Phasor Measurements Units (PMU) have been used to help aid in monitoring the power grid and are one of the most important measuring devices in the future of power systems. It was proposed that our group improve on an existing design of a PMU that was developed by a previous group called the Grid Friendly Appliance (GFA).

The team would like to thank the dedicated support of their industry mentor Rick Pratt, and instructor Dr. Delgado-Frias.

### Requirements
- Measure frequency accurate to 0.001Hz and reach a 7.5Hz update rate
- Capability to measure A.C.line current, voltage, and phase.
  - Graphically display voltage, current, phase shift, and frequency vs time using PNNL provided software.

The basic program flow of our system is as follows: Sample a period and a half of a 60 Hz sin wave via the ADC, calculate desired values, wait until half a second has passed, output data across the UART, reset the system. One important part of this system is the ADC sample rate which is set to 111,111 Hz and equates to approximately 925 samples per 60 Hz wave. Additionally, our developed algorithm sorts through the sampled data to calculate minimum, maximum, and zero crossing values. From these values we are able to implement transfer functions and scaling values to accurately compute RMS, phase shift and frequency.

The microcontroller used for this project is the MSP430. The circuit consists of an OP484 Op-amp that is used as both a summing amplifier and an inverter for current and voltage. 5V and -5V voltage regulators are present in order to power the op-amp. Lastly, a LM285 1.25V voltage reference is used to give the offset required to feed the signal into the MSP430. Additionally we are using a 5:1 step down transformer and SCT-0250 current sensing transformer.

Team Liszt was able to meet nearly all of the requirements put forth by their mentor. Frequency, voltage, current and phase shift can all be measured from a wall socket with our design. We are also able to graph the frequency using PNNL software.

- Choose a more suitable board to remove hardware limitations.
- Increase frequency accuracy to required 0.001Hz
- Graphically be able to display current and phase shift using PNNL software.
- Design our board in a cost effective manner.
- Be able to get all measurements with just a socket.

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Team Liszt