Cranberry
EE496 Final Presentation

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Overview

- Motivation & Goals
- Block Diagram
- Overall Design
- Power Budget and BOM
- Problems and Solutions
- Final status of project
- Future improvements

Team Motivation

- Improve hardware of first generation weatherbox
  - Add functionality
  - Lower cost
- Deploy Cranberry 4.0
- Improve debugging and circuit design skills???

EMILY LUM

FEARLESS LEADER
JEN CHUN

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Semester Goals

- Populate and deploy Cranberry v4.0

  - 1 for software

  - 1 for Holmes Hall roof

- Fix design problems (Cranberry 4.1)

- Improve board layout
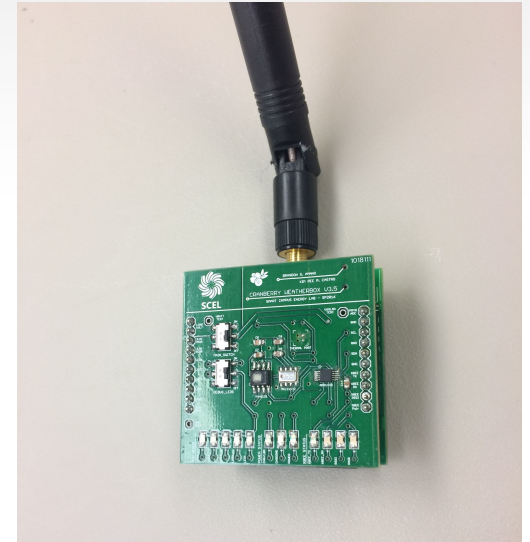
Overall Design

- 2.375" X 2.375" stacked boards

- Top: Sensor Board

- Bottom: Main Board

  - GPS and RTC

- Housing Design

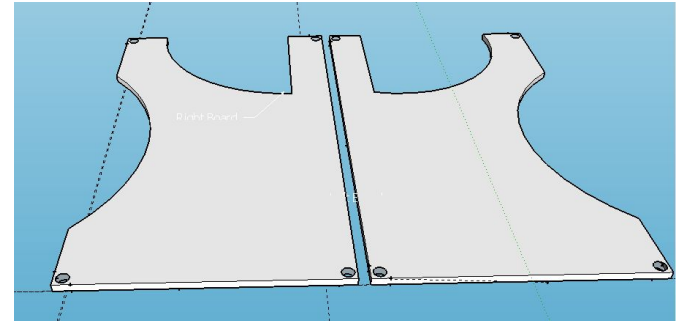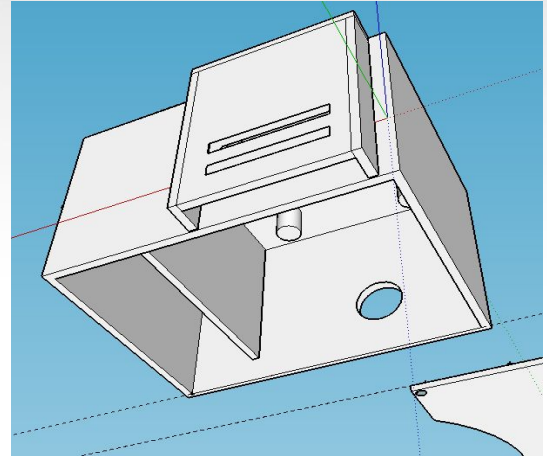 - Two main parts: box and panels

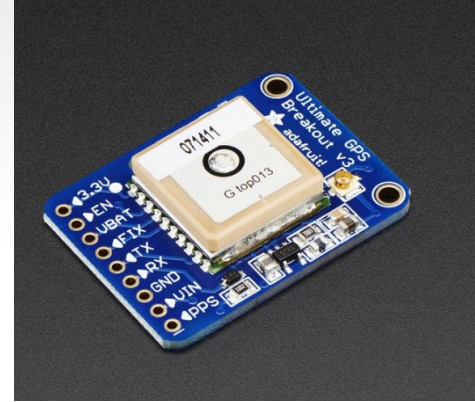 - Mounting piece

Block Diagram

Housing Design

- Box
  - Upside down box
  - Board mounted to roof
  - Separate battery compartment
- Panels
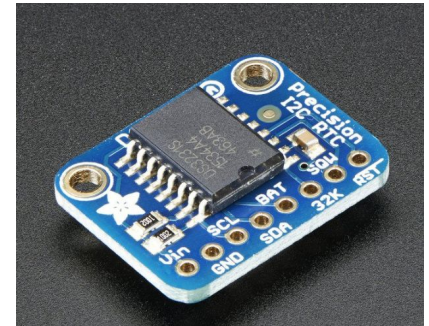- Mounting Piece
  - Borrowed from Apple

GPS and RTC

- Adafruit Ultimate GPS Breakout
  - 66 channel w/10 Hz updates
  - Standby Mode
  - Needs an external real time clock
  - 3.3 volts
  - Medium cost

- Adafruit DS3231 Precision RTC Breakout
 - I2C
  - Breakout board

Power Budget

Device Name	Idle (mA)	Typical Current Draw (mA)	Max Current Draw (mA)
XBee Transmit	15.00	205.00	220.00
XBee Receive			
Barometer	0.01	0.01	0.01
Humidity (HIH6031)	0.00	0.65	1.00
V. Reg 3.3V (Main)		0.35	0.90
V. Reg 3.3V (Xbee)		0.35	0.90
Atmega 328P MCU	0.70	1.70	2.70
Irradiance ADC	0.01	0.15	0.30
Irradiance Op Amp		0.80	2.20
Adafruit GPS (MTK3339)		20	
RTC (DS3231)	0.11		0.2
Total Current Draw (mA)	15.83	229.01	228.21
Supply Voltage (V)	3.30	3.30	3.30
Total Power Consumption (mW)	**52.23**	**755.72**	**753.08**

Cranberry Data
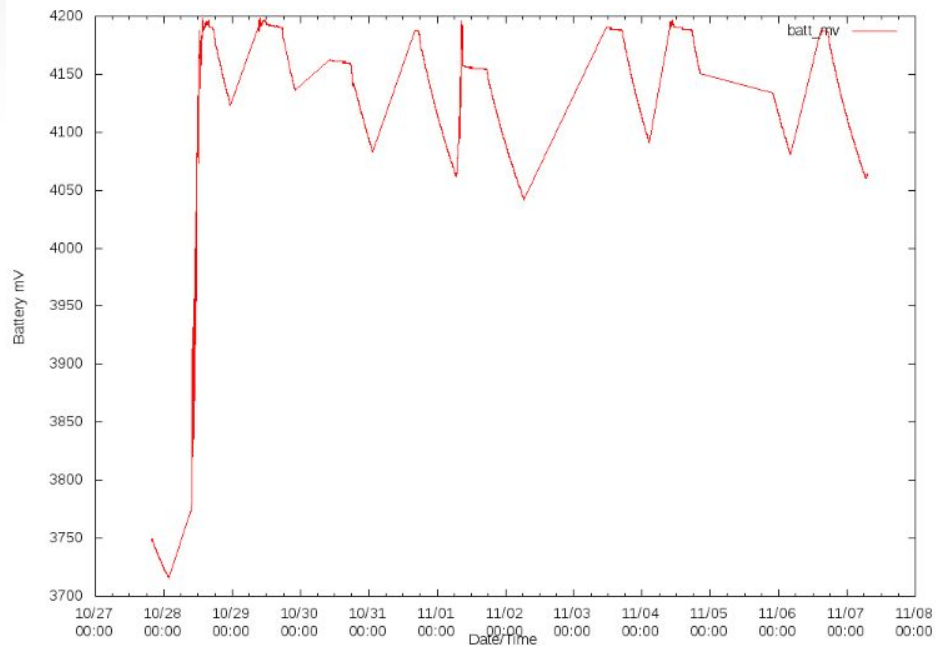
Bill of Materials

| #	Part Name	Unit Cost	Quantity	Sub-Total
1	Solar Irradiance Sensor	$235.00	1	$235.00
2	PCB Manufacturing Costs	$30.00	2	$60.00
3	6V Solar Panel	$59.00	1	$59.00
4	Solar Irradiance Leveling Plate	$35.00	1	$35.00
5	3.7V Lithium Ion battery	$29.00	1	$29.50
6	XBee Pro S2B	$29.00	1	$29.00
7	Humidity Sensor	$15.13	1	$15.13
8	Polarized 470 uF Decoupling Capacitors	$2.26	5	$11.30
9	External Temperature Sensor	$9.95	1	$9.95
10	Solar Irradiance ADC	$6.51	1	$6.51
11	Barometer Sensor	$5.10	1	$5.10
12	Status and Debugging LEDs	$0.38	12	$4.55
13	ATMEGA328P MCU	$3.70	1	$3.70
14	XBee Pin Headers	$1.48	2	$2.96
15	Polarized 2.2uF Decoupling Capacitors	$0.69	4	$2.76
16	Mechanical Sliding Switches	$1.37	2	$2.74
17	Miscellaneous Discrete Components			$17.74
18	Adafruit Ultimate GPS Breakout	$15.95	1	$15.95
19	RTC Module	$14.95	1	$14.95
	Cranberry v4.0 Total Cost			$545.89

Progress

- Finished populating two Cranberry 4.0
  - Both are programmed
  - Errors with certain values

- Worked on debugging the boards
  - Correct temperature, humidity, and battery voltage
  - Incorrect solar panel and solar irradiance
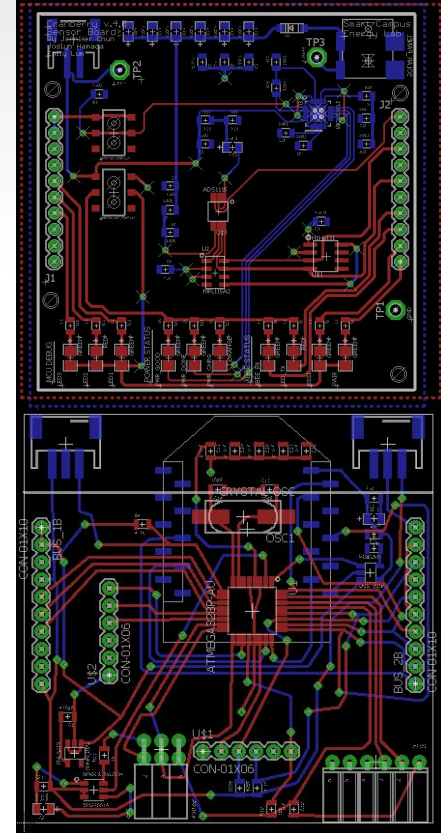
Progress Cont.

- Completed Eagle redesign for Cranberry 4.1

    - Changed RTC to SMD and moved to sensor board
    - Moved the GPS header
    - Fixed solar panel and battery wiring

- Updated housing to match new board dimensions
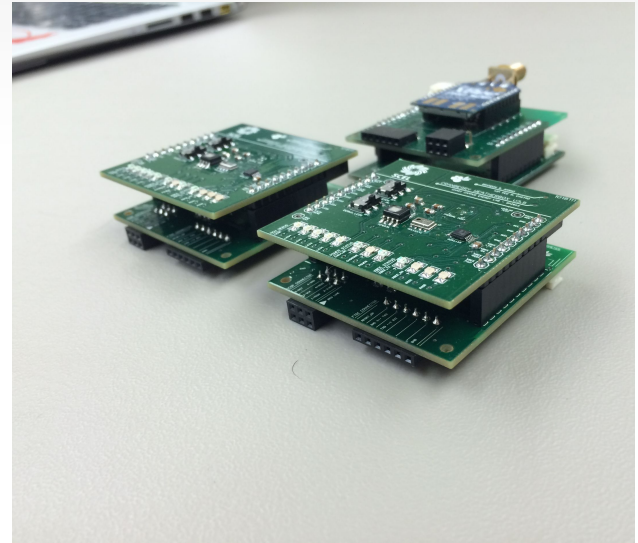
    - Mounting holes
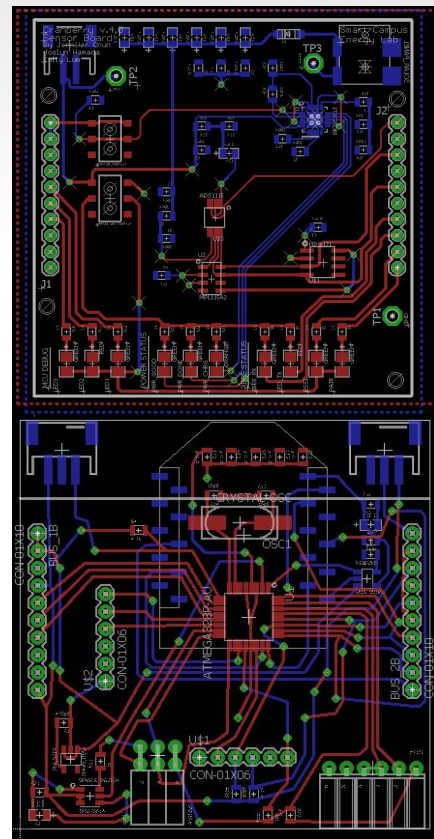
Problems & Solutions

- Programming the board
  - Bootloading
  - Documentation
- Found and fixed several wiring errors:
  - Battery voltage not tied to ADC
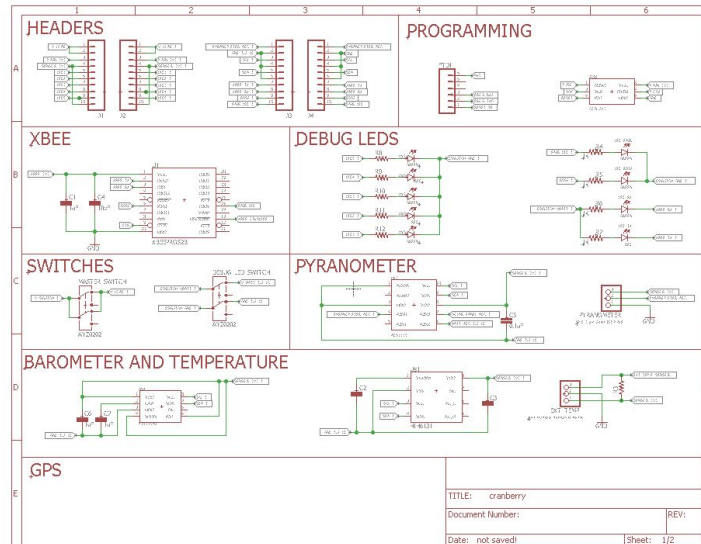 - Solar panel not tied to the VCC

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Future Work

- Get populated board to display the correct values
  - Deploy Cranberry 4.0
- Order Cranberry 4.1 PCBs
- Create an actual power budget using 4.0

Remaining Work

- Deploy Cranberry v4.0

- Populate and deploy Cranberry v4.1

Any Questions?