Commuter Tracking Sensor Network

Weekly Report - October 12th, 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	Soldered the xbee usb programmer and downloaded the program that will help program the XBees.
2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth, Jared	10/16/2014	6/1/2014	Antennas have arrived. Soldering connectors to second XBee to continue testing. The XBee can communicate with the Pi over uart but a second XBee must be set up before testing can begin.
2.2 Range Test	Seth, Jared	10/17/2014	6/9/2014	Antennas have arrived. Soldering connectors to second XBee to continue testing.
2.3 Small-scale trail deployment	Seth, Jared	10/22/2014	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	10/20/2014	6/1/2014	Stencils are made. QFN to DIP converter boards have been baked. Doing continuity tests on modules with a multimeter before connecting via breadboard. Need

				to acquire headers for the chips. Step-down and secondary converters have been researched and ordered. Need to order DIP converters for those (WSON to DIP and SON to DIP).
3.2 PCB design	Alex	10/22/2014	6/10/2014	Prior to continuing with PCB design, breadboard prototyping should be completed.
3.3 Ship design for stamping	Alex	10/22/2014	6/18/2014	3.2 Must be completed first
3.4 Spice Transient Analysis	Alex, Jared	10/20/2014	9/22/2014	Extending analysis process to cover secondary boost converter (TPS61040/41), and buck converter (TPS62742). We are looking for 6-10V or 5V to power the CMUCam. The XBee requires 3-3.3V, so we will need to do transient analysis on both to ensure the correct levels.
4. Windbelt power module construction and testing		10/22/2014	6/30/2014	
4.1 Solder on components	Alex	11/7/2014	6/29/2014	3.3 Must be completed first
4.2 Continuity tests	Alex	11/7/2014	6/30/2014	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	10/15/2014	7/1/2014	Connected the Pi to the XBee over Uart. Awaiting on an XBee-to-bread board converter

				so we can communicate between 2 XBees
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	10/19/2014	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	Outdoor testing was very successful! The windbelt was taken outside and exposed to an average of 25 MPH winds, and produced voltage that was read in by an ADC on an attached BeagleBone Black. The BBB then communicated the information through WiFi to our Raspberry-Pi server. This information was analyzed further in Excel, and normalized to standard voltage values ranging from 0-1.8V. The voltage produced was theoretically enough to keep the boost converter in operational

				mode for extended periods of time. This process will be repeated once the boost conveters are tested for continuity and proven to be working correctly.
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 must 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	10/31/2014	10/4/2014	Dependent on 7.2
14.2 Sensors can communicate and write target data to database	Seth	10/31/2014	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 environment for multiple nodes	Team	11/13/2014		

Current Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
3.1 Breadboard prototyping	Alex, Jared	10/20/2014	6/1/2014	Stencils are made. QFN to DIP converter boards have been baked. Doing continuity tests on modules with a multimeter before connecting via breadboard. Need to acquire headers for the chips. Step-down and secondary converters have been researched and ordered. Need to order DIP converters for those (WSON to DIP and SON to DIP).
3.2 PCB design	Alex	10/22/2014	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	Extending analysis process to cover secondary boost converter (TPS61040/41), and buck converter (TPS62742). We are looking for 6-10V or 5V to power the CMUCam. The XBee requires 3-3.3V, so we will need to do transient analysis on both to ensure the correct levels.
5.2 Interface XBee with Pi	Seth	10/15/2014	7/1/2014	Connected the Pi to the XBee over Uart. Awaiting on an XBee-to-bread board

				converter so we can communicate between 2 XBees
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.
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Outdoor testing was very successful! The windbelt was taken outside and exposed to an average of 25 MPH winds, and produced voltage that was read in by an ADC on an attached BeagleBone Black. The BBB then communicated the information through WiFi to our Raspberry-Pi server. This information was analyzed further in Excel, and normalized to standard voltage values ranging from 0-1.8V. The voltage produced was theoretically enough to keep the boost converter in operational mode for extended periods of time. This process will be repeated once the boost conveters are tested for continuity and proven to be working correctly.

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.
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.

Next 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	Antennas have arrived. Soldering connectors to second XBee to continue testing. The XBee can communicate with the Pi over uart, but a second XBee must be set up before testing can begin.
2.2 Range Test	Seth, Jared	10/17/2014	6/9/2014	Antennas have arrived. Soldering connectors to second XBee to continue testing.
3.1 Breadboard prototyping	Alex, Jared	10/20/2014	6/1/2014	Stencils are made. QFN to DIP converter boards have been baked. Doing continuity tests on modules with a multimeter before connecting via breadboard. Need to acquire headers for the chips. Step-down and secondary converters have been researched and ordered. Need to order DIP converters for those (WSON to DIP and SON to DIP).
3.2 PCB design	Alex	10/22/2014	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	Extending analysis process to cover secondary boost converter (TPS61040/41), and buck converter (TPS62742). We are looking for 6-10V or 5V to power the CMUCam. The XBee requires 3-3.3V, so we will need to do transient analysis on both to ensure the correct levels.
5.2 Interface XBee with Pi	Seth	10/15/2014	7/1/2014	Connected the Pi to the XBee over Uart. Awaiting on an XBee-to-bread board converter so we can communicate between 2 XBees
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.

Status

Difficulties

The XBees do not interface with breadboards directly for testing. We need to acquire devices that allow the XBee to be plugged into a breadboard.

WSON to DIP and SON to DIP converters must be purchased and soldered to prototype the step-down and secondary boost converters on the breadboard. Prior to doing so, transient analysis must be performed in stages for each circuit.

Surprises

There were some security related things that we did not think of that Jared and Stanley were able to show us during their penetration test this Sunday.

Reflow soldering was fairly easy to do. Nick Conn met with us and brought in his oven to help us solder the primary boost converters. We are now doing continuity testing on the completed modules.

Successes

The server was pentested by two security majors. They were unable to gain root shell access, break in over ssh, or directly access the database. There are a few problems with the website that need to be addressed. This includes using https, limiting the amount of login attempts, and perhaps adding a captcha.

The windbelt was taken outside and tested with the BeagleBone Black ADC. It produced 1.8V peak and about 1.2V on average. Data was tabulated and plotted over the sampling period. It seems as though we will be able to adequately power the boost converter during periods of high or moderate wind.

One of the XBees are connected to the Pi, and can send characters over uart. Once another XBee is connected to a breadboard, getting them communicating with each other should be trivial.

Gantt Chart

	Name	% Complete	Finish
1	Commuter Tracking Sensor Network Project	54%	11/17/2014
2	Contact Monroe County	0%	10/28/2014
3	Discuss deployment options for sensor nodes	0%	10/28/2014
4	Networking Architecture Configuration and Testi	16%	10/21/2014
5	Configure XBees for DigiMesh and have them	20%	10/16/2014
6	Range Test	0%	10/17/2014
7	Small-scale trail deployment	0%	10/21/2014
8	Windlbelt power module design	52%	10/23/2014
9	Breadboard prototyping	50%	10/21/2014
10	PCB design	50%	10/23/2014
11	Ship design for stamping	72%	10/23/2014
12	Spice Transient Analysis	50%	10/20/2014
13	Windbelt power module construction and testing	0%	11/07/2014
14	Solder on components	0%	11/07/2014
15	Continuity tests	0%	11/07/2014
16	Server/Gateway setup	73%	10/15/2014
17	Install software (Django, Apache, etc.)	100%	06/17/2014
18	Interface XBee with Pi	20%	10/15/2014
19	Install and configure fail2ban	100%	09/01/2014
20	Server/Gateway testing	94%	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	100%	06/18/2014
24	Ping disabled test - looking into other options	80%	10/31/2014
25	White Hat Hacker Test	100%	10/13/2014
26	Sensor Hardware testing and integration	34%	10/31/2014
27	Begin playing with Pixy cam in USB tethered m	100%	09/15/2014
28	Interface Pixy Cam with an XBee	26%	10/22/2014
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	57%	11/04/2014
38	Early testing with focus on size	100%	09/05/2014
39	Early testing with focus on maximizing current	100%	09/08/2014
40	Early testing with focus on maxmizing current	100%	09/09/2014
41	Intermediate I testing with focus on smoothing	100%	09/24/2014
42	Intermediate II testing with focus on providing	0%	10/22/2014
43	Intermediate II testing with focus on battery dis	0%	10/23/2014
44	Intermediate II testing with focus on safe outpu	0%	10/24/2014
45	Intermediate II testing with focus on providing	0%	10/27/2014
46	Advanced I testing with focus on duration and	0%	10/28/2014
47	Advanced I testing with MPPT enabled for a sol	0%	10/29/2014
48	Advanced I testing with boost converter configu	0%	10/31/2014
49	Advanced II testing with focus on configuring th	0%	11/04/2014
50	Integration Testing	0%	11/13/2014
51	Advanced II integration testing with focus on si	0%	11/05/2014
52	Advanced II integration testing with focus on de	0%	11/10/2014
53	Advanced II testing with focus on operation in c	0%	11/13/2014
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, an	10%	10/31/2014
57	Train camera to figure out what direction the ta	10%	10/31/2014
58	Database Creation	90%	10/31/2014
59	Create mysql or mariadb database so data fro	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 el	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%	10/31/2014
70	Sensors communciate target data with each o	0%	10/31/2014
71	Sensors can communicate and write data to d	0%	10/31/2014
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 Testin	0%	11/04/2014
77	Intermediate - CV Algorithm Component Testin	0%	11/05/2014
78	Advanced- CV Algorithm Component Testing	0%	11/06/2014
79	Advanced - CV Algorithm and Infrared Integrati	0%	11/07/2014
80	Advanced - Computer Vision and Networking	0%	11/10/2014
81	Advanced - Computer Vision and Power Mana	0%	11/11/2014
82	Advanced - Computer Vision Acceptance Testi	0%	11/12/2014
83	Deployment	33%	11/17/2014
84	Deploy Nodes	0%	11/17/2014