# Commuter Tracking Sensor Network

Weekly Report - September 7th, 2014


***Team Members:***

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Jared Mistretta (jxm6666@rit.edu)

***Other Collaborators*:**

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***Project Website:***

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**TABLE OF CONTENTS**

# 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 witl the PixyCam now, and familiarized ourselves with its basic operation. |
| 5.3 Install and configure fail2ban | Seth | 9/1/2014 | 6/21/2014 | **COMPLETE** |
| 3.1 Breadboard prototyping | Alex | 9/5/2014 | 6/1/2014 | Started with half-wave rectifier circuit, and building up to the power amplification and conditioning circuit. |
| 6.3 Disable password login test - must log in with SSH key | Alex, Jared, Seth | 9/5/2014 | 6/21/2014 | Not done yet. Jared still needs to generate keys. |
| 6.5 Ping disabled test | Seth, Security Majors | 9/5/2014 | 6/21/2014 | **DEFERRED** While the server is on the RIT campus, thi is completed since outsiders can not ping rit.edu. If the server moves of campus for whatever reason, this will need to be revisited |
| 12.1 Create status webpage, | Seth | 9/5/2014 | 9/5/2014 | **COMPLETE** Status webpage that |

| | | | | |
|---|---|---|---|---|
| hosted somewhere else | | | | pings the gateway is functional. Its current 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**<br>Code review was completed. Informatio was documented regarding each file's contents. |
| 10.2 Compile GCC version of Pixy software and note differences | Seth | 9/8/2014 | 9/8/2014 | **DEFERRED**<br>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. |
| 3.2 PCB design | Alex | 9/12/2014 | 6/10/2014 | Boost converter library for Eagle complete schematic development underway. Nick Conn has agreed to be a point of contact for us if we have difficulty. We have many other sources to make this work. |
| 6.4 White Hat Hacker Test | Seth | 9/18/2014 | 6/21/2014 | Waiting for keys to be generated. Seth will talk with some people this week to see if anyone is willing to attempt to hack the server. |
| 8.1 Use CAD tools to design sensor enclosure | Jared | 9/19/2014 | 7/1/2014 | Everything that is not dependent on the size of the custom PCB is complete. Awaiting dimensions to continue. |
| 10.3 Train camera for identifying walkers, bikers, and horses | Seth | 9/19/2014 | 8/1/2014 | **BLOCKED**<br>Currently blocked due to licensing issues. Keil license renewed, and awaiting system wide update in the department to continue development. |
| **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 | Jared | 9/23/2014 | 9/5/2014 | MariaDB is installed on the server, and is ready to go |

| | | | | |
|---|---|---|---|---|
| 12.3 Link to database | Jared, Alex | 9/23/2014 | 9/21/2014 | Database library is readily available and easily linkable through Django framework. |
| 8.2 Use 3D printer to print the enclosures | Jared | 9/26/2014 | 7/15/2014 | |
| **12. Website Creation** | | 9/26/2014 | 9/28/2014 | |
| 12.2 Create front end | Jared, 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 | |
| **10. Sensor Software - Identify targets** | | 10/1/2014 | 9/1/2014 | |
| 10.4 Train camera to figure out what direction the target is going | Seth | 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 | The XBee did not arrive on time, so this slipped. |
| **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 | The XBees did not come in on time, so this had to be pushed back. All Raspberry Pis have software on them so they can use uart to communicate with the XBees when needed for testing purposes. |
| 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** | Jared | 10/28/2014 | 10/27/2014 | Not a priority until we complete more of the technical requirments. |

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|---|---|---|---|---|
| **Discuss deployment options for sensor nodes.** | | | | |
| **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 | 10/29/2014 | 5/27/2014 | Frame and coil assemblies are complete for the 3rd Windbelt prototype. One coil is complete. Waiting for epoxy to cure completely before beginning second winding. Plan to test with one n=1000 coil to see how much AC voltage is generated prior to connecting a second coil in series. With the specifications being used, the windbelt should provide 3.3 VAC. |
| **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 powe 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 |
|---|---|---|---|---|
| 5.3 Install and configure fail2ban | Seth | 9/1/2014 | 6/21/2014 | **COMPLETE** |
| 3.1 Breadboard prototyping | Alex | 9/5/2014 | 6/1/2014 | Started with half-wave rectifier circuit, and building up to the power amplification and conditioning |
| 6.3 Disable password login test - must log in with SSH key | Alex, Jared, Seth | 9/5/2014 | 6/21/2014 | Not done yet. Jared still need to generate keys. |
| 6.5 Ping disabled test | Seth, Security Majors | 9/5/2014 | 6/21/2014 | **DEFERRED**<br>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 |
| 12.1 Create status webpage, hosted somewhere else | Seth | 9/5/2014 | 9/5/2014 | **COMPLETE**<br>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_statu s . |
| 10.1 Code Review for Pixy Software | Alex, Seth, Jared | 9/8/2014 | 9/8/2014 | **COMPLETE**<br>Code review was completed. Information was documented regarding each file's contents. |
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| | | | | a point of contact for us if we have difficulty. We have many other sources to make this work. |
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## Next Milestones

| Milestone | Team Member in Charge | Modified Completion Date | Original Completion Date | Comments |
|---|---|---|---|---|
| 3.1 Breadboard prototyping | Alex | 9/5/2014 | 6/1/2014 | Started with half-wave rectifier circuit, and building up to the power amplification and conditioning |
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| 3.2 PCB design | Alex | 9/12/2014 | 6/10/2014 | Boost converter library for Eagle complete, schematic development underway. Nick Conn has agreed to be a point of contact for us if we have difficulty. We have many other sources to make this work. |
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| 8.1 Use CAD tools to design sensor enclosure | Jared | 9/19/2014 | 7/1/2014 | Everything that is not dependent on the size of the custom PCB is complete. Awaiting dimensions to continue. |
| 10.1 Train camera for identifying walkers, bikers, and horses | Seth | 9/19/2014 | 8/1/2014 | Currently blocked due to licensing issues. Keil license renewed, and awaiting system wide update to continue development. |

# Status

## Difficulties

Inductor coil assembly is a bit touchy, as epoxy between the plexiglass and ferrite core is taking extended periods to cure, despite the advertised bonding strength and drying time. The assembly was left to dry after being wound for the second time, since the plexiglass would come loose from the core during the winding process. Several applications of epoxy were attempted, since the first would not hold as the wire expanded around the core, and the previous applications had to be removed prior to repeated attempts. A vice was used to stabilize the assembly while it was drying, which had significantly better results than placing them under heavy objects.

From the software side of things, getting the compiler to work for the Pixy Cam has been bumpy. ARMCC, which is included with the Keil IDE in the CE department, will work, but there were licensing problems on the computers. In the meantime, there was an attempt to use GCC instead of ARMCC, however, GCC is not ready to be used on the Pixy cam according to the developers. Everything compiles fine, but the generated .hex file can not be flashed to the camera as of yet without error occurring. Once the Keil license is settled in the department, development on the Pixy cam can continue.

## Surprises

Loctite epoxy does not cure to maximum psi as fast as advertised. It also smells like a sewer.

rit.edu is not pingable. This means that our router does not need to disable pinging, as RIT handles that for us.

## Successes

AutoCad design is going smoothly. Awaiting PCB dimensions to continue.

Windbelt prototype construction is going fairly smoothly. The fourth prototype version increases the number of windings the coil by about 500. Two coils are placed in series, with n=1000 windings each. This design is proven to generate 3.3 VAC, which will be sufficient for the boost converter to power on. The windbelt frame is made out of 1” board, and design can be found at the following site: Windbelt Prototype Drawings.

The status webpage the pings the CTSN server is up and running. It is located on one of Seth;s Pis off campus. It can be reachable at http://people.rit.edu/~srh7240/ctsn_status . It is updated every minute. It shows “Ok” if the server is working fine.

## Open Questions & Problems

The only problem we have right now is waiting for the Keil license in the department to be sorted out so development on the Pixy Cam can continue.

# Gantt Chart

| | Name | Duration | % Complet | Start | Finish | Predecessors | Resources |
|---|---|---|---|---|---|---|---|
| 1 | **Commuter Tracking Sensor Network Pro** | **111d?** | **26%** | **06/16/2014** | **11/17/2014** | | |
| 2 | **Contact Monroe County** | **7d** | **0%** | **10/20/2014** | **10/28/2014** | | |
| 3 | Discuss deployment options for se | 7d | 0% | 10/20/2014 | 10/28/2014 | | Jared |
| 4 | **Networking Architecture Configuratio** | **9d** | **0%** | **10/01/2014** | **10/13/2014** | | |
| 5 | Configure XBees for DigiMesh and | 5d | 0% | 10/01/2014 | 10/07/2014 | | Seth,Jared |
| 6 | Range Test | 2d | 0% | 10/08/2014 | 10/09/2014 | 5 | Seth,Jared |
| 7 | Small-scale trail deployment | 2d | 0% | 10/10/2014 | 10/13/2014 | 6 | Seth,Jared |
| 8 | **Windlbelt power module design** | **29d** | **8%** | **08/25/2014** | **10/02/2014** | | |
| 9 | Breadboard prototyping | 10d | 15% | 08/25/2014 | 09/05/2014 | | Alex |
| 10 | PCB design | 5d | 15% | 09/08/2014 | 09/12/2014 | 9 | Alex |
| 11 | Ship design for stamping | 14d | 0% | 09/15/2014 | 10/02/2014 | 10 | Alex |
| 12 | **Windbelt power module construction** | **2d** | **0%** | **10/03/2014** | **10/06/2014** | | |
| 13 | Solder on components | 1d | 0% | 10/03/2014 | 10/03/2014 | 11 | Alex |
| 14 | Continuity tests | 1d | 0% | 10/06/2014 | 10/06/2014 | 13 | Alex |
| 15 | **Server/Gateway setup** | **81d** | **67%** | **06/16/2014** | **10/06/2014** | | |
| 16 | Install software (Django, Apache, et | 2d | 100% | 06/16/2014 | 06/17/2014 | | Seth |
| 17 | Interface XBee with Pi | 4d | 0% | 10/01/2014 | 10/06/2014 | | Seth |
| 18 | Install and configure fail2ban | 6d | 100% | 08/25/2014 | 09/01/2014 | | Seth |
| 19 | **Server/Gateway testing** | **69d** | **30%** | **06/16/2014** | **09/18/2014** | | |
| 20 | Disable root login test | 1d | 100% | 06/16/2014 | 06/16/2014 | | Seth |
| 21 | Set the SSH port to a non-standard | 1d | 100% | 06/17/2014 | 06/17/2014 | 20 | Seth |
| 22 | Disable password login test - must | 1d | 66% | 06/18/2014 | 06/18/2014 | 21 | Alex,Seth,Jared |
| 23 | Ping disabled test - looking into oth | 5d | 50% | 09/01/2014 | 09/05/2014 | 22 | Seth |
| 24 | White Hat Hacker Test | 9d | 0% | 09/08/2014 | 09/18/2014 | 23 | Seth,Security Maj |
| 25 | **Sensor Hardware testing and integrat** | **35d** | **13%** | **09/15/2014** | **10/31/2014** | | |
| 26 | Begin playing with Pixy cam in USB | 1d | 100% | 09/15/2014 | 09/15/2014 | | Alex,Seth,Jared |
| 27 | Interface Pixy Cam with an XBee | 5d | 0% | 10/14/2014 | 10/20/2014 | 7 | Jared |
| 28 | Integrate with existing power modul | 2d | 0% | 10/30/2014 | 10/31/2014 | 27,49 | Alex,Jared |
| 29 | **Sensor Enclosure Design / Testing** | **28d** | **0%** | **09/01/2014** | **10/08/2014** | | |
| 30 | Use cad tools to design sensor en | 15d | 0% | 09/01/2014 | 09/19/2014 | | Jared |
| 31 | Use 3D printer to etch out enclosur | 5d | 0% | 09/22/2014 | 09/26/2014 | 30 | Jared |
| 32 | Temperature test | 2d | 0% | 09/29/2014 | 09/30/2014 | 31 | Jared |
| 33 | Rain Test | 2d | 0% | 10/01/2014 | 10/02/2014 | 32 | Jared |
| 34 | Execute drop test | 2d | 0% | 10/03/2014 | 10/06/2014 | 33 | Jared |
| 35 | Fire test | 2d | 0% | 10/07/2014 | 10/08/2014 | 34 | Jared |
| 36 | **Windbelt Testing** | **48d** | **16%** | **08/25/2014** | **10/29/2014** | | |
| 37 | Early testing with focus on size | 10d | 50% | 08/25/2014 | 09/05/2014 | | Alex |
| 38 | Early testing with focus on maximizi | 1d | 15% | 09/08/2014 | 09/08/2014 | 37 | Alex |
| 39 | Early testing with focus on maxmizi | 1d | 15% | 09/09/2014 | 09/09/2014 | 38 | Alex |
| 40 | Intermediate I testing with focus on | 2d | 0% | 09/10/2014 | 09/11/2014 | 39 | Alex |
| 41 | Intermediate I testing with focus on | 2d | 0% | 09/12/2014 | 09/15/2014 | 40 | Alex |
| 42 | Intermediate II testing with focus on | 3d | 0% | 10/07/2014 | 10/09/2014 | 14 | Alex |
| 43 | Intermediate II testing with focus on | 1d | 0% | 10/10/2014 | 10/10/2014 | 42 | Alex |
| 44 | Intermediate II testing with focus on | 1d | 0% | 10/13/2014 | 10/13/2014 | 43 | Alex |
| 45 | Intermediate II testing with focus on | 3d | 0% | 10/14/2014 | 10/16/2014 | 44 | Alex |
| 46 | Advanced I testing with focus on du | 2d | 0% | 10/17/2014 | 10/20/2014 | 45 | Alex |
| 47 | Advanced I testing with MPPT enabl | 2d | 0% | 10/21/2014 | 10/22/2014 | 46 | Alex |
| 48 | Advanced I testing with boost conve | 2d | 0% | 10/23/2014 | 10/24/2014 | 47 | Alex |
| 49 | Advanced II testing with focus on co | 3d | 0% | 10/27/2014 | 10/29/2014 | 48 | Alex |
| 50 | **Integration Testing** | **9d** | **0%** | **11/03/2014** | **11/13/2014** | | |
| 51 | Advanced II integration testing with | 3d | 0% | 11/03/2014 | 11/05/2014 | 3,28,49 | Alex,Seth,Jared |
| 52 | Advanced II integration testing with | 3d | 0% | 11/06/2014 | 11/10/2014 | 51 | Alex,Seth,Jared |
| 53 | Advanced II testing with focus on op | 3d | 0% | 11/11/2014 | 11/13/2014 | 52 | Alex,Seth,Jared |
| 54 | **Sensor Software - Identify Targets** | **23d?** | **11%** | **09/01/2014** | **10/01/2014** | | |
| 55 | Code review for Pixy software | 5d? | 66% | 09/02/2014 | 09/08/2014 | | Alex,Seth,Jared |
| 56 | Compile GCC version of Pixy softw | 2d? | 0% | 09/05/2014 | 09/08/2014 | | Seth |
| 57 | Train camera for identifying walkers | 15d | 0% | 09/01/2014 | 09/19/2014 | | Seth |
| 58 | Train camera to figure out what dire | 8d | 0% | 09/22/2014 | 10/01/2014 | 57 | Seth |
| 59 | **Database Creation** | **2d** | **0%** | **09/22/2014** | **09/23/2014** | | |
| 60 | Create mysql or mariadb database | 2d | 0% | 09/22/2014 | 09/23/2014 | | Jared |
| 61 | **Website Creation** | **61d** | **90%** | **07/04/2014** | **09/26/2014** | | |
| 62 | Create front end | 4d | 0% | 09/23/2014 | 09/26/2014 | | Alex,Jared |
| 63 | Link to database | 1d | 0% | 09/23/2014 | 09/23/2014 | | Alex,Jared |
| 64 | Create status webpage, hosted sor | 46d | 100% | 07/04/2014 | 09/05/2014 | | Seth |
| 65 | **Website Testing** | **1d** | **0%** | **09/30/2014** | **09/30/2014** | **86** | |
| 66 | Sanitation Test | 1d | 0% | 09/30/2014 | 09/30/2014 | | Jared |
| 67 | Password Protection Test | 0.33d | 0% | 09/30/2014 | 09/30/2014 | | Alex,Seth,Jared |
| 68 | User Login Test | 0.33d | 0% | 09/30/2014 | 09/30/2014 | | Alex,Seth,Jared |
| 69 | White-hat hacker test | 1d | 0% | 09/30/2014 | 09/30/2014 | | Seth,Security Maj |
| 70 | **Target Data Communication** | **20d** | **0%** | **10/01/2014** | **10/28/2014** | | |
| 71 | Sensors communciate target data v | 2w | 0% | 10/01/2014 | 10/14/2014 | | Seth |
| 72 | Sensors can communicate and wri | 2w | 0% | 10/15/2014 | 10/28/2014 | | Seth |
| 73 | **Computer Vision Testing** | **7.5d** | **0%** | **10/02/2014** | **10/13/2014** | | |
| 74 | Early - Image Sensor Component T | 0.5d | 0% | 10/02/2014 | 10/02/2014 | 58 | Alex,Seth |
| 75 | Early - Image Sensor Component T | 0.5d | 0% | 10/02/2014 | 10/02/2014 | 74 | Alex,Seth |
| 76 | Intermediate - Infrared Component | 0.5d | 0% | 10/03/2014 | 10/03/2014 | 75 | Alex,Seth |
| 77 | Intermediate - CV Algorithm Compo | 0.5d | 0% | 10/03/2014 | 10/03/2014 | 76 | Alex,Seth |
| 78 | Intermediate - CV Algorithm Compo | 0.5d | 0% | 10/06/2014 | 10/06/2014 | 77 | Alex,Seth |
| 79 | Advanced- CV Algorithm Componer | 1d | 0% | 10/06/2014 | 10/07/2014 | 78 | Alex,Seth |
| 80 | Advanced - CV Algorithm and Infrar | 1d | 0% | 10/07/2014 | 10/08/2014 | 79 | Alex,Seth |
| 81 | Advanced - Computer Vision and N | 1d | 0% | 10/08/2014 | 10/09/2014 | 80 | Alex,Seth |
| 82 | Advanced - Computer Vision and Pi | 1d | 0% | 10/09/2014 | 10/10/2014 | 81 | Alex,Seth |
| 83 | Advanced - Computer Vision Accep | 1d | 0% | 10/10/2014 | 10/13/2014 | 82 | Alex,Seth |
| 84 | **Deployment** | **36d** | **0%** | **09/29/2014** | **11/17/2014** | | |