Commuter Tracking Sensor Network

Weekly Report - September 21st, 2014

Team Members:

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***Other Collaborators*:**

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Project Website:

Navigate to Google Drive Share

Updated Milestone Chart

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
5.1 Install software (Django, Apache, etc.)	Seth	6/21/2014	6/17/2014	**COMPLETE** Apache, Django, MariaDB are installed and ready to go.
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
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.
5.3 Install and configure fail2ban	Seth	9/1/2014	6/21/2014	**COMPLETE**
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
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 .
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.
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	9/23/2014	9/5/2014	The database has been expanded to have the tables needed for Django and a user table that holds email and phone numbers so admins can be notified if something bad occurs. The node table will be expanded early this coming week to hold each trail node's status and location.
12.3 Link website to database	Seth	9/23/2014	9/21/2014	Database tables needed for DJano user authentication have been created and linked to the website. Database tables needed for the nodes will be done in the next couple days.
3.4 Spice Transient Analysis	Alex, Jared	9/24/2014	9/22/2014	Using TI Boost Converter model to simulate while attached to windbelt sin source and half-wave rectifier. Simulations for 200 ohms, 10k ohms and no load are complete. Continuing with Monte Carlo analysis, 10% tolerance on RL. Once complete, add full-wave rectifier and test again to see change in output voltage. Currently getting 3.1V out of the

				boost converter. If full-wave doesn't work then attempt to increase gain on boost converter. Once output is decent, tune OV, UV and MPPT. TI provides spreadsheet to assist with this.
12. Website Creation		9/26/2014	9/28/2014	
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Admin panel is up and running. Admins can add and remove users.
16.2 Activate website	Team	9/29/2014	11/9/2014	Admin panel is live, but the actual site needs to be done still.
13. Website Testing (See Gantt Chart)	Team	9/30/2014	10/4/2014	
3.1 Breadboard prototyping	Alex, Jared	10/1/2014	6/1/2014	**BLOCKED** Voltage is adequate for boost converter at 2.2 VDC average. Attempting to increase Vout by using full-wave rectifier instead of half. We should see gains in power efficiency by about 30% theoretically. Breadboard prototyping is on hold until simulations of Boost Converter are complete in OrCad in order to determine the optimal resistor and capacitor values for the RC filter. Purchase of a QFN to DIP converter will allow us to prototype the boost converter on the breadboard as well. Pushing back due date to allow

				for this. Next step is to solder the boost converter to the DIP board and test it for continuity.
6.4 White Hat Hacker Test	Seth	10/1/2014	6/21/2014	**DEFERRED** Date has been pushed back to after the website is completed to allow attackers to attempt exploitation of the completed server. Found volunteers to pen test the server.
3. Windbelt power module design		10/2/2014	6/18/2014	
3.2 PCB design	Alex	10/6/2014	6/10/2014	**BLOCKED** Pushed back to take advantage of slack time prior to start of enclosure task on the 19th. PCB Design is on hold until necessary output current levels are determined for the BQ25504 boost converter. This will require further analysis of datasheets and/or meeting with a resource in the department.
5. Server/Gateway setup	Seth	10/6/2014	7/1/2014	The server is a Raspberry Pi located at ctsn.student.rit.edu.
5.2 Interface XBee with Pi	Seth	10/6/2014	7/1/2014	Ordering new antennas for the XBees as the parts ordered have proprietary connectors.
6. Server/Gateway testing		10/6/2014	7/1/2014	Continuing this when the website is complete.
2.1 Configure XBees for DigiMesh and have them	Seth, Jared	10/7/2014	6/1/2014	

communicating in close proximity				
2.2 Range Test	Seth, Jared	10/9/2014	6/9/2014	
8.1 Use CAD tools to design sensor enclosure	Jared	10/10/2014	7/1/2014	**DEFERRED** Date was changed due to breadboard protyping, transient analysis, and Eagle design taking longer than expected. Everything that is not dependent on the size of the custom PCB is complete. Awaiting dimensions to continue.
7.2 Interface Pixy Cam with an XBee	Jared, Alex	10/10/2014	6/22/2014	
2. Networking Architecture Configuration and Testing		10/13/2014	6/15/2014	Soldered the xbee usb programmer and downloaded the program that will help program the XBees
2.3 Small-scale trail deployment	Seth, Jared	10/13/2014	6/15/2014	
14.1 Sensors communicate target data with each other	Seth, Alex	10/14/2014	10/4/2014	
10.3 Train camera for identifying walkers, bikers, and horses	Seth	10/15/2014	8/1/2014	Algorithms researched and added to project database. Continuing research. Jared will be moving to assist with hardware, and Seth will continue with this after finishing the website (hence the date change).

8.2 Use 3D printer to print the enclosures	Jared	10/15/2014	7/15/2014	8.1 Must be done first
3.3 Ship design for stamping	Alex	10/17/2014	6/18/2014	3.2 Must be completed first
4.1 Solder on components	Alex	10/20/2014	6/29/2014	3.3 Must be completed first
4. Windbelt power module construction and testing		10/22/2014	6/30/2014	
4.2 Continuity tests	Alex	10/22/2014	6/30/2014	4.1 Must be completed first
8. Sensor Enclosure Design / Testing		10/22/2014	8/7/2014	
8.3 Test (See Gantt Chart)	Jared	10/22/2014	8/7/2014	Dependent on 8.2
10. Sensor Software - Identify targets		10/24/2014	9/1/2014	
10.4 Train camera to figure out what direction the target is going	Jared	10/24/2014	9/1/2014	10.3 Must be done first
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.
14. Target Data Communication		10/28/2014	10/5/2014	

14.2 Sensors can communicate and write target data to database	Seth	10/28/2014	10/5/2014	
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
10.2 Compile GCC version of Pixy software and note differences	Seth	10/31/2014	9/8/2014	**DEFERRED** According to the pixy cam developers, GCC version is not ready to use yet. That's fine though, we can use Keil instead.
7. Sensor hardware testing and integration		10/31/2014	7/11/2014	
7.3 Integrate with existing power module	Jared, Alex	10/31/2014	7/11/2014	Will be done upon completion of the power module.
15. Computer Vision Testing (See Gantt Chart)	Alex, Seth	11/1/2014	10/28/2014	
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	BLOCKED Awaiting completion of transient analysis and breadboard prototyping to continue testing with focus on smoothing levels for a half-wave and full-wave rectifier with the boost converter QFN to DIP package installed.

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.Integration Testing		11/13/2014		
17.3 Advanced II testing with focus on operation in outdoor environment for multiple nodes	Team	11/13/2014		
16. Deployment		11/17/2014	11/9/2014	
16.1 Deploy nodes on trail	Team	11/17/2014	11/5/2014	

Current Milestones

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3.1 Breadboard prototyping	Alex, Jared	10/1/2014	6/1/2014	BLOCKED Voltage is adequate for boost converter at 2.2 VDC average. Attempting to increase Vout by using full-wave rectifier instead of half. We should see gains in power efficiency by about 30% theoretically. Breadboard prototyping is on hold until simulations of Boost Converter are complete in OrCad in order to determine the optimal resistor and capacitor values for the RC filter. Purchase of a QFN to DIP converter will allow us to prototype the boost converter on the breadboard as well. Pushing back due date to allow for this. Next step is to solder the boost converter to

				the DIP board and test it for continuity.
3.2 PCB design	Alex	10/6/2014	6/10/2014	BLOCKED Pushed back to take advantage of slack time prior to start of enclosure task on the 19th. PCB Design is on hold until necessary output current levels are determined for the BQ25504 boost converter. This will require further analysis of datasheets and/or meeting with a resource in the department.
10.3 Train camera for identifying walkers, bikers, and horses	Seth	10/15/2014	8/1/2014	Algorithms researched and added to project database. Continuing research. Jared will be moving to assist with hardware, and Seth will continue with this after finishing the website (hence the date change).
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	9/23/2014	9/5/2014	The database has been expanded to have the tables needed for Django and a user table that

				holds email and phone numbers so admins can be notified if something bad occurs. The node table will be expanded early this coming week to hold each trail node's status and location.
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				change in output voltage. Currently getting 3.1V out of the boost converter. If full-wave doesn't work then attempt to increase gain on boost converter. Once output is decent, tune OV, UV and MPPT. TI provides spreadsheet to assist with this.
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Admin panel is up and running. Admins can add and remove users.
2. Networking Architecture Configuration and Testing		10/13/2014	6/15/2014	Soldered the xbee usb programmer and downloaded the program that will help program the XBees

Next Milestones

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3.4 Spice Transient Analysis	Alex, Jared	9/24/2014	9/22/2014	Using TI Boost Converter model to simulate while attached to windbelt sin source

				and half-wave rectifier. Simulations for 200 ohms, 10k ohms and no load are complete. Continuing with Monte Carlo analysis, 10% tolerance on RL. Once complete, add full-wave rectifier and test again to see change in output voltage. Currently getting 3.1V out of the boost converter. If full-wave doesn't work then attempt to increase gain on boost converter. Once output is decent, tune OV, UV and MPPT. TI provides spreadsheet to assist with this.
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Admin panel is up and running. Admins can add and remove users.

Status

Difficulties

Other class assignments have been slowing progress with the project.

No difficulties from the software side of things.

Working on the boost converter configuration has proven to be a more difficult task than anticipated. TI has provided spreadsheets to configure the overvoltage, undervoltage and MPPT resistor configurations, which will speed up the process somewhat.

Surprises

Unit testing is awesome. It has prevented several bugs from escaping and causing problems down the line.

Simulations for the boost converter take 30 minutes on average for a 1.4 second runtime.

The QFN to DIP converters that were ordered for prototyping are ridiculously small, but will serve their purpose well, eliminating dependencies during the Windbelt testing phase on the completed power module circuit board.

Successes

Admin page for the website is up and running at ctsn.student.rit.edu/admin. The database construction is still underway, and should be mostly complete enough early this coming week to get started on implementing the actual front end.

If an error on the network occurs, the gateway process can query the databases for admins phone numbers and emails and notify them via text and/or email with what went wrong.

Spice analysis is going smoothly for a half-wave rectifier configuration going into the boost converter. Output at the boost converter was simulated for different resistor values in the RC filter following the rectifier. This will be repeated for a full-wave rectifier. Currently, output voltage is at 3.1V, which is slightly under the necessary 3.7 volts, so

either the full-wave rectifier will provide more power to the boost converter (expected), or the boost converter will be reconfigured to provide higher gain.

A meeting with Professor Cliver resulted in a heightened understanding of the boost converter component, along with connections to several resources that will be able to assist with the application. Namely, Jeff Lonneville will be able to assist with soldering the bq device to the DIP converter using the tools available in the CE Tech building.

Open Questions & Problems

None this week.

Gantt Chart

	Name	Duration	% Complete	Finish
1	**Commuter Tracking Sensor Network Project**	**114d?**	**42%**	**11/20/2014**
2	**Contact Monroe County**	**7d**	**0%**	**10/28/2014**
3	Discuss deployment options for sensor nodes	7d	0%	10/28/2014
4	**Networking Architecture Configuration and Testin**	**9d**	**0%**	**10/13/2014**
5	Configure XBees for DigiMesh and have them c	5d	0%	10/07/2014
6	Range Test	2d	0%	10/09/2014
7	Small-scale trail deployment	2d	0%	10/13/2014
8	**Windlbelt power module design**	**20d**	**26%**	**10/17/2014**
9	Breadboard prototyping	5d	50%	10/01/2014
10	PCB design	3d	25%	10/06/2014
11	Ship design for stamping	9d	8%	10/17/2014
12	Spice Transient Analysis	3d	40%	09/24/2014
13	**Windbelt power module construction and testing**	**3d**	**0%**	**10/22/2014**
14	Solder on components	1d	0%	10/20/2014
15	Continuity tests	2d	0%	10/22/2014
16	**Server/Gateway setup**	**81d**	**67%**	**10/06/2014**
17	Install software (Django, Apache, etc.)	2d	100%	06/17/2014
18	Interface XBee with Pi	4d	0%	10/06/2014
19	Install and configure fail2ban	6d	100%	09/01/2014
20	**Server/Gateway testing**	**100d**	**35%**	**10/31/2014**
21	Disable root login test	1d	100%	06/16/2014
22	Set the SSH port to a non-standard port test	1d	100%	06/17/2014
23	Disable password login test - must login with Sl	1d	100%	06/18/2014
24	Ping disabled test - looking into other options	5d	50%	10/31/2014
25	White Hat Hacker Test	9d	5%	10/01/2014
26	**Sensor Hardware testing and integration**	**40d**	**13%**	**11/07/2014**
27	Begin playing with Pixy cam in USB tethered mo	1d	100%	09/15/2014
28	Interface Pixy Cam with an XBee	5d	0%	10/20/2014
29	Integrate with existing power module	2d	0%	11/07/2014
30	**Sensor Enclosure Design / Testing**	**28d**	**56%**	**10/22/2014**
31	Use cad tools to design sensor enclosure	20d	75%	10/10/2014
32	Use 3D printer to etch out enclosure	2d	0%	10/15/2014
33	Temperature test	1d	0%	10/16/2014
34	Rain Test	1d	0%	10/17/2014
35	Execute drop test	1d	0%	10/20/2014
36	Fire test	2d	0%	10/22/2014
37	**Windbelt Testing**	**53d**	**52%**	**11/05/2014**
38	Early testing with focus on size	10d	100%	09/05/2014
39	Early testing with focus on maximizing current pı	1d	100%	09/08/2014
40	Early testing with focus on maxmizing current pr	1d	100%	09/09/2014
41	Intermediate I testing with focus on smoothing l	1d	50%	09/24/2014
42	Intermediate I testing with focus on smoothing l	1d	0%	09/25/2014
43	Intermediate II testing with focus on providing sa	1d	0%	10/23/2014
44	Intermediate II testing with focus on battery disc	1d	0%	10/24/2014
45	Intermediate II testing with focus on safe output	1d	0%	10/27/2014
46	Intermediate II testing with focus on providing sa	1d	0%	10/28/2014
47	Advanced I testing with focus on duration and le	1d	0%	10/29/2014
48	Advanced I testing with MPPT enabled for a sola	1d	0%	10/30/2014
49	Advanced I testing with boost converter configur	2d	0%	11/03/2014
50	Advanced II testing with focus on configuring the	2d	0%	11/05/2014
51	**Integration Testing**	**7d**	**0%**	**11/18/2014**
52	Advanced II integration testing with focus on sin	1d	0%	11/10/2014
53	Advanced II integration testing with focus on dep	3d	0%	11/13/2014
54	Advanced II testing with focus on operation in ou	3d	0%	11/18/2014
55	**Sensor Software - Identify Targets**	**44d?**	**26%**	**10/31/2014**
56	Code review for Pixy software	5d?	100%	09/08/2014
57	Compile GCC version of Pixy software and note	2d?	20%	10/31/2014
58	Train camera for identifying walkers, bikers, and	15d	10%	10/15/2014
59	Train camera to figure out what direction the tar	5d	0%	10/24/2014
60	**Database Creation**	**2d**	**75%**	**09/23/2014**
61	Create mysql or mariadb database so data from	2d	75%	09/23/2014
62	**Website Creation**	**61d**	**92%**	**09/26/2014**
63	Create front end	4d	10%	09/26/2014
64	Link to database	1d	75%	09/23/2014
65	Create status webpage, hosted somewhere els	46d	100%	09/05/2014
66	**Website Testing**	**1d**	**0%**	**11/04/2014**
67	Sanitation Test	1d	0%	11/04/2014
68	Password Protection Test	0.33d	0%	11/04/2014
69	User Login Test	0.33d	0%	11/04/2014
70	White-hat hacker test	1d	0%	11/04/2014
71	**Target Data Communication**	**20d**	**0%**	**10/28/2014**
72	Sensors communciate target data with each oth	2w	0%	10/14/2014
73	Sensors can communicate and write data to dat	2w	0%	10/28/2014
74	**Computer Vision Testing**	**7.5d**	**0%**	**11/05/2014**
75	Early - Image Sensor Component Testing	0.5d	0%	10/27/2014
76	Early - Image Sensor Component Testing	0.5d	0%	10/27/2014
77	Intermediate - Infrared Component Testing	0.5d	0%	10/28/2014
78	Intermediate - CV Algorithm Component Testing	0.5d	0%	10/28/2014
79	Intermediate - CV Algorithm Component Testing	0.5d	0%	10/29/2014
80	Advanced- CV Algorithm Component Testing	1d	0%	10/30/2014
81	Advanced - CV Algorithm and Infrared Integratior	1d	0%	10/31/2014
82	Advanced - Computer Vision and Networking Sy	1d	0%	11/03/2014
83	Advanced - Computer Vision and Power Manage	1d	0%	11/04/2014
84	Advanced - Computer Vision Acceptance Testin	1d	0%	11/05/2014
85	**Deployment**	**14d**	**0%**	**11/20/2014**
86	Deploy Nodes	2d	0%	11/20/2014