These lights display air quality. How?
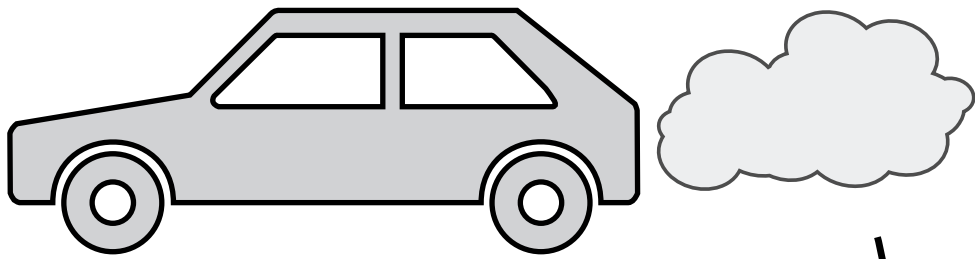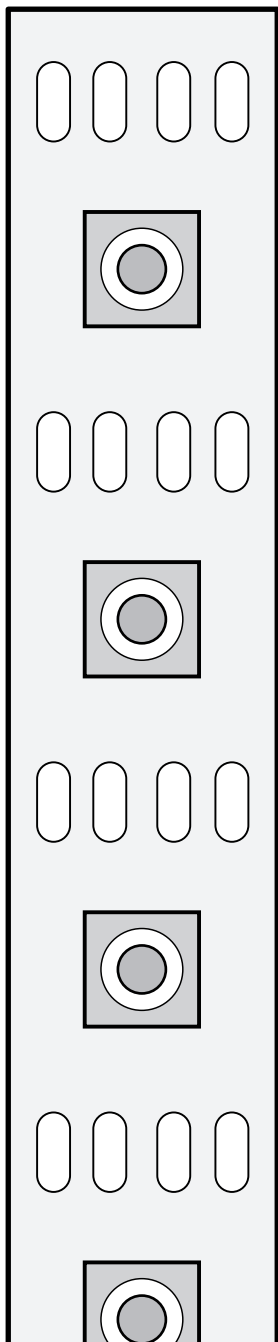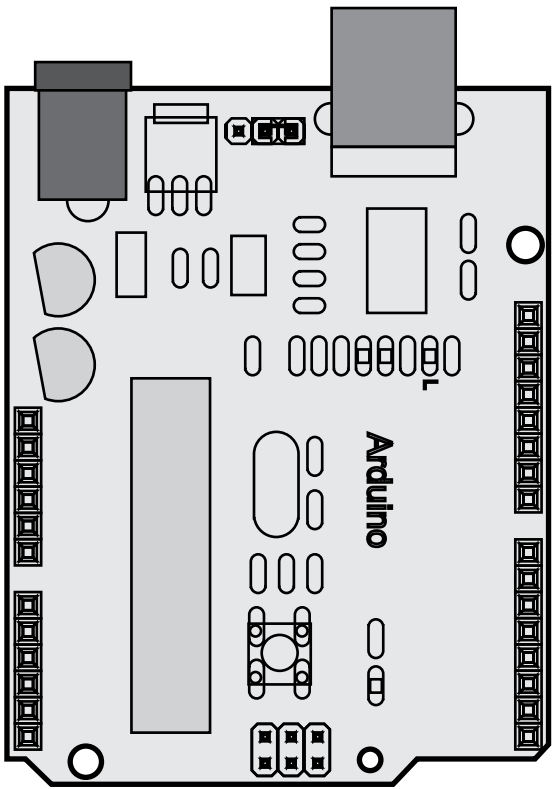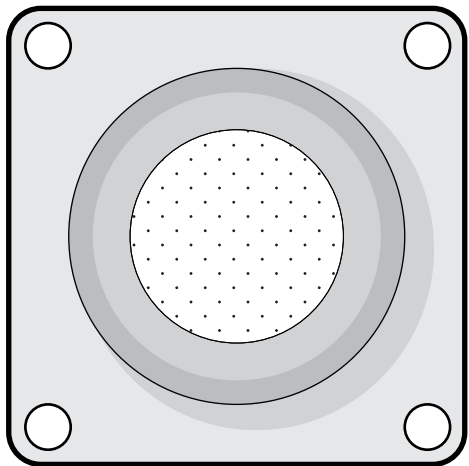
Combustion produces pollution.

Carbon monoxide is a pollutant released by the burning of fossil fuels (and several other processes). It is dangerous indoors in high concentrations, but outdoors it very rarely reaches dangerous levels. However, it is an indicator of other air pollutants. When it is present, other pollutants like NOx, SOx, and particulate matter, which are harmful to people, are often also present.

Sensor outputs pollution concentration.

A sensor at head height on the stick continually measures carbon monoxide (abbreviated CO). Electrolyte goo inside the sensor reacts with the CO in the atmosphere and changes electrical current passing through it. The sensor sends information about the CO level to a circuit board called an echem328. It was designed to turn the readings from the sensor into useful information.

The sensor and echem are very good at measuring small concentrations of CO in the atmosphere. They can detect just a few CO molecules in a sea of billions of other gas molecules. In fact, they can detect you too! Try breathing on the sensor and see if the lights respond!

The echem328 board was designed by our friend Ken McGary. For more information on the echem board visit: http://circuitsci.com.

Try breathing on me!

Arduino translates pollution concentration into light levels.

The echem sends information to an Arduino circuit board. Arduino is an open source microcontroller designed to be used by everyone from experts to amateurs. Arduinos can be programmed to send and receive information from other electronic devices. Our Arduino board runs a program which converts the values it receives from the sensor into a number between 0 and 60. The Arduino then sends a message to the lights to tell which of the 60 LEDs to light up and what color they should be.

The Arduino uses a software serial port to communicate between the Arduino and echem. This allows us to use the real serial connection on the Arduino for data logging and troubleshooting.

Dotstars illuminate air quality.

The Arduino sends instructions to a strip of 60 small lights called RGB LEDs. The lights are wired together, but each light can be individually controlled, changing color and intensity. The Dotstars are designed for light painting and other applications where a fast refresh rate is necessary.

It is possible to power the Dotstars directly from an Arduino, but it can be difficult for the microcontroller to provide enough current for a long strip. We use an auxiliary battery pack with 4 rechargeable AA batteries, which provides just the right amount of voltage to the lights. Non-rechargeable batteries need an additional resistor to prevent the extra voltage from zapping the LEDs! The pack is attached with Velcro for easy loading.