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Our Project

An estimated 16% of the global population do not have access to electricity. When one looks at the 50 poorest nations in the 79% of the world, population does not have access to electricity.



The Energy Monitoring and Management System project is developing a meter to help the energy impoverished gain more ready access to electricity.

Our primary partner is Open Door Development, located in Mahadaga, Burkina Faso, a remote location in western Africa. We are developing meters to be used with various isolated solar power systems the organization has installed throughout the region.

Immediate Need

The EMMS meter fills a unique role in the monitoring and control of electrical energy. The modular design of the meter will allow the addition of communication, reporting, and payment systems that make the meter unique in its field.

- Make meter modular to support future features.
- Modify user interface to aid manufacturing methods and costs
- Test the meter for reliability, accuracy, and usability

Clients

- Matt Walsh; Open Door Development, Mahadaga, Burkina Faso.
- *Ray Motsi*; President of the Theological College of Zimbabwe
- Sam Owus-Akyaw; Attrium Group, Ghana
- IEEE Smart Village





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Process: The two main types of tests that were developed are the static load test and the dynamic load test. These tests were run for either short or long periods of time in order for us to observe how the meter responded under different conditions. Testing data that helped us accurately check our desired criteria was recorded periodically throughout each of the tests.

Results: From our data we were able to conclude that the power readings from the meter were both consistent and accurate for low loads. For higher loads, the readings remained consistent, but were not quite as accurate. In terms of functionality, positive results were obtained regarding reset time and relay control. However, several features including the emergency allocation button and power draining time, failed to work as expected.



Purpose: With the goal of making the meter cheaper, and moving away from 3D printed enclosures, we worked towards fitting the User Interface components in an off the shelf enclosure with a new, cheaper LCD screen.

Process: We purchase a few different manufactured boxes and chose the best option. We then modeled the new electrical componentry in SolidWorks. This allowed us to determine constraints on the electronics and box more efficiently as well as determine necessary mounting hardware. The box was then cut to accommodate the electrical hardware and was assembled.

Results: We assembled the first prototype which will be very similar to the design going out to Burkina Faso summer of 2017. The new User Interface components fit within the box, and work properly.

Developing Test Procedures

Purpose: In order to ensure the successful operation of our meters in the field, our project developed a series of testing procedures to be performed on the meters prior to their shipment. These tests are designed specifically to evaluate the accuracy, consistency and functionality of our meter when operating with different loads over varying lengths of time.



User Interface Enclosure









User Interface Circuit Board

Purpose: In order to accommodate for the new User Interface enclosure, the internal circuit board needed to be rearranged and resized to the new fit. Additionally, we decided to replace the LCD display with a cheaper variant which used a different pin layout. This required modifications to the board's trace design to reconnect the LCD.

Process: We updated the User Interface schematic into the EAGLE design software to conform with current project standards. Several prototypes were created to determine which layout would best fit the new enclosure.

Results: The selected design was tested to ensure the circuit functions correctly, and we have completed a working finished prototype in the enclosure. The new User Interface is now complete and ready to be included with the newest model of the meter.



Future Work

- Testing: We would like to continue modifying the tests to focus more on confirming the predetermined criteria for the operation and accuracy of our meters. We will also be looking into developing some new tests, which better replicate the field environment of Burkina Faso.
- User Interface: We need to assemble the new boxes that we are taking out so that they are all ready to be installed in Burkina Faso and replace the old, 3D printed boxes. Changes to design will be made as issues occur.
- Develop communication module (WiFi): First new module, primary focus for payment system.
- Develop payment system: Meet the micro-grid needs of our clients, and set groundwork for future large-scale systems.

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