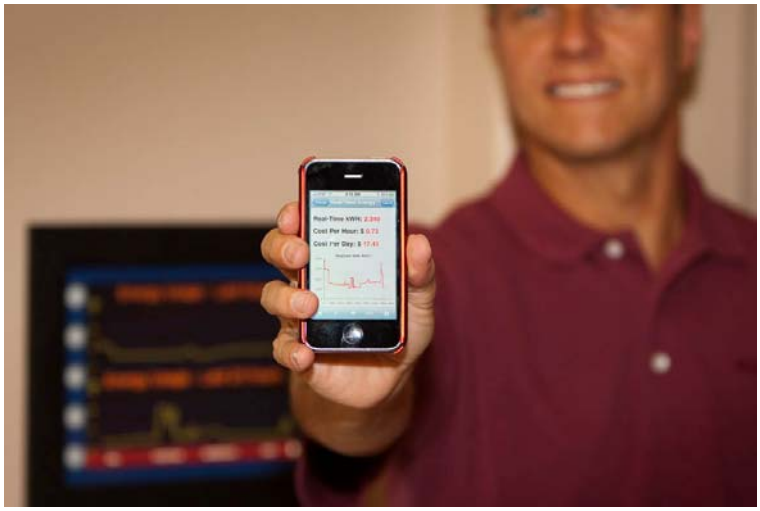

Benson Warms Up to Remote Energy Monitoring

Does Apple's iPhone really have "an application for everything?" Benson Hougland thinks so. He built his own energy monitor for use in his home. A programmable automation controller, a power-monitoring I/O module, and two current transformers let him measure current and voltage to provide power-use data in real time. And Benson can tap into his system to collect power-consumption data from anywhere and view it on his Apple iPhone. The result? An interactive, real-time awareness of energy use that helped him save $200 a month on his power bill.

Build Instructions

This Gadget Freak project gathers the raw data needed to calculate and measure the amount of power consumed in a home.

The heart of this project comprises an Ethernet-based rack-mounted SNAP-PAC-R2 programmable automation controller, a SNAP-AIPM-3 analog-input power-monitor module, and a SNAP-PAC-RCK4 four-module mounting rack. A separate 5V, 4A supply powers the units.

Connect the SNAP-PAC-R2 controller and the SNAP-AIPM-3 to the mounting rack and connect the 5-V power supply to the assembled system as shown in the instructions that accompany the supply. Use a 3-wire grounded power cord to connect line power to the power supply. Likely you will want to mount this complete assembly close to your circuit-breaker panel.

Place one split core current transformer around each power-line cable as it enters your circuit-breaker box. As a last resort, you might place the current transformers inside your breaker box, but always follow the National Electrical Code and take the necessary safety

precautions. If necessary, a licensed electrician can attach and wire the transformers for you.

Route the two current-output wires from each transducer to the first two channels of the SNAP-AIPM-3 module. (See the SNAP-AIPM-3 data sheet for connection details.) The current transducer will reduce the house-current to a smaller value that the module can measure on its two 0-to-10A power-monitoring inputs.

Next, you'll need a voltage reading, which you can obtain from a nearby electrical outlet. (Cut the female end off an extension cord to make this connection between the SNAP-AIPM-3 module and an outlet.) Now, because power equals voltage times current ($P = V \times I$) the module can calculate kilowatts. The number of kilowatts used over time is expressed as "kilowatt hours," the unit power companies use to bill you for electricity.

Use your power-bill information or call your power company to determine the rate you pay per kilowatt hour (kwh). The SNAP PAC controller comes with PAC Control programming software--a flowchart-based tool for developing control applications. Use this software to multiply the power measured by the SNAP-AIPM-3 by the cost per kilowatt hour to determine your power cost at that moment.

As the power you use fluctuates throughout a day, the power monitoring module and SNAP PAC controller will continuously use the kilowatt hour reading to recalculate in real time the cost to power your home at that given moment. The SNAP-PAC-R2 includes two independent, 10/100 Mbps Ethernet interfaces, so you can connect it to a home network or other Ethernet-compatible device. The two interfaces have different IP addresses. In addition, the module offers an RS-232 serial port with hardware handshaking, which you can use for point-to-point communications.

You use PAC Control software to manage external communications via several different protocols that include TCP/IP, EtherNet/IP, PPP, Modbus/TCP, SNMP for network management, SMTP for emailing, and OptoMMP, the open memory-mapped protocol used by all Opto 22 Ethernet-based devices.

You can attach an optional OptoTerminal-G75 to your home network and configure it to display a simple trend that shows how your electricity costs change as you turn on or off lights, appliances, entertainment equipment, and other devices.

For access to your power-use and -cost information over the Internet from a remote PC, you'll need a web server that will accept HTTP requests and serve up a proper responses. You can then use the SNAP PAC hardware's IP address to access the information remotely. For similar accessibility from an iPhone, you must create a styled web page and placed it on a web server. (Free iPhone cascading style sheets, or CSS templates are widely available on the Web). I created the slick iPhone interface in the nearby photo by using a cascading style sheet template. With just a few lines of HTML code, you can create a simple Web interface that provides a single table of electricity-use information.

Now you have an excellent way to track the real-time cost of running your home. Awareness really does make a difference. Having a screen show you the real cost you incur for turning on lights, running your air conditioner, or preheating an oven for too long, gives you pause, makes you more conscious about your energy consumption, and helps you to conserve.

Parts List

Amt	Part Description	Allied Part #
1	SNAP-PAC-R2 Programmable Automation Controller	691-0357
1	SNAP-AIPM-3 Three-Phase Power Monitoring Module	691-0378
1	SNAP-PAC-RCK4 4-Module Mounting Rack	691-0378
1	SNAP Power Supply, 110 VAC to 5 VDC	691-1011

Additional parts:

Veris Split Core Current Transformer, 200A In, 5A Out (Model: VS H6810-200A-5A, two required). Available from www.mymeterstore.com

Ethernet cable, power cords, mounting hardware.

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