

Grid Friendly Appliance (GFA)

Sponsor: PNNL

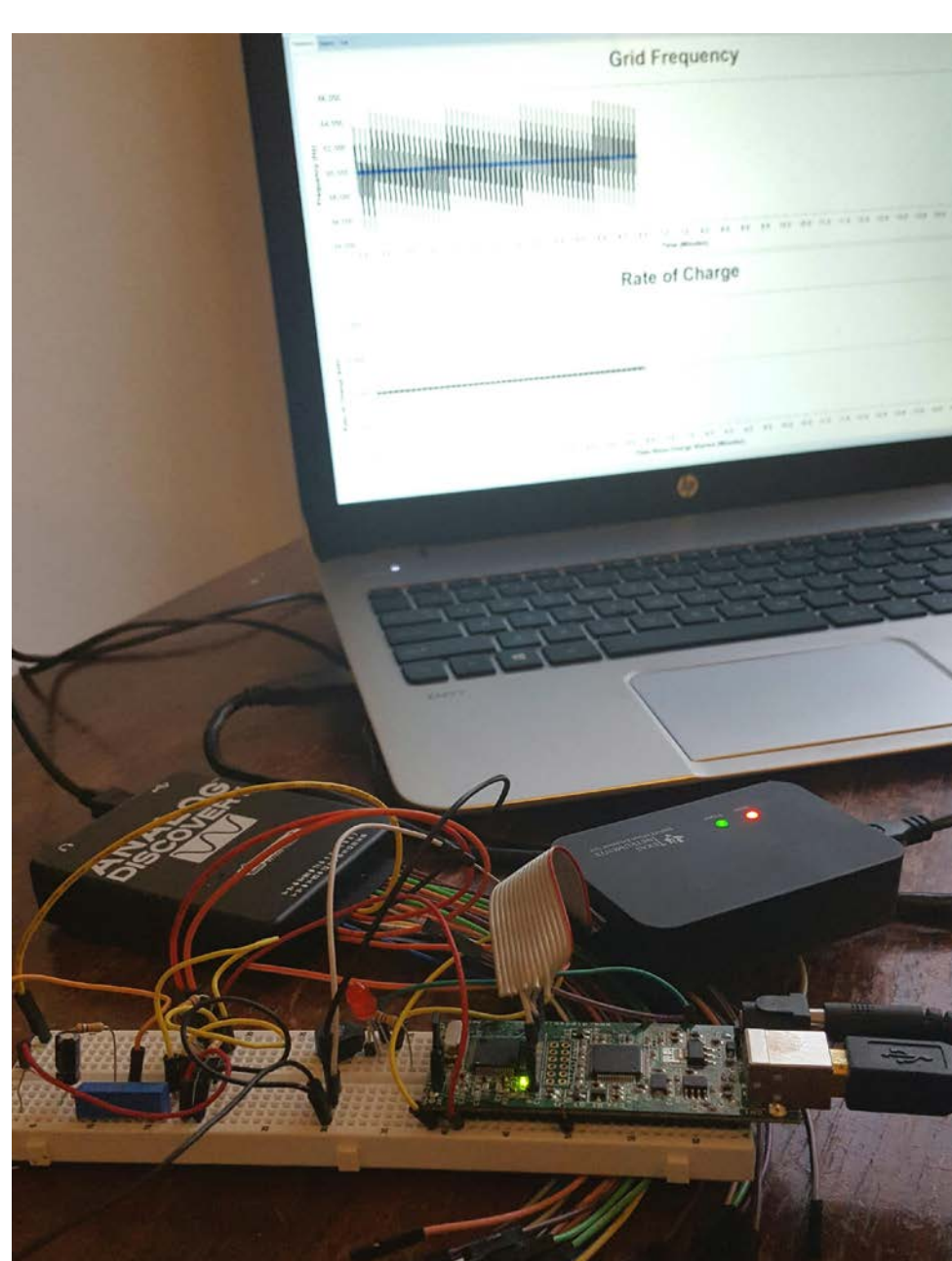
Mentor: Richard Pratt

Jacob Greig-Prine, Aaron Miyasaki, Kaitlin Nakai, William Van Vogt

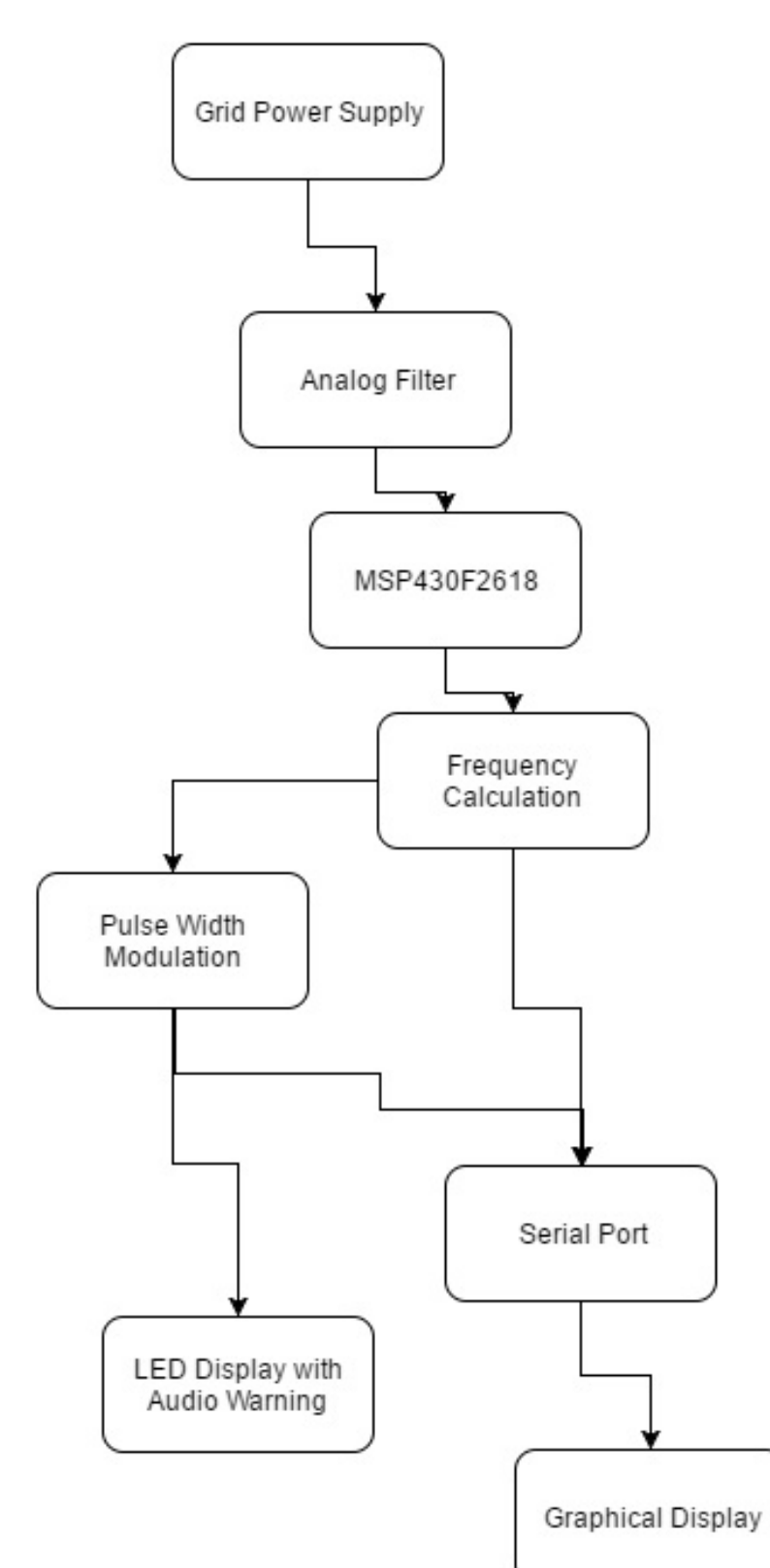
Objectives

- Read in voltage from the wall
- Create a real time frequency and charge rate graph
- Light and sound outputs based on frequency from the wall

Design



GFA Final Prototype



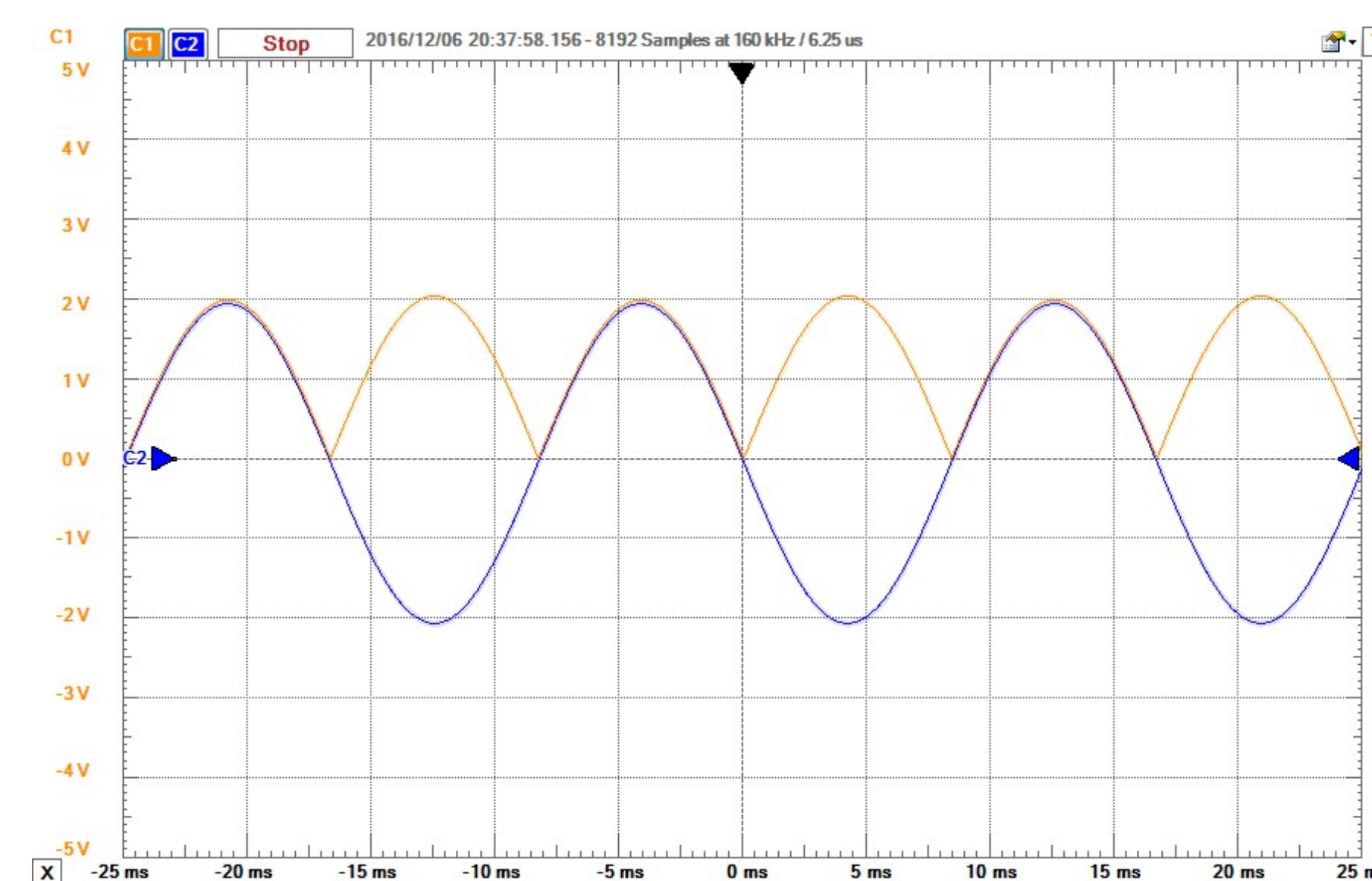
Abstract

As the power grid becomes more complex, the need for energy stability and efficiency grows. Fluctuations in power generation and demand need to be monitored in order to provide the best service possible. The GFA solves this by providing an economic platform for distributed control. By monitoring voltage and frequency in real time the GFA can be programmed to implement voltage and frequency regulation algorithms to provide a stable and efficient grid.

Filter

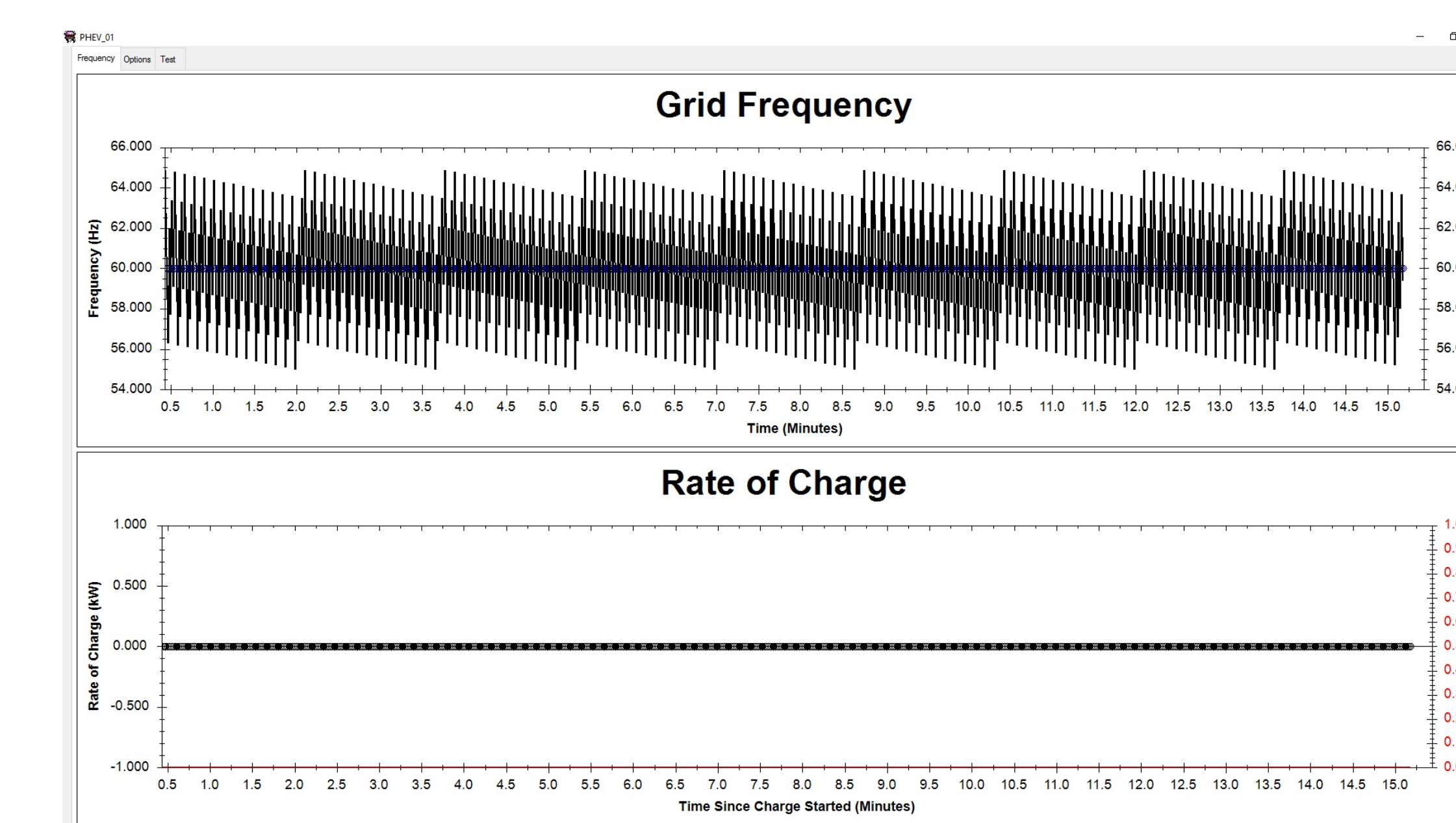
Design Requirements:

- Read in, step down, and rectify voltage from grid
- Remove any possible DC bias
- Remove noise



Graphical Display

Real Time Frequency and Charge Rate Display



PWM

- Drives LED at a brightness determined by the frequency
 - Lower frequency – dimmer
 - Higher frequency - brighter
- Sounds buzzer should frequency be out of expected range

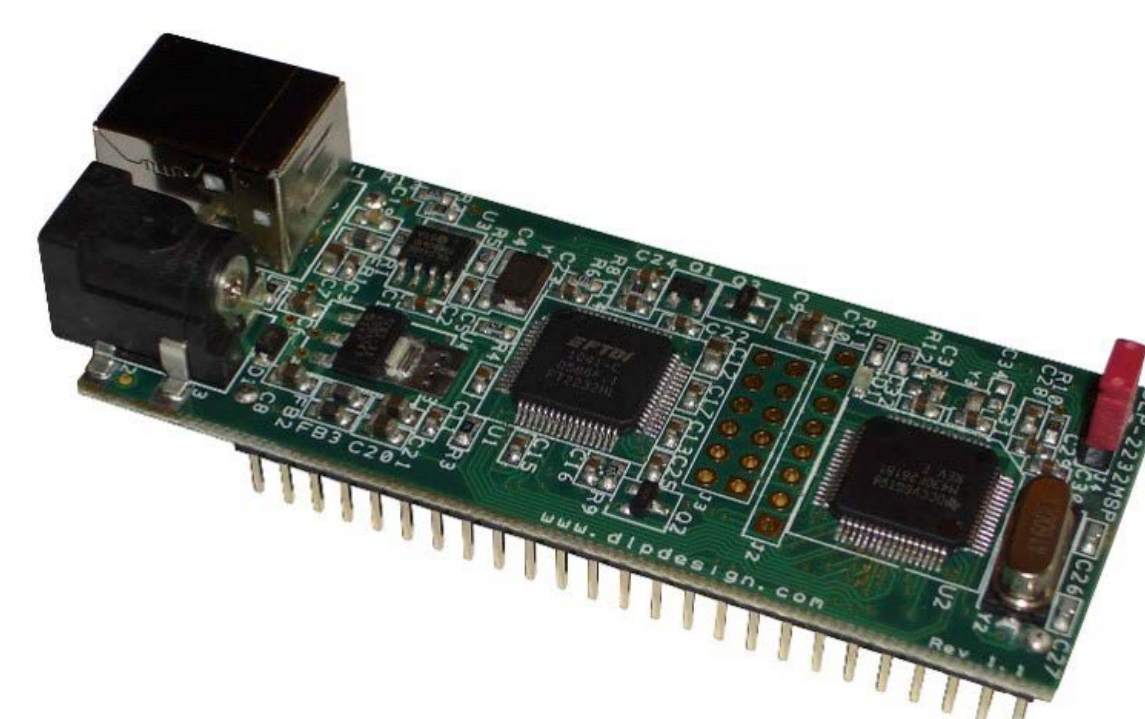
Future Design

- Implement current measurements for phase calculations
- Further development of PWM calculation for frequency regulation through load control
- Implementation of affordable design in small scale uses

Hardware

The board selected is the DLP-2232MSP

- Uses an MSP430F2618 microprocessor
 - DMA included
 - Multiple ADC12



- MSP430 is already mounted
- Easy to power
- Inexpensive
- Compatible with C code
- Compatible with Texas Instrument compiler Code Composer

Impact Analysis

If implemented correctly:

- Increase stability
- Increase efficiency for home and grid
- Minimize stress on the grid

If implemented incorrectly:

- Loads not allowed to operate
- Potential spikes in frequency
- Adjusts for wrong frequency

Glossary

- ADC12: 12-bit Analog to Digital Converter,
- DC bias: Direct Current bias
- DMA: Direct Memory Access
- GFA: Grid Friendly Appliance
- LED: Light Emitting Diode
- PWM: Post Width Module

This project would not have been a success without the assistance of numerous individuals however we would especially like to thank Rick Pratt of PNNL and Scott Hanson.

Team Shannon