University of Hawaii at Manoa SCEL

Dragon Fruit
Final Presentation

Tyler Yamauchi
Kyaw Hein
Kevin Wong (Honorary Member)
Advisor: Dr. Anthony Kuh

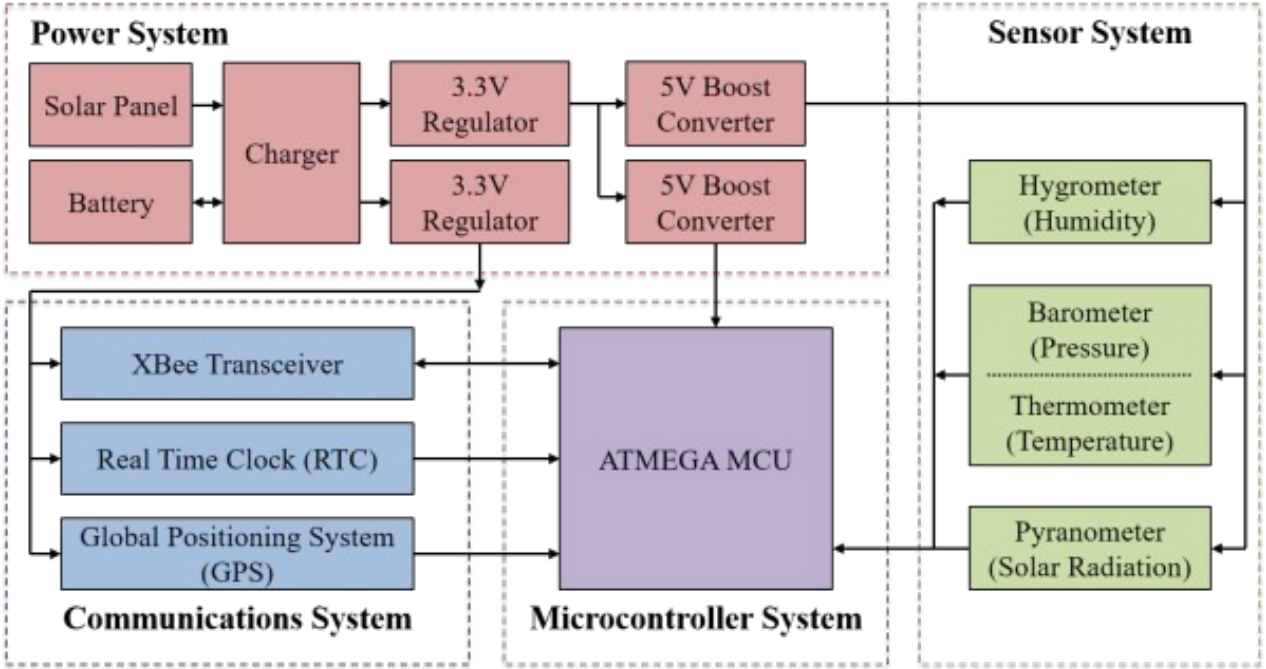
Overview

- Block Diagram
- Major Problems
- Solutions
- Power Budget
- Bill of Materials
- Future Tasks

Project Motivation

To design a weatherbox that maximizes design quality, power efficiency, and processing speed

Block Diagram

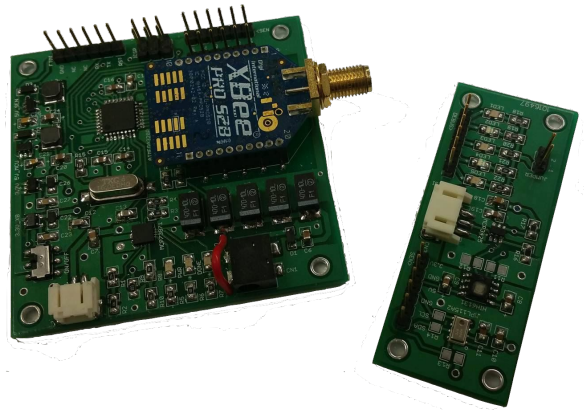


Major Problems

- Deployed board stopped transmitting (Version 2)
  - Voltages on the board are normal
- Newly populated board (Version 3) gets hot when programming
  - Also does not program
- XBee configuration problems
- Solar Irradiance data incorrect
- Lack of access to roof

Solutions

- Redesign a new Version 4
  - Use Apple Atmega package
  - Possibly solving programming heating problem
  - Solar Irradiance data straight to Atmega ADC



Power Budget

Part	Typical current draw (mA)	Average Current Draw (mA)	Average Power Consumed (mW)	Max Power Consumed (mW)
Xbee	205 mA	16.33 mA	49.568552	49.568552
Vreg 3.3V	0.35	0.175	0.5775	2.97
Atmega 328P (5V)	5.2	5.2	26	45
Solar Irradiance	0.3	0.3	1.5	1.5
Vreg 5v (Atmega)	0.07	0.07	0.35	0.5
ADC 16bit	0.155	0.07775	0.38875	0.95
Barometer	0.005	0.2525	0.83325	0.03
Humidity - HIH6131	0.65	0.3255	1.07415	5

Bill of Materials

Item #	Part Decription	Part Name	Vendor	Product ID/#	Unit Cost	Quantity	Subtotal
1	Solar Charging Chip	IC USB/AC Battery Charger	DigiKey	MCP73871-2CCI/ML-ND	$1.84	1	$1.84
2	Charging chip - Diode	Diode Schottky 20V 1A SOD123FL	DigiKey	MBR120VLSFT3GOSCT-ND	$0.39	3	$1.17
3	Charging chip 3x, Solar Irradience 1x, Voltage	10uF 10V Ceramic Capacitor	DigiKey	311-1355-1-ND	$0.18	6	$1.08
4	Charging Chip - passives	1k Ohm SMD 0805	DigiKey	P1.0KACT-ND	$0.10	6	$0.60
5	Charging Chip - passives	2k Ohm SMD 0805	DigiKey	P2.0KACT-ND	$0.10	1	$0.10
6	- Charging Chip 1x, ATmega 1x, Voltage Divide	10k Ohm SMD 0805	DigiKey	RMCF0805JT10K0CT-ND	$0.10	7	$0.70
7	Charging Chip - passives	100k Ohm SMD 0805	DigiKey	P100KACT-ND	$0.10	2	$0.20
8	Charging Chip - passives	150k Ohm SMD 0805	DigiKey	P150KACT-ND	$0.10	1	$0.10
9	Charging Chip - passives	270k Ohm SMD 0805	DigiKey	P270KACT-ND	$0.10	1	$0.10
10	Charging Chip - passives	470uF 10V Tantalum Capacitor	DigiKey	718-1753-1-ND	$2.15	5	$10.75
11	Charging Chip - Solar Panel Connector	Connector Power Jack 1.3x3.4MM Solder	DigiKey	CP-014DHPJCT-ND	$1.02	1	$1.02
12	Charging Chip - Battery Connector	2 Position Header Connector 2MM SMD	DigiKey	455-1749-1-ND	$0.58	2	$1.16
13	Charging Chip - LED RED	Red LED SMD 0805	DigiKey	160-1415-1-ND	$0.35	3	$1.05
14	Charging Chip - LED GREEN	Green LED SMD 0805	DigiKey	475-1410-1-ND	$0.25	1	$0.25
15	Charging Chip - LED ORANGE	Orange LED SMD 0806	DigiKey	160-1413-1-ND	$0.31	1	$0.31
16	Vregs for MCU and Sensors	5V 0.13A IC Boost Regulator 5TSOP	DigiKey	NCP1402SN50T1GOSCT-ND	$0.77	2	$1.54
17	68uF Cap for boost circuit	68uF 6.3V Tantalum Capacitor	DigiKey	478-8414-1-ND	$0.85	2	$1.70
18	47uH Inductor for boost circuit	47uH Inductor 170mA 3.7 Ohm SMD	DigiKey	445-6400-1-ND	$0.14	2	$0.28
19	Humidity sensor	Humidity/Temperature Sensor 5V I2C SMD	DigiKey	480-3652-1-ND	$15.13	1	$15.13
20	Humidity sensor - I2C	0.22uF 50V Ceramic Capacitor	DigiKey	490-1670-1-ND	$0.32	1	$0.32
21	I2C Resistor	4.7k Ohm SMD 0805	DigiKey	311-4.7KCRCT-ND	$0.10	6	$0.60
22	Solar Radiance Sensor	SP-215 Amplified 0-5 Volt Pyranometer	Apogee	SP-215	$235.00	1	$235.00
23	Solar Radiance connector	3 Position Header Connector 2MM SMD	DigiKey	455-1750-1-ND	$0.69	1	$0.69
24	Barometer sensor	IC Barometer I2C Digital Mini 8-LGA	DigiKey	MPL115A2T1CT-ND	$7.29	1	$7.29
25	- Atmega 4x, Humidity 1x, Barometer 2x, Sola	10000pF 50V Ceramic Capacitor	DigiKey	1276-2437-1-ND	$0.10	4	$0.40
26	ecoupling Capacitor - Radiance 1x, Humidity 1	0.1uF 50V Ceramic Capacitor	DigiKey	311-1361-1-ND	$0.10	3	$0.30
27	pling Capacitor - Atmega 1x, Pressure/Tempera	1uF 10V Ceramic Capacitor	DigiKey	311-1458-1-ND	$0.10	3	$0.30
28	Vreg for Xbee & system	near Voltage Regulator IC 3.3V 0.5A SOT23	DigiKey	576-1281-1-ND	$0.92	2	$1.84
29	Vreg Capacitor 2.2uF	2.2uF 6.3V Tantalum Capacitor	DigiKey	511-1439-6-ND	$0.58	2	$1.16

Total Cost of Version 3 System: $512

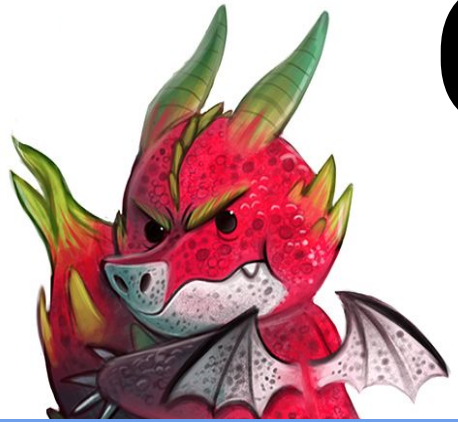
Excludes housing and PCB fabrication

Future tasks

- Re-program and debug Version 2 & 3
- Redesign a new Version 4
- Looking into new 5V step up options
- Redesign of housing for Version 4
- Perform comprehensive current draw test on all sections

Schedule

	Project (Gantt Chart)		
Week	14	15	16
Date	11/27/2017	12/4/2017	12/11/2017
Presentations			
Proposal			
Preliminary Design (PDR)			
Critical Design (CDR)			
Final Design (FDR)			
Test + New Version			
Test Deployment (Version 2)			
Solder New Board (Version 3)			
Test (Version 3)			
Deployment (Version 3)			
Power Analysis (Version 2+3)			
Housing			
Edit Housing Design (Version 3)			
Rough Schedule for Next Semester			
Redesign (Version 4)			
Debug and Re-program (Version 2 +3)			
Mill, Solder & Test (Version 4)			
Deployment (Version 4)			
Power Analysis (Version 4)			
Report			



Questions?

Image Sources

http://cryptid-creations.deviantart.com/art/Daily-Paint-1081-Dragon-Fruit-Keeper-570702189

http://www.michaelleestallard.com/wp-content/uploads/Hello-My-Name-Is-Name-Badge.jpg

Detailed Block Diagram

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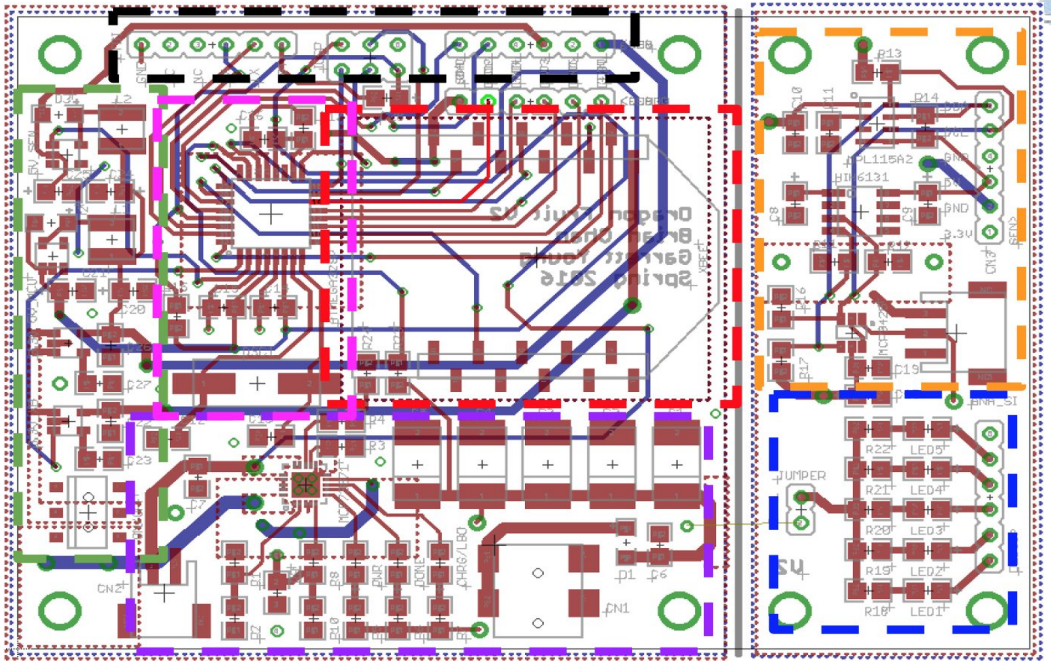
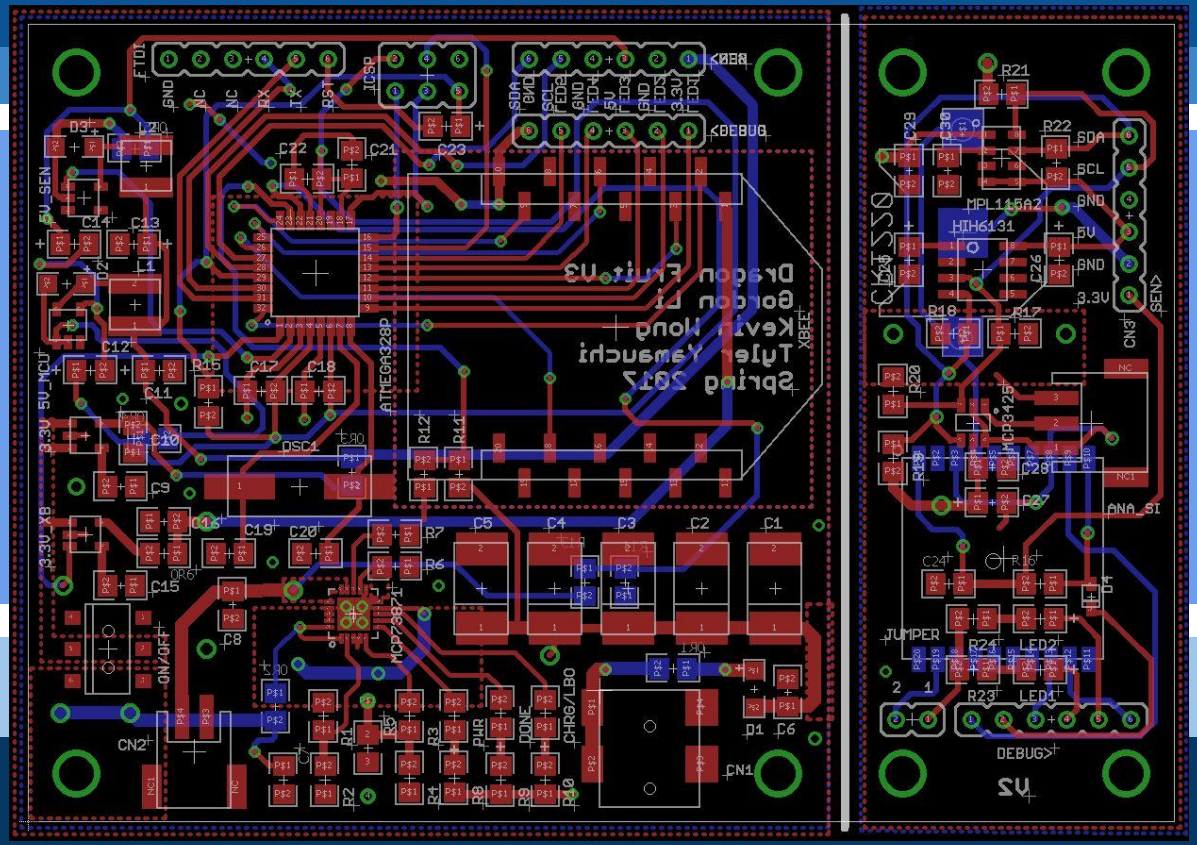
Green - Power
Purple - Charging Circuit
Black - Bus interface
Pink - MCU
Red - Xbee
Orange - Sensors
Blue - Debug LEDs



PCB



- Same dimensions
  - 3.59 in (dimension x)
  - 2.5 in (dimension y)