

# Commuter Tracking Sensor Network

Weekly Report - November 23, 2014

## ***Team Members:***

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## ***Project Website:***

[Navigate to Google Drive Share](#)

## Updated Milestone Chart

<b>Milestone</b>	<b>Team Member in Charge</b>	<b>Modified Completion Date</b>	<b>Original Completion Date</b>	<b>Comments</b>
<b>1. Contact Monroe County</b> <b>Discuss deployment options for sensor nodes.</b>	Jared	11/25/2014	10/27/2014	Pushed back. Not a priority at this time.
<b>2. Networking Architecture Configuration and Testing</b>		10/13/2014	6/15/2014	
2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth	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, Alex	11/25/2014	6/9/2014	Will be completed Monday or Tuesday. Rained out yet again, and pushed back.
2.3 Small-scale trail deployment	Seth, Alex	11/25/2014	6/15/2014	Dependent on 2.1 and 2.2 and 5.2
<b>3. Windbelt power module design</b>		10/2/2014	6/18/2014	
3.1 Breadboard prototyping	Alex, Jared	11/21/2014	6/1/2014	COMPLETE Breadboard prototyping complete. The secondary boost converter and buck converter work well together. Power has been supplied to both an XBee radio and PixyCam through the battery management system. Testing of TX still remains, but is expected to succeed.

3.2 PCB design	Alex	11/26/2014	6/10/2014	COMPLETE Jeff Lonneville in SIMS has agreed to assist with the PCB reflow soldering through use of RIT facilities. He will be returning from a trip to Washington the week of the 23rd, and will be able to assist either Monday or Tuesday of that week. In the meantime, the 3x PCBs are scheduled to arrive on the 18th, and all SMT parts have been ordered.
3.3 Ship design for stamping	Alex	11/5/2014	6/18/2014	COMPLETE First iteration of design is ordered. Parts for the board are known, and will be ordered within the weekend. Future iterations of design will merge the EVM functionality to the custom design.
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.
<b>4. Windbelt power module construction and testing</b>		10/22/2014	6/30/2014	
4.1 Solder on components	Alex	11/26/2014	6/29/2014	All parts have arrived and Jeff Lonneville has been notified. Scheduled for construction on either Monday or Tuesday of this upcoming week. The

				boards have been visually inspected, and were fabricated as expected.
4.2 Continuity tests	Alex	11/26/2014	6/30/2014	Dependent on 4.1.
<b>5. Server/Gateway setup</b>	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
<b>6. Server/Gateway testing</b>		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 off campus for whatever reason, this will need to be revisited
<b>7. Sensor hardware testing and integration</b>		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	12/1/2014	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. Pushed back since other tasks took priority.
7.3 Integrate with existing power module	Jared, Alex	11/21/2014	7/11/2014	COMPLETE Pending TX test while Pixy is connected. Expected to succeed.
<b>8. Sensor Enclosure Design / Testing</b>		11/14/2014	8/7/2014	
8.1 Use CAD tools to design sensor enclosure	Jared	12/1/2014	7/1/2014	Pushed back due to prioritizing of tasks. CV algorithm is taking precedence, but printing of enclosure should be complete by end of week per Jared.
8.2 Use 3D printer to print the enclosures	Jared	12/1/2014	7/15/2014	8.1 Must be done first
8.3 Test (See Gantt Chart)	Jared	12/1/2014	8/7/2014	Dependent on 8.2

<b>9. Windbelt Testing (See Gantt Chart)</b>	Alex	11/21/2014	5/27/2014	COMPLETE. Testing has been completed with an 800mV AC signal while driving both the PixyCam and the XBee through the battery management system. The battery holds charge for extended periods of time.
<b>10. Sensor Software - Identify targets</b>		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, Seth	12/1/2014	8/1/2014	LibCCV is installed on the computer that will be doing the CV algorithms. Jared has been working on getting the sift algorithm working with it. Seth, meanwhile, has been implementing the network logic that will send the data to the big computer from the gateway node.
10.4 Train camera to figure out what direction the target is going	Jared, Seth	12/1/2014	9/1/2014	LibCCV is installed on the computer that will be doing the CV algorithms. Jared has been working on getting the sift algorithm working with it. Seth, meanwhile, has been implementing the network logic that will send the data to the

				big computer from the gateway node.
<b>11. Database Creation</b>		9/23/2014	9/14/2014	COMPLETE
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	11/5/2014	9/5/2014	COMPLETE
<b>12. Website Creation</b>		9/26/2014	9/28/2014	COMPLETE. Final website is located at <a href="https://ctsn.student.rit.edu">https://ctsn.student.rit.edu</a>
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 <a href="http://people.rit.edu/~srh7240/ctsn_status">http://people.rit.edu/~srh7240/ctsn_status</a> .
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	COMPLETE Website now no longer uses hardcoded values to display results.
<b>13. Website Testing (See Gantt Chart)</b>	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.
<b>14. Target Data Communication</b>		11/21/2014	10/5/2014	

14.1 Sensors communicate target data with each other	Seth, Alex	Postponed to R2	10/4/2014	Probably not going to make it. The fact that we are unable to set the XBees address makes this task difficult to dynamically add or remove nodes to the trail. Although it can be done given more time, right now its not feasible. Its a "nice to have" feature, and is not a show-stopper.
14.2 Sensors can communicate and write target data to database	Jared, Seth	12/1/2014	10/5/2014	Gateway side is done. Only need to do the Pixy Cam side.
<b>15. Computer Vision Testing (See Gantt Chart)</b>	Alex, Seth	11/1/2014	10/28/2014	Dependent on 10.3 and 10.4
<b>16. Deployment</b>		11/17/2014	11/9/2014	
16.1 Deploy nodes on trail	Team	12/2/2014	11/5/2014	Adjusted to meet new hard deadline of the Tuesday after Thanksgiving break. We should be able to demonstrate in lab, but deploying nodes on the trail will probably be postponed. We will need more Windbelts, enclosures, integration time, and trail testing time.
16.2 Activate website	Team	9/27/2014	11/9/2014	Complete. Website is located at <a href="http://ctsn.student.rit.edu">http://ctsn.student.rit.edu</a> (login required)
<b>17.Integration Testing</b>		11/13/2014		
17.1 Advanced II integration testing with focus on single node	Team	12/2/2014		Some of the integration testing will need to be completed with the prototype in place due to



in controlled environment				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	12/2/2014		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 environment for multiple nodes	Team	12/2/2014		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.

## Current Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
3.1 Breadboard prototyping	Alex, Jared	11/21/2014	6/1/2014	COMPLETE Breadboard prototyping complete. The secondary boost converter and buck converter work well together. Power has been supplied to both an XBee radio and PixyCam through the battery management system. Testing of TX still remains, but is expected to succeed.
7.3 Integrate with existing power module	Jared, Alex	11/21/2014	7/11/2014	COMPLETE Pending TX test while Pixy is connected. Expected to succeed.
<b>9. Windbelt Testing (See Gantt Chart)</b>	Alex	11/21/2014	5/27/2014	COMPLETE. Testing has been completed with an 800mV AC signal while driving both the PixyCam and the XBee through the battery management system. The battery holds charge for extended periods of time.
10.3 Train camera for identifying walkers, bikers, and horses	Jared, Seth	12/1/2014	8/1/2014	LibCCV is installed on the computer that will be doing the CV algorithms. Jared has been working on getting the sift algorithm working with it. Seth,

				meanwhile, has been implementing the network logic that will send the data to the big computer from the gateway node.
10.4 Train camera to figure out what direction the target is going	Jared, Seth	12/1/2014	9/1/2014	LibCCV is installed on the computer that will be doing the CV algorithms. Jared has been working on getting the sift algorithm working with it. Seth, meanwhile, has been implementing the network logic that will send the data to the big computer from the gateway node.

## Next Milestones

Milestone	Team Member in Charge	Modified Completion Date	Original Completion Date	Comments
2.2 Range Test	Seth, Alex	11/25/2014	6/9/2014	Will be completed Monday or Tuesday. Rained out yet again, and pushed back.
2.3 Small-scale trail deployment	Seth, Alex	11/25/2014	6/15/2014	Dependent on 2.1 and 2.2 and 5.2
4.1 Solder on components	Alex	11/26/2014	6/29/2014	All parts have arrived and Jeff Lonneville has been notified. Scheduled for construction on either Monday or Tuesday of this upcoming week. The boards have been visually inspected, and were fabricated as expected.
4.2 Continuity tests	Alex	11/26/2014	6/30/2014	Dependent on 4.1.
7.2 Interface Pixy Cam with an XBee	Jared	12/1/2014	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. Pushed back since other tasks took priority.
8.1 Use CAD tools to design sensor enclosure	Jared	12/1/2014	7/1/2014	Pushed back due to prioritizing of tasks. CV algorithm is taking precedence, but printing of enclosure should be complete by end of week per Jared.

8.2 Use 3D printer to print the enclosures	Jared	12/1/2014	7/15/2014	8.1 Must be done first
8.3 Test (See Gantt Chart)	Jared	12/1/2014	8/7/2014	Dependent on 8.2
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14.2 Sensors can communicate and write target data to database	Jared, Seth	12/1/2014	10/5/2014	Gateway side is done. Only need to do the Pixy Cam side.
16.1 Deploy nodes on trail	Team	12/2/2014	11/5/2014	Adjusted to meet new hard deadline of the Tuesday after Thanksgiving break. We should be able to demonstrate in lab, but deploying nodes on the

				trail will probably be postponed. We will need more Windbelts, enclosures, integration time, and trail testing time.
17.1 Advanced II integration testing with focus on single node in controlled environment	Team	12/2/2014		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	12/2/2014		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 environment for multiple nodes	Team	12/2/2014		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.

## Status

### Difficulties

When trying to compile libccv on the big computer, it was causing a segmentation fault. The problem was the package libpng-dev was not installed, and therefore trying to open a .png file would result in a segmentation fault.

### Surprises

No surprises this week.

### Successes

Seth found a public domain base64 library, which will encode the images from the Pixy cam so that they can be send over the XBee without any interruption. After testing the library, it seems like its going to work.

LibCCV is compiling and running on the big computer that will run the CV algorithms. Jared has continued work writing code to get libccv working, and Seth has been working on the networking portion of it.

Alex has completed, breadboard prototyping and windbelt testing successfully. Tests showed that the battery management system with the battery connected can support the load drawn by the Pixy and the Xbee. Further testing will be completed to show that data transmission succeeds without drawing too much current. This is expected to succeed, as a resistor was used to simulate the extra current draw, and the system held for an extended duration of about 4 hours.

### Open Questions and Concerns

We're probably not going to make the deployment deadline. But we should be able to have something demoable in a lab setting provided that the computer vision portion of development goes successfully.

# Gantt Chart

