Automated Testing Station for Sensing Applications

Group:
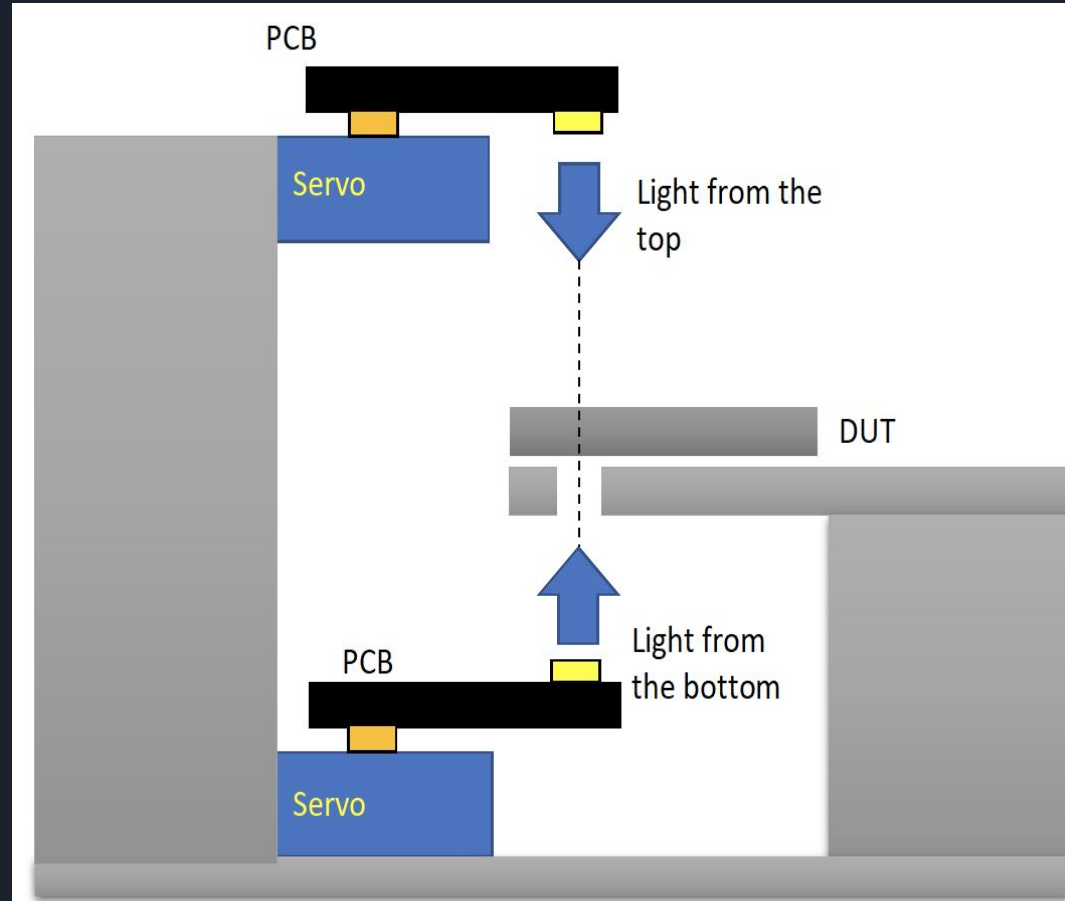
sdmay23-41

Team:

Thomas McCoy, Garth Anderson, Malvin Lim, Matthew Rief

Introduction

- 2 PCBS with LEDs and photodetector mounted on motors

- Encased in container with a mass flow controller

- Testing the IV response of the DUT (photosensitive device)

Implementation

Software:

LabView program:

- Provides virtual interface
- Measurements via Keithley 2400
- Controls servo rotation
- Controls LED configurations

Hardware:

MFC:

- Provides the gas regulation
- Power up the gas pump

LED PCBs:

- Photodetectors
- SMD LEDs
- Mounted on servos

3D-Printed "stage" :

- Holds DUT (device under testing)
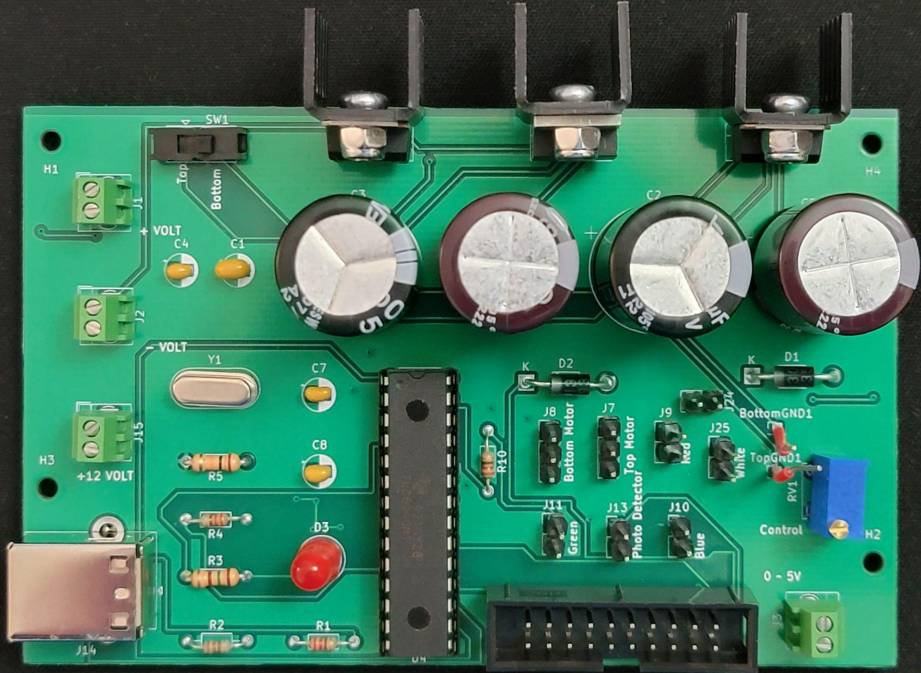
Front Panel Interface

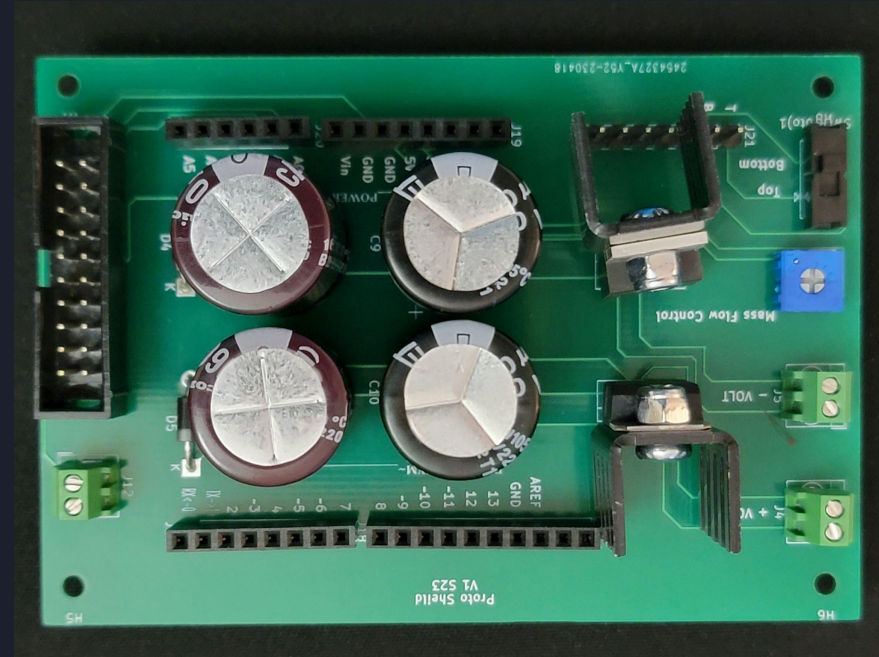# PCB Design

Figure: Mass Flow Controller

Figure: Proto Shield

Work Accomplishments

Design Milestones:
- Design circuit schematic and PCB which pass KiCad DRC
- Select a servo motor based on size of PCB
- Make final parts list with projected cost
- General plan for labview program

Procurement Milestones:
- Order PCB
- Obtain a box that meets the requirements for the device
- Obtain gas regulators, probes, and photosensitive device

Construction Milestones:
- Solder parts to PCB
- Attach PCB to motor
- Assemble PCB, motor, gas regulators and probes within the box
- Finalize software interface to output desired data

Testing Milestones:
- Software attached to device and outputs data as expected
- **Calculate expected results and achieve 90% accuracy compared to device output
- **Make any necessary hardware or software modifications

Key Contributions

Thomas McCoy - Group organizer, takes meeting notes/summaries, LabView programmer.

Garth Anderson - PCB design and implementation

Malvin Lim - PCB design and implementation.

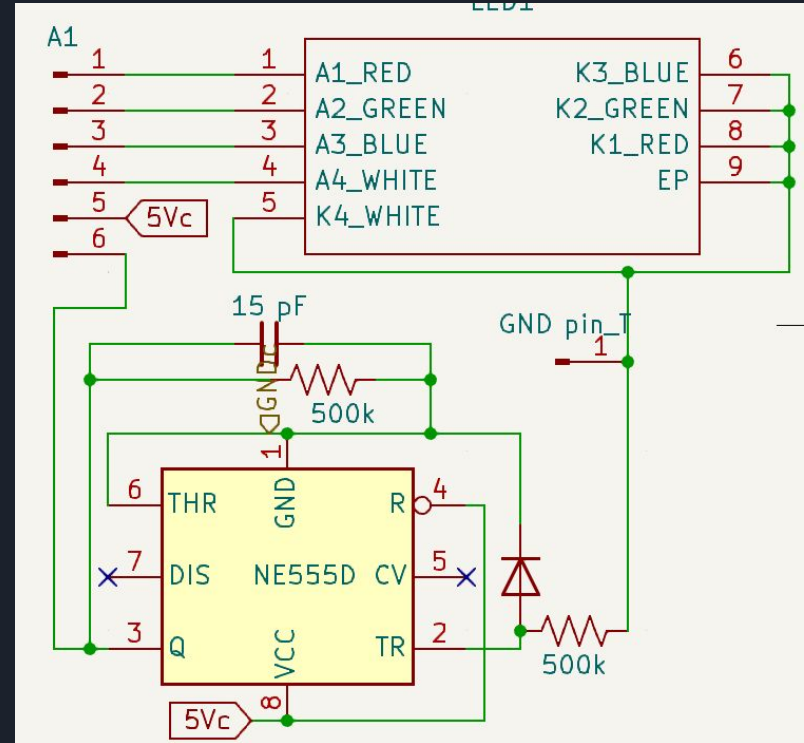Matthew Rief - CAD designs and design pressure container.

Software Challenges and Solutions

- Arduino Uno servo control override 2 PWM channels. After some testing was able to determine which channels were being taken, and switched LED so they wouldn't be conflicting.

- Potentiometer was originally going to be done via software using analog channels on the Arduino Uno, but the Arduino doesn't support Analog write, so we move it to the hardware.

Hardware Challenges and Solutions

- Combining all circuits into a single KiCad project produced several errors

- Power supply & distribution issues

- No existing symbol or footprint for components

- Mechanism for switching between top/bottom PCB for testing with limited controller pins

- Issues in 3d printing Box sidewalls
  - Made them out of cut plexiglass sheets instead

- Long 3d print times
  - Accessing 3d printers at Black Engineering to parallelize printing.
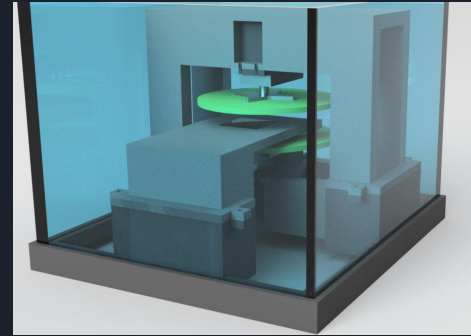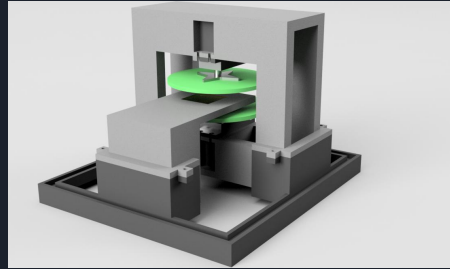
Future Work

Software:

1. Add file saving for graph data.
2. Add second measurement that runs in opposite direction
3. Fix bugs/add QoL features.

Hardware:

1. Choosing the right footprints for components.
2. Better component placement for proto shield.
3. Solar Cell / DUT holding bracket needs updates for quicker loading/unloading and better depth adjustability.

Conclusion

Our group set out to develop a device that can automatically collect electrical characteristic data from solar cells and other optoelectronic devices for use in a research lab setting. Our goals were largely met by our design and implementation of said design. These goals included a software interface, a circuit board that houses a microcontroller and constructing a gas testing chamber. Unexpected issues in manufacturing include various components being delayed and difficulties with soldering SMD components. This leaves future work to be done to further integrate the subcomponents and unit test our final product.