final design may be specific to one microscope if modifications cannot be made externally.
- Optical Magnification must not be changed
  - The addition of extra lenses and mirrors may effect the overall magnification of the microscope.

8 Market Research

Surgical microscopes with heads-up displays are becoming increasingly popular. These alternatives are very specialized and bulky for Honeywell's applications. Miniature projectors are currently on the market, but are designed to display on a large area. The microscope will require the projector beam to be focused on a much smaller surface.

9 Project Timeline

October 23: Deliver a working verification that an image can be displayed in our microscope using a test light source
November 7th: Finish schematic and PCB layout.
End of Semester: Working prototype of microscope. Begin testing our projector circuit.
Febraury 2016: Finish code for MSP432, begin modifying original circuit design.
March 2016: Design universal mechanical adapter for microscope and continue testing.
May 2016: Project Deadline