Our Project

The Energy Monitoring and Management System is a device which measures, displays, and regulates the energy consumption of individual buildings in order to help educate communities about conscientious energy use while protecting the solar generation system from damage due to overloading.

Our system has been increasing energy savings and education for organizations in Burkina Faso and Zimbabwe, and we are currently expanding our impact in regions of Ghana and other countries.

Current Need

As our project progresses, more representatives and organizations are hearing about our meter and how it can affect their communities. With more clients, there are a wider range of features that are desired in order to best serve their needs.

We are in the process of a major update to support adding function modules.

- This requires SPI communication between boards
- Work is also progressing on one of the first modules for wireless communication between systems
- In light of these developments, the enclosure of our system is going through iterations to better house additional modules

Clients

- Matt Walsh; SIM missionary in Mahadaga, Burkina Faso.
- Ray Motsi; President of the Theological College of Zimbabwe
- Sam Owusu-Akwa; Attrium Group, Ghana

SPI Communication

Purpose: In our current design, the main computing chip is only able to “talk” with one other subsystem. Since expansion requires the ability to communicate with multiple subsystems, we are currently moving to an SPI protocol, a design which allows us to interface with multiple subsystems more effectively.

Process: We developed code that would enable SPI in our microcontroller and created simple tests that would send one character from an SPI Master to an SPI Slave.

Results: We successfully sent a 13-character string from an SPI Master to an SPI Slave, and then passed back a manipulated version of this string. This operation reflects the main purpose of SPI for our meter: to send a command that can be received and acted upon correctly.

Enclosure

Purpose: With new changes in componentry, and possibilities of extensions within the box, such as WIFI capabilities, it became necessary to look into new ways to manufacture the box, as well as working on a new layout to house the new components more conveniently.

Process: We modeled the new electrical componentry in SolidWorks. This allowed us to place subsystems more efficiently as well as determine necessary mounting hardware. One major change resulting from this repositioning of subsystems was that the command board is now mounted vertically against the wall, rather than horizontally on-top of other components, as it was previously.

Results:

We made necessary changes to the box mounting hardware to allow the components to be more easily accessed. We were then able to successfully 3D print a new box layout in addition to multiple prototypes of our mounting hardware.

Wireless Meter Network

Purpose: The latest version of the meter doesn’t have the ability to communicate with other meters or computing systems. Any changes to the settings or other protocols of the meter have to be made physically on the meter itself. Communicating with each meter from a central unit would make it both easier to change settings and more convenient to work from a remote location.

Process: Our objectives were to research the best mediums and modules to achieve wireless communication, and send characters and commands to a central control modem. The ESP8266 WiFi Transceiver and the SI4432 Radio Transceivers were the modules we chose to test.

Results & Current Status: The ESP8266 module was determined to be the better option after the initial tests. The protocol and communication concepts of the ESP8266 were researched further and we developed a web server with the module.

Next Steps

- SPI Communication: We are now able to integrate our functions into the overall communication code of our project. Once this is integrated and successfully tested, we will be able to support future modules beginning with wireless communication.
- Wireless Meter Network: Now that we have an identified wireless protocol, we need to verify that we can use this wireless link to send our current system commands. When this protocol has been fully developed, we will begin work to support both remote administration as well as a pay-as-you-go version feature.
- Enclosure: We are currently looking into buying an off-the-shelf box and 3D printing our designed baseplate for additional modules to be mounted on. This will increase our efficiency in production by implementing a model that can support future updates while minimizing the production times.

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