Automated Testing Station for Sensing Applications

Team:
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Garth Anderson - LED PCB Developer
Malvin Lim - Gas Regulation PCB Developer
Matthew Rief - CAD Design Developer

Client/Advisor:
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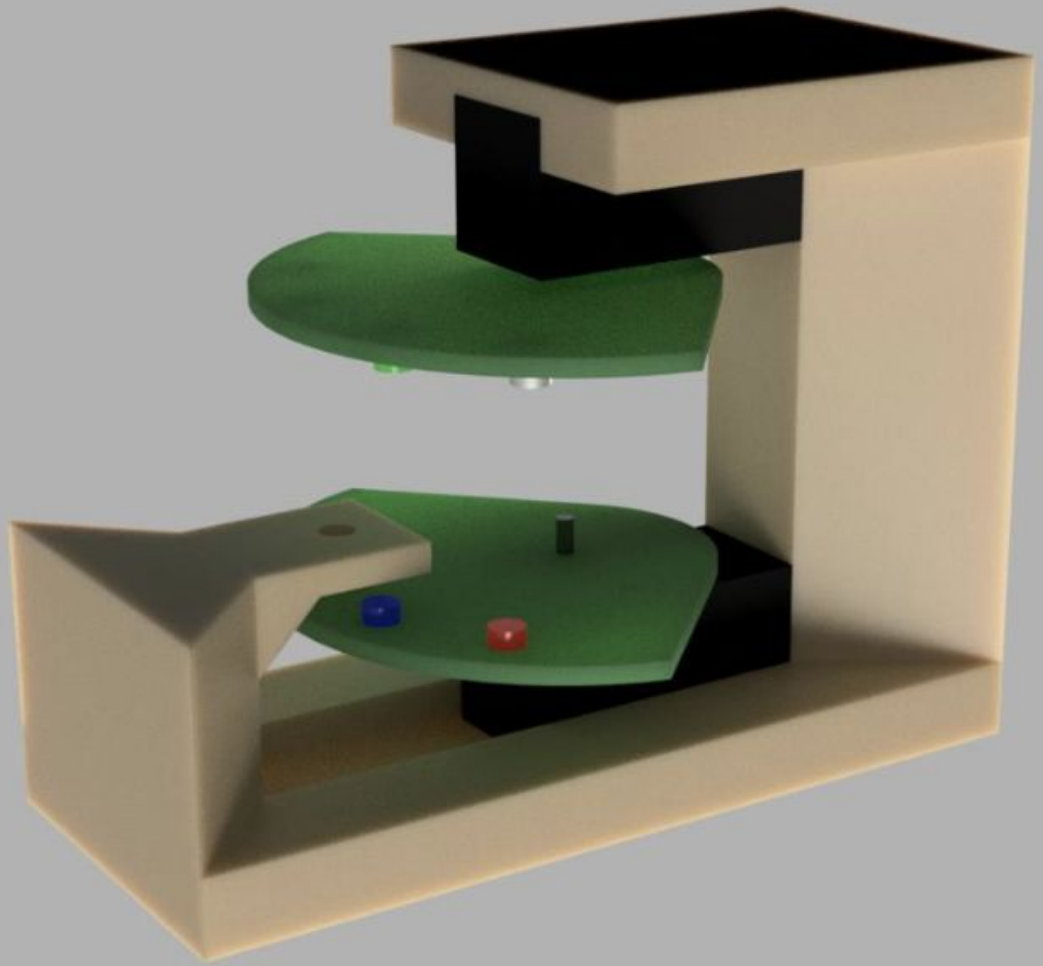
Project Vision

The goal of this project is to develop an automated probe station enclosed in a sealed housing for gas sensing and photodetection applications.

It is being developed for the purpose of reducing the time and complexity of the current testing processes of these devices for the benefit of researchers, industry, and students.

Concept

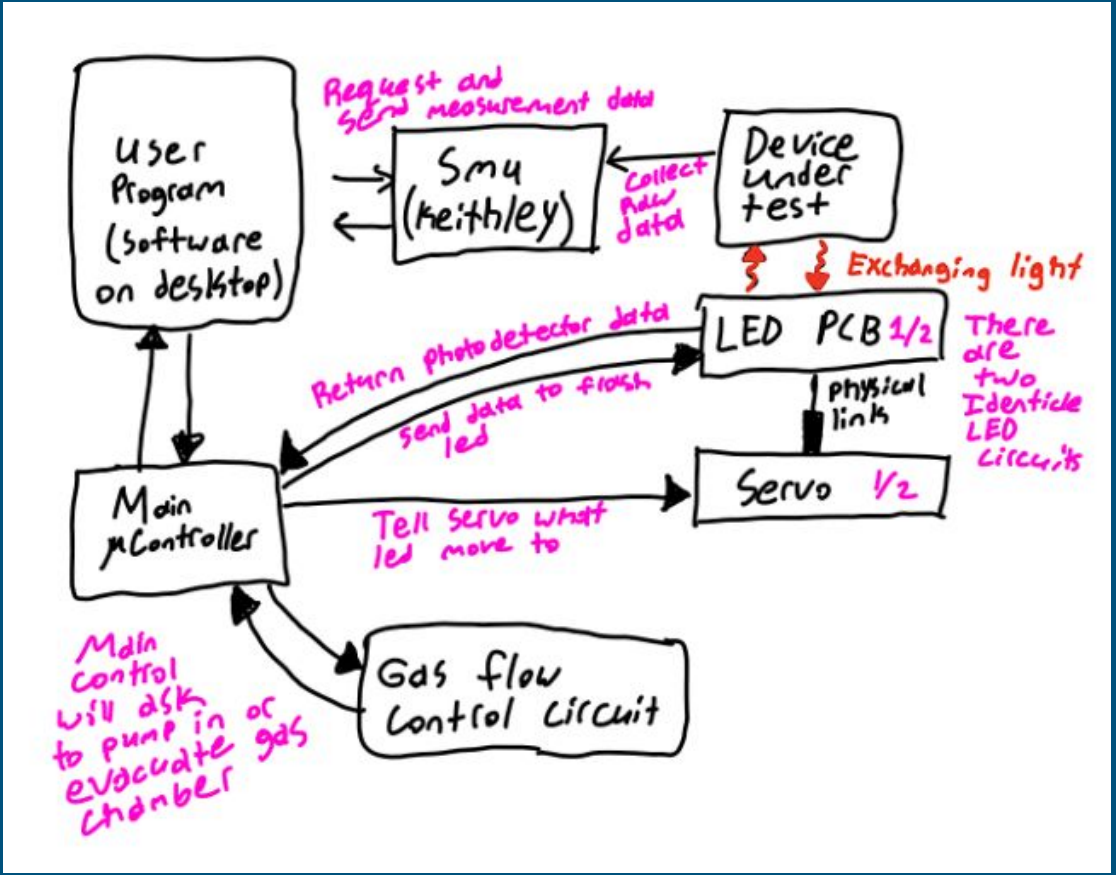
- Automated testing station
- Target clientele: students, researchers, industry
- Unique approach



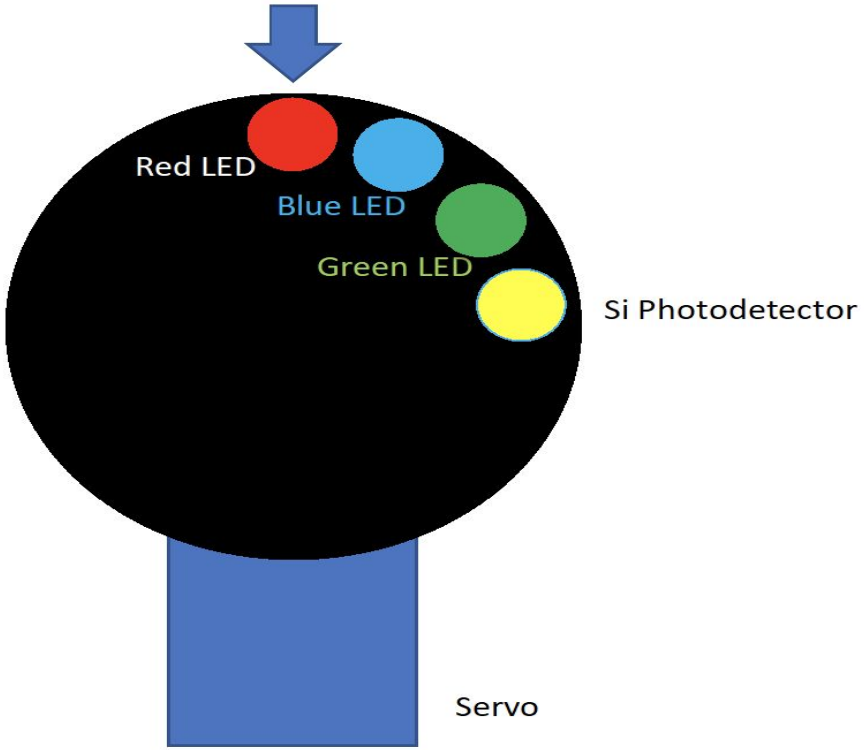
Requirements

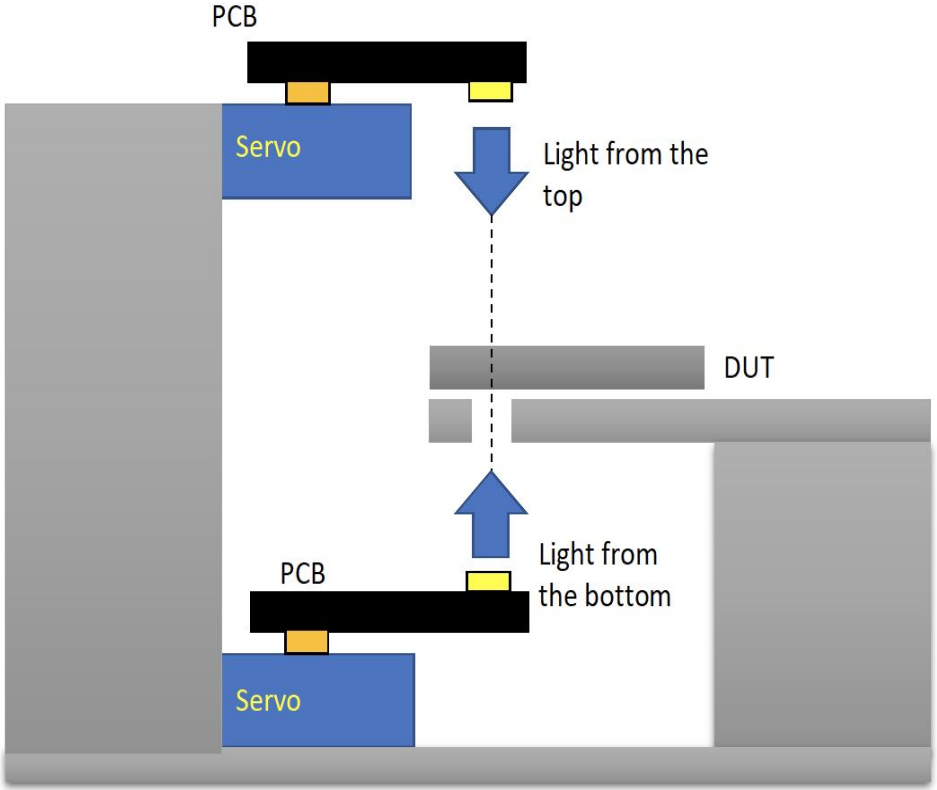
- Functional
  - Must be able to collect I-V, which is the reflected light from the device under testing (DUT)
  - Can shine LEDs with different wavelengths desired by the user rom the top and bottom o the DUT.
  - Provides a different testing environment for DUT by changing the type of gas present between the sensors and the DUT
- Resource
  - PCBs
  - Servos
  - Probes for the DUT
  - Pressure container
  - Gas regulators/valves and tanks
- User Interface
  - Provide tables of processed data
  - Easy to navigate
  - Gives option to view raw data

Conceptual Diagram



System Design





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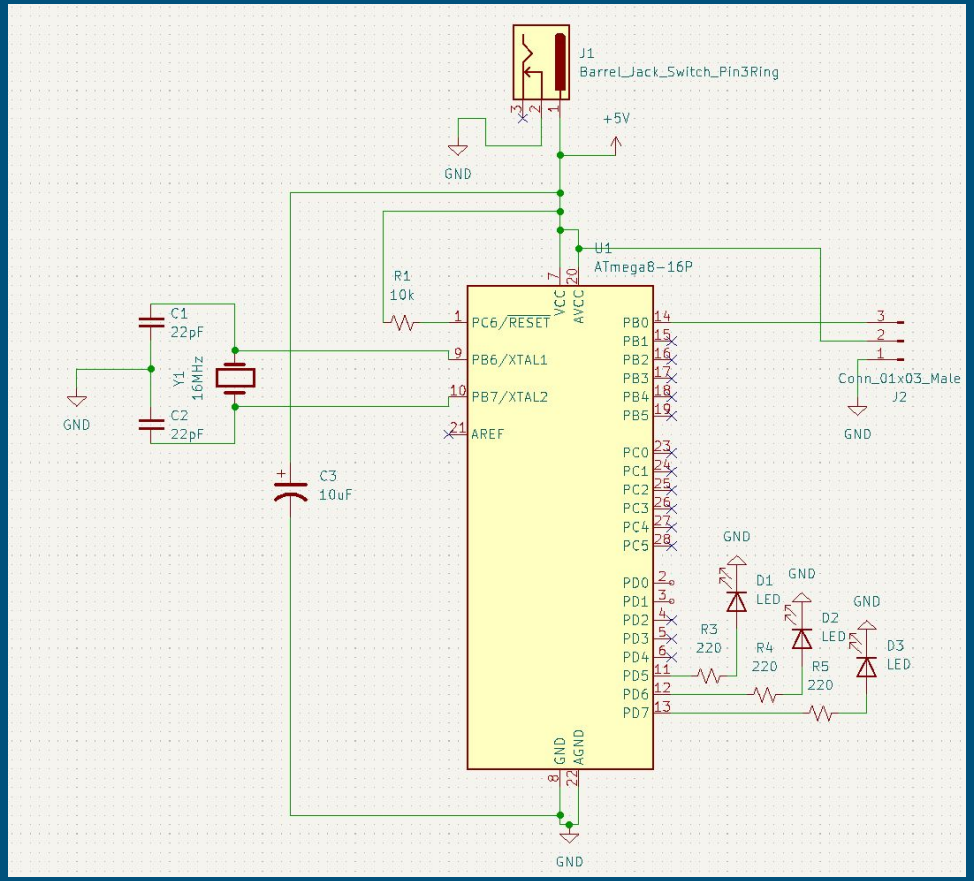

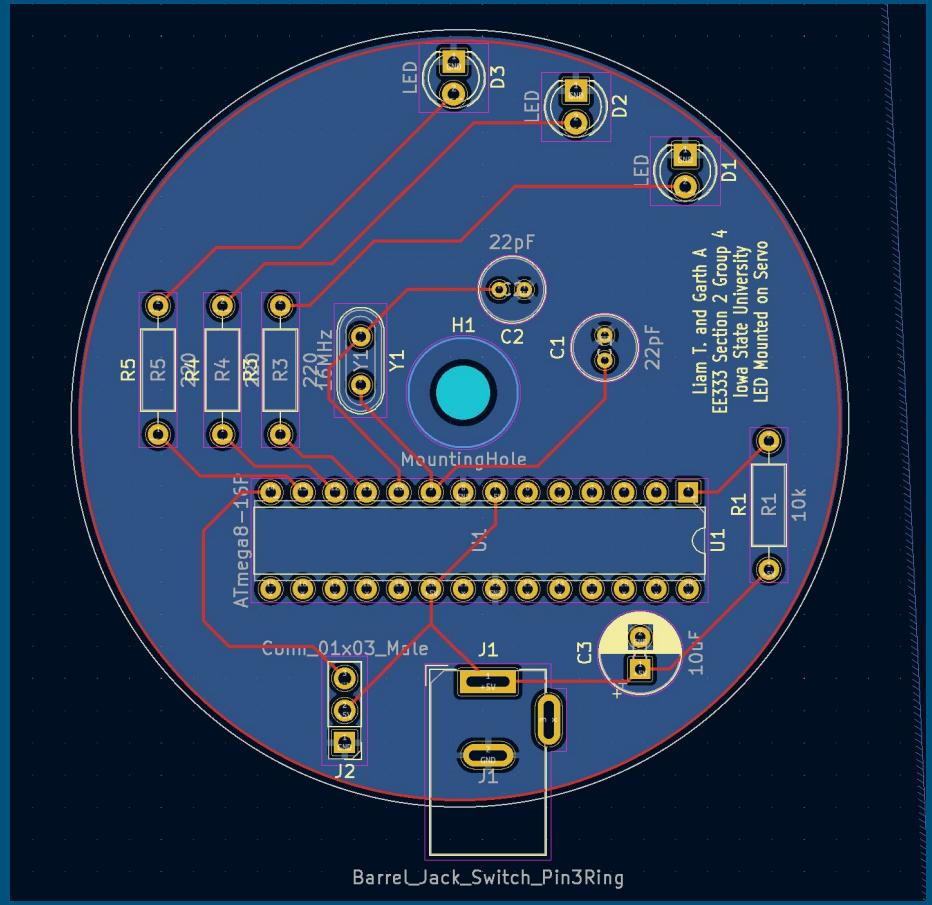

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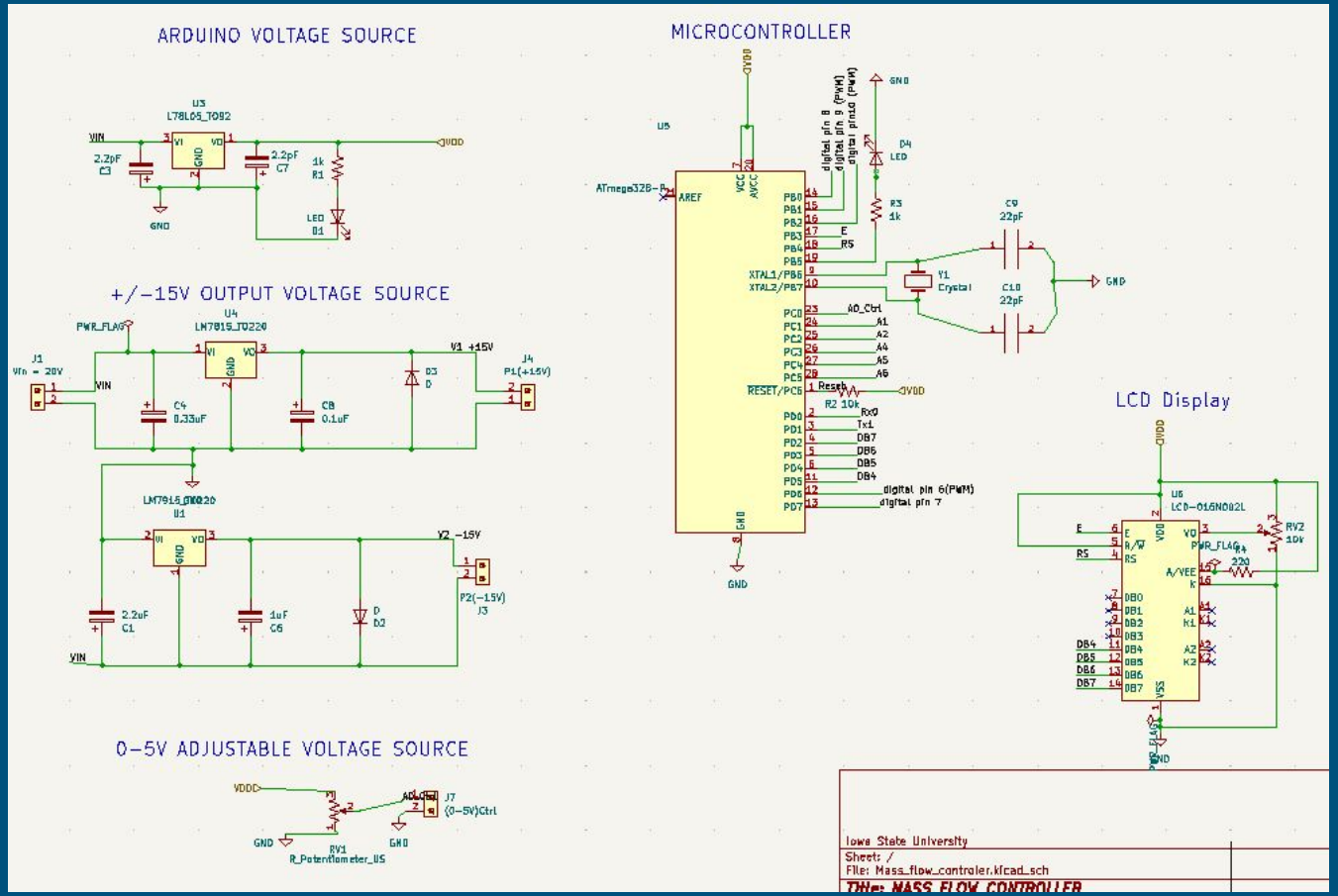

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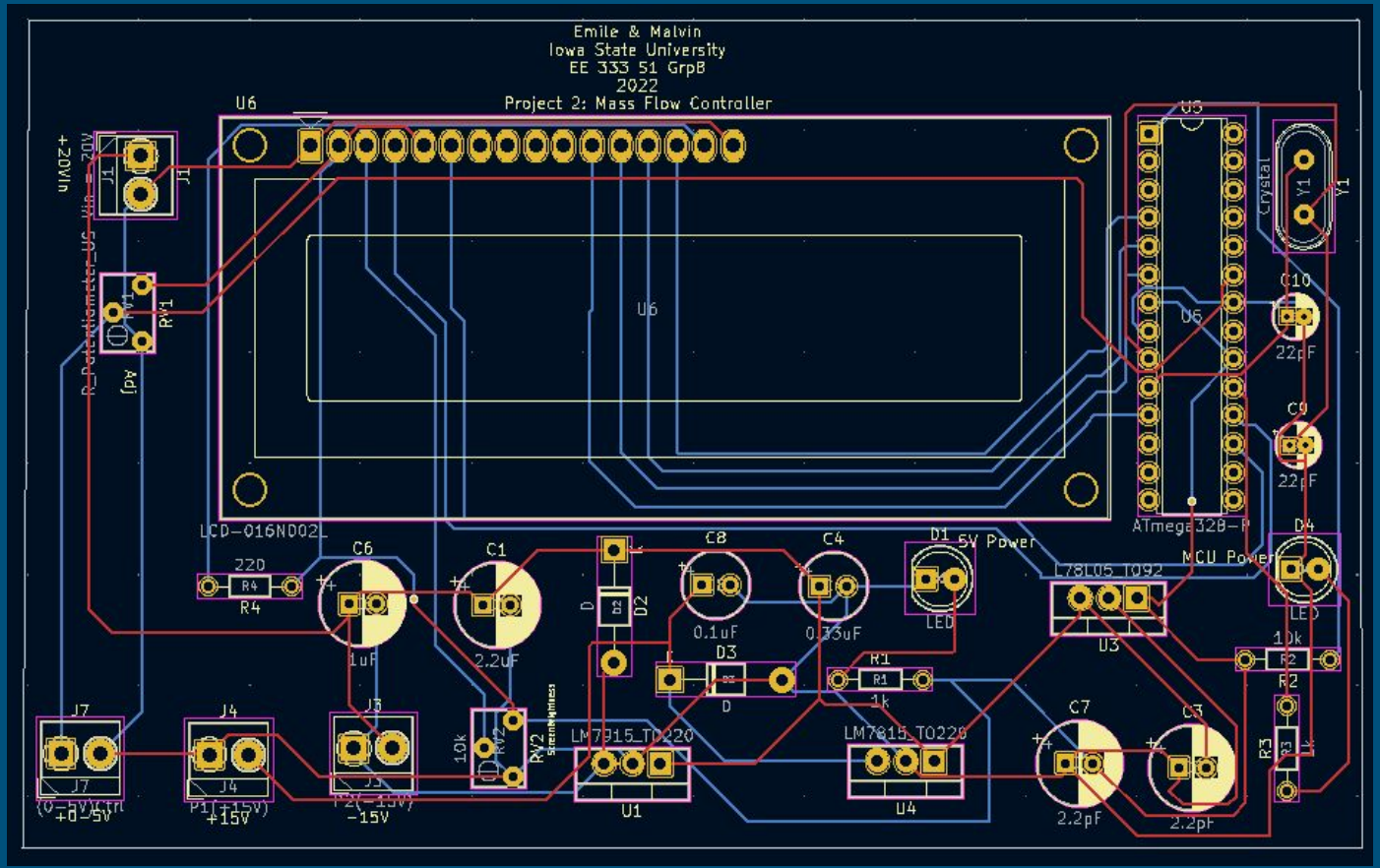


Prototype Implementations

2 PCBs

- LED Mounted On Servo

- Mass Flow Controller

PCB Prototypes

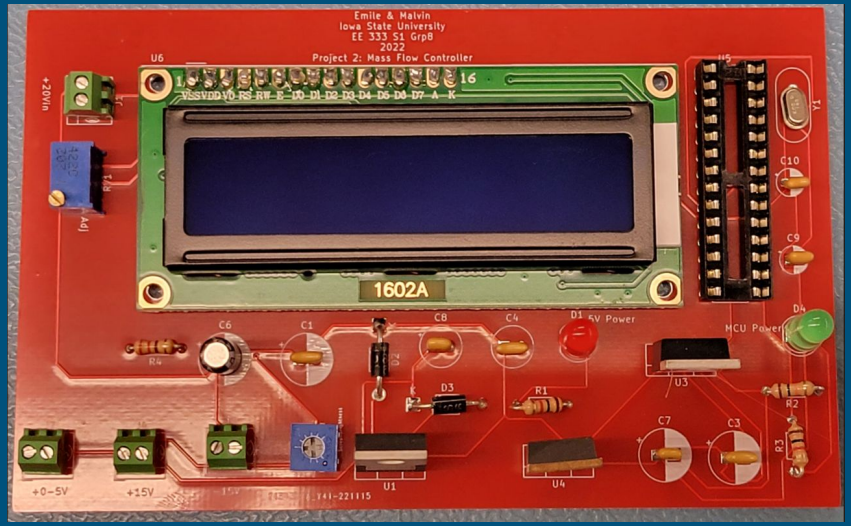


Figure : Prototype for Mass Flow Controller

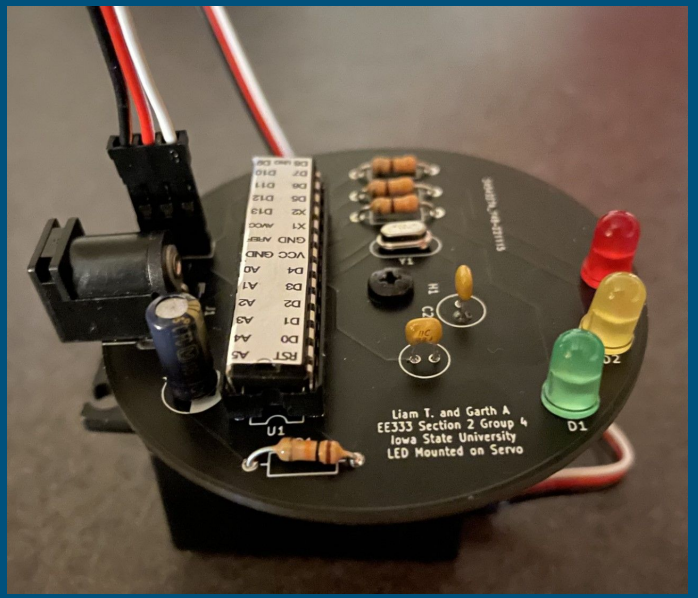


Figure : Prototype for LED Mounted on motor

PCB output

- Mass Flow Controller
  - Regulated +/-15V and +5V
  - Adjustable 0 - +5V
  - LCD screen turned on

- LED Mounted on Motor
  - Moving motor
  - LED blinking

Design Complexity

- Distinct components that require distinct solutions
  - LED PCBs
  - Power considerations
  - Gas Regulation
  - Software Interface
- Cost effective and efficient
  - Need to be inexpensive
  - Has to last for years
  - Needs to be accurate and precise
  - Needs to be quick and easy to use

Project Plan - Risks and Risk Mitigation

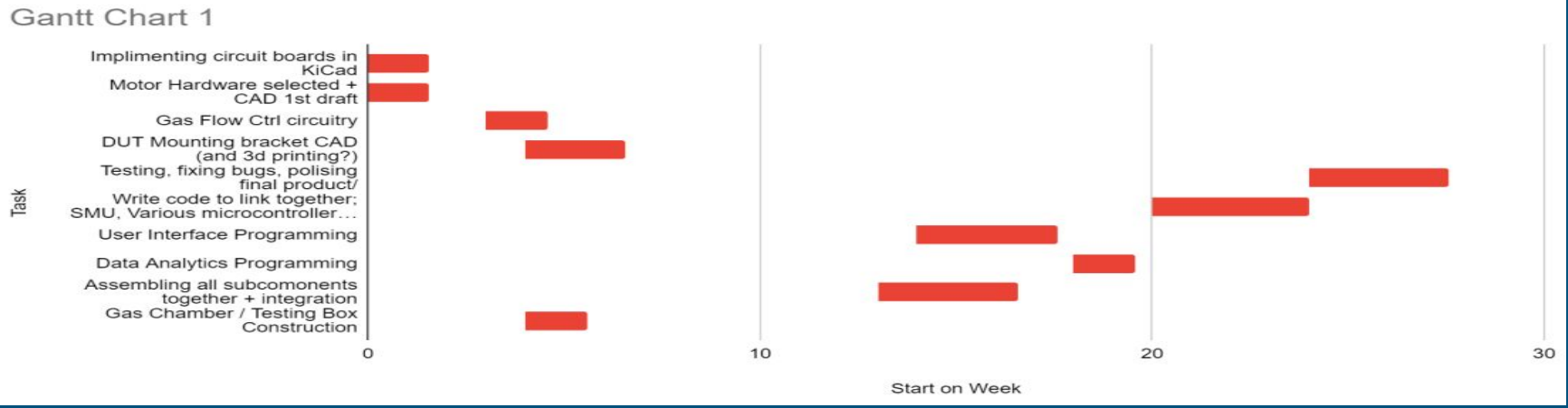
- **PCBs**
  - **Risks**
    - **Soldering mistake could destroy PCB components are cause unintended behavior**
    - **Overvoltage can destroy components**
  - **Mitigation**
    - **Have backup components and PCBs**
    - **Double check voltage limits and supplies**
- **Software**
  - **Risks**
    - **Could crash if not coded correctly**
    - **Could misinterpret data leading to unintended results**
  - **Mitigation**
    - **Run different types of testing (unit tests, acceptance tests, etc.)**
    - **Add easy way to allow software updates**

Project Plan - Milestones

- 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
  - Calculated expected results and achieve 90% accuracy compared to device output
  - Make any necessary hardware or software adjustments

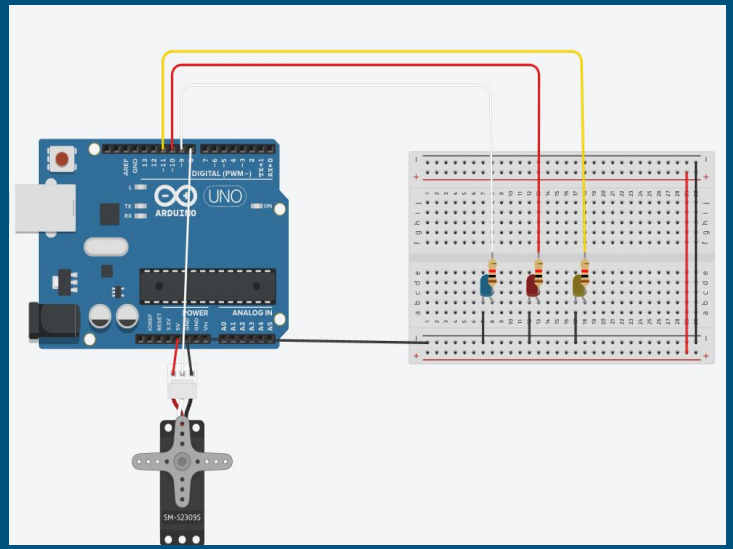
Project Plan - Schedule

	Task	Start date	End date
2	Implimenting circuit boards in KiCad	Oct-17	Oct 28
3	Motor Hardware selected + CAD 1st draft	Oct 17	Oct 28
4	Gas Flow Ctrl circuitry	Nov 7	Nov 18
5	DUT Mounting bracket CAD (and 3d printing?)	Nov 14	Dec 2
6	Testing, fixing bugs, polising final product/	Apr 3	Apr 28
7	Write code to link together; SMU, Various microcontrollers controlling the device, User Program running on desktop.	Mar 6	Apr 3
8	User Interface Programming	Jan 23	Feb 17
9	Data Analytics Programming	Feb 20	Mar 3
10	Assembling all subcomonents together + integration troubleshooting	Jan 16	Feb 10
11	Gas Chamber / Testing Box Construction	Nov 14	Nov 25

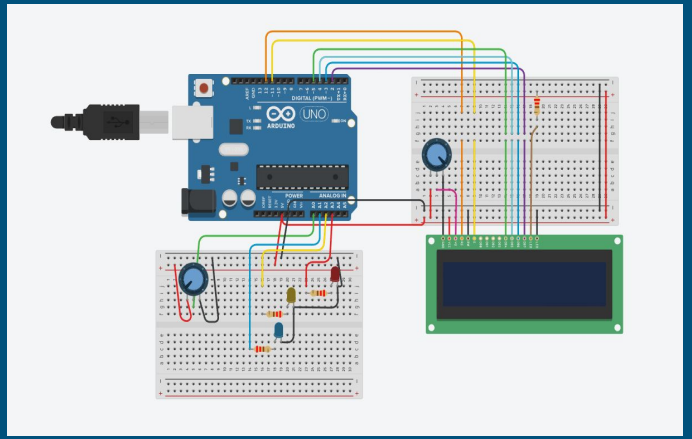


Test Plan

Breadboard Simulation



Tinkercad



TinkerCad & Multimeter

Conclusions

- Accomplishments thus far
  - Produced LED PCB prototype
  - Produce gas flow PCB prototype
  - Successful simulations
- Plans for next semester
  - PCB modifications
  - Simulations
  - Prototype testing
  - Software implementation
  - Final product
- Member contributions
  - Thomas
    - Website design and updates
    - Weekly Reports
    - Design Documents
    - LabView Research
  - Matt
    - 3D CAD modeling
    - Vacuum Chamber initial research
  - Garth & Malvin
    - PCB design
    - Prototype testing