Enhanced Capability Fluorescence Microscope

Introduction
Fluorescence microscopes provide researchers with capabilities to observe the behavior of cells. They have many uses, but they are expensive and hard to use due to complicated software that comes with them. Focusing on an image can also prove to be a tough task for a new user. Developing a cheaper, simpler fluorescence microscope with the ability to autofocus would be a great benefit to researchers who have limited time to learn an application.

Objectives
The purpose of this project is to make a fluorescence microscope that has autofocus capabilities and uses laser diodes instead of normal lasers. To do this, a simple graphical user interface (GUI) needed to be developed to tie everything together. Being able to control these from the GUI can take an often complicated tool and make it much more simple and reliable.

In addition, the ability to get a live image and a snapshot of the image taken is essential if any quantitative data is to be obtained. This microscope will need to have that capability in order to be useful to research.

Materials and Methods
To accomplish this, a microscope, a camera, a motor, and three laser diodes were needed. Drivers for the motor and laser diodes were also obtained. Circuits were also made to connect the microcontrollers to the different components.

Results
The simple GUI was developed. It gives the user access to turning on the laser diodes, to focusing the image, to pressing a button to autofocus the image, and to see a live image of the viewing screen.

The motors were mounted and then attached to the microscope knobs so that they could control the focusing of the microscope. The laser diodes were connected to their drivers, mounted, and connected to the microcontroller.

Conclusion
The laser diodes are attached and working well. The motors are connected to the focus knobs and are able to adjust the focusing of the image.

The objectives of making a simple GUI and using laser diodes have been accomplished. The autofocus, putting the live images onto the GUI, and using perfecting the GUI still have work to do.

Future Work
The GUI has work to do. In order for an adequate autofocus algorithm to be made, a live image needs to be displayed on the GUI. To get a decent live image, the lighting of the samples as well as the placement of the camera are imperative. This will be a focus point as this project nears completion.

The circuitry also needs to be modified so that it is more reliable. The power needs for this project are too much for the current design and changes will need to be made.

Garrett Hinton
garrett.w.hinton@gmail.com