

American Electric Power Challenge: Home Status Indicator(s)

Challenge: Create a device to provide visually appealing indications of home utility usage and other home information data. This can be breadboard only or a 3D printed case could be added.

Materials: Single board development system such as Arduino, RasPi, etc. will work well. Displays can be LCD-TFT Screens, individual LEDs, RGB-LEDs, etc. Clever use of servos/solenoids may be an approach to a retro type design. If a RasPi is used, the display can be on a computer monitor.

Input Signals: Input utility signals are to be simulated. This can be preprogrammed sequences or with potentiometer/analog input.

Utility signals/data:

Electric Usage:

kW: Current power usage: Typically between 0 and 10kW.

kWh: Total energy usage: Typically 400 (spring) to 1500 (summer) per month.

Natural Gas Usage:

CCF (100 cubic feet): Typically between 2 (summer) and 70 (winter) per month.

Water Usage:

Gal (gallon): Typically between 2000 and 10,000 per month.

Environmental Data: The display can also incorporate environmental monitors such as temperature, humidity, co2, etc. Similar to above, these values can be included in the display with the other information.

Displays: For each of these, an alarm level could be set to flash, colors could be adjusted to fade through a range based on usage, or a comparison to a budget value could first be used and then display the difference. This could have multiple screens that the user could select and include dashboards, graphs, pie charts, bar charts, numeric data, etc.

Other Functions: Functions such as text or email notifications could be added to alert the user to specific situations.

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Background: AEP and other utilities offer monthly and yearly usage and efficiency reports. These reports provide overall indications of power usage, benchmarking to similar homes and seasonal adjustments to expected power usage. This analysis and reporting is available to both commercial and residential customers.

Currently AEP is installing advanced metering. These meters allow for the collection of power usage data at 15-minute intervals. The data offers the opportunity for a more detailed understanding of power usage.

As part of these advanced meters, customers can install a device for their home that provides continuous indication and visual displays of power usage via a phone app.

The AEP MakeOhio 2020 challenge is to create a visual indicator to fit in between the monthly report and the instantaneous data. The idea is a device that could be mounted on a wall or a tabletop device that will provide a quick summary of conditions. It is to provide a display that would catch your attention that something is different from normal and prompts the user to look deeper into an issue.

Some ideas on the device are:

- *Simple depiction of information, use of colors/patterns
 - *Design approaches can be modern sleek look, a retro look, etc.
 - *Data/conditions can be simulated by simple programs or manually generated with analog inputs.
 - *Device can build in environment sensors such as temperature, humidity, air quality, etc.
- Note: A small number of CCS811 and temp/humidity sensors will be available for teams undertaking the challenge.

Comments and Components: A limited amount of these devices is available for the students working on this challenge.

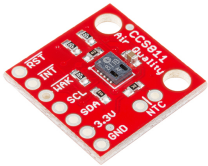
- 1) 1.8" LCD TFT Display: This device is from Sparkfun and can be easily interfaced to an Arduino. It will be necessary to load the associated libraries for the Arduino IDE. Also, the Sparkfun website has detailed tutorials on wiring and programming the device.

CAREFUL: The screen/break-board are not fixed together. This lets them be mounted separately. The ribbon cable is delicate!



- 2) CCS811: This device is from Sparkfun and provides CO2 and TVOC readings. It is good for basic air quality measurements. Tutorials and example code are available on the website and load with the library. This is an I2C device. Address is 0x5A.

Note: This is a 3.3Volt device.

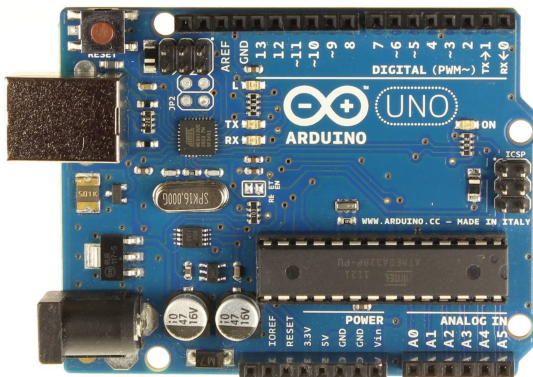


- 3) Si7021: This device is from Sparkfun and provides Humidity and Temperature readings. Tutorials and example code are available on the website and load with the library. This is an I2C device. Address is 0x40.

Note: This is a 3.3Volt device.



- 4) Arduino Uno and Mega work well for interfacing. The Uno can handle both SPI and I2C communications. The Mega has more I/O and memory available for additional inputs/outputs and more involved graphics.

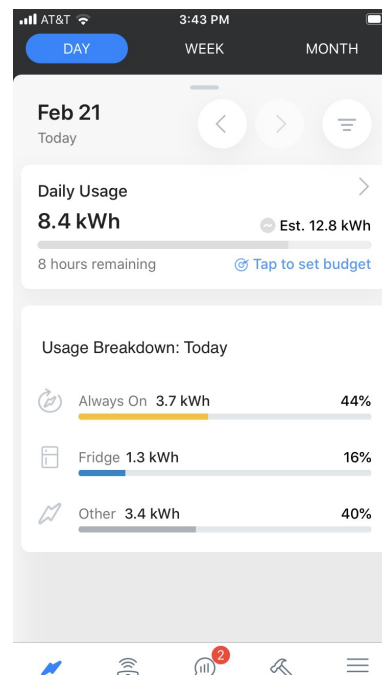
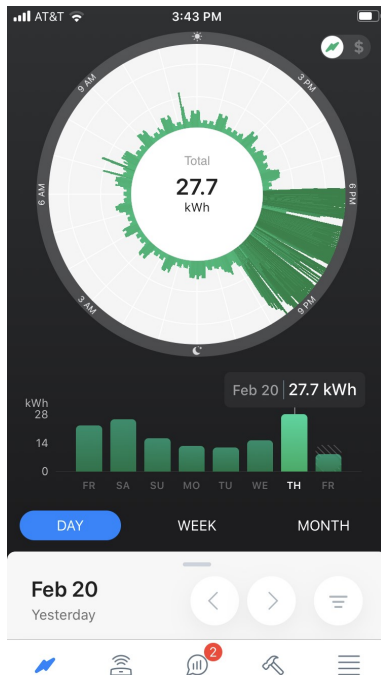
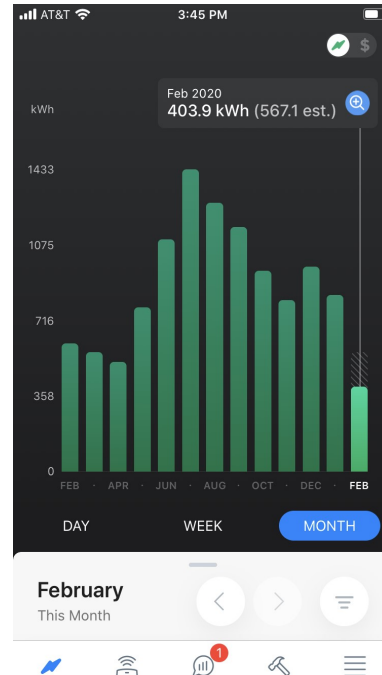
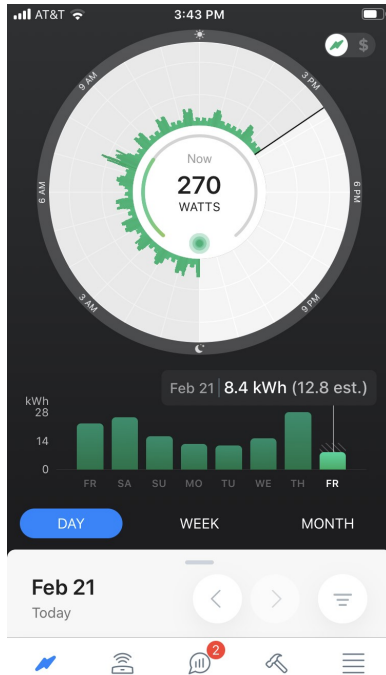


Example of a Utility Monthly Report for a Commercial Customer (Test Program)



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Example of Phone App displays



Reference: <https://itsyourpowerohio.com/>