photon ALARM

Demo at YouDoIt Electronics, Needham MA
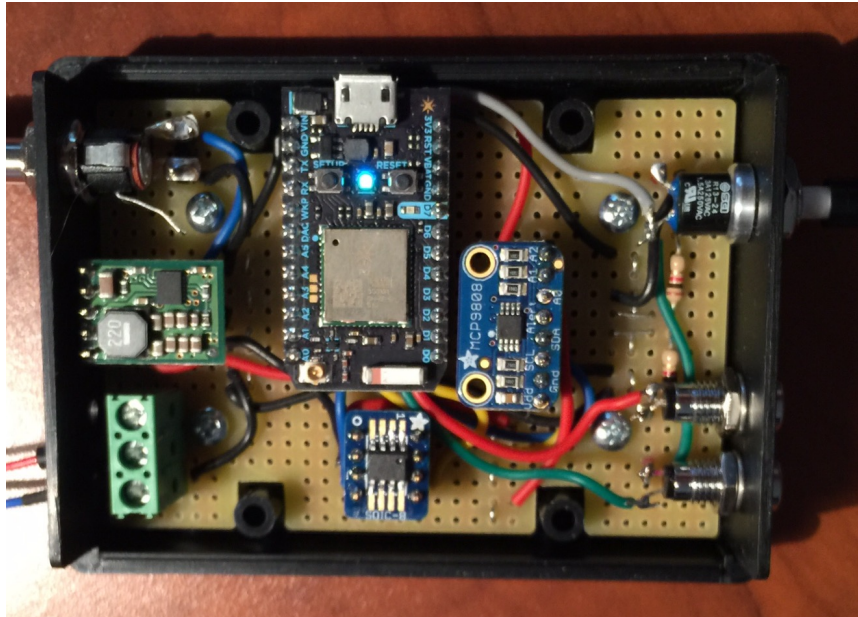
April 2, 2016

The Internet of Things Home Alarm

Prototype Design of a Flexible IoT Alarm and Home Monitor System
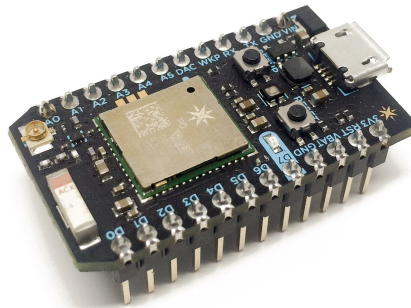
re: Engineering

March 2016

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Project Description

This project is a working prototype of a flexible, self-contained and inexpensive micro-processor system which provides a platform for various alarm and home monitoring functions completely managed via an iPhone or other smart phone. Sensor devices are connected via a 1-Wire or I2C bus and includes temperature, humidity, water detection, smoke alarm, motion detection and magnetic door closure. The microprocessor utilized is the Particle Photon which provides an Arduino-like environment but much more powerful since it is based upon an STM32F205 120Mhz ARM Cortex M3 processor with built 802.11b/g/n Wi-Fi (Photon) or direct cellular connect (Electron). The ARM Cortex has 1MB flash and128KB RAM.
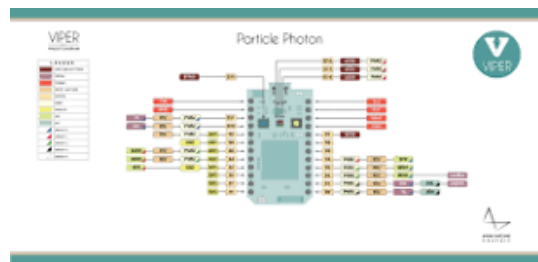

PHOTON

About re: Engineering

re:Engineering is my not-for-profit home engineering workshop with the mission of exploring the latest in hobbyist trends and technology and bringing these to useful prototypes for educational purposes. The software developed is made available to the public via GitHub and is licensed under the GNU General Public License.
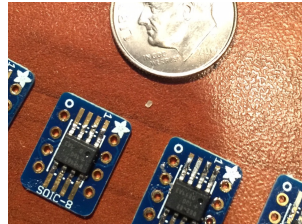
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The Hardware

The Particle Photon processor is available at the Particle Store here for just $19.

https://store.particle.io

PARTICLE PHOTON

The sensors are connected via a DS2482-100 1-wire bridge which connects to the Photon via the I2C bus. The Arduino wire library, adapted to the Photon and the DS2482 bridge, is included in the source.
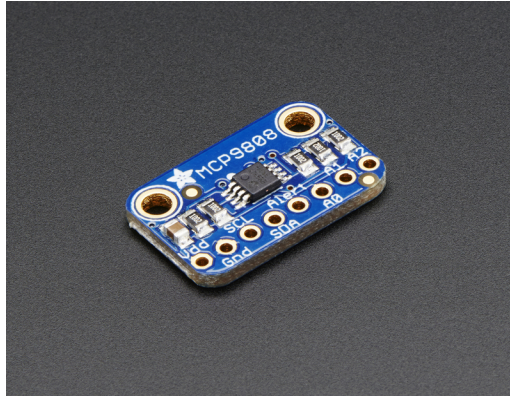

DS2482-100

You can learn all about 1-wire here:

https://www.maximintegrated.com/en/products/digital/one-wire.htm

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Temperature can be measured with a 1-wire DS18B20 or the Adafruit MCP9807 precision temperature sensor available for $4.95 from Adafruit. The Arduino library is included in the source.

Power required is unregulated DC from 2.5 to 18 volts and is up/down-converted and regulated to 5 VDC via a Pololu 5V Step-Up/Step-Down Voltage Regulator S10V4F5.
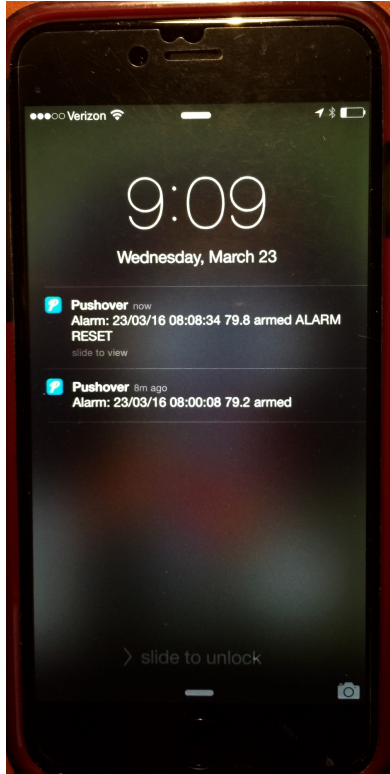

Source is available here:
https://github.com/dont45/PhotonAlarm
Donald Thompson
thompsondd@comcast.net

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Alarm Operation

The primary communication of the alarm is through alerts pushed to a smart phone as shown here on an iPhone. These alerts are pushed from the photon to the phone using Pushover.

Pushover is a highly reliable and secure system to easily push alerts to one or more of your smart devices including desktop computers and even with email. It is relatively inexpensive, requiring only a per device license fee of $4 which is a one-time cost for a maximum of 7500 alerts per month. You can learn all about pushover here: https://pushover.net/.

The following alerts are pushed to your phone:

• Alarm Alerts resulting from a tripped sensor

• State changes such as a tripped sensor now clear, or alarm disarmed.

• A periodic 'worry' alert to ensure system is operational. The time between these worry alerts can be set to 0, no worry alerts, or from 1 to 12 hours.

• Informational Alerts as a result of component failures or other unusual system events.

• Alerts as a result of user interaction with the system via an iPhone management app (still under development) or system management web page (temporary solution until app is available).

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Alarm Management

All management commands which effect changes to the alarm operation, such as disabling operation, require a secret code to confirm the change. This secret code is a 4 digit random number sent via an alert and must be sent back by the user via the phone or web app to effect the change. Command execution or failure is confirmed via an alert. Management commands currently included in the prototype are:

- SET - set alarm to armed state,
- DIS - disable alarm operation,
- ACK - acknowledge alarm condition and reset
- HOU - set number of hours between worry alerts.
- LIST - display brief sensor devices list
- UPD - send current alarm status information
- RAN - send a random seed which is required for above commands

Current Hardware

Current project hardware is an operational version built into a small project box as shown on the first page of this document and a second version assembled on a breadboard. Both will be shown at the Arduino Day event.

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Origin, Future Projects and Ideas

This project has it's origins in an event which took place at my house 20 years ago.   A water pipe froze and burst in the second floor bathroom, resulting in flooding of much of the house and massive damage. This event prompted me to build a simple alarm system using a Motorola 68HC11 micro controller with a serial port connected to a modem, programmed to read various sensors and issue messages to my pager. Similar to the current Photon model, the first version utilized Dallas Semiconductor 1-Wire devices to connect the sensors. The technology of today has advanced significantly, making it much easier and cheaper to develop more feature rich and user friendly systems.

This current project is a powerful framework for many kinds of various systems, not just alarm systems. The core technology which this system utilizes is the Particle Cloud. Communication to Pushover is done via the particle publish command, which logs the data to their cloud. This data is then easily accessible to other systems. For example, a simple nodejs script can log all of your data to a MySQL database or to Amazon's AWS. With simple changes to the software other sensor devices, such as a GPS module, can be easily added. Switching the Wifi based Photon to the cellular Electron and the system can be deployed anywhere. Just think of what you can do with this! Your summer cottage in the woods in Maine can now have a powerful system to monitor intrusion, water leaks, freezing, power outage, and anything else you can think of. No contracts, no monitoring fees, no wifi or internet required, just cellular service with a monthly cost of only $2 per month and you have complete and instant monitoring of your property.