Wepwawets PDR

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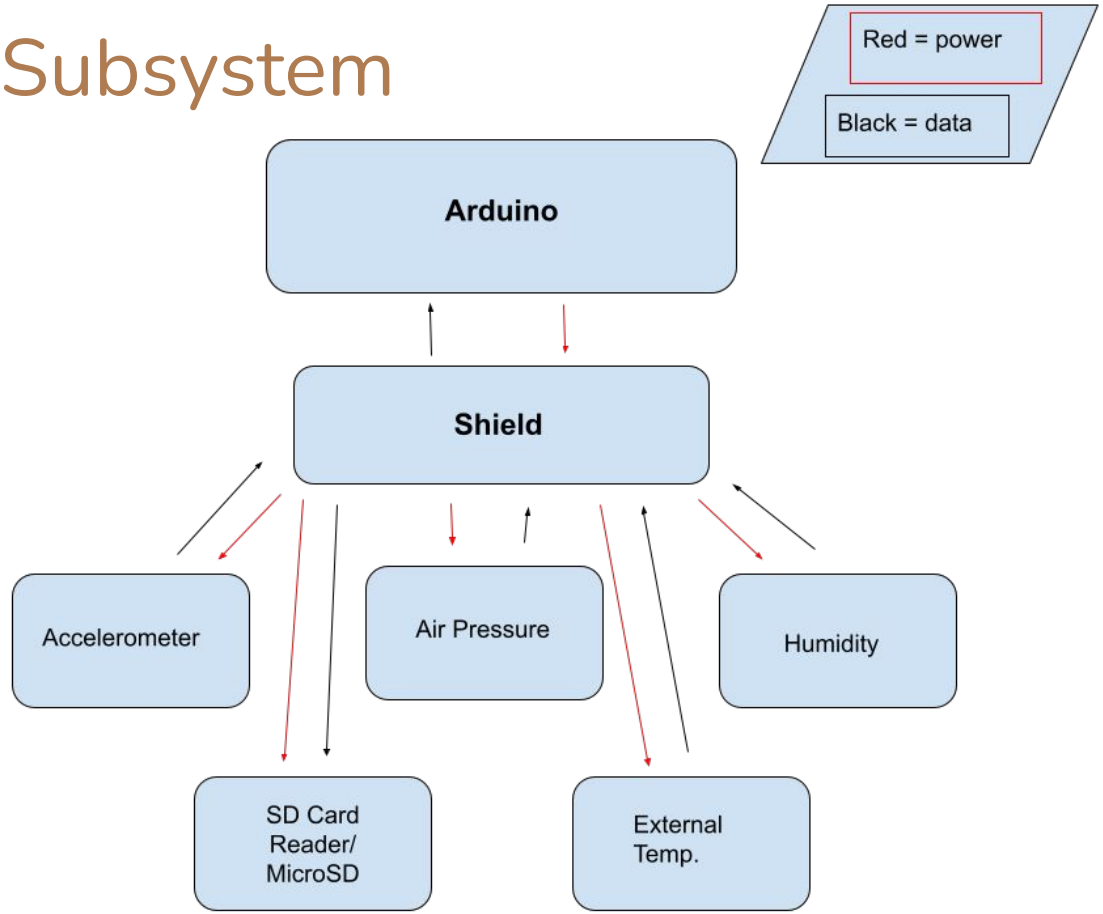
Mission Overview

- Create an efficient, cost-effective, sustainable, and reusable solar-powered weather balloon.
- Current radiosonde network is very expensive and wasteful.
  - ~1,800 balloon launches daily across the world
  - US- 92x2 daily @ $325/launch ~$22mill/year US alone
  - Many are lost, not retrieved, do not use reusable batteries - waste of resources/money
- Challenges:
  - Solar power system strong enough
  - Predicting weather accurately from data

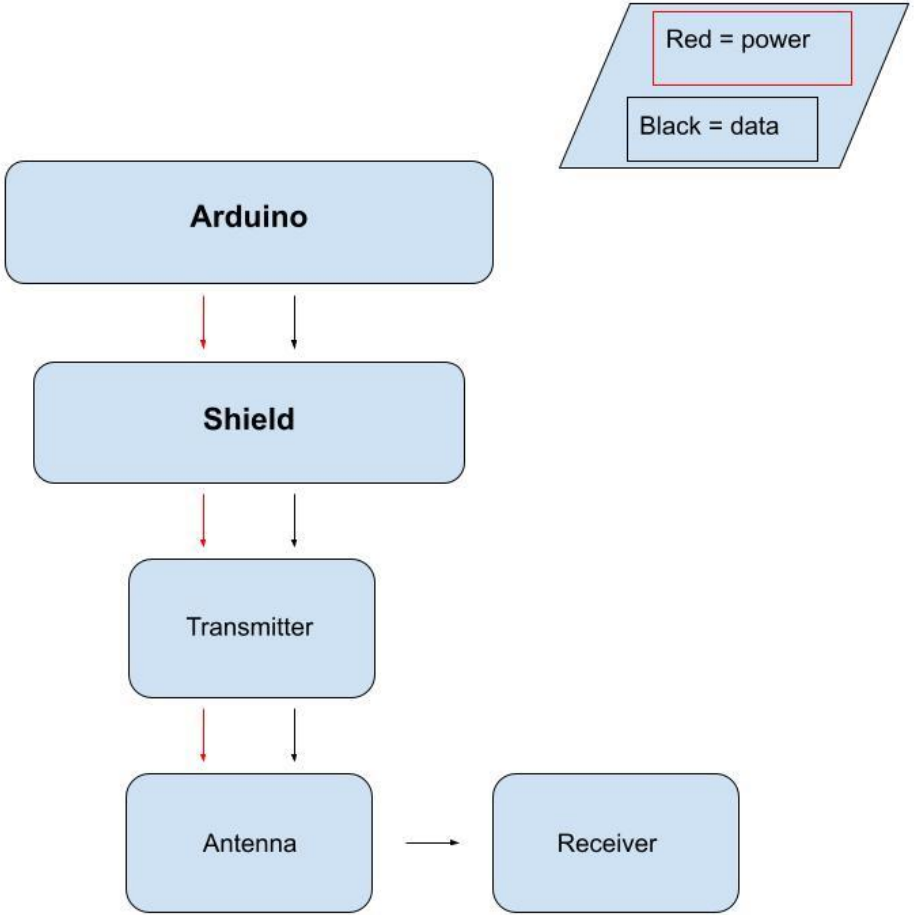
Subsystems

- Three subsystems:
  - Weather balloon
  - Data transmission
  - Solar powered battery system
- Subsystems separate - do not impose on each other
- Special requirements:
  - Ham radio technician license

Weather Balloon Subsystem



Telemetry Subsystem



Telemetry Hardware

Running Frequency: 433MHz

Air

IoT Node

Antenna

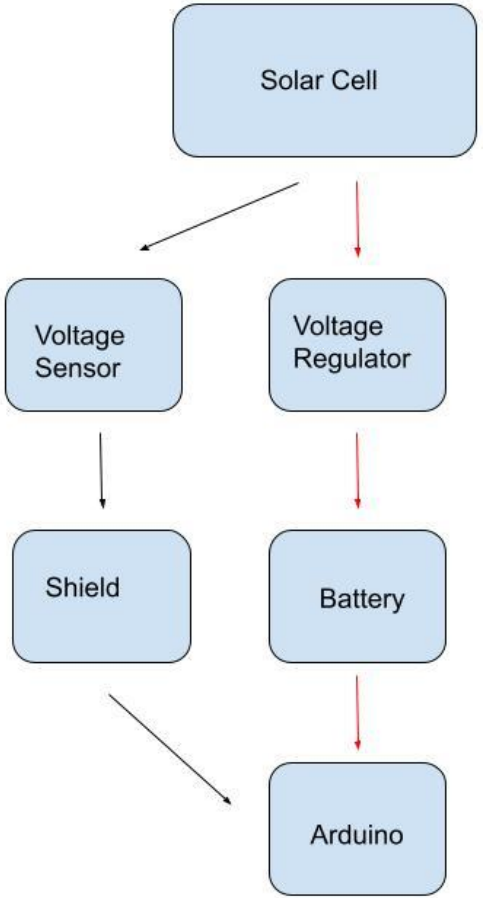
Ground

LoRa Radio

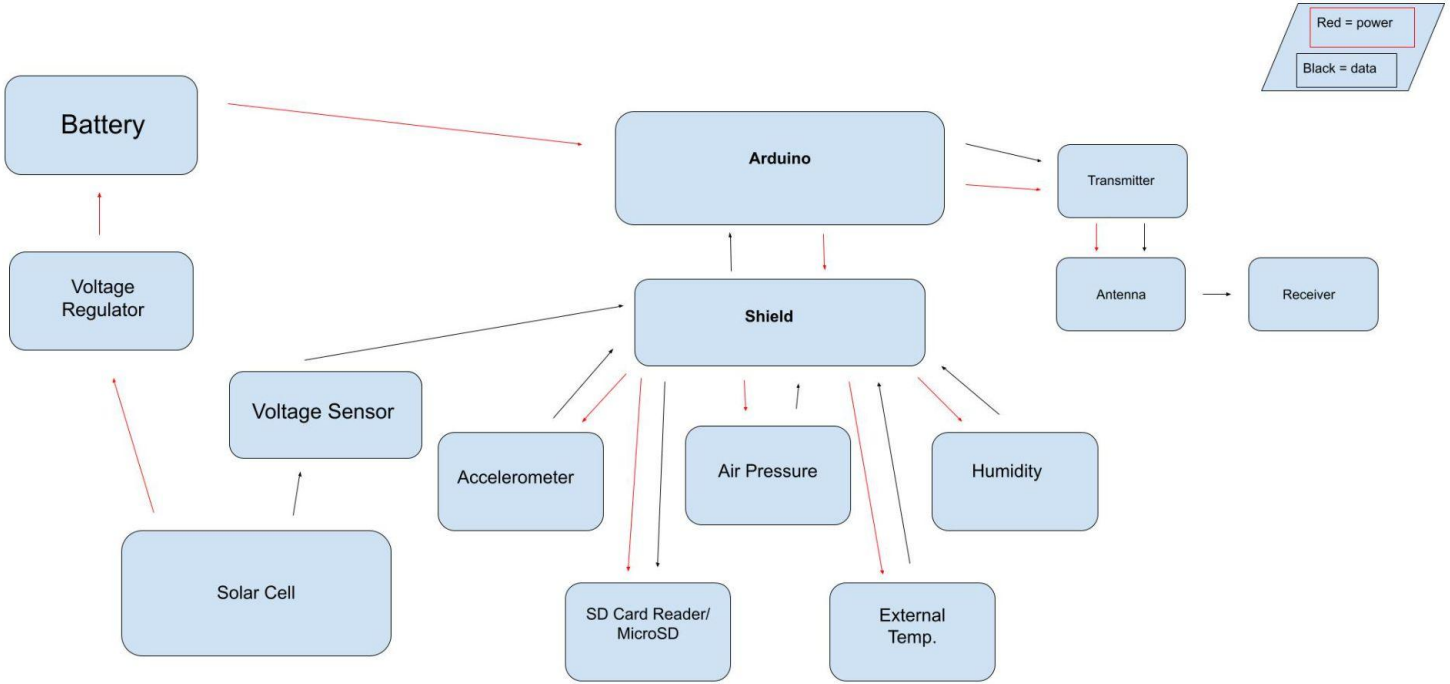
USB to PSI

Omnidirectional Antenna

Solar Power Battery Pack Subsystem



Whole System



Commands and Sensors

1. Collect voltage readings from all sensors (external temperature, humidity, air pressure, accelerometer, and voltage sensor)
2. Send data to SD card
3. Convert data to correct units via Arduino
4. Send new data as a packet to transmitter
5. Transmitter will send packet to the antenna at selected frequency
6. Receiver will receive the packet and save the data

Test Plans

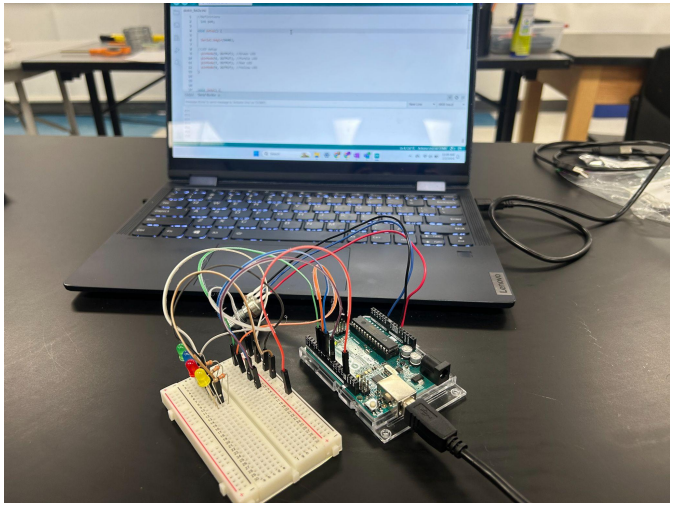
Testing:

- Solar Panel Strength Test
- Telemetry Testing
- Whip Test
- Freeze Test
- Drop Test

Potential points of failure:

- Solar panel failure
- Telemetry failure
- Structural failure from drop/whip test

Testing



Checking that parts work

Solar Panel Testing

Date	Location & Time	Condition	Avg Voltage
1/30/24 Single panel	Outside, 5:20pm Boulder CO	Clear skies, dusk, 49℉	3.08V
	Inside, 5:20pm	Next to lamp, 76℉	4.30V
	Inside, 5:20pm	Hand covering panel	0.45V

Part List

Build:

- Foam core
- Insulation
- Aluminum tape
- Flight Tube

Weather Balloon Subsystem:

- External temperature
- Humidity
- Air pressure
- Accelerometer
- SD card reader
- Micro SD

Battery Subsystem:

- Solar panels
- Voltage sensor
- Rechargeable Lithium Battery

Telemetry Subsystem:

- Transmitter
- Antenna
- Receiver

Budget

Part	Pack Cost	Cost/Piece
Arduino Pro Mini	$24.61	$24.61
Voltage Regulator	$5.99	$1.20
Solar Panel Packs	$30.46	$5.07
Accelerometer	$6.49	$6.49
Antenna	$13.99	$4.66
Voltmeters	$5.89	$1.18
Radio	$29.95	$29.95
Arduino Iot node	$45.80	$45.80
Antenna for box	$6.50	$6.50
Antenna for ground		
Total	$169.68	$125.46

Conclusion

- Mission: Preventing further weather balloon waste by creating a sustainable radiosonde
- Next steps:
  - Building
  - Tests
  - EOSS Coordination

References

- How many weather balloons are out there? Hundreds, it turns out - ABC News (go.com)
- LMS-6 Radiosonde - RECESSIM
- Weather balloons vital for climate science but pollution they create poses dilemma for BOM - ABC News