Commuter Tracking Sensor Network

Weekly Report - November 2, 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	11/11/2014	10/27/2014	Pushed it back to deployment approach time.
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	11/4/2014	6/9/2014	Tried it again this past week on RIT's campus. However, the range is not far enough, but there may have been interference. A reattempt needed to be pushed back due to rain on Friday and Saturday. Will try again this coming week.
2.3 Small-scale trail deployment	Seth, Jared	11/8/2014	6/15/2014	Dependent on 2.1 and 2.2 and 5.2
3. Windbelt power module design		10/2/2014	6/18/2014	

3.1 Breadboard prototyping	Alex, Jared	11/8/2014	6/1/2014	TI Registration has been accepted, and EVM for step-down converter has been ordered. Also, transient analysis for the Secondary Boost converter has been cleared up. Results are now acceptable, and confirmation request sent to area TI representative that the TPS device will provide the correct output current. Also, there is some question as to how low the inducto value can go on the top-hatch of the boost converter. Will order EVM for boost converter once confirmation is received. Also, once step-down EVM comes in, prototyping will begin for that portion of the circuit.
3.2 PCB design	Alex	11/5/2014	6/10/2014	BQ device is being implemented in EAGLE. Discussed pins from XBee and PIXY that need to be routed through the custom PCB. Made the decision to keep data off of the PCB and keep it to just power signals on the board. Any data will be routed directly between the PIXY and the XBee. A breadboard or other interface will be used to mount the XBee to the enclosure and wires will be used to connect the two. The PIXY can be mounted right to the enclosure itself.
3.3 Ship design for stamping	Alex	11/5/2014	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 per transient simulations produced by TI's WEBDESIGN application.
4. Windbelt power module construction and testing		10/22/2014	6/30/2014	
4.1 Solder on components	Alex	11/21/2014	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	11/24/2014	6/30/2014	These got pushed back since they require a 2 week shipment turnaournd time. Will probably need just the weekend to test this.
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	10/31/2014	7/1/2014	COMPLETE Are able to Tx and Rx with the XBees between two pis.
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	Seth	11/14/2014	6/22/2014	Now that the "algorithm" is figured out after doing 5.2, this shouldn't take too long to plug into the Pixy Cam's firmware
7.3 Integrate with existing power module	Jared, Alex	11/12/2014	7/11/2014	Will be done upon completion of 3.1. Pushed back due to power module dependency, and

				implementation issues/ordering wait time for power modules.
8. Sensor Enclosure Design / Testing		11/14/2014	8/7/2014	
8.1 Use CAD tools to design sensor enclosure	Jared	11/14/2014	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. Jared currently working on CV, which is a higher priority task.
8.2 Use 3D printer to print the enclosures	Jared	11/14/2014	7/15/2014	8.1 Must be done first
8.3 Test (See Gantt Chart)	Jared	11/14/2014	8/7/2014	Dependent on 8.2
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Scheduled to be completed this week. Plan on connecting battery to BQ prototype and testing with the Windbelt as the input.
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	11/14/2014	8/1/2014	Found a Library that will take care of the algorithms for us. Now its a matter of plugging it into the Pixy Cam Firmware.

10.4 Train camera to figure out what direction the target is going	Jared	11/14/2014	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	11/5/2014	9/5/2014	Pushed back since energy was focused on getting the XBees working. Only have a few more tables to create.
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 must be identified and linked to the database to render on the webpage.
12.3 Link website to database	Seth	11/5/2014	9/21/2014	Pushed back since energy was focused on getting the XBees working. A few more tables will need to be created and linked with 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		11/21/2014	10/5/2014	
14.1 Sensors communicate target data with each other	Seth, Alex	11/21/2014	10/4/2014	Dependent on 7.2
14.2 Sensors can communicate and write target data to database	Seth	11/21/2014	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	11/10/2014		Some of the integration testing will need to be completed with the prototype in place due to time constraints. Date adjusted due to change in prototyping timeframe.
17.2 Advanced II integration testing with focus on single node in an outdoor environment	Team	11/12/2014		Some of the integration testing will need to be completed with the prototype in place due to time constraints. Date adjusted due to change in prototyping timeframe.
17.3 Advanced II testing with focus on operation in outdoor	Team	11/14/2014		Some of the integration testing will need to be completed with the prototype in place due to time

environment for multiple nodes				constraints. Date adjusted due to change in prototyping timeframe.

Current Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
2.2 Range Test	Seth, Jared	11/4/2014	6/9/2014	Tried it again this past week on RIT's campus. However, the range is not far enough, but there may have been interference. A reattempt needed to be pushed back due to rain on Friday and Saturday. Will try again this coming week.
2.3 Small-scale trail deployment	Seth, Jared	11/8/2014	6/15/2014	Dependent on 2.1 and 2.2 and 5.2
3.1 Breadboard prototyping	Alex, Jared	11/8/2014	6/1/2014	TI Registration has been accepted, and EVM for step-down converter has been ordered. Also, transient analysis for the Secondary Boost converter has been cleared up. Results are now acceptable, and confirmation request sent to area TI representative that the TPS device will provide the correct output current. Also, there is some question as to how low the inductor value can

				go on the top-hatch of the boost converter. Will order EVM for boost converter once confirmation is received. Also, once step-down EVM comes in, prototyping will begin for that portion of the circuit.
3.2 PCB design	Alex	11/5/2014	6/10/2014	BQ device is being implemented in EAGLE. Discussed pins from XBee and PIXY that need to be routed through the custom PCB. Made the decision to keep data off of the PCB and keep it to just power signals on the board. Any data will be routed directly between the PIXY and the XBee. A breadboard or other interface will be used to mount the XBee to the enclosure and wires will be used to connect the two. The PIXY can be mounted right to the enclosure itself.
5.2 Interface XBee with Pi	Seth	10/31/2014	7/1/2014	COMPLETE Are able to Tx and Rx with the XBees between two pis.
10.3 Train camera for identifying walkers, bikers, and horses	Jared	11/14/2014	8/1/2014	Found a Library that will take care of the algorithms for us. Now its a matter of plugging it into the Pixy Cam Firmware.

10.4 Train camera to figure out what direction the target is going	Jared	11/14/2014	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
2.2 Range Test	Seth, Jared	11/4/2014	6/9/2014	Tried it again this past week on RIT's campus. However, the range is not far enough, but there may have been interference. A reattempt needed to be pushed back due to rain on Friday and Saturday. Will try again this coming week.
2.3 Small-scale trail deployment	Seth, Jared	11/8/2014	6/15/2014	Dependent on 2.1 and 2.2 and 5.2
3.1 Breadboard prototyping	Alex, Jared	11/8/2014	6/1/2014	TI Registration has been accepted, and EVM for step-down converter has been ordered. Also, transient analysis for the Secondary Boost converter has been cleared up. Results are now acceptable, and confirmation request sent to area TI representative that the TPS device will provide the correct output current. Also, there is some question as to how low the inductor value can go on the top-hatch of the boost converter. Will order EVM for boost converter once confirmation is

				received. Also, once step-down EVM comes in, prototyping will begin for that portion of the circuit.
3.2 PCB design	Alex	11/5/2014	6/10/2014	BQ device is being implemented in EAGLE. Discussed pins from XBee and PIXY that need to be routed through the custom PCB. Made the decision to keep data off of the PCB and keep it to just power signals on the board. Any data will be routed directly between the PIXY and the XBee. A breadboard or other interface will be used to mount the XBee to the enclosure and wires will be used to connect the two. The PIXY can be mounted right to the enclosure itself
3.3 Ship design for stamping	Alex	11/5/2014	6/18/2014	3.2 Must be completed first
7.2 Interface Pixy Cam with an XBee	Seth	11/14/2014	6/22/2014	Now that the "algorithm" is figured out after doing 5.2, this shouldn't take too long to plug into the Pixy Cam's firmware
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Scheduled to be completed this week. Plan on connecting battery to BQ prototype and testing with the Windbelt as the input.

10.3 Train camera for identifying walkers, bikers, and horses	Jared	11/14/2014	8/1/2014	Found a Library that will take care of the algorithms for us. Now its a matter of plugging it into the Pixy Cam Firmware.
10.4 Train camera to figure out what direction the target is going	Jared	11/14/2014	9/1/2014	10.3 and 10.4 are not dependent on one another These two tasks should be completed in parallel.
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	11/5/2014	9/5/2014	Pushed back since energy was focused on getting the XBees working. Only have a few more tables to create.
12.3 Link website to database	Seth	11/5/2014	9/21/2014	Pushed back since energy was focused on getting the XBees working. A few more tables will need to be created and linked with the database.

Status

Difficulties

To debug the CV algorithms, we need to send the video over usb to the PixyCam's desktop software. This involves using an algorithm called chirp, and it is very difficult to figure out.

Surprises

When sending an XBee packet, some characters need to be escaped. Bytes two and three of the packet represent the length of the packet. Escaped characters, surprisingly, did not get added to the length of the packet, or get applied to the checksum.

Successes

Can now transmit and receive messages with the XBees from a Raspberry Pi (and a linux-enabled desktop if needed) with escape characters turned on. Onwards to the Pixy Cam!

EAGLE PCB design progress is going well. Research for schematic, layout, GERBER and Excellon file creation has been successful. Currently applying new research to BQ25504 design.

We have figured out which files to use to interface with our CV algorithm on the PIXY. Jared has continued with implementation of the SIFT algorithm.

Open Questions and Concerns

There has been some concern about the Secondary Boost converter providing enough output current to the PIXY. This has been addressed, and confirmation has been requested through our local TI rep. It seems that in order to get our needed 150mA load current, the inductor value needs to be changed from 4.7uH to about 1.5uH. There is some question as to what effect this change will have on the output.

Gantt Chart

	Name	% Complete	Finish
1	**⊟Commuter Tracking Sensor Network Project**	**64%**	**12/02/2014**
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**	**56%**	**11/07/2014**
5	Configure XBees for DigiMesh and have them communicatir	100%	10/16/2014
6	Range Test	50%	11/04/2014
7	Small-scale trail deployment	0%	11/07/2014
8	**⊟Windlbelt power module design**	**74%**	**11/07/2014**
9	Breadboard prototyping	70%	11/07/2014
10	PCB design	50%	11/05/2014
11	Ship design for stamping	20%	11/05/2014
12	Spice Transient Analysis	100%	10/20/2014
13	**⊟Windbelt power module construction and testing**	**0%**	**11/24/2014**
14	Solder on components	0%	11/21/2014
15	Continuity tests	0%	11/24/2014
16	**⊟Server/Gateway setup**	**100%**	**10/31/2014**
17	Install software (Django, Apache, etc.)	100%	06/17/2014
18	Interface XBee with Pi	100%	10/31/2014
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**	**21%**	**11/14/2014**
27	Begin playing with Pixy cam in USB tethered mode	100%	09/15/2014
28	Interface Pixy Cam with an XBee	20%	11/13/2014
29	Integrate with existing power module	3%	11/14/2014
30	**⊟Sensor Enclosure Design / Testing**	**60%**	**11/19/2014**
31	Use cad tools to design sensor enclosure	75%	11/12/2014
32	Use 3D printer to etch out enclosure	0%	11/13/2014
33	Temperature test	0%	11/14/2014
34	Rain Test	0%	11/17/2014
35	Execute drop test	0%	11/18/2014
36	Fire test	0%	11/19/2014
37	**⊟Windbelt Testing**	**69%**	**11/19/2014**
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 hε	100%	09/24/2014
42	Intermediate II testing with focus on providing safe levels at t	100%	11/10/2014
43	Intermediate II testing with focus on battery discharge time a	50%	11/11/2014
44	Intermediate II testing with focus on safe output levels from v	0%	11/12/2014
45	Intermediate II testing with focus on providing safe voltage le	0%	11/13/2014
46	Advanced I testing with focus on duration and level of charge	0%	11/14/2014
47	Advanced I testing with MPPT enabled for a solar energy app	0%	11/17/2014
48	Advanced I testing with boost converter configured for MPPT '	0%	11/18/2014
49	Advanced II testing with focus on configuring the boost conve	0%	11/19/2014
50	**⊟Integration Testing**	**0%**	**11/28/2014**
51	Advanced II integration testing with focus on single node in c	0%	11/20/2014
52	Advanced II integration testing with focus on deploying a sin(	0%	11/25/2014
53	Advanced II testing with focus on operation in outdoor enviro	0%	11/28/2014
54	**⊟Sensor Software - Identify Targets**	**52%**	**11/14/2014**
55	Code review for Pixy software	100%	09/08/2014
56	Train camera for identifying walkers, bikers, and horses	40%	11/14/2014
57	Train camera to figure out what direction the target is going	40%	11/14/2014
58	**⊟Database Creation**	**90%**	**11/05/2014**
59	Create mysql or mariadb database so data from trail can be	90%	11/05/2014
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%**	**11/21/2014**
70	Sensors communciate target data with each other	0%	11/21/2014
71	Sensors can communicate and write data to database	0%	11/21/2014
72	**⊟Computer Vision Testing**	**0%**	**11/26/2014**
73	Early - Image Sensor Component Testing	0%	11/17/2014
74	Early - Image Sensor Component Testing	0%	11/17/2014
75	Intermediate - Infrared Component Testing	0%	11/18/2014
76	Intermediate - CV Algorithm Component Testing	0%	11/18/2014
77	Intermediate - CV Algorithm Component Testing	0%	11/19/2014
78	Advanced- CV Algorithm Component Testing	0%	11/20/2014
79	Advanced - CV Algorithm and Infrared Integration Testing	0%	11/21/2014
80	Advanced - Computer Vision and Networking System Integra	0%	11/24/2014
81	Advanced - Computer Vision and Power Management Syster	0%	11/25/2014
82	Advanced - Computer Vision Acceptance Testing	0%	11/26/2014
83	**⊟Deployment**	**33%**	**12/02/2014**
84	Deploy Nodes	0%	12/02/2014
85	Activate Website	100%	11/03/2014