Commuter Tracking Sensor Network

Weekly Report - September 28th, 2014

Team Members:

Alex Sarra (ags7798@rit.edu)

Seth Hendrick (srh7240@rit.edu)

Jared Mistretta (jxm6666@rit.edu)

***Other Collaborators*:**

Professor Wagner (mjwgse@rit.edu) (585) 475-5289

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	Done for now. There will probably need to be some work done once the nodes need to save data to the database.
12.3 Link website to database	Seth	9/23/2014	9/21/2014	Done for now. There will probably need to be some work done once the nodes need to save data to the database.
3.4 Spice Transient Analysis	Alex, Jared	9/24/2014	9/22/2014	Simulations are complete for the time being. This process could be extended for analysis of the secondary boost converter output, however, memory issues with OrCad are limiting use of the program. Results show that a 1.25V amplitude rectified DC signal (pulsating) can provide a 4.1V DC steady signal at the output of the boost converter, providing our Li-Ion battery with the necessary power to trickle charge.
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

12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Front end is complete. There may need to be some backend work down the road when the nodes need to save data to the database.
16.2 Activate website	Team	9/27/2014	11/9/2014	Complete. Website is located at http://ctsn.student.rit.edu:1415 (login required)
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	No longer blocked. We can begin work with prototyping the boost converter. Our contact, Nick Conn, has agreed to provide us with the equipment we need to solder the bq qfn chip to a DIP converter. Jared is currently creating a stencil for the QFN to dip converter so that we can accurately apply solder paste to the pads. Once complete, we will be able to test the bq hardware on the breadboard.
6.4 White Hat Hacker Test	Seth	10/1/2014	6/21/2014	Found volunteers to pen test the server. Since the website is mostly complete, we will begin testing.
3. Windbelt power module design		10/2/2014	6/18/2014	
3.2 PCB design	Alex	10/6/2014	6/10/2014	Progress can continue with this, since an evaluation module layout has been researched, and parts for each resistor configuration have been

				determined through simulation. Also, pricing for stamping through OSHPark has been researched, and they charge $5 per square inch. With a limited board size of 4 x 3.2 inches due to use of Eagle Freeware, and a limitation of 2 sided boards, the price is maxed at $64 per board.
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	Found volunteers to try to hack the server.
2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth, Jared	10/7/2014	6/1/2014	
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	This can continue with the maximum values for board size taken into account, which is 4 x 3.2 inches. We will most likely need this size board to fit all of the resistor configurations for the boost converters, along with other peripherals.

7.2 Interface Pixy Cam with an XBee	Jared, Alex	10/10/2014	6/22/2014	Antennas need to be ordered still.
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	No longer blocked. Continuing testing of Windbelt with natural wind speeds, angles, and variation to measure efficiency over a period of time. Test data will be captured using a BeagleBone Black, and data will be sent to the server to test the database and website response. Once the QFN to DIP module is soldered (due to happen this week), testing can continue with the Windbelt connected to the bq device.
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

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	9/23/2014	9/5/2014	Done for now. There will probably need to be some work done once the nodes need to save data to the database.
12.3 Link website to database	Seth	9/23/2014	9/21/2014	Done for now. There will probably need to be some work done once the nodes need to save data to the database.
3.4 Spice Transient Analysis	Alex, Jared	9/24/2014	9/22/2014	Simulations are complete for the time being. This process could be extended for analysis of the secondary boost converter output, however, memory issues with OrCad are limiting use of the program. Results show that a 1.25V amplitude rectified DC signal (pulsating) can provide a 4.1V DC steady signal at the output of the boost converter, providing our Li-Ion battery with the necessary power to trickle charge.
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Front end is complete. There may need to be some backend work down the road when the nodes need to save data to the database.

16.2 Activate website	Team	9/27/2014	11/9/2014	Complete. Website is located at http://ctsn.student.rit.edu:1415 (login required)
3.1 Breadboard prototyping	Alex, Jared	10/1/2014	6/1/2014	No longer blocked. We can begin work with prototyping the boost converter. Our contact, Nick Conn, has agreed to provide us with the equipment we need to solder the bq qfn chip to a DIP converter. Jared is currently creating a stencil for the QFN to dip converter so that we can accurately apply solder paste to the pads. Once complete, we will be able to test the bq hardware on the breadboard.
6.4 White Hat Hacker Test	Seth	10/1/2014	6/21/2014	Found volunteers to pen test the server. Since the website is mostly complete, we will begin testing.
3.2 PCB design	Alex	10/6/2014	6/10/2014	Progress can continue with this, since an evaluation module layout has been researched, and parts for each resistor configuration have been determined through simulation. Also, pricing for stamping through OSHPark has been researched, and they charge $5 per square inch. With a limited board size of 4 x 3.2 inches due to use of Eagle Freeware, and a limitation of 2 sided boards, the price is maxed at $64 per board.

Next Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
3.1 Breadboard prototyping	Alex, Jared	10/1/2014	6/1/2014	No longer blocked. We can begin work with prototyping the boost converter. Our contact, Nick Conn, has agreed to provide us with the equipment we need to solder the bq qfn chip to a DIP converter. Jared is currently creating a stencil for the QFN to dip converter so that we can accurately apply solder paste to the pads. Once complete, we will be able to test the bq hardware on the breadboard.
3.2 PCB design	Alex	10/6/2014	6/10/2014	Progress can continue with this, since an evaluation module layout has been researched, and parts for each resistor configuration have been determined through simulation. Also, pricing for stamping through OSHPark has been researched, and they charge $5 per square inch. With a limited board size of 4 x

				3.2 inches due to use of Eagle Freeware, and a limitation of 2 sided boards, the price is maxed at $64 per board.
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).
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	No longer blocked. Continuing testing of Windbelt with natural wind speeds, angles, and variation to measure efficiency over a period of time. Test data will be captured using a BeagleBone Black, and data will be sent to the server to test the database and website response. Once the QFN to DIP module is soldered (due to happen this week), testing can continue with the Windbelt connected to the bq device.

Status

Difficulties

Learning the Django templating language was a tad difficult at first. Once things started to “click”, however, it was not too bad.

Output values of certain ports in the boost converter are somewhat unintuitive, as the UV (undervoltage) and OV (overvoltage) signals are based on a dynamic reference value that is generated by internals within the device. Even though the boost converter is tuned for an overvoltage value of 4.2V and an undervoltage value of 3.2V, the voltages coming out of those ports are pulses that are interpreted by the chip itself, and have no significance to the user. The same goes for the “battery ok” signal and its associated reference values. Reading output from OrCad is basically not useful for those ports.

Surprises

Making Auth in Django is surprisingly easy. It took about an hour to do.

After the ShellShock bug was discovered, the Pi was upgraded to the latest software to get the latest version of bash. This broke Apache, which is what serves the website. The website went down for a few hours until an out-of-date library was uninstalled from the server.

We will be able to hand-solder the boost converter to a breakout board despite its size. This will allow us to breadboard with it prior to custom PCB finalization.

Successes

Website frontend is completed. There will need to be some work on the backend down the road when the nodes need to talk to the database.

OrCad simulation resulted in output values of 4.1V to the battery. MPPT is also working, adjusting the reference voltage to drive up the voltage at the output of the chip dynamically. Simulation plots have been captured.

Open Questions & Problems

OrCad is very memory intensive, and often crashes during lengthy simulations of the boost converter. For this reason, the power module will have to be simulated in stages.

Gantt Chart

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