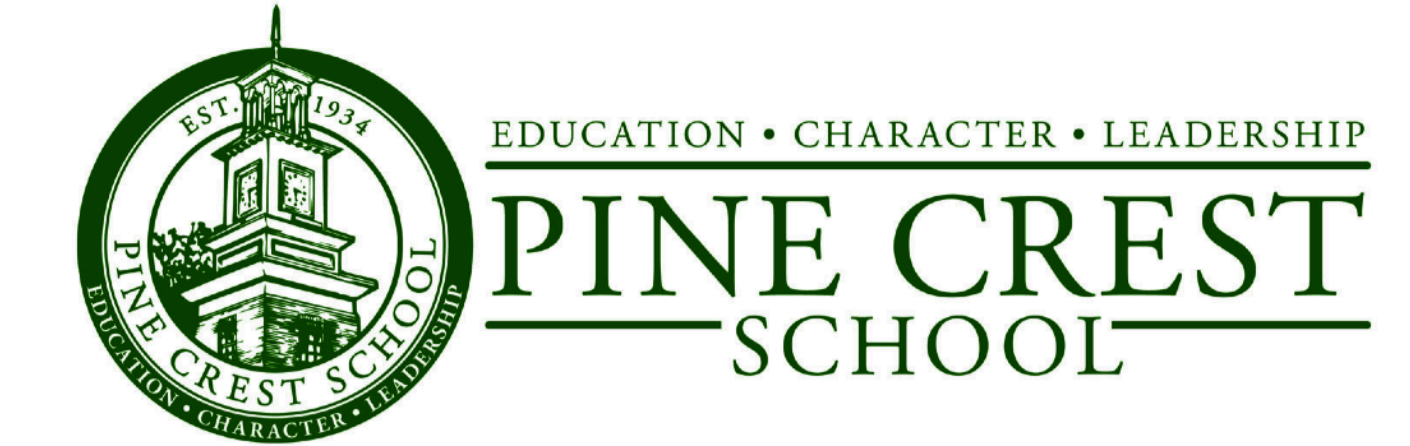


# STUDENT BUILT "SMART" PROJECTS

Kris Swanson (@krswan) and Vicki Spitalnick (@vspitalnick13)  
Innovation Specialists, Pine Crest School Boca Raton Campus



## How to Help Your Students Use Microcontrollers in Classroom Projects

### What is a Microcontroller?

A microcontroller is a circuit board that has at least a microprocessor (the brain), a way to program the microprocessor to do what you want, and a variety of inputs and outputs to which you can attach things like lights, motors, buttons, or sensors. Think of it as a tiny and inexpensive computer. It may only do a few things but can fit into whatever project you or your students may be working on.

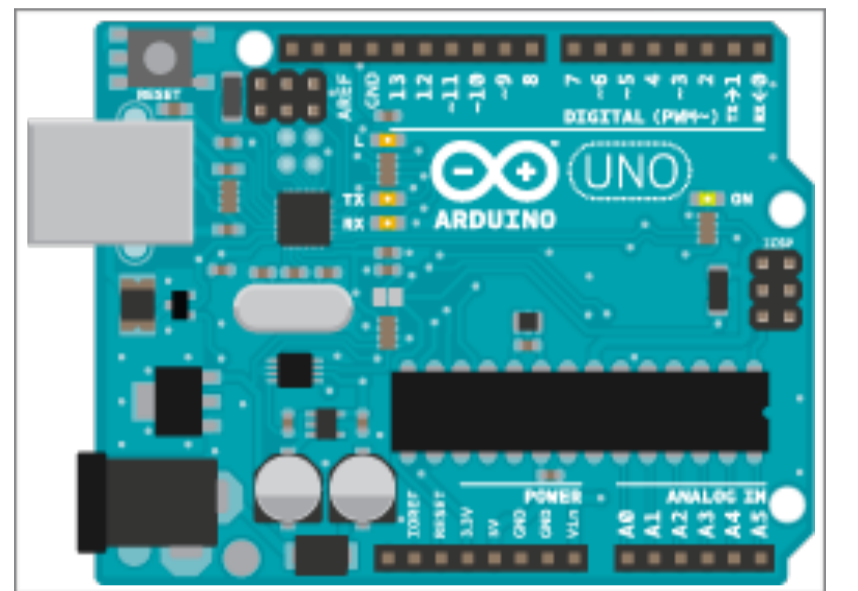


### Why Use Microcontrollers?

Microcontrollers are great for students when they want to build a project that will record or interact with its environment. Maybe your students want to create a weather station that records temperature data outside of your classroom for an extended period of time, or create a set of buttons that run a quiz game program written in Scratch. Maybe they want to add a remote control to a lamp, or rebuild one of their own remote controlled cars so that it can be programmed to do things autonomously. The truth is, you probably have no idea what your students may do with a microcontroller, and neither will they until they have an amazing idea and start building.

### What is Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. A worldwide community of makers: students, hobbyists, artists, programmers, and professionals, have gathered around this open-source platform. Their contributions have resulted in an incredible amount of accessible knowledge useful to both novices and experts alike. The Arduino platform is easy-to-use for beginners and flexible enough for advanced users.



## Student - Focused Board and Language Selection (which we use and find to work well with our students)

Links to the text, boards, languages, and a .pdf of the poster are at:  
<http://krisswanson.blog/2018/01/22/fetcsmart/>  
<https://goo.gl/Eg8L2b>



### Boards

### Language / IDE

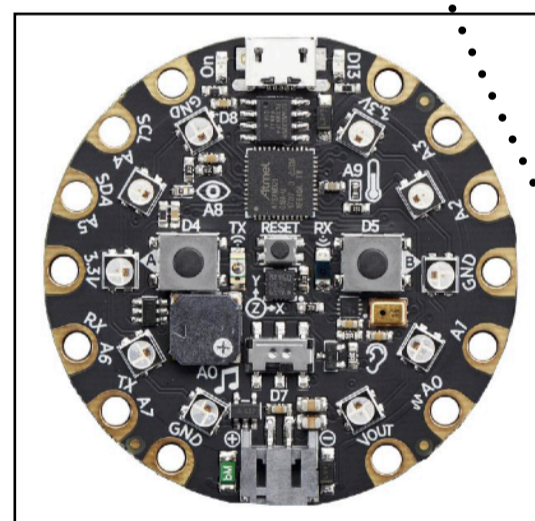
Easier

Harder

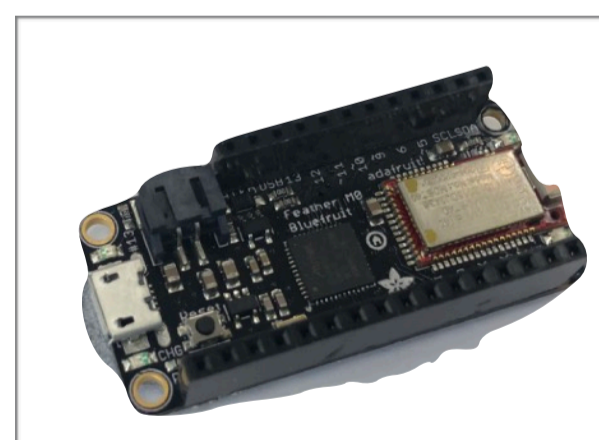
BBC Micro:bit



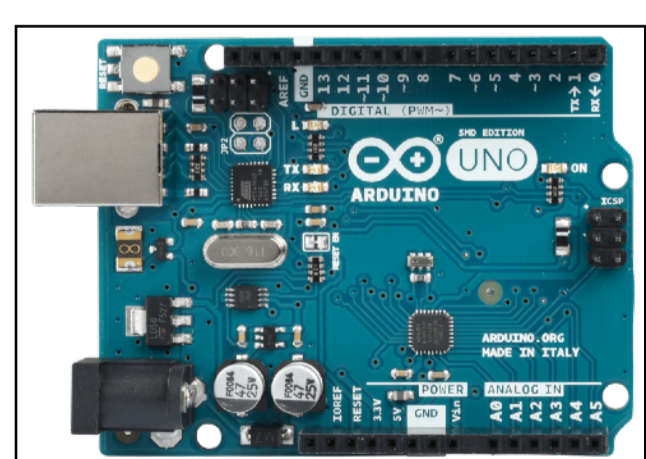
Adafruit Circuit Playground Express



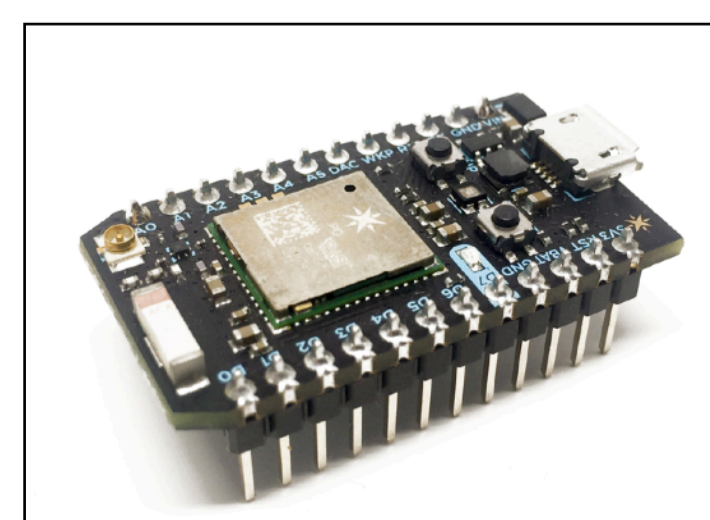
MO Boards



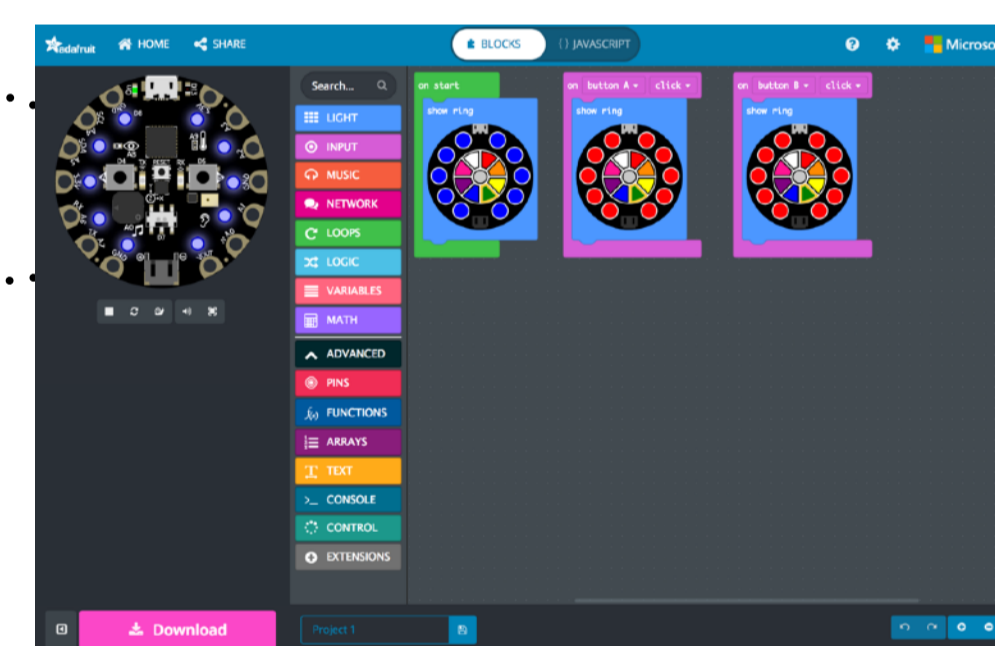
Arduino (Many different sizes, features)



Particle Photon (wifi) and Electron (cel phone)

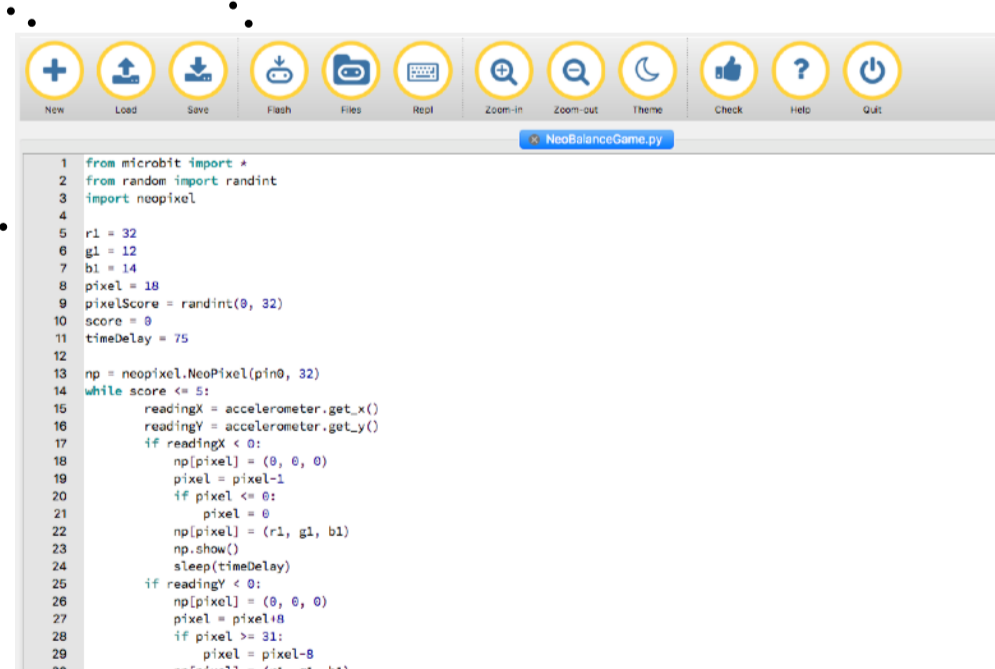


### Microsoft MakeCode



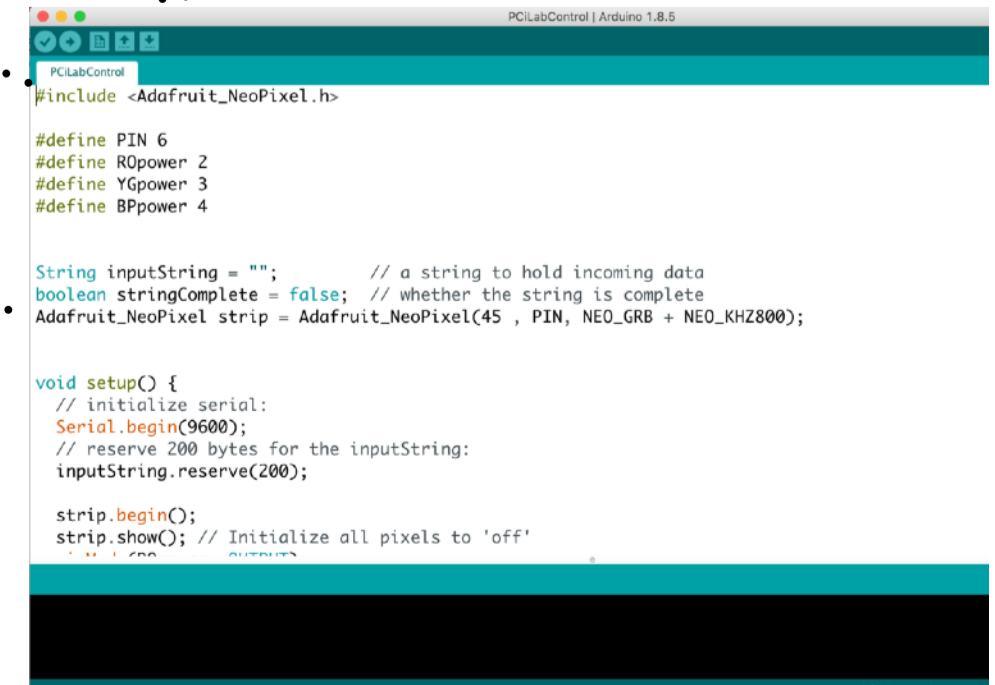
If you and your students have used Scratch or other block-based languages before, you will be comfortable coding with MakeCode. It works with a growing assortment of boards, and can be coded with Javascript as well.

### Mu Python Editor



Still in Beta and only set up to work easily with the BBC:Micro:bit, this promises to become the easiest way to program the Micro:bit, Circuit Playground Express, and other MO Micropython and Circuitpython compatible boards.

### Arduino IDE

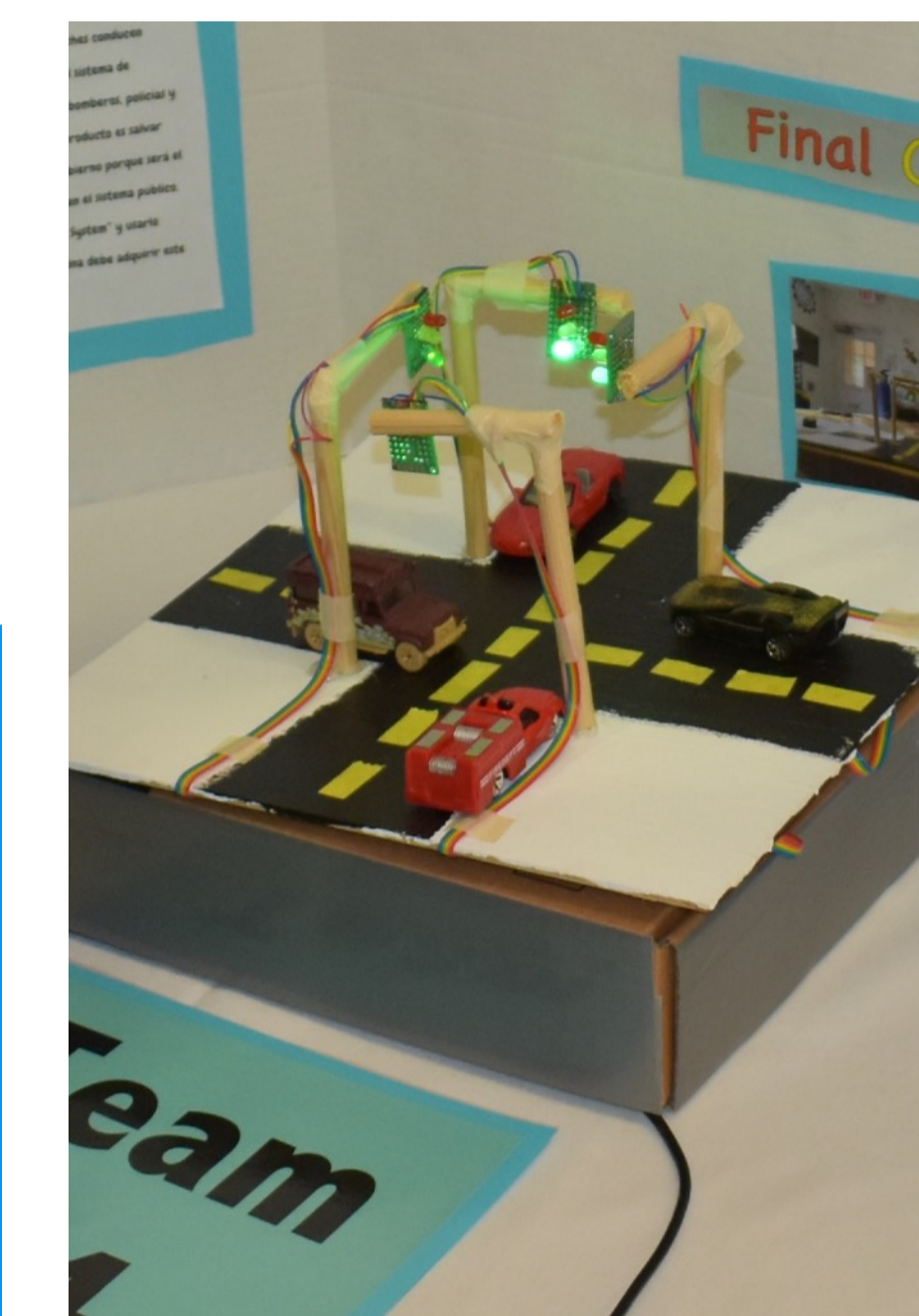


The original way to program Arduino-compatible boards is with the all-purpose Arduino IDE. It uses a text-based coding language based on C, and is simple and powerful compared to other systems for programming microcontrollers. This may be a little intimidating to teachers and students without some coding experience.

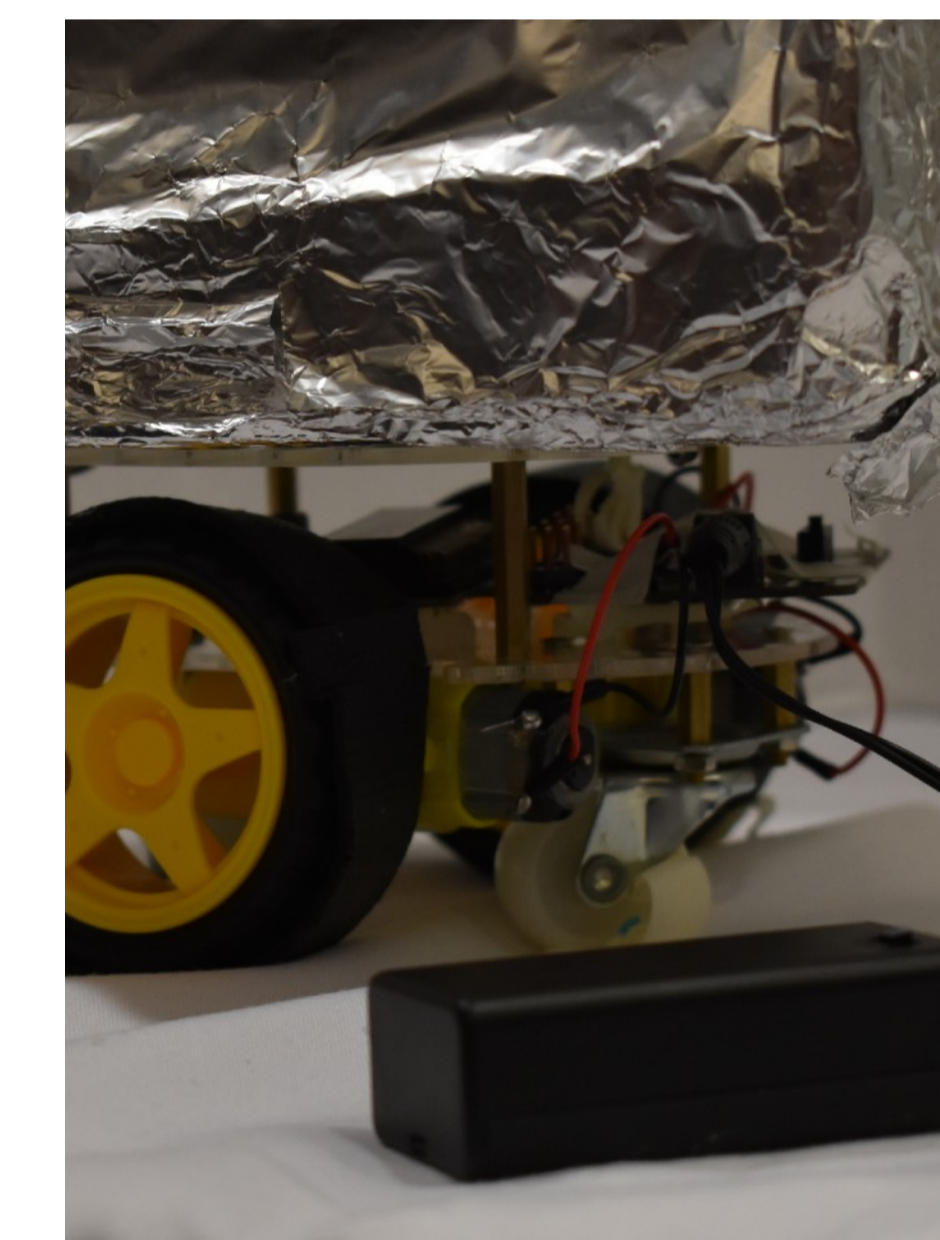
I'm a Teacher, not an Engineer!  
How do I start?

Purchase a simple, inexpensive board and start playing. We recommend a BBC Micro:bit or an Adafruit Circuit Playground Express for teachers who are not comfortable with coding or electronics yet. There are many online tutorials and projects designed to help you get started!

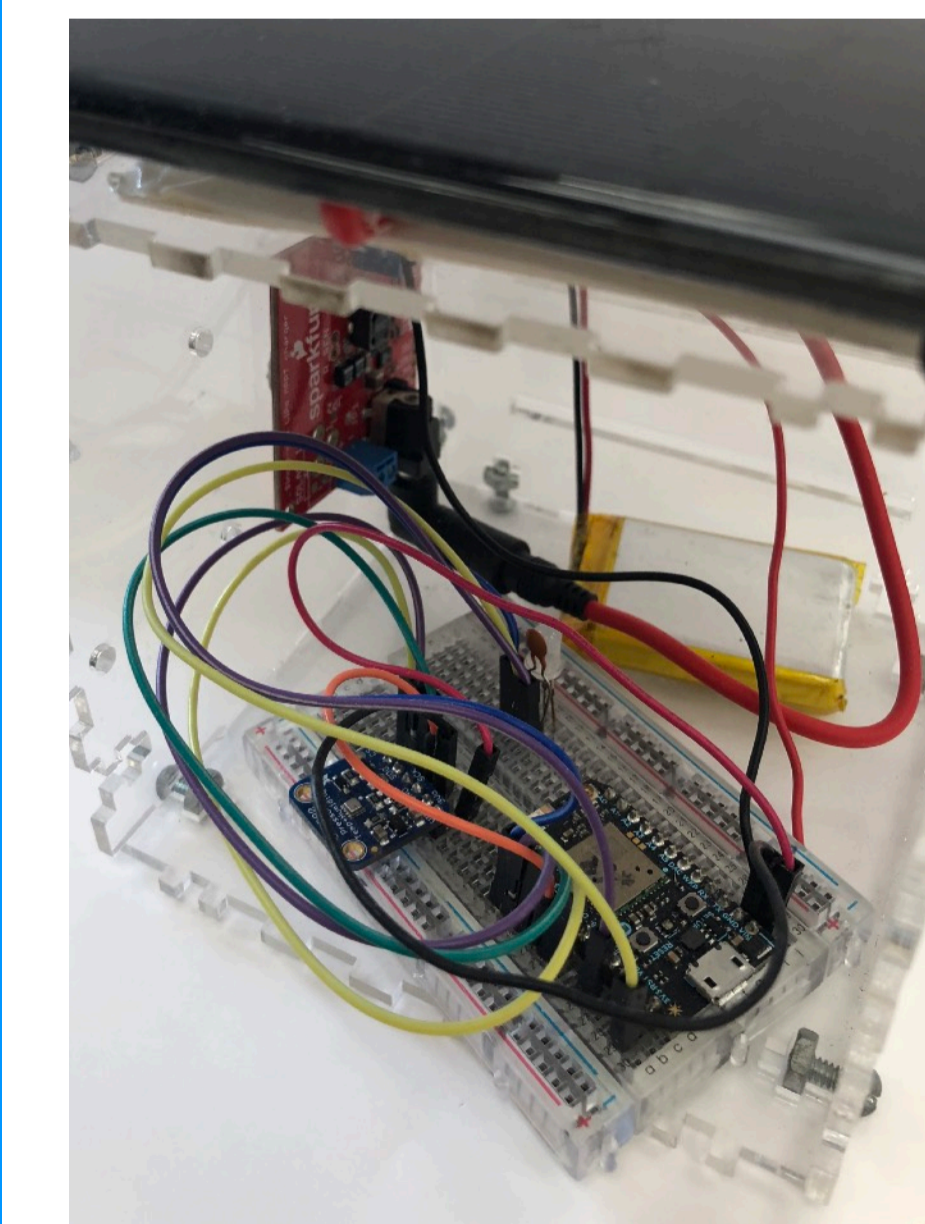
## Student Project Examples!



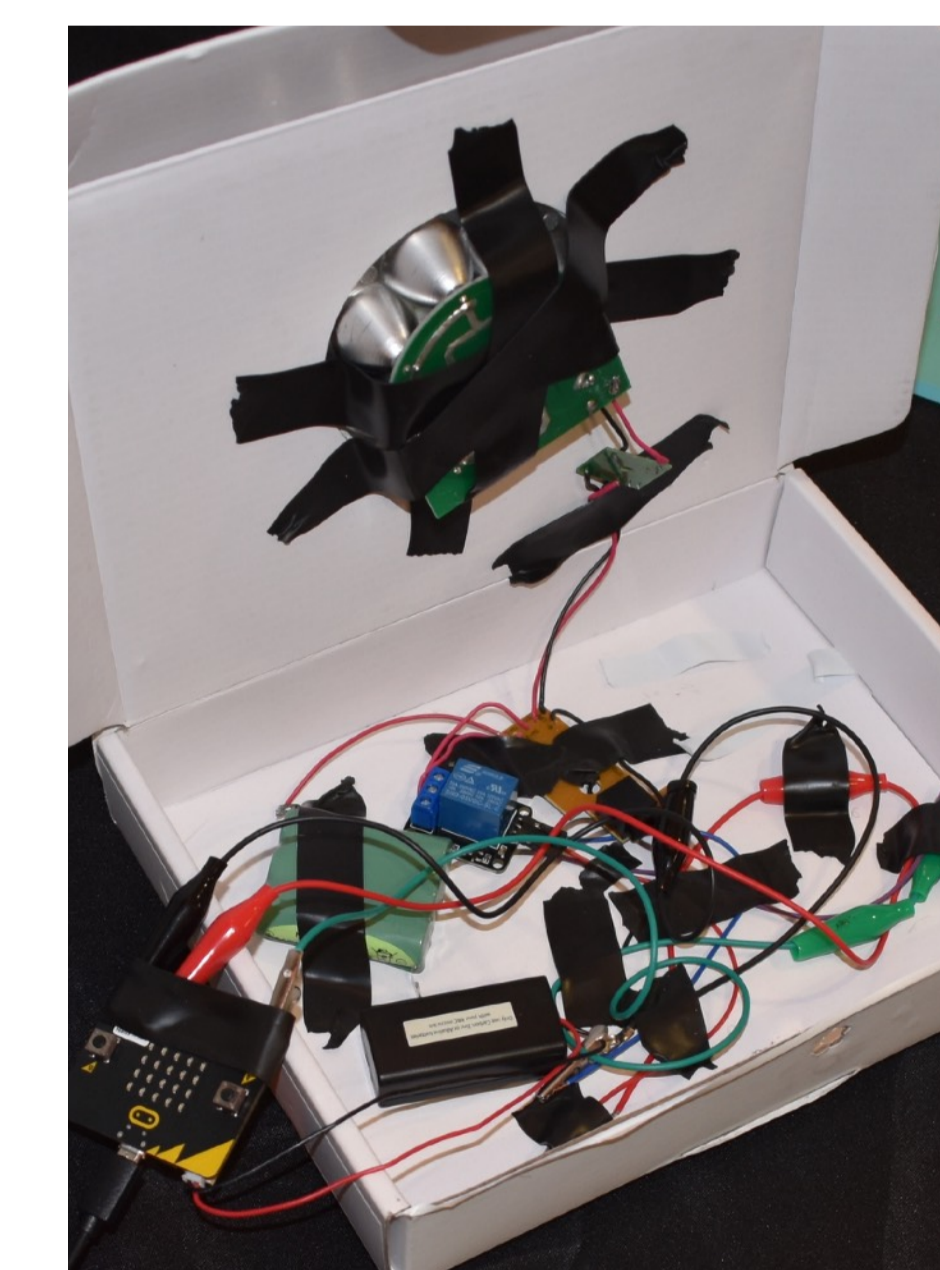
**Emergency Traffic Signal**  
Students wanted to demonstrate a proposed emergency traffic signal with 12 separate lights and remote control ability. They used one **Micro:bit** to control the traffic lights, and a second as a remote control.



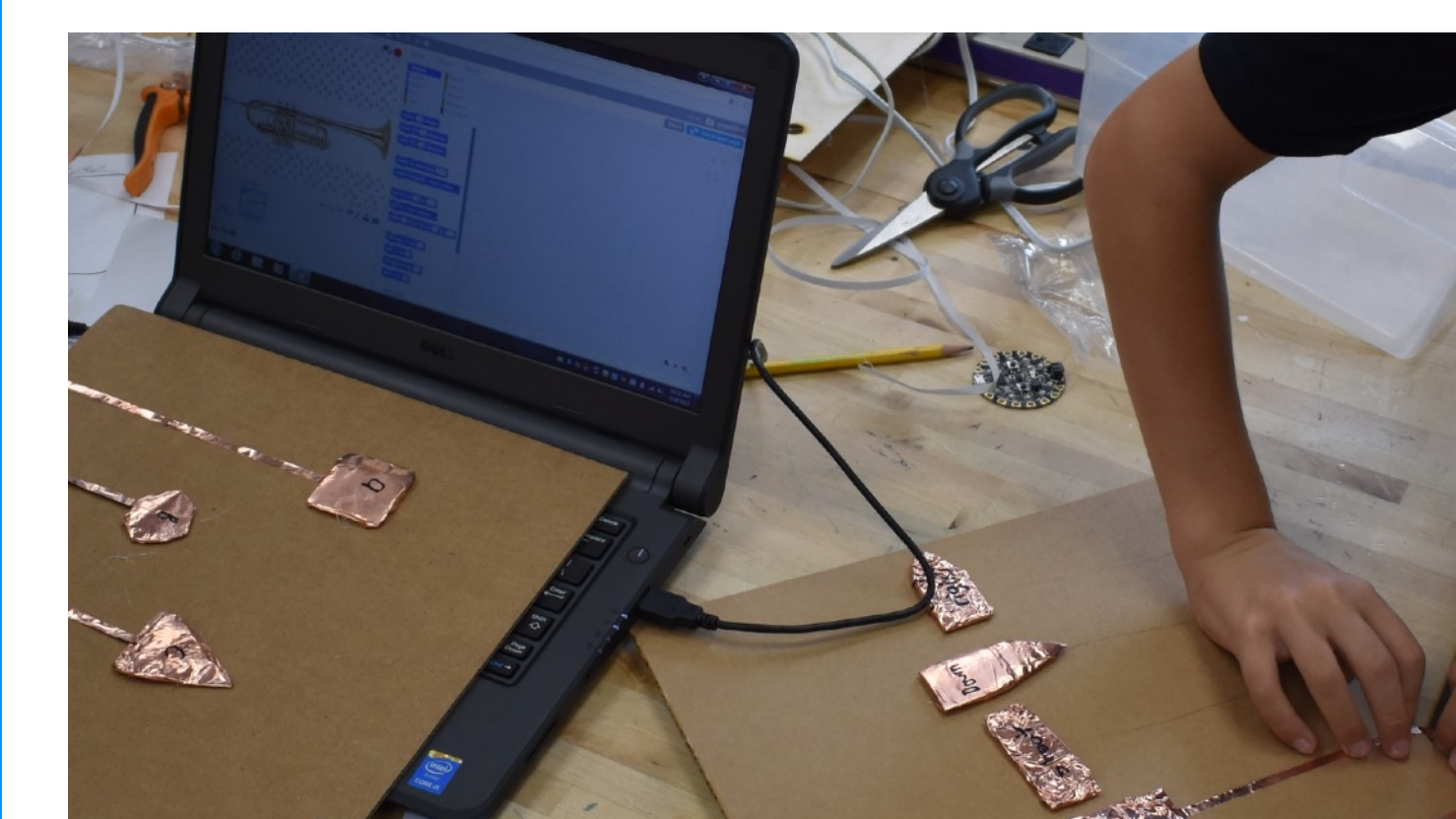
**Automatic Garbage Can**  
Students prototyped a garbage can which could drive itself to the curb using an inexpensive robot base (\$15 on Amazon) and a Micro:bit with a Moto:bit board attached to control the more power-hungry motors.



**BIBO**  
A solar powered weather monitor, using a **Particle Photon** Arduino compatible board with built in wifi. This device sent temperature and humidity data to an online database which students could access anywhere.



**Car Finder**  
One **Micro:bit** served as a remote and a second as a receiver which activated a spotlight through a car's front windshield to help locate the car in a crowded parking lot at night. A relay served as the connector between the Micro:bit and 12v spotlight.



**Touch-Controlled Musical Instruments**  
Students used Scratch to create a musical instrument. The Scratch program was controlled by copper tape buttons attached to an **Adafruit Circuit Playground Express** programmed to emulate a **Makey-Makey** board. While the microcontroller was pre-programmed by the teacher in this project, it was a great introduction to what students would do later on.