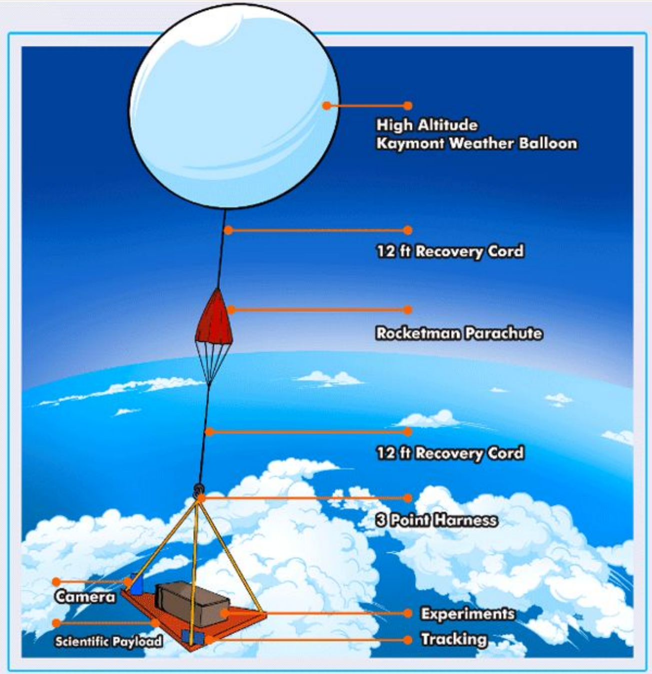
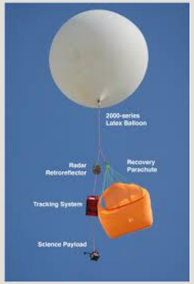
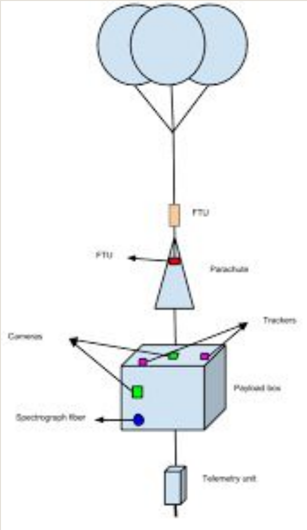
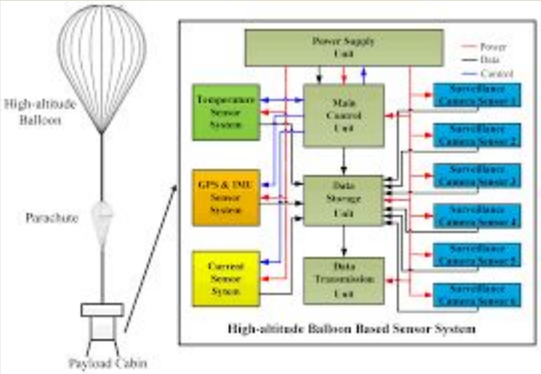
Final Project

Alternative Payload Design for DemoSat High Altitude Balloon





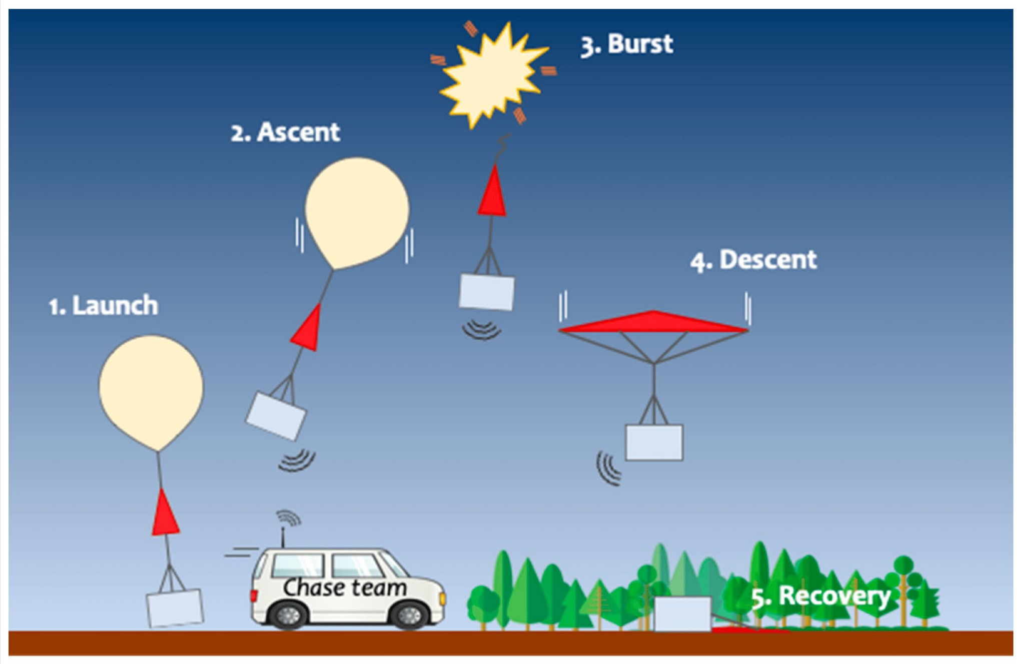




Eli Leshtz

DemoSat High Altitude Balloon Payload

The DemoSat High-Altitude Balloon is a compact, cost-effective experimental platform designed to reach near-space altitudes of approximately 100,000 feet. It provides a testing ground for engineering experiments in extreme conditions, including low pressure & intense cold. This project focuses on redesigning the payload to improve performance while ensuring component availability, reducing costs, and minimizing weight.



Project Objectives

Objectives:

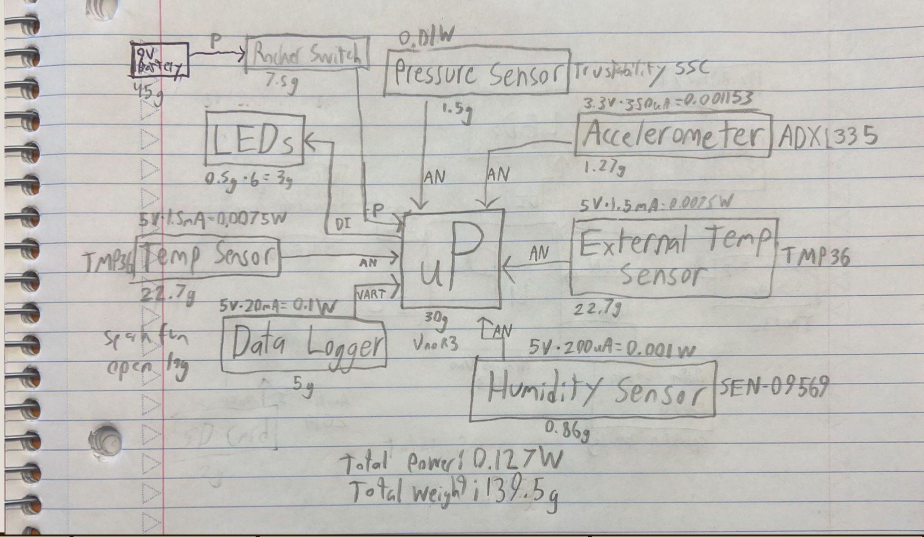
- Evaluate the existing payload system & create detailed block diagram.
- Identify alternative components to maintain or improve functionality.
- Develop a custom PCB for optimized integration with my alternative components.
- Ensure compliance with a 200g weight limit and a $147 budget.
- Compare weight, power, and cost analysis to the original design.

System Evaluation (Phase 1 Findings)

Original Payload Design

<u>Key Components:</u> See below.

<u>Challenges Identified:</u> Limited component availability, outdated components, & high cost.



Original Design						
<u>Type</u>	<u>Component</u>	<u>Quantity</u>	<u>Weight (g)</u>	<u>Cost ($)</u>	<u>Power Consumption (W)</u>	<u>Link:</u>
Pressure Sensor	TruStability SSC	1	1.5	40.56	0.01	Link
Accelerometer	ADXL335	1	1.27	7.5	0.001153	Link
Temp Sensor	TMP36	2	22.7	3.95	0.0075	Link
Humidity Sensor	SEN-09569	1	0.86	20.5	0.001	Link
Open Log Board	Sparkfun Open Log	1	5	16.95	0.1	Link
LEDs	XXXXXXXXXXX	6	0.5	0.4	0	XXXXXXX
Rocker Switch	XXXXXXXXXXX	1	7.5	4.55	0	XXXXXXX
uP	Arduino Uno R3	1	30	26	0	Link
9 Volt Battry	Battery	1	45	4.5	0	XXXXXXX
		<u>Totals:</u>	139.53	130.86	0.127153	

Alternative System Design (Phase 2)

- Component Selection: Researched and selected alternative sensors with improved efficiency and compatibility.
- New Circuit Design: Implemented a custom PCB layout to for optimized integration with chosen alternative components.
- Performance Improvements:
  - Lower power consumption with optimized components.
  - Reduced weight while maintaining full functionality.
  - Streamlined system integration for easier assembly and testing.

Cost, Power, and Weight Breakdown

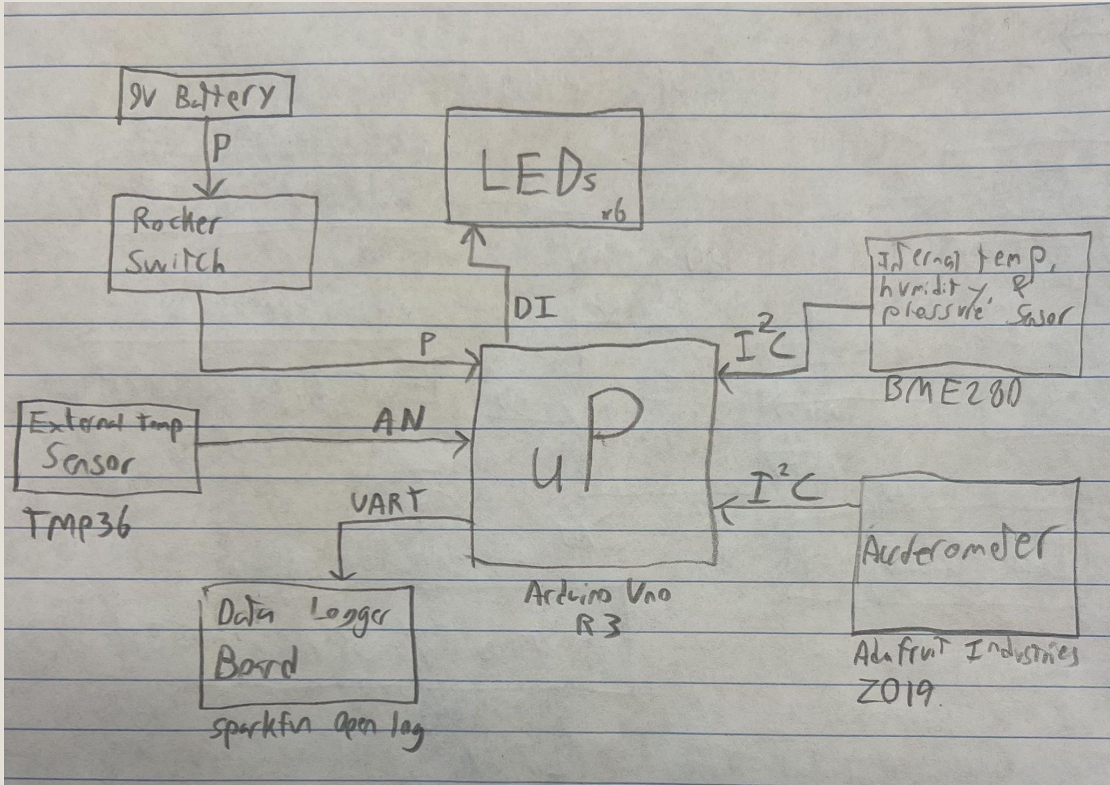
- Comparison Table:
    - Total Cost Calculation (Bill of Materials)
    - Power Consumption Analysis
    - Weight Estimation

Feature	Original System	Alternative Design
Weight	139.53g	115.47g
Cost	$130.86	$96.55
Power Consumption	0.127	0.122

Alternative Design						
Type	Component	Quantity	Weight	Cost	Power Consumption	Link:
Accelerometer	Adafruit Industries 2019	1	1.27	15	0.001153	Link
Pressure, Humidity, & Temp Sensor	Adafruit BME280	1	1	23.2	0.012	Link
Temp Sensor	TMP36	1	22.7	3.95	0.0075	Link
Open Log Board	Sparkfun Open Log	1	5	16.95	0.1	Link
LEDs	XXXXXXXX	6	0.5	0.4	0.00025	XXXXXXX
Rocker Switch	XXXXXXXX	1	7.5	4.55	0	XXXXXXX
uP	Arduino Uno R3	1	30	26	0	Link
9V Battery	Battery	1	45	4.5	0	XXXXXXX
		Totals:	115.47	96.55	0.122153	

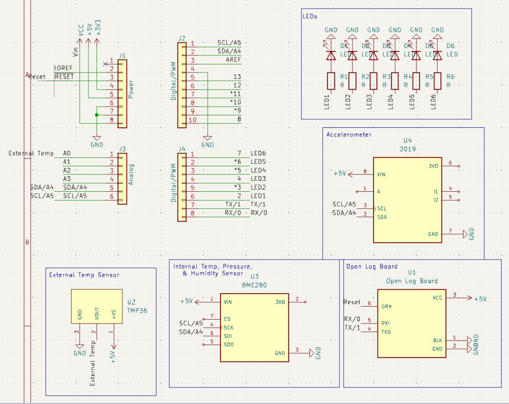
Block Diagram of the Alternative System

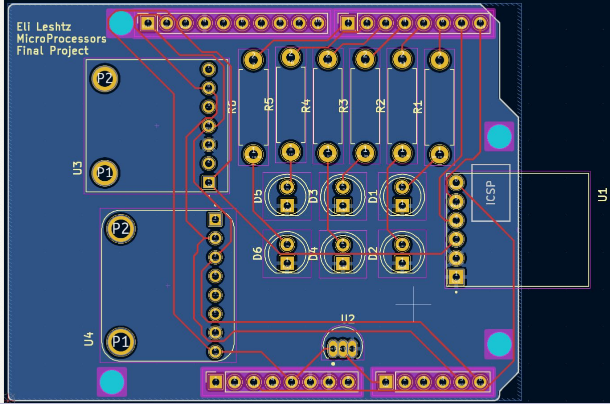
A block diagram was constructed similar to the one designed for the original prototype. Slight differences in components and connections were needed. Specific Components are listed.

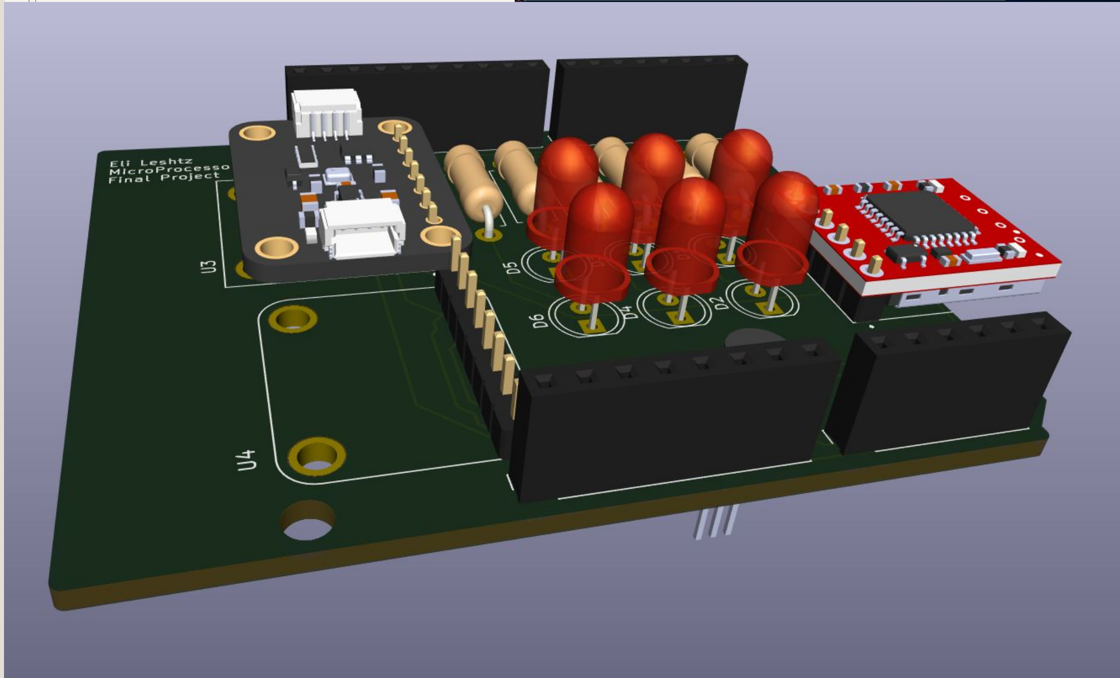


PCB Design

The custom PCB was a crucial part our design process. I focused on creating a layout that minimized trace lengths and improved component placement. By integrating multiple sensor symbols found online, I created my labels, made connections to the arduino sockets, and assigned my footprints which I also found online. The new PCB layout led to a more efficient and user-friendly design, making future iterations easier to implement.







Conclusion

- Final Summary:
  - Successfully designed an alternative payload system
  - Met weight, cost, and power constraints
  - Ensured full functionality
- Future Projects:
  - Explore additional power-saving techniques
  - Test system in a real-world launch environment

Thank You

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03/14/25