

## Weekly Progress Report

**Project Name:** Energy Management System (EMS)

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**Project URL:** <https://edge.rit.edu/edge/C15505/public/Home>

**Updated Milestone Chart:**

Updates from previous revisions are italicized for clarity.

Task Description	Original Scheduled Completion Date	Responsible Team Member	Modified Completion Date	Comments
Critical Component Breakout Boards	8/24/2015	RM, DM	9/28/2015	COMPLETE: Critical component breakout boards have been completed for all functions. Messages have successfully been sent through the power line using the provided evaluation boards.
User Interface Implementation	8/24/2015	JL, AC	11/16/2015	IN PROGRESS: Rest of system does not heavily depend on webapp so completion delay is not a large factor. This milestone has slipped again from its previous date of 10/12.

<b>Task Description</b>	<b>Original Scheduled Completion Date</b>	<b>Responsible Team Member</b>	<b>Modified Completion Date</b>	<b>Comments</b>
Web App Database Communication	8/24/2015	AC, JL	9/13/2015	COMPLETE: The web application is able to communicate with the database using Hibernate (An Object-Relational Mapping library for Java)
Order Parts	8/24/2015	All	9/20/2015	COMPLETE: Cypress has provided a new PLC evaluation kit which functions correctly.
Initial PCB Design	8/31/2015	DM	9/6/2015	COMPLETE: Focusing efforts on vero-boarding initial hardware design instead of PCB design. Breadboard has been constructed. PCB may still be constructed if time permits, but based on summer slippage time for spinning PCB my not be available. Completion of breadboard has met the intent of this task.
Obtain and Verify Parts	9/7/2015	All	9/20/2015	COMPLETE: All parts except PLC have been received and verified. Completion date has been pushed back as received evaluation PLC boards are not functioning properly.
Verification of Power Supply Circuitry	9/14/2015	DM	9/14/2015	COMPLETE: Power Supply circuitry has been verified.
Verification of Breadboard Load Switch	9/14/2015	DM	9/14/2015	COMPLETE: Load Switch is operational, and a load is able to be switched ON and OFF via an external voltage (provided from FPGA or other embedded system).
Verification of Breadboard Current Sense	9/21/2015	DM	9/21/2015	COMPLETE: Current sense circuitry is operational.

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Verification of Breadboard Voltage Sense	9/21/2015	DM	9/21/2015	COMPLETE: Voltage sense circuitry is operational
Outlet Communication with PLC	9/28/2015	RM	9/25/2015	COMPLETE: Messages have been successfully sent via the power line.
Interface PLC with Pi	9/28/2015	RM, JL	10/7/2015	COMPLETE: Team has decided to acquire PLC evaluation boards. PLC communication is occurring with the Pi but communications does not work consistently. Communication has improved from last status report, and various issues have been discovered and solved. Team successfully sent messages from Pi to FPGA.
Verification of Breadboard Processor	10/5/2015	All	10/9/2015	COMPLETE: FPGA has been selected to perform necessary embedded processing. Necessary power calculation is working properly within Modelsim simulation using a bus functional model of the ADC. FPGA I2C interface necessary for PLC communication has also been simulated. Team is working on determining final communication protocol between FPGA and Pi. All VHDL has been synthesized successfully. Messages have successfully been sent from FPGA to PLC to Pi (Both ways have been tested and are working)
Final PCB Design	10/19/2015	All	10/18/2015	COMPLETE: Based on team progress to this point, the decision has been made not to have a PCB manufactured.

Task Description	Original Scheduled Completion Date	Responsible Team Member	Modified Completion Date	Comments
				Completion of veroboard has met the intent of this task and shall be used for verifying functionality of the project.
Finalized Database Structure	10/19/2015	AC, JL	11/16/2015	IN PROGRESS: This will be a result of the webapp completion.
PI PLC API	10/26/2015	RM, AC, JL	10/26/2015	COMPLETE – A python module has been written to act as the API for the Pi communication with the PLC chip. Additionally several python scripts have been written to handle commands to be sent from the Pi to the remote outlet modules.
System recognizes new outlets automatically	11/2/2015	All	11/12/2015	COMPLETE – The Pi's I2C will rarely read incorrect bits for the outlet module's address (e.g. 1000 instead of 1010). This results in a new, different address being stored in the database. However, it happens about 1% of the time, so the incorrect outlets (which would have much less readings than the correct outlets) could be deleted from the database. Another option is to read the address twice from I2C and compare the two values. If they are unequal, then the measurement may not be stored. Other solutions are being considered.
Send Hardware Measurement over PLC	11/9/2015	RM, JL, DM	11/15/2015	COMPLETE – Hardware Measurements have been sent over PLC. Team is working on tweaking accuracy of measurements.

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Receive and store measured data	11/9/2015	AC, JL, RM	11/9/2015	COMPLETE – Measured data has been received and can be stored in the database.
View measured data	11/9/2015	JL, AC	11/9/2015	COMPLETE – Team currently has downloaded current version of web application onto the Raspberry Pi and has demonstrated capability to view data on web application.
Toggle state of single outlet from web interface	11/16/2015	All		
Toggle state of a group of outlets	11/16/2015	All		
Outlets and groups follow schedule	11/16/2015	All		
Data Compression Verification	11/16/2015	AC		
Full system test passed	11/25/2015	All		

**Current Milestones:**

<b>Task Description</b>	<b>Original Scheduled Completion Date</b>	<b>Responsible Team Member</b>	<b>Modified Completion Date</b>	<b>Comments</b>
User Interface Implementation	8/24/2015	JL, AC	11/16/2015	Rest of system does not heavily depend on webapp so completion delay is not a large factor. This milestone has slipped again from its previous date of 9/28.
Toggle state of single outlet from web interface	11/16/2015	All		
Toggle state of a group of outlets	11/16/2015	All		
Outlets and groups follow schedule	11/16/2015	All		
Data Compression Verification	11/16/2015	AC		

**Next Milestones:**

Task Description	Original Scheduled Completion Date	Responsible Team Member	Modified Completion Date	Comments
Full system test passed	11/25/2015	All		

**Status****Difficulties:**

PLC PSoC hardware is becoming overwhelmed and does not function properly when transmission speeds are set to high. This issue can cause reliability issues as commands are received/transmitted intermittently. Currently, sending outlet measurements (12 Bytes) every second (real time) from the outlet module causes the main module to lock up after about 5 minutes.

**Surprises**

PLC PSoC can only perform PLC functions and cannot perform any calculations on voltage current data. Therefore an additional embedded platform will be needed to perform controller functionality.

Additional PLC PSoC difficulties are occurring in which fast transmission rates are overwhelming the PLC PSoC thus causing it to not function properly. Team is currently working to determine if there is a solution to this issue, and also to determine the fastest transmission rates which can occur without the PLC functioning incorrectly.

**Successes:**

The charts tab within the web application has been fully completed. The current web application (some functionality missing) was successfully loaded onto the Raspberry Pi. Basic functional tests were then run to ensure that the Pi was able to run both the webapp and the MySQL at the same time. The web application was able to successfully receive data from the remote outlet which indicated power consumption, and voltage and load current. This data was then plotted within the web application. Various testing indicated that the plotting results were functioning as expected. The ability to name outlets was also tested from within the web application and was seen to work. The next step of the web application will be to complete the implementation of the missing functionality.

**Questions/problems for consideration:**

We have decided not to make an overall PCB but to develop a working hardware prototype on vero-board which can be used to demonstrate the functionality of the system, and if time/budget permits then complete a PCB design.

Team is considering moving proposal document from a word document to a LaTeX document to avoid Figure number issues etc.

We are making a design change within the web application. We are switching from using the Python based Django framework to the Java based Vaadin framework. This is being done because the team is more familiar with Java and the Vaadin framework and also because Java is a more powerful platform for development. This means we will need a way for the Java app to talk to native Python scripts running on the Raspberry Pi (possibly Jython) and that the web application will use significantly more system memory. Some additional tests will be run in the near future to ensure the memory usage is not too high.



## Gantt Chart:

