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Team Bumblebee Final Presentation

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Overview

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- Project Goal
- Block Diagrams
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Background and Motivation

The Bumblebee Weatherbox is a second generation communications module designed to relay meteorological data collected by the other weatherboxes. Its purpose is to increase the effective range of the weatherboxes.



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Project Goals

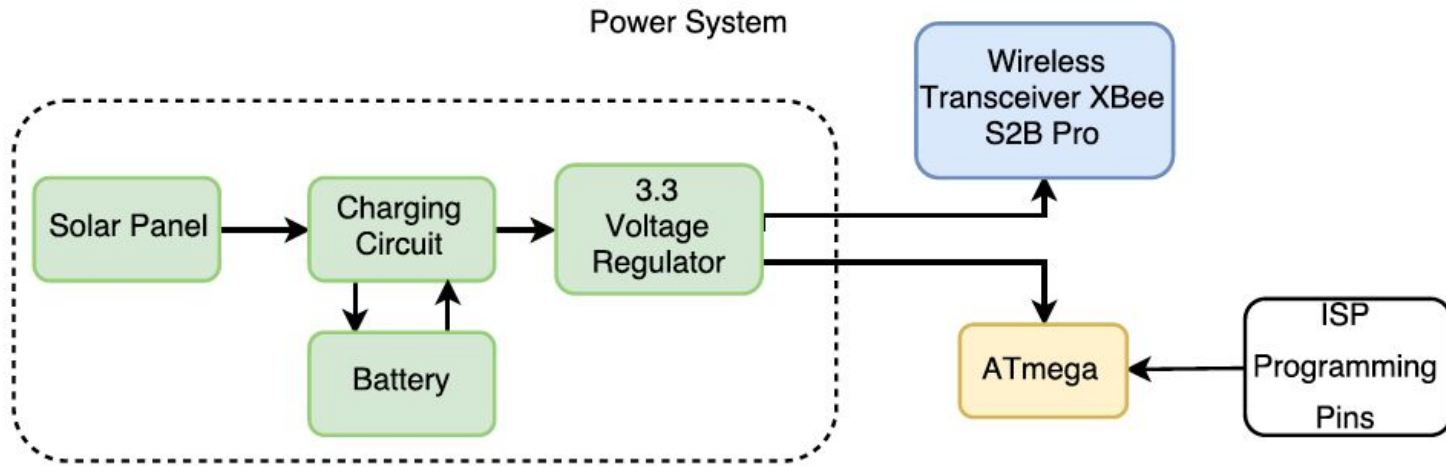
- Design and fabricate a circuit board
- Design and build housing
- Deploy and test
- Do more extensive Xbee field tests



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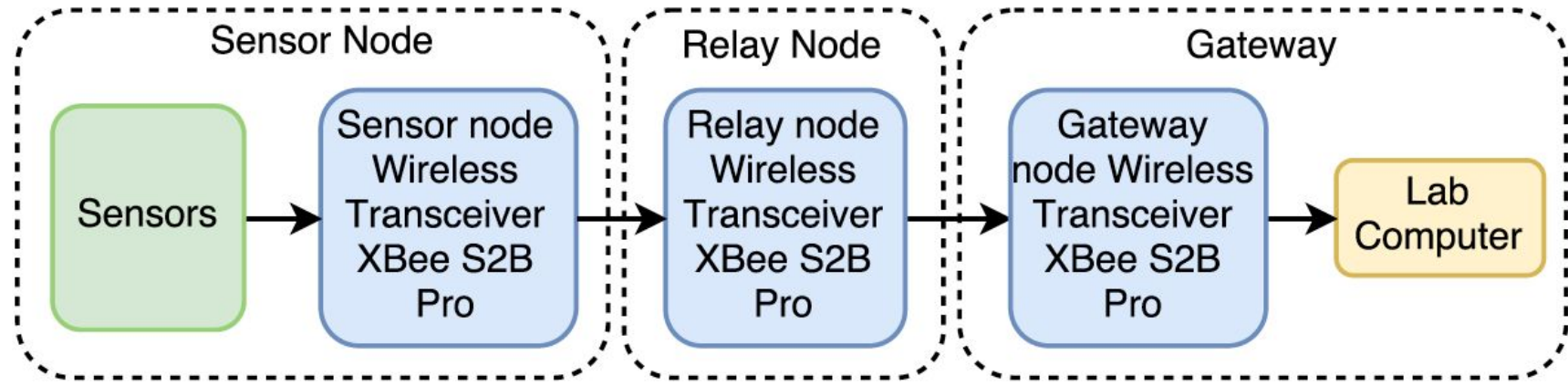
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Block Diagram (Power)





Block Diagram (Signal/Communication)





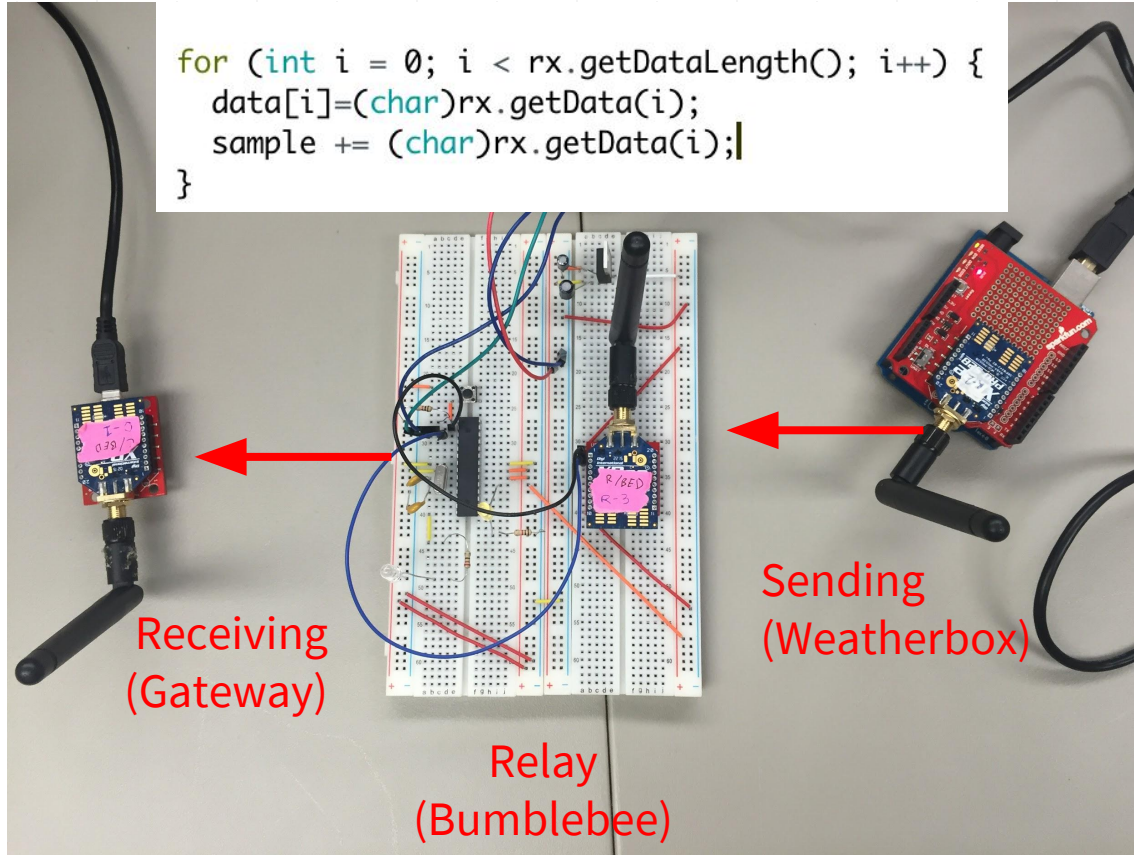
Relay Layout



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```
for (int i = 0; i < rx.getDataLength(); i++) {  
  data[i]=(char)rx.getData(i);  
  sample += (char)rx.getData(i);  
}
```



Receiving
(Gateway)

Relay
(Bumblebee)

Sending
(Weatherbox)



```
void loop() {
```

```
    struct ga_packet{  
        uint16_t schema = 1;  
        uint16_t node_addr = 1;  
        uint32_t uptime_ms = 1;  
        uint16_t batt_mv = 1;  
        uint16_t panel_mv = 1;  
        uint32_t bmp085_press_pa = 1;  
        int16_t bmp085_temp_decic = 1;  
        uint16_t humidity_centi_pct = 1;  
        uint16_t apogee_w_m2 = 1;  
    };
```

Gateway Simulation

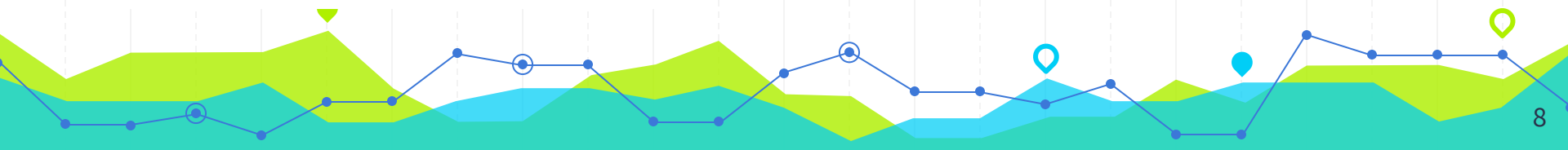
```
apogee_w_m2: 0.25  
batt_mv: 1  
humidity_centi_pct: 1  
node_addr: 1  
panel_mv: 1  
press_pa: 1  
schema: 1  
temp_c: 1  
time_received: 2017-04-27 12:55:03.855483  
uptime_ms: 1
```

```
Checking Schema  
1:22  
apogee_w_m2: 0.25  
batt_mv: 1  
humidity_centi_pct: 1  
node_addr: 1  
panel_mv: 1  
press_pa: 1  
schema: 1  
temp_c: 1  
time_received: 2017-04-27 12:55:09.069993  
uptime_ms: 1
```



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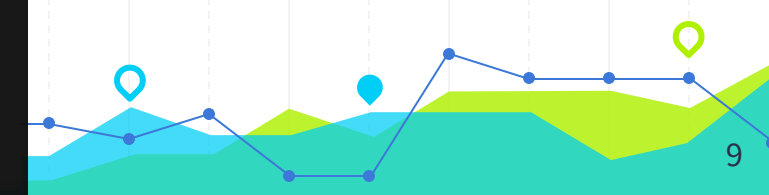

```
Checking Schema
1:22
apogee_w_m2: 0.25
batt_mv: 1
humidity_centi_pct: 1
node_addr: 1
panel_mv: 1
press_pa: 1
schema: 1
temp_c: 1
time_received: 2017-12-01 16:04:07.005388
uptime_ms: 1
```

```
Checking Schema
2:22
apogee_w_m2: 1.0
batt_mv: 2
humidity_pct: 2
node_addr: 2
panel_mv: 2
press_pa: 131074
schema: 2
temp_cK: 0
time_received: 2017-12-01 16:04:09.708754
uptime_ms: 2
```

```
Checking Schema
62216:22
Not A Valid Packet
```

```
Checking Schema
2:22
apogee_w_m2: 1.0
batt_mv: 2
humidity_pct: 2
node_addr: 2
panel_mv: 2
press_pa: 131074
schema: 2
temp_cK: 0
time_received: 2017-12-01 16:04:14.699961
uptime_ms: 2
```

```
Checking Schema
1:22
apogee_w_m2: 0.25
batt_mv: 1
humidity_centi_pct: 1
node_addr: 1
```

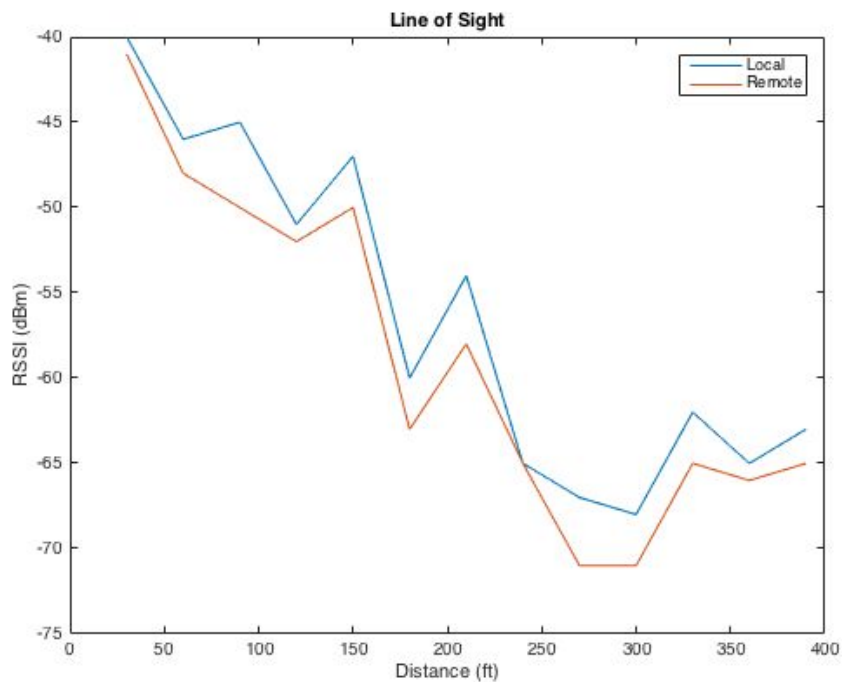




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Range Testing



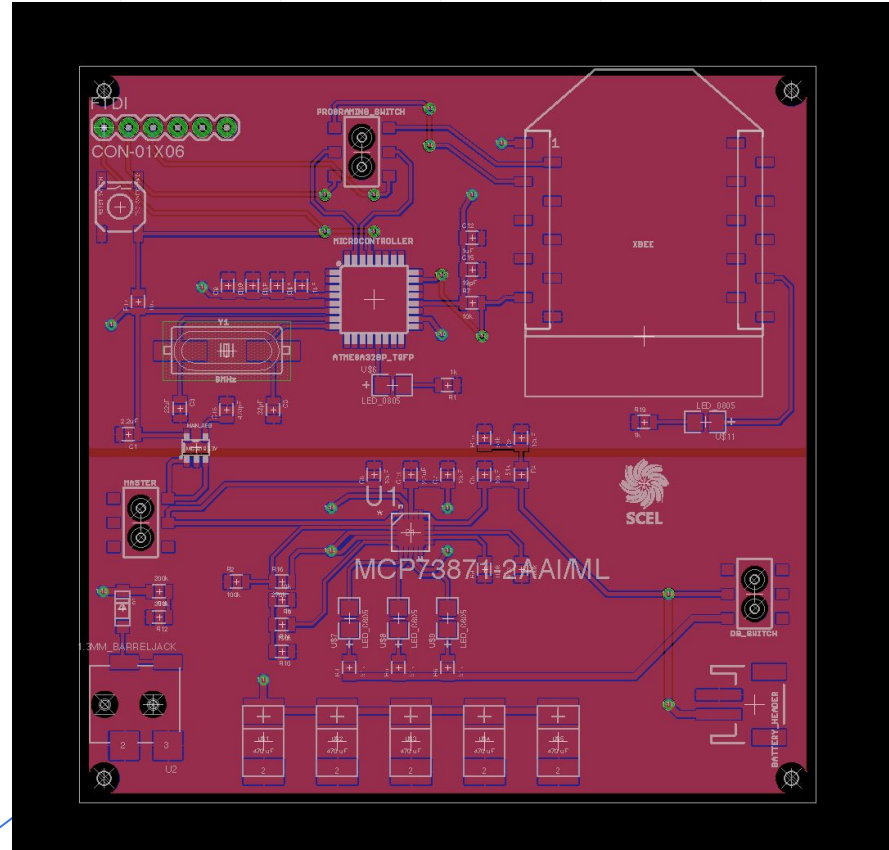


PCB



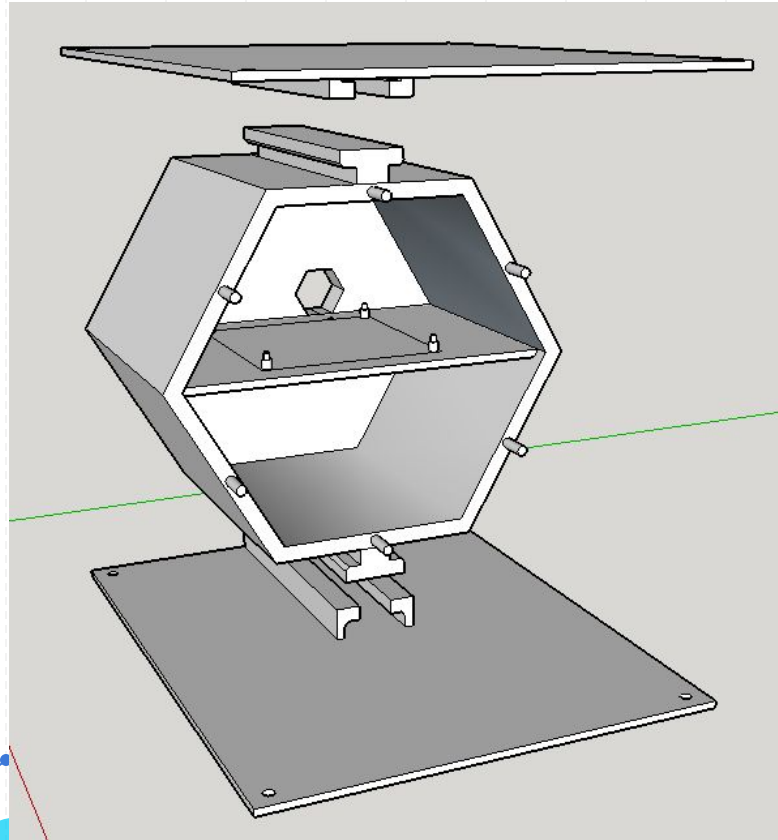
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Housing



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Problems Encountered



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Problems

- Unsteady voltage supplied to Xbee
- Eagle
 - Learning curve
 - Libraries
- Unable to order PCB

Solutions

- Added decoupling capacitors
- Matched parts to Cranberry's architecture



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Power Budget

Bumblebee Power Budget

Part Name	Idle Current (mA)	Typical Current (mA)	Max Current (mA)	Voltage (V)	Avg Power (mW)	Max Power (mW)
XBee Transmit	15.00	205.00	220.00	3.3	484	726
XBee Receive				3.3		
V. Reg 3.3V (Main)		0.35	0.90	3.3	1.375	2.97
Atmega 328P MCU	0.70	1.70	2.70	3.3	5.61	8.91
Total	15.70	207.05	223.60	13.2	490.985	737.88

Battery	Voltage (V)	Current (mAH)	Useable Energy (%)
6600 mAh Li-ion 3.7	3.7	6600	80.0%

Battery	Energy (mWH)	V. Reg Efficiency (%)	Max Power Consumption (mW)	Max (Hrs)	Max w/ V. Reg Efficiency (Hrs)
6600 mAh Li-ion 3.7	19536	80.0%	75.99	257.1	205.67

Run Time (Hrs)	21.18067979
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Bill of Materials

Team Bumblebee's Bill of Materials

Part Name	Part Name/Vendor Number	Package Type	quantity	Unit cost	Total Cost
Xbee Breakout Board	BOB-08276	THRU	1	\$2.95	\$2.95
Microprocessor	ATMEGA328P-PU-ND	THRU	1	\$2.14	\$2.14
Xbee Pro S2B	602-1180-ND	THRU	1	\$29.00	\$29.00
Duck Antenna	730-1005-ND	EXT	1	\$10.50	\$10.50
Solar Panel	1525	EXT	1	\$59.00	\$59.00
Charging Chip	MCP73871-2CCI/ML-ND	SMD	1	\$1.84	\$1.84
Battery	3.7V 6600mAh / 353	EXT	1	\$29.50	\$29.50
LEDS	160-1415-1-ND	SMD	3	\$0.35	\$1.05
8 Mhz clock crystal	887-1263-1-ND	SMD	1	\$0.59	\$0.59
(sliding?) switch	401-2002-2-ND	SMD	1	\$0.26	\$0.26
3.3V regulator	LM1086	SMD	1	\$2.12	\$2.12
Passive Components	Various			\$30.00	\$30.00
				Total Parts Cost	\$138.95



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Final Status

- Enabled bare Arduino to work
 - Able to relay a packet
- Range Tested
 - Line of sight, non line of sight, floors
- Relaying test weatherbox packets to the gateway simulation
- Set design for housing
- PCB ready to order



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Future Work

- More range testing
 - Distance
 - Weather
 - Obstacles (buildings/walls)
- Order PCB and test
- Print Housing
- Weatherbox network



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QUESTIONS?

