Commuter Tracking Sensor Network

Weekly Report - September 14th, 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:

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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.
3.1 Breadboard prototyping	Alex	9/19/2014	6/1/2014	Completion date pushed back since enclosure work is not beginning unti the 19th. Taking advantage of the slack time to gather more data. Half-wave rectifier circuit testing is underway. Output current of 3 mA becoming more of a priority and concern. Voltage is adequate for boost converter at 2.2 VDC average.
3.2 PCB design	Alex	9/19/2014	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	Jared	9/19/2014	8/1/2014	Jared is researching algorithms that can be used.

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	Database work has begun. We currently have tables for error messages, nodes, and an error log. Next is a user table. The database can be talked to via a C API.
12.3 Link website to database	Seth, Alex	9/23/2014	9/21/2014	Database library is readily available and easily linkable through Django framework.
8.1 Use CAD tools to design sensor enclosure	Jared	9/26/2014	7/1/2014	**DEFERRED** Date was changed due to breadboard protyping 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.
8.2 Use 3D printer to print the enclosures	Jared	10/3/2014	7/15/2014	
12. Website Creation		9/26/2014	9/28/2014	
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Stub Django project is installed on the server and ready to be modified.
16.2 Activate website	Team	9/29/2014	11/9/2014	
13. Website Testing (See Gantt Chart)	Team	9/30/2014	10/4/2014	
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.
10. Sensor Software - Identify targets		10/1/2014	9/1/2014	
10.4 Train camera to figure out what direction the target is going	Jared	10/1/2014	9/1/2014	
3. Windbelt power module design		10/2/2014	6/18/2014	
3.3 Ship design for stamping	Alex	10/2/2014	6/18/2014	
4.1 Solder on components	Alex	10/3/2014	6/29/2014	
4. Windbelt power module construction and testing		10/6/2014	6/30/2014	
4.2 Continuity tests	Alex	10/6/2014	6/30/2014	
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	XBees are in, but the antennas are not correct. This will have to wait for the correct antennas to be ordered
6. Server/Gateway testing		10/6/2014	7/1/2014	

2.1 Configure XBees for DigiMesh and have them communicating in close proximity	Seth, Jared	10/7/2014	6/1/2014	
8. Sensor Enclosure Design / Testing		10/8/2014	8/7/2014	
8.3 Test (See Gantt Chart)	Jared	10/8/2014	8/7/2014	
2.2 Range Test	Seth, Jared	10/9/2014	6/9/2014	
2. Networking Architecture Configuration and Testing		10/13/2014	6/15/2014	XBees are in, but the antennas are not correct. This will have to wait for the correct antennas to be ordered
2.3 Small-scale trail deployment	Seth, Jared	10/13/2014	6/15/2014	
15. Computer Vision Testing (See Gantt Chart)	Alex, Seth	10/13/2014	10/28/2014	
14.1 Sensors communicate target data with each other	Seth	10/14/2014	10/4/2014	
7.2 Interface Pixy Cam with an XBee	Jared	10/22/2014	6/22/2014	
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 requirements.
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	
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Testing has begun for prototype four of the windbelt test fixture. Two coils were configured in series and data points were taken for a 470uF capacitor with a 150 ohm load and an IN5817 diode. This resulted in fairly consistent data set of 0.95 VAC before the diode, 0.3 mA of DC current over the load, and an average VDC and VRMS of about 1.25 VDC
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, when the licensing update in

				the department is rolled out.
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.
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
3.1 Breadboard prototyping	Alex	9/19/2014	6/1/2014	Completion date pushed back since enclosure work is not beginning unti the 19th. Taking advantage of the slack time to gather more data. Half-wave rectifier circuit testing is underway. Output current of 3 mA becoming more of a priority and concern. Voltage is adequate for boost converter at 2.2 VDC average.
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
3.2 PCB design	Alex	9/19/2014	6/10/2014	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	Jared	9/19/2014	8/1/2014	Jared is researching algorithms that can be used.
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	9/23/2014	9/5/2014	Database work has begun. We currently have tables for error messages, nodes, and an error log. Next is a user table. The database can be talked to via a C API.
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Testing has begun for prototype four of the windbelt test fixture. Two coils were configured in series and data points were taken for a 470 uF capacitor with a 150 ohm load and an IN5817 diode. This resulted in fairly consistent data set of 0.95 V_{AC} before the diode, 0.3 mA of DC current over the load, and an average V_{DC} and V_{RMS} of about 1.25 V_{DC}

Next Milestones

3.1 Breadboard prototyping	Alex	9/19/2014	6/1/2014	Completion date pushed back since enclosure work is not beginning until the 19th. Taking advantage of the slack time to gather more data. Half-wave rectifier circuit testing is underway. Output current of 3 mA becoming more of a priority and concern. Voltage is adequate for boost converter at 2.2 VDC average.
3.2 PCB design	Alex	9/19/2014	6/10/2014	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	Jared	9/19/2014	8/1/2014	Jared is researching algorithms that can be used.
11.1 Create mysql or mariadb database so data from trail can be saved to it	Seth	9/23/2014	9/5/2014	Database work has begun. We currently have tables for error messages, nodes, and an error log. Next is a user table. The

				database can be talked to via a C API.
12.3 Link website to database	Seth, Alex	9/23/2014	9/21/2014	Database library is readily available and easily linkable through Django framework.
12.2 Create web front end	Seth, Alex	9/26/2014	9/14/2014	Stub Django project is installed on the server and ready to be modified.
9. Windbelt Testing (See Gantt Chart)	Alex	11/5/2014	5/27/2014	Testing has begun for prototype four of the windbelt test fixture. Two coils were configured in series and data points were taken for a 470uF capacitor with a 150 ohm load and an IN5817 diode. This resulted in fairly consistent data set of 0.95 V_{AC} before the diode, 0.3 mA of DC current over the load, and an average VDC and $_{VRMS}$ of about 1.25 V_{DC}

Status

Difficulties

It is not apparent what current must be sent into the boost converter device for it to start up and continue running. Voltage levels are obvious from reading the datasheet, with 330 mV for cold-start and but only peak current levels are given for the signal entering VIN_DC on the converter at 200 mA typical and 300 mA maximum.

No difficulties from the software side of things.

Surprises

Maximum power out of the rectifier is extremely low right now at about 3-4 mW due to low current levels across the load.

MariaDB is actually pretty intuitive and not difficult to use. The documentation is plentiful.

Successes

The fourth version of Windbelt testing prototype is complete. Orientation of the magnet was changed so that its poles are oscillating directly into two coils, one on either side of the band for most efficient signal generation. The Windbelt is able to produce approximately 2 V_{AC} peak-to-peak, and 2.25 V_{DC} on average after rectification. An IN5817 diode was used in combination with a 470 uF capacitor for smoothing.

Database creation is underway. At the moment, error messages can be logged successfully to the error log table. The database can be directly communicated with any device directly connected to the router, but not the world.

In order to ssh into the server, an ssh key is required, instead of just a password. This will increase security, as it prevents brute force attacks.

Open Questions & Problems

Rectified DC current out of the Windbelt is quite small at 3 mA with a 150 ohm load. Increasing the load further decreases the current, so there is question as to whether the Windbelt will be able to drive the boost converter adequately. It should be a device of relatively low equivalent resistance, and the next step would be to try to attempt to quantify it.

Gantt Chart

	Name	Duration	% Complete	Finish
1	**Commuter Tracking Sensor Network Project**	**116d?**	**30%**	**11/24/2014**
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 Testing**	**9d**	**0%**	**10/13/2014**
5	Configure XBees for DigiMesh and have them communicating in cl	5d	0%	10/07/2014
6	Range Test	2d	0%	10/09/2014
7	Small-scale trail deployment	2d	0%	10/13/2014
8	**Windbelt power module design**	**24d**	**8%**	**10/09/2014**
9	Breadboard prototyping	10d	15%	09/19/2014
10	PCB design	5d	15%	09/19/2014
11	Ship design for stamping	14d	0%	10/09/2014
12	**Windbelt power module construction and testing**	**2d**	**0%**	**10/13/2014**
13	Solder on components	1d	0%	10/10/2014
14	Continuity tests	1d	0%	10/13/2014
15	**Server/Gateway setup**	**81d**	**67%**	**10/06/2014**
16	Install software (Django, Apache, etc.)	2d	100%	06/17/2014
17	Interface XBee with Pi	4d	0%	10/06/2014
18	Install and configure fail2ban	6d	100%	09/01/2014
19	**Server/Gateway testing**	**78d**	**32%**	**10/01/2014**
20	Disable root login test	1d	100%	06/16/2014
21	Set the SSH port to a non-standard port test	1d	100%	06/17/2014
22	Disable password login test - must login with SHH key	1d	100%	06/18/2014
23	Ping disabled test - looking into other options	5d	50%	09/05/2014
24	White Hat Hacker Test	9d	0%	10/01/2014
25	**Sensor Hardware testing and integration**	**40d**	**13%**	**11/07/2014**
26	Begin playing with Pixy cam in USB tethered mode	1d	100%	09/15/2014
27	Interface Pixy Cam with an XBee	5d	0%	10/20/2014
28	Integrate with existing power module	2d	0%	11/07/2014
29	**Sensor Enclosure Design / Testing**	**33d**	**0%**	**10/15/2014**
30	Use cad tools to design sensor enclosure	20d	0%	09/26/2014
31	Use 3D printer to etch out enclosure	5d	0%	10/03/2014
32	Temperature test	2d	0%	10/07/2014
33	Rain Test	2d	0%	10/09/2014
34	Execute drop test	2d	0%	10/13/2014
35	Fire test	2d	0%	10/15/2014
36	**Windbelt Testing**	**53d**	**36%**	**11/05/2014**
37	Early testing with focus on size	10d	100%	09/05/2014
38	Early testing with focus on maximizing current production for varied	1d	50%	09/08/2014
39	Early testing with focus on maxmizing current production for varied	1d	50%	09/09/2014
40	Intermediate I testing with focus on smoothing levels for a half-wav	2d	50%	09/11/2014
41	Intermediate I testing with focus on smoothing levels for a full-wave	2d	0%	09/15/2014
42	Intermediate II testing with focus on providing safe levels at the outp	3d	0%	10/16/2014
43	Intermediate II testing with focus on battery discharge time and volt	1d	0%	10/17/2014
44	Intermediate II testing with focus on safe output levels from voltage	1d	0%	10/20/2014
45	Intermediate II testing with focus on providing safe voltage levels fr	3d	0%	10/23/2014
46	Advanced I testing with focus on duration and level of charge on bat	2d	0%	10/27/2014
47	Advanced I testing with MPPT enabled for a solar energy application	2d	0%	10/29/2014
48	Advanced I testing with boost converter configured for MPPT with fo	2d	0%	10/31/2014
49	Advanced II testing with focus on configuring the boost converter for	3d	0%	11/05/2014
50	**Integration Testing**	**9d**	**0%**	**11/20/2014**
51	Advanced II integration testing with focus on single node in controlli	3d	0%	11/12/2014
52	Advanced II integration testing with focus on deploying a single nod	3d	0%	11/17/2014
53	Advanced II testing with focus on operation in outdoor environment	3d	0%	11/20/2014
54	**Sensor Software - Identify Targets**	**16d?**	**28%**	**09/22/2014**
55	Code review for Pixy software	5d?	100%	09/08/2014
56	Compile GCC version of Pixy software and note differences	2d?	0%	09/08/2014
57	Train camera for identifying walkers, bikers, and horses	15d	10%	09/19/2014
58	Train camera to figure out what direction the target is going	1d	0%	09/22/2014
59	**Database Creation**	**2d**	**0%**	**09/23/2014**
60	Create mysql or mariadb database so data from trail can be saved	2d	0%	09/23/2014
61	**Website Creation**	**61d**	**90%**	**09/26/2014**
62	Create front end	4d	0%	09/26/2014
63	Link to database	1d	0%	09/23/2014
64	Create status webpage, hosted somewhere else	46d	100%	09/05/2014
65	**Website Testing**	**1d**	**0%**	**10/03/2014**
66	Sanitation Test	1d	0%	10/03/2014
67	Password Protection Test	0.33d	0%	10/03/2014
68	User Login Test	0.33d	0%	10/03/2014
69	White-hat hacker test	1d	0%	10/03/2014
70	**Target Data Communication**	**20d**	**0%**	**10/28/2014**
71	Sensors communciate target data with each other	2w	0%	10/14/2014
72	Sensors can communicate and write data to database	2w	0%	10/28/2014
73	**Computer Vision Testing**	**7.5d**	**0%**	**10/02/2014**
74	Early - Image Sensor Component Testing	0.5d	0%	09/23/2014
75	Early - Image Sensor Component Testing	0.5d	0%	09/23/2014
76	Intermediate - Infrared Component Testing	0.5d	0%	09/24/2014
77	Intermediate - CV Algorithm Component Testing	0.5d	0%	09/24/2014
78	Intermediate - CV Algorithm Component Testing	0.5d	0%	09/25/2014
79	Advanced- CV Algorithm Component Testing	1d	0%	09/26/2014
80	Advanced - CV Algorithm and Infrared Integration Testing	1d	0%	09/29/2014
81	Advanced - Computer Vision and Networking System Integration	1d	0%	09/30/2014
82	Advanced - Computer Vision and Power Management System Integ	1d	0%	10/01/2014
83	Advanced - Computer Vision Acceptance Testing	1d	0%	10/02/2014
84	**Deployment**	**38d**	**0%**	**11/24/2014**
85	Deploy Nodes	2d	0%	11/24/2014
86	Activate Website	1d	0%	10/02/2014