

# Smart Box Power Management System (SBPMS)

Final Report

Submitted to Dr. Chika Nwankpa and the

Senior Design Committee

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To: Dr. Chika Nwankpa  
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From: Senior Design Team ECE-08  
Date: 05/07/2010  
Re: Executive Summary

With the advent of “smart” technologies, the general public has the potential to control certain aspects of their lives which they were previously unable to do. The Smart Box Power Management System (SBPMS) allows for this control to extend to energy usage in homes. Giving the public the information about their power usage, as well as the ability to control it will have the effect of lowering their monthly energy cost by way of encouraging demand side response.

The design for the system consists of standardized equipment, and can therefore be installed/interchanged at will, and can be installed on both existing and new residential electrical systems. Additionally, the SBPMS is capable of sending load profiling data to the utility companies in order for them to be able to better forecast load requirements for the areas they provide service to. Another benefit to the utility company lies in the fact that demand side response leads to a flatter load profile for the residential areas, making it cheaper for the utilities to produce power for their respective regions.

To date, the software model of the SBPMS is complete, as well as the construction of the hardware prototype. However, the software GUI designed to control the device has not been fully realized. This puts us slightly behind schedule, as we had planned on having the software controller up and running by this point. In order for public distribution, further work must be done in this area to ensure the device will work properly.

## **Abstract**

The management of customer consumption of electricity is a crucial factor that is being addressed as demand for energy increases rapidly. The objective of load side response is to make the electrical power industry more reliable and efficient by providing information to the customers to make them realize the value of reducing their demand for electricity. By curtailing customer usage and shifting demand from the peak busy hours to when demand can be met with base load power, less strain is put on the grid. This process could gradually lead to limiting the overall cost of this valuable energy source. As a result, monitoring of consumer loads has been given priority from a utility perspective and the concept of smart metering has been incorporated at a consumer level of power distribution.

The solution proffered by our senior design group involves designing a smart power management system that replaces the receptacle. The box functions by acquiring usage data and by giving the user the ability to perform load control. More importantly, it provides the residence with a heads up display showing the current cost of power as well as the cost they have accumulated over a specified period of time, thereby encouraging them to better manage their energy usage. The smart box power management system will also send this load profile information through a data concentrator to the utility company for analysis and use in load forecasting. The team has identified and utilized both LabVIEW and Simulink as the software packages that were used to create our software model of the SBPMS. Through the use of the Simulation Interface Toolkit, we were able to create a VI that was actionable in real time. We have stayed within the limits of our budget by utilizing software that is available for free and by choosing a communication device which is 40% the cost of the original specification. The team has spent the entirety of the term building and debugging the hardware prototype as well as learning and building the software interface program. At this point in time, both the hardware device and its software controller counterpart are completed and viable.

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