

Final Presentation

Team Apple

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Overview

- Project Background
- Goals
- Block Diagrams
 - Signal & Power
- Progress Updates
 - Board Designs
- Setbacks
- Upcoming Plans
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- Q & A





Background / Motivation / Goals



Project Background and Motivation

- Hawaii has a strong dependency on imported resources
- Photovoltaic (PV) is more sustainable and practical, yet we cannot rely on them entirely
- Collect and monitor weather and irradiance patterns to help us predict energy patterns



Goals

- Optimize the latest version of Apple hardware
 - Debug/Understand the Apple board
 - Use previous housing design
 - Complete a working Weatherbox
 - Improve/Redesign a new version of Apple





Block Diagrams



Overall Block Diagram



Signal Block Diagram



Power Block Diagram



Current Sensor is
acting as a short





Progress Updates



Team's Progress Since CDR

- Updated power budget
- Started on final report
- Changed charging circuit
 - Programming Resistor (2k to 1k ohms)

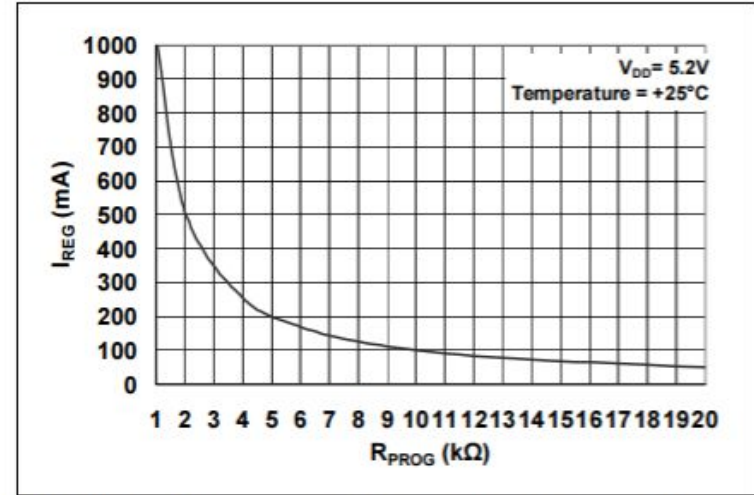
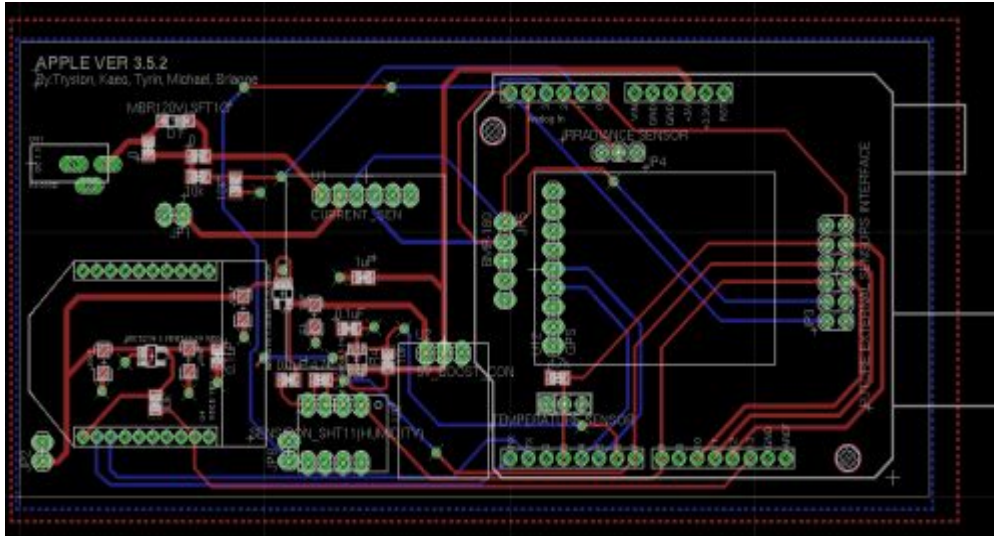


FIGURE 2-3: Charge Current (I_{OUT}) vs. Programming Resistor (R_{PROG}).



Version 3.5.3



Dimensions:

5.12in x 2.36 in

Area~12.09in²



Version 4.0.0 (4th Generation, 0 Schematic, 0 Board Design)

Dimensions:

3.3in x 3.22 in

Area~ 10.63 in²

Changes from 3.5.3:

- Complete Redesign of the PCB
- Routed Enable Pin from GPS (for Programming)
- Took out extra 0 Ohm Resistors
- Traced a new route for TX and RX from XBEE
- Added ON/OFF Physical Switch
- Put new package for ON/OFF Sensor Switch





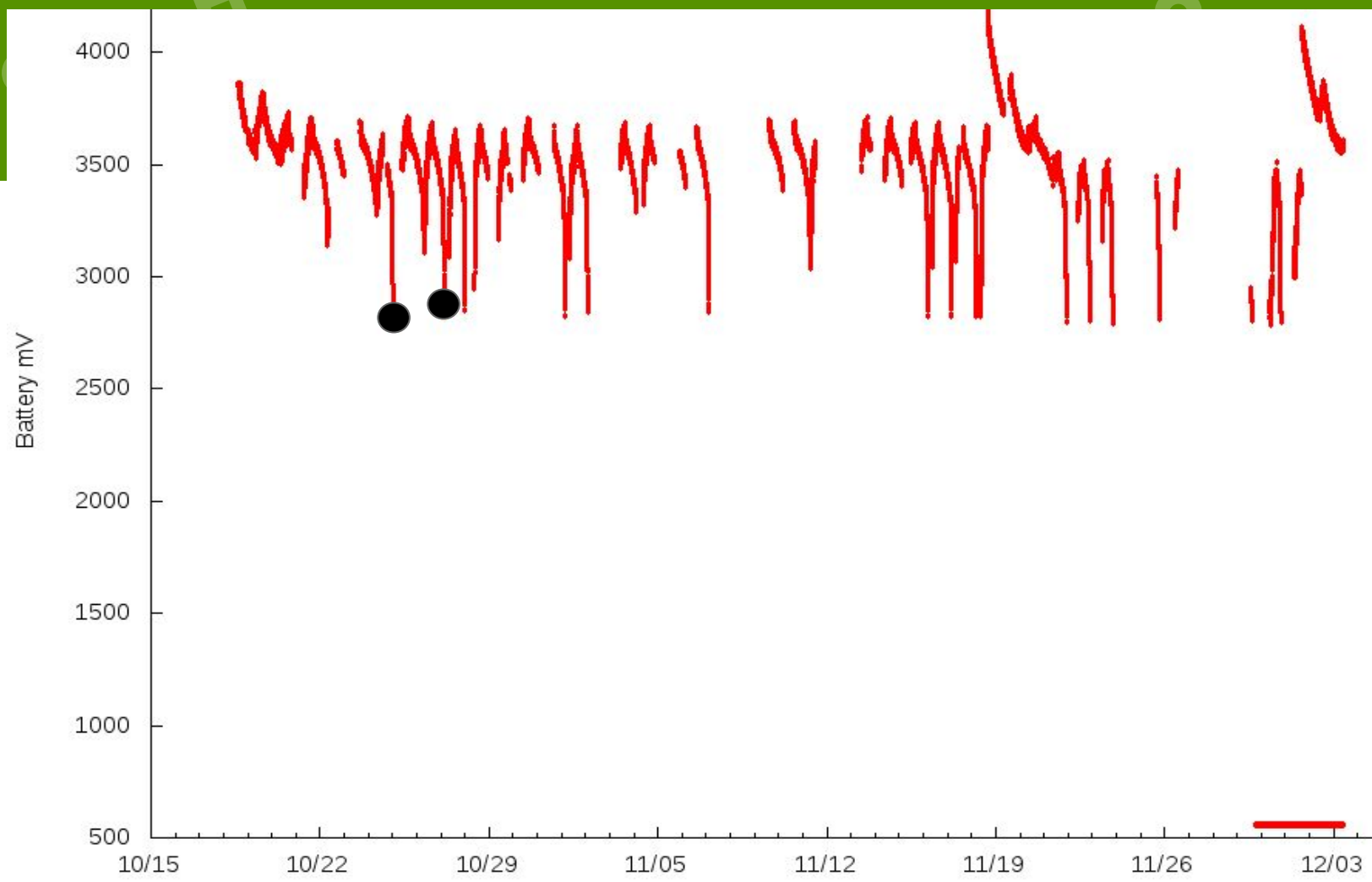
Setbacks



Setbacks

- Problem with deployed Weatherbox
 - Battery wouldn't fully charge
- Cannot 3D print
 - Filament not working properly







Power Budget & Bill of Materials



Power Budget

5 Volt Modules	Datasheet Values			Calculated Values	
Part Name	Idle Current(mA)	Typical Current(mA)	Max Current(mA)	Measured Current(mA)	Average Power(mW)
Arduino	0.0001	20	50	32	160
DC Current Sensor	0.006	0.7	1	0.74	3.7
GPS Sensor	4	12	20	21.15	105.75
Humidity/Temperature Sensor	0.0003	0.028	1	0.28	1.4
Pressure Sensor	0.001	0.65	1	0.01	0.05
Solar Irradiance	0.0001	0.15	0.3	0.23	1.15
Roof Temperature	Not Currently Implemented				
Total	4.0075	33.528	73.3	54.41	272.05
3.3 Volt Modules	Datasheet Values			Calculated Values	
Part Name	Idle Current(mA)	Typical Current(mA)	Max Current(mA)	Average Current(mA)	Average Power(mW)
Xbee	0.0035	15	220	29.5	0.00001262415
Overall Power					
	Total Idle Current	Total Typical Current	Total Max Current	Total Average Current Draw(mA)	Total Average Power(mW)
	4.011	48.528	293.3	83.91	272.0500013
Battery Supply					
Part Name	Supply Voltage(V)	Discharge Rate(mAh)	Usable Energy		
3.7V 6600 mAh	3.7	6600	65%		
XBee Characteristics					
Idle Time	99.9891%				
Transmit Time	0.01093%				
Calculated Run Time					
Energy(mWh)	Usable Energy	Max Power Consumed(mW)	Max Current Run Time of Usable Energy(Hours)	Average Current Run Time of Usable Energy(Hours)	
18650	65%	366.5909005	33.06819668	44.55982336	

Bill of Materials

Apple v3 Bill of Materials

Part Description	Part Name	Vendor	Product ID#	Unit Cost	Quantity	Reason
Battery	Tenergy Li-Ion 18650 3.7V 6600mAh	Adafruit	353	\$29.50	1	Battery provides enough power to supply board
Solar Charging Chip	USB LiPoly/Li-Ion Charger(3.7/4.2V) MCP73871	Adafruit	390	\$17.50	1	Charger compatible with the battery
Solar Panel	Large 6V 3.4W Solar Panel	Adafruit	500	\$39.00	2	Good size and provides enough power
Microprocessor	Arduino Uno R3	Adafruit	50	\$24.95	1	Easy to use and beginner-friendly
Wireless Transciever	Digi International XBee Pro S2B	Adafruit	967	\$37.95	1	Common Wireless Transceiver
Duck Antenna	2.4GHz Duck Antenna RP-SMA-Large	Sparkfun	558	\$9.95	1	Compatible with XBee
Antenna Extension	Interface Cable-RPSMA Female to RPSMA Male(25cm)	Sparkfun	12860	\$4.95	1	Helps Antenna with Attenuation
Current Sensor	INA 219 High Side DC Current Sensor Breakout 26V±3.2V	Adafruit	904	\$9.95	1	Recommended on Adafruit
GPS Sensor	Ultimate GPS Breakout v3	Adafruit	746	\$39.95	1	Unique Weatherbox Locations
Solar Irradiance Sensor	Silicon-Cell Pyranometer SP-215	Apogee	SP-215	\$235.00	1	Self powered and doesn't require Op Amp
Solar Irradiance Sensor Stabilizer	AL-100 Solar Sensor Leveling Plate	Apogee	AL-100	\$35.00	1	Necessity
Temperature Sensor	One Wire Digital Temperature Sensor-DS18B20	Sparkfun	245	\$4.25	1	Temperature sensor that fits in the box
Pressure Sensor	Barometric Pressure Sensor BMP180(newer model)	Adafruit	1603	\$9.95	1	Old model discontinued
Humidity/Temperature Sensor	Sensirion Temperature/Humidity Sensor-SHT11	Adafruit	246	\$35.00	1	Dual sensor module that was power efficient
Complete Unit Subtotal Cost						
\$571.90						
Current Unit Subtotal Cost						
\$488.70						



Denouement/Peroration/Coda



Overall Status of the Project

- Able to deploy one box (3.5.3 Gen. Apple)
- Box accurately records data
- Have two more boards to deploy
 - Need to make housing and mount for 2 boards
- Awaiting approval for PCB fabrication (4.0.0 Gen. Apple)



Upcoming Plans (Spring 2017)

- Deploy two more weather boxes
- Assemble bare Arduino and test to make sure it programs and runs
- Create new housing design for latest Apple version 4.0.0
- Finish up Final Report
- Brainstorming Future Designs



Gantt Chart

Team Apple Weatherbox Project																
(Gantt Chart)																
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Date	8/29/2016	9/5/2016	9/12/2016	9/19/2016	9/26/2016	10/3/2016	10/10/2016	10/17/2016	10/24/2016	10/31/2016	11/7/2016	11/14/2016	11/21/2016	11/28/2016	12/5/2016	12/12/2016
Presentations																
Proposal																
PDR																
CDR																
Final																
Apple																
Testing/Debugging																
Housing																
Weatherbox																
Redesign PCB and Housing																
Solder the remaining boards																
Reports																
Final Report																

Thanksgiving !



Gantt Chart

Week	16
Date	12/12/2016
Presentations	
Proposal	
PDR	
CDR	
Final	
Apple	
Testing/Debugging	
Housing	
Weatherbox	
Redesign PCB and Housing	
Solder the remaining boards	
Reports	
Final Report	





Thanks!

Any questions?



