Commuter Tracking Sensor Network

Weekly Report - October 19th, 2014

Team Members:

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Project Website:

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Updated Milestone Chart

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
1. Contact Monroe County Discuss deployment options for sensor nodes.	Jared	10/28/2014	10/27/2014	Not a priority until we complete more of the technical requirments.
2. Networking Architecture Configuration and Testing		10/13/2014	6/15/2014	
2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth, Jared	10/16/2014	6/1/2014	Done for now. Some additional configuration changes might need to be updated as more testing is done.
2.2 Range Test	Seth, Jared	10/25/2014	6/9/2014	Waiting for the XBees to be interfaced with the Pi so this can be done easily.
2.3 Small-scale trail deployment	Seth, Jared	10/25/2014	6/15/2014	Dependent on 2.1 and 2.2
3. Windbelt power module design		10/2/2014	6/18/2014	
3.1 Breadboard prototyping	Alex, Jared	10/25/2014	6/1/2014	BQ25504 appears to be working on the breadboard for the Windbelt configuration determined during transient simulation. Tuning to get levels that are more on par with what the simulation predicted. QFN to DIP converters for the secondary

				boost converter and buck converter have been ordered.
3.2 PCB design	Alex	10/25/2014	6/10/2014	Prior to continuing with PCB design, breadboard prototyping should be completed.
3.3 Ship design for stamping	Alex	10/25/2014	6/18/2014	3.2 Must be completed first
3.4 Spice Transient Analysis	Alex, Jared	10/20/2014	9/22/2014	COMPLETE Transient analysis is complete for both the buck and secondary boost converter. Levels are attainable for both the 6-10V unregulated (Pixy) and 3-3.3V regulated (XBee) ranges.
4. Windbelt power module construction and testing		10/22/2014	6/30/2014	
4.1 Solder on components	Alex	11/14/2014	6/29/2014	These got pushed back since they require a 2 week shipment turnaround time. 3.3 Must be completed first.
4.2 Continuity tests	Alex	11/14/2014	6/30/2014	These got pushed back since they require a 2 week shipment turnaournd time. Can be done at same time as 4.1
5. Server/Gateway setup	Seth	10/10/2014	7/1/2014	The server is a Raspberry Pi located at ctsn.student.rit.edu.
5.1 Install software (Django, Apache, etc.)	Seth	6/21/2014	6/17/2014	COMPLETE Apache, Django, MariaDB are installed and ready to go.
5.2 Interface XBee with Pi	Seth	10/22/2014	7/1/2014	In progress. Right now, raw packets are able to be sent between the XBees, but these packets must be parsed so the message can be received. This was unforseen, and therefore the day was pushed back

5.3 Install and configure fail2ban	Seth	9/1/2014	6/21/2014	COMPLETE
6. Server/Gateway testing		10/12/2014	7/1/2014	COMPLETE
6.1 Disable root login test	Seth	6/21/2014	6/16/2014	COMPLETE Done automatically when Raspbian was updated
6.2 Set the SSH port to a non-standard port test	Seth	6/21/2014	6/17/2014	COMPLETE SSH Port is set to 1315, not the default port of 22
6.3 Disable password login test - must log in with SSH key	Alex, Jared, Seth	9/5/2014	6/21/2014	COMPLETE SSH Keys are required to login to the server via SSH
6.4 White Hat Hacker Test	Seth	10/12/2014	6/21/2014	COMPLETE. They could not access the server via ssh, get a root shell, or access the database directly. Jared (security major) will be providing a formal report of the pen test results. We will be able to fortify security based on the results
6.5 Ping disabled test	Seth, Security Majors	10/31/2014	6/21/2014	DEFERRED While the server is on the RIT campus, this is completed since outsiders can not ping rit.edu If the server moves of campus for whatever reason, this will need to be revisited
7. Sensor hardware testing and integration		10/31/2014	7/11/2014	
7.1 Begin playing with Pixy Cam in USB tethered mode	Jared, Alex, Seth	7/11/2014	5/1/2014	COMPLETE We've all experimented and interfaced with the PixyCam now, and familiarized ourselves with its basic operation.
7.2 Interface Pixy Cam with an XBee	Jared, Alex	10/31/2014	6/22/2014	Antennas are in. Dependent on 2.2

7.3 Integrate with existing power module	Jared, Alex	10/31/2014	7/11/2014	Will be done upon completion of 3.1
8. Sensor Enclosure Design / Testing		10/31/2014	8/7/2014	
8.1 Use CAD tools to design sensor enclosure	Jared	10/24/2014	7/1/2014	This is no longer blocked. This process can continue taking into account the largest board size available through the evaluation version of EAGLE.
8.2 Use 3D printer to print the enclosures	Jared	10/29/2014	7/15/2014	8.1 Must be done first
8.3 Test (See Gantt Chart)	Jared	10/31/2014	8/7/2014	Dependent on 8.2
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Once BQ25504 device is working as predicted in simulation, it will be connected to the windbelt and tested outdoors. The same will be done for the secondary boost and buck converters.
10. Sensor Software - Identify targets		10/24/2014	9/1/2014	
10.1 Code Review for Pixy Software	Alex, Seth, Jared	9/8/2014	9/8/2014	COMPLETE Code review was completed. Information was documented regarding each file's contents.
10.2 Compile GCC version of Pixy software and note differences			9/8/2014	No longer a requirement. Keil will work just fine.
10.3 Train camera for identifying walkers, bikers, and horses	Jared	10/31/2014	8/1/2014	Jared has been playing with various algorithms on his computer at home with a webcam. The code location in the Pixy cam firmware

				where to inject the algorithm has been located.
10.4 Train camera to figure out what direction the target is going	Jared	10/31/2014	9/1/2014	10.3 and 10.4 are not dependent on one another. These two tasks should be completed in parallel.
11. Database Creation		9/23/2014	9/14/2014	
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	10/31/2014	9/5/2014	The rest of this can be completed in parallel with the CV algorihms. Need to know what data needs to be saved to the database resultant of the CV algorithms.
12. Website Creation		9/26/2014	9/28/2014	Front end is complete, but there may need to be some work done on the backend down-the-road when nodes need to send data to the database
12.1 Create status webpage, hosted somewhere else	Seth	9/5/2014	9/5/2014	COMPLETE Status webpage that pings the gateway is functional. Its currently hosted on one of Seth's pis, located at http://people.rit.edu/~srh7240/ctsn_status .
12.2 Create web front end	Seth, Alex	10/31/2014	9/14/2014	Front end is COMPLETE. Data results from the CV algorithms mus be identified and linked to the database to render on the webpage.
12.3 Link website to database	Seth	10/31/2014	9/21/2014	Done for now. There will need to be some work done once the nodes need to save data to the database.
13. Website Testing (See Gantt Chart)	Team	10/12/2014	10/4/2014	COMPLETE. Jared (security major) will be providing a formal report of the pen test results. We will be able to

				fortify security based on the results
14. Target Data Communication		10/28/2014	10/5/2014	
14.1 Sensors communicate target data with each other	Seth, Alex		10/4/2014	Dependent on 7.2
14.2 Sensors can communicate and write target data to database	Seth	11/7/2014	10/5/2014	Dependent on 7.2
15. Computer Vision Testing (See Gantt Chart)	Alex, Seth	11/1/2014	10/28/2014	Dependent on 10.3 and 10.4
16. Deployment		11/17/2014	11/9/2014	
16.1 Deploy nodes on trail	Team	11/17/2014	11/5/2014	
16.2 Activate website	Team	9/27/2014	11/9/2014	Complete. Website is located at http://ctsn.student.rit.edu:1415 (login required)
17.Integration Testing		11/13/2014		
17.1 Advanced II integration testing with focus on single node in controlled environment	Team	11/5/2014		
17.2 Advanced II integration testing with focus on single node in an outdoor environment	Team	11/10/2014		
17.3 Advanced II testing with focus on operation in outdoor	Team	11/13/2014		

environment for multiple nodes				

Current Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth, Jared	10/16/2014	6/1/2014	Done for now. Some additional configuration changes might need to be updated as more testing is done.
3.1 Breadboard prototyping	Alex, Jared	10/25/2014	6/1/2014	BQ25504 appears to be working on the breadboard for the Windbelt configuration determined during transient simulation. Tuning to get levels that are more on par with what the simulation predicted. QFN to DIP converters for the secondary boost converter and buck converter have been ordered.
3.2 PCB design	Alex	10/25/2014	6/10/2014	Prior to continuing with PCB design, breadboard prototyping should be completed.
3.4 Spice Transient Analysis	Alex, Jared	10/20/2014	9/22/2014	COMPLETE Transient analysis is complete for both the buck and secondary boost converter. Levels are attainable for both the 6-10V unregulated (Pixy)

				and 3-3.3V regulated (XBee) ranges.
5.2 Interface XBee with Pi	Seth	10/22/2014	7/1/2014	In progress. Right now, raw packets are able to be sent between the XBees, but these packets must be parsed so the message can be received. This was unforseen, and therefore the day was pushed back.
10.3 Train camera for identifying walkers, bikers, and horses	Jared	10/31/2014	8/1/2014	Jared has been playing with various algorithms on his computer at home with a webcam. The code location in the Pixy cam firmware where to inject the algorithm has been located.
10.4 Train camera to figure out what direction the targe is going	Jared	10/31/2014	9/1/2014	10.3 and 10.4 are not dependent on one another. These two tasks should be completed in parallel.

Next Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
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2.2 Range Test	Seth, Jared	10/25/2014	6/9/2014	Waiting for the XBees to be interfaced with the Pi so this can be done easily.
2.3 Small-scale trail deployment	Seth, Jared	10/25/2014	6/15/2014	Dependent on 2.1 and 2.2
3.1 Breadboard prototyping	Alex, Jared	10/25/2014	6/1/2014	BQ25504 appears to be working on the breadboard for the Windbelt configuration determined during transient simulation. Tuning to get levels that are more on par with what the simulation predicted. QFN to DIP converters for the secondary boost converter and buck converter have been ordered.
3.2 PCB design	Alex	10/25/2014	6/10/2014	Prior to continuing with PCB design, breadboard prototyping should be completed.
5.2 Interface XBee with Pi	Seth	10/22/2014	7/1/2014	In progress. Right now, raw packets are able to

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9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Once BQ25504 device is working as predicted in simulation, it will be connected to the windbelt and tested outdoors. The same will be done for the secondary boost and buck converters.
10.3 Train camera for identifying walkers, bikers, and horses	Jared	10/31/2014	8/1/2014	Jared has been playing with various algorithms on his computer at home with a webcam. The code location in the Pixy cam firmware where to inject the algorithm has been located.
10.4 Train camera to figure out what direction the target is going	Jared	10/31/2014	9/1/2014	10.3 and 10.4 are not dependent on one another. These two tasks should be completed in parallel.

Status

Difficulties

The boost converter is giving higher than expected values at the VBAT pin. The theory is that ground levels are unbalanced across the chip. Further research has shown that one of the ground pins actually should be taking signal ground as opposed to general ground. Making this change should allow us to see behavior comparable to that in the simulations.

Surprises

The XBees are a bit more difficult to work with than originally thought. In order to use them, the characters that are sent over uart need to be in a packet from. Our code not only needs to put messages into this form, but also needs to parse the packets to get the actual message. Things get more difficult since the Pi's Uart only receives 8 characters at a time. Luckily, code has been written for the parsing. It acts like a state machine. Now the code just needs to be plugged into what already exists.

For a bit, the XBee was not able to send or receive characters over Uart when connected to the Pi, but an XBee with almost the same configuration was able to when connected via USB to a computer. The problem was the XBee's ground and the Pi's ground were completely different, by about 300 mV. After connecting the two grounds, everything finally worked.

Successes

We were able to get the XBees communicating with each other over a small range in lab. However, as mentioned, parsing of the sent packets needs to be done, which has been started, but is not complete yet.

The boost converter soldering went well. There are no shorts across the chip.

Gantt Chart

	Name	% Complete	Finish
1	**Commuter Tracking Sensor Network Project**	**60%**	**11/20/2014**
2	**Contact Monroe County**	**0%**	**10/28/2014**
3	Discuss deployment options for sensor nodes	0%	10/28/2014
4	**Networking Architecture Configuration and Testing**	**60%**	**10/24/2014**
5	Configure XBees for DigiMesh and have them communicati	100%	10/16/2014
6	Range Test	0%	10/24/2014
7	Small-scale trail deployment	0%	10/24/2014
8	**Windlbelt power module design**	**78%**	**10/28/2014**
9	Breadboard prototyping	40%	10/24/2014
10	PCB design	50%	10/28/2014
11	Ship design for stamping	72%	10/28/2014
12	Spice Transient Analysis	100%	10/20/2014
13	**Windbelt power module construction and testing**	**0%**	**11/14/2014**
14	Solder on components	0%	11/14/2014
15	Continuity tests	0%	11/14/2014
16	**Server/Gateway setup**	**80%**	**10/22/2014**
17	Install software (Django, Apache, etc.)	100%	06/17/2014
18	Interface XBee with Pi	60%	10/22/2014
19	Install and configure fail2ban	100%	09/01/2014
20	**Server/Gateway testing**	**100%**	**10/31/2014**
21	Disable root login test	100%	06/16/2014
22	Set the SSH port to a non-standard port test	100%	06/17/2014
23	Disable password login test - must login with SHH key	100%	06/18/2014
24	Ping disabled test - looking into other options	100%	10/31/2014
25	White Hat Hacker Test	100%	10/13/2014
26	**Sensor Hardware testing and integration**	**27%**	**10/31/2014**
27	Begin playing with Pixy cam in USB tethered mode	100%	09/15/2014
28	Interface Pixy Cam with an XBee	20%	10/31/2014
29	Integrate with existing power module	5%	10/31/2014
30	**Sensor Enclosure Design / Testing**	**56%**	**11/05/2014**
31	Use cad tools to design sensor enclosure	75%	10/24/2014
32	Use 3D printer to etch out enclosure	0%	10/29/2014
33	Temperature test	0%	10/30/2014
34	Rain Test	0%	10/31/2014
35	Execute drop test	0%	11/03/2014
36	Fire test	0%	11/05/2014
37	**Windbelt Testing**	**61%**	**11/07/2014**
38	Early testing with focus on size	100%	09/05/2014
39	Early testing with focus on maximizing current production for	100%	09/08/2014
40	Early testing with focus on maxmizing current production for	100%	09/09/2014
41	Intermediate I testing with focus on smoothing levels for a h	100%	09/24/2014
42	Intermediate II testing with focus on providing safe levels at	50%	10/27/2014
43	Intermediate II testing with focus on battery discharge time c	50%	10/28/2014
44	Intermediate II testing with focus on safe output levels from	0%	10/29/2014
45	Intermediate II testing with focus on providing safe voltage l	0%	10/30/2014
46	Advanced I testing with focus on duration and level of charg	0%	10/31/2014
47	Advanced I testing with MPPT enabled for a solar energy ap	0%	11/03/2014
48	Advanced I testing with boost converter configured for MPPT	0%	11/05/2014
49	Advanced II testing with focus on configuring the boost conv	0%	11/07/2014
50	**Integration Testing**	**0%**	**11/18/2014**
51	Advanced II integration testing with focus on single node in	0%	11/10/2014
52	Advanced II integration testing with focus on deploying a sin	0%	11/13/2014
53	Advanced II testing with focus on operation in outdoor envirc	0%	11/18/2014
54	**Sensor Software - Identify Targets**	**28%**	**10/31/2014**
55	Code review for Pixy software	100%	09/08/2014
56	Train camera for identifying walkers, bikers, and horses	10%	10/31/2014
57	Train camera to figure out what direction the target is going	10%	10/31/2014
58	**Database Creation**	**90%**	**10/31/2014**
59	Create mysql or mariadb database so data from trail can be	90%	10/31/2014
60	**Website Creation**	**100%**	**10/31/2014**
61	Create front end	100%	10/31/2014
62	Link to database	100%	10/31/2014
63	Create status webpage, hosted somewhere else	100%	09/05/2014
64	**Website Testing**	**100%**	**11/04/2014**
65	Sanitation Test	100%	11/04/2014
66	Password Protection Test	100%	11/04/2014
67	User Login Test	100%	11/04/2014
68	White-hat hacker test	100%	11/04/2014
69	**Target Data Communication**	**0%**	**11/07/2014**
70	Sensors communciate target data with each other	0%	11/07/2014
71	Sensors can communicate and write data to database	0%	11/07/2014
72	**Computer Vision Testing**	**0%**	**11/12/2014**
73	Early - Image Sensor Component Testing	0%	11/03/2014
74	Early - Image Sensor Component Testing	0%	11/03/2014
75	Intermediate - Infrared Component Testing	0%	11/04/2014
76	Intermediate - CV Algorithm Component Testing	0%	11/04/2014
77	Intermediate - CV Algorithm Component Testing	0%	11/05/2014
78	Advanced- CV Algorithm Component Testing	0%	11/06/2014
79	Advanced - CV Algorithm and Infrared Integration Testing	0%	11/07/2014
80	Advanced - Computer Vision and Networking System Integr	0%	11/10/2014
81	Advanced - Computer Vision and Power Management Syste	0%	11/11/2014
82	Advanced - Computer Vision Acceptance Testing	0%	11/12/2014
83	**Deployment**	**33%**	**11/20/2014**
84	Deploy Nodes	0%	11/20/2014
85	Activate Website	100%	11/03/2014