



ROBOTS FOR SCHOOLS AND HOW TO PROGRAM THEM.

WHAT ARE SOME OF THE NEW OR REVISED ROBOTS IDEAS THAT ARE AVAILABLE FOR SCHOOLS TO USE.

HOW I GOT INVOLVED WITH ROBOTS

- Aprox. 2 yrs ago some students asked if I would be a robotic club advisor.
- They secured funding for a starter set for the VEX robot. The seniors designed and built a robot that carried bottled water around the gym following black electrical tape during Project Graduation.
- My interest is not in building robots but trying to control them once built.
- So this session will look more at what is available to be controlled rather than how to build them.

WHY NOW?

- In the past few years there has been a big push to get students interested into STEM-C courses (Science, Technology, Engineering, Math and Computing).
- Computing is not just coding or creating games. It is also creating and controlling devices remotely to complete tasks.
- One of the hooks is to give students something to play with. Then provide tools to control them.
- This increased interest and funding has given many companies and organizations reason to develop these tools.

TWO MAIN PURPOSES OF THIS SESSION

The two main purposes of this session are:

1. to give you chance to work with some to robots currently available and sources of robots and their programming environments.
2. Provide you with links to get more information on the robots

There is no special order to the robots being presented.



VEX ROBOTS

WEB SITE: WWW.VEXROBOTICS.COM

- This is the erector set of robots used in Project Lead The Way classes.
- They now have different types of sets. VEX EDR older of the two. Metal components and the VEX IQ plastic pieces.
- VEX EDR start kits costs start at \$439 and goes up depending on accessories. Classroom set for 24-30 students \$5,299.99
- VEX IQ starter kits start at \$279 and goes up. A classroom set of 12 kits is \$3,849.99.
- They have yearly challenge contests where you design and build a robot to compete. Fox Valley Tech is the closest host site to Stevens Point.



ROBOTC: THE SOFTWARE TO CONTROL VEX ROBOTS

WEBSITES: WWW.ROBOTC.NET
WWW.ROBOTVIRTUALWORLDS.COM

- This is a C programming Language for Robots.
- They support both the VEX robot and Lego Mindstorm robot Systems
- They also provide Virtual Worlds where you use the ROBOTC language to control VEX and Lego robots through many challenges without needing to purchase the actual kits.
- I have used this in my C and Robotic Programming classes to good effect.
- They offer a free trial download.
- They have yearly licenses for \$299 for 30 seats but I recommend the perpetual licenses at \$599 for 30 seats (don't need to renew yearly) they also have building licenses as well
- They also provide curriculum for the virtual worlds.

EDISON COST UNDER \$50

WEBSITE: MEETEDISON.COM

This robot, power by 4 AAA batteries, has a number of built in sensors. It can detect obstacles in it way, follow a light, sense sound (responds to a clap), follow a line or stay within borders, infrared receiver.

It has two red LED lights, a Buzzer to give feedback.

Each wheel has its own motor.

It is constructed to be expandable by using Lego bricks.

It is programmable with it apps for PC, MAC, iOS, Android and Chrome. It connects to your device using a custom cable coming from your headphone jack.

You can download the free lesson plans and activities from their web site. (I have a hard copy in a binder for you to look at.)

It is possible to connect multiple Edison to make a more complex robot (web site show two together as a bulldozer)



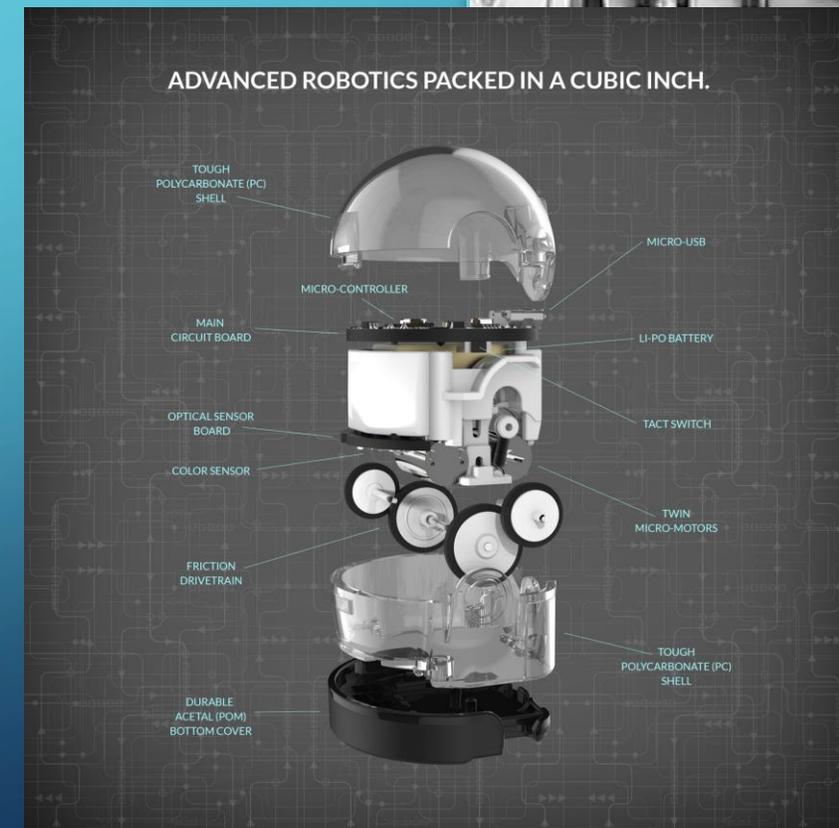
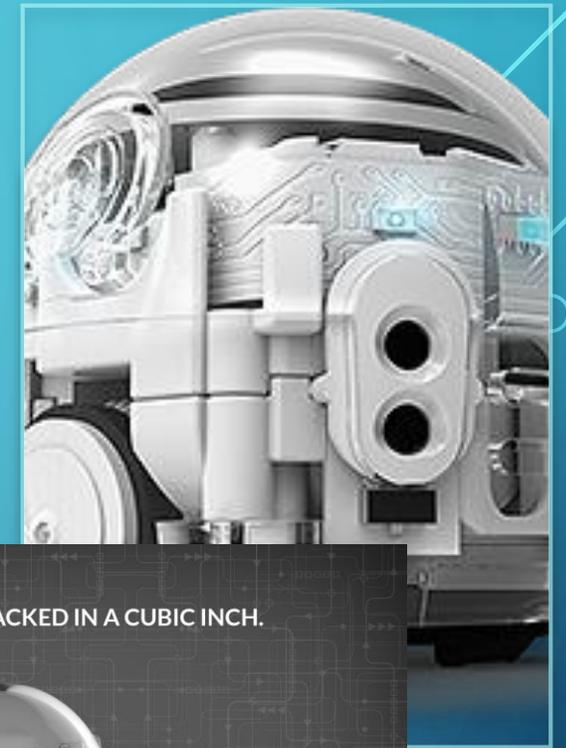
OZOBOT BIT \$59 OR OZOBOT EVO \$99 CLASSROOM SETS \$1195 (BIT HAS 18 EVO HAS 12 IN CLASSROOM SETS) WEB SITE OZOBOT.COM

This robot is recharged by usb cable similar to a cell phone (classroom set comes with multiport chargers)

Key features include Line following, Color Detection, Mobile apps (it fits on a tablet and reads the screen) You can program it using a color code. It also has a drag and drop block programming similar to Scratch called OzoBlockly Programming. It also comes with a cover you can customize.

The EVO has proximity sensors and Blue Tooth connectivity the BIT does not. This will also allow you to drive it by smart phone or tablet.

There is a Teacher's Guide (I have a hardcopy with me you can look at.) They also encourage teachers to share lessons they have created. Ozobot has a series of PD you can watch both in video



SPHERO/SPRK COST 129.99

WEBSITES: SPHERO.COM , SPRK.SPHERO.COM

This waterproof sphere is powered by a lithium battery that is charged by induction. It charge last for about an hour (I have used it for 90 min.) then needs to be recharged for approx.. 2 hr.

It's sensor data available are Inertial Measurement Unit, Collision Detection, and Locator.

It has two LEDs, a RGB and a Blue light.

It connects to your device by Bluetooth from your tablet or smart phone. They have many apps available but the main one for programming is the Lightning Lab App. They have recently releases a windows app but I have not had a chance to look at that.

This article talks about uses of a sphero in classes other than math and computer science. <http://dailygenius.com/teaching-with-sphero-the-robot-in-math-science-and-beyond/>

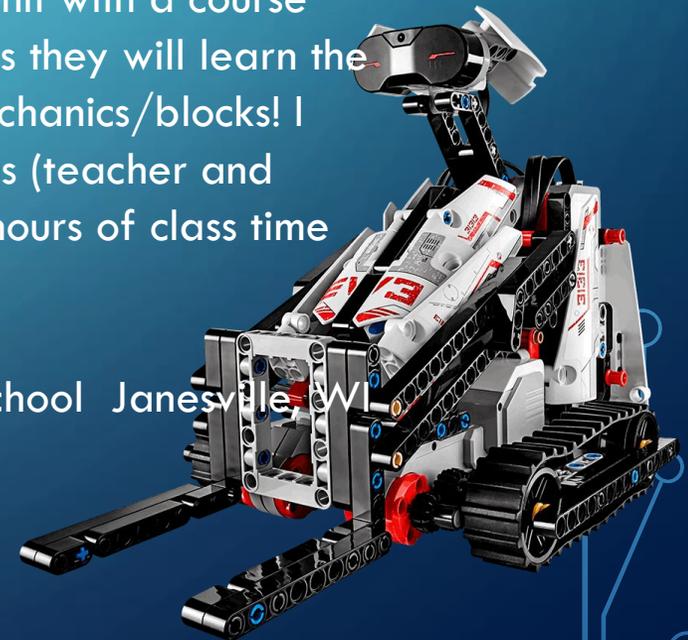


LEGO MINDSTORMS EV3

While I have not worked the Lego system here are some comments and links from those that have. These were gathered from the wi-csandit-teachers email list.

I use both AI2 and EV3 Mindstorms in my 4/5 classroom, but I have never used the Mindstorm programming options through AI2. We download the EV3 software from the Lego Education website to laptops and/or desktops. I simply use the tutorial program <http://www.education.rec.ri.cmu.edu/content/lego/ev3/preview/> to teach the basics of the EV3 robots. This would be enough, but I also extend the online tutorials with the First Lego League challenge missions (I am a FLL coach as well). I strongly recommend beginning this unit with a course from Code.org. It makes the EV3 programming so much easier for kids to process as they will learn the foundational concepts in programming before applying them to the unique EV3 mechanics/blocks! I can tell you all three resources, Code.org, EV3, and AI2, are a highlight for all of us (teacher and students:-). These three resources take me about 3 months to cover taking about 3 hours of class time each week. Please let me know if you need any other information. Happy to help.

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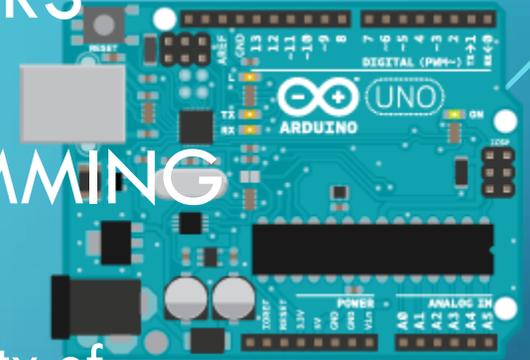
MORE ON LEGOS

- Here's a link to the educational version:
- <https://education.lego.com/en-us/products/lego-mindstorms-education-ev3-core-set-/5003400>
- It's \$379 which is just \$5 more than the cost of the non-educational cost of the EV3 set on Amazon. It comes with 48 step-by-step tutorials, a nicely labeled storage box, and I believe one additional or different sensor from the consumer version.
- I also highly recommend the book "Classroom Activities for the Busy Teacher: EV3"
- \$54.99 or used from about \$22 + shipping from Amazon.
- Pinterest resources:
- <https://www.pinterest.com/search/pins/?q=lego+mindstorms+ev3>
- Tim Fahlberg
- Math/CS/Fabrication Wisconsin School for the Blind and Visually Impaired Janesville, WI



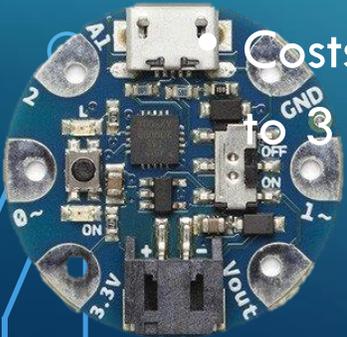
ARDUINO: PROGRAMMABLE MICRO PROCESSORS

WEB SITES: ARDUINO.CC, ADAFRUIT.COM,
SPARKFUN.COM, MUZECs WEB-BASED PROGRAMMING
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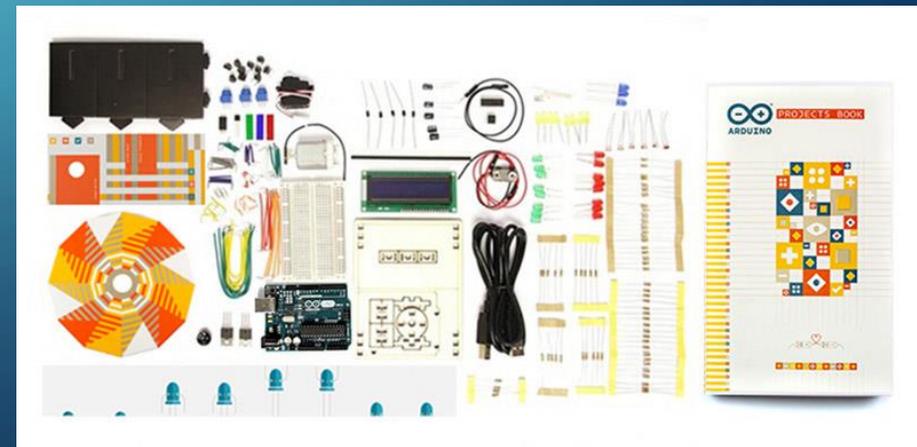
- Arduino and their clones are the basis from which you can build a variety of programmable devices to control LED lights, motors receiving input from attached sensors. This could include wearable electronic art.
- I have my 9th grade students build circuits and program it to play music based on how far a hand is away from the sensor. Once programmed it stays program until a new program overwrites it even if power is removed

Costs start at \$25 for the board itself \$99 for a Starter kit. (I recommend 1 kit for 2 students.)



ARDUINO CONT.

- Marquette University has built an add-on board for the Arduino which contains 4 buttons, 4 LED lights, speaker, and distance sensor that can be attached and is used in the ECS (Exploring Computer Science) Curriculum.
- The web sites listed earlier all have tutorials and projects that begin with the basics and work up.
- The starter kit comes with a variety of components and a book of instructions ready to use without soldering.
- You will need a computer to program the board
- You can add pieces as you go.
- See the web sites for what is available and costs.



RASPBERRY PI

WEB SITES: RASPERRYPI.ORG, ADAFRUIT.COM, SPARKFUN.COM,
ELEMENT14.COM, INSTRUCTABLES.COM/ID/RASPERRY-PI-PROJECTS

- The Raspberry Pi is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and developing countries.
- It's pricing starts at \$35 for latest model but the basic RaspberryPi does not come with a monitor or keyboard or mouse which will increase your cost. Starter Kits similar to Arduinos approx. \$75 – 90 no monitor, keyboard or mouse
- What's the difference between Arduino and RaspberryPi: A microcontroller is a simple computer that can run one program at a time, over and over again. It is very easy to use. A Raspberry Pi is a general-purpose computer, usually with a Linux operating system, and the ability to run multiple programs. It is more complicated to use than an Arduino

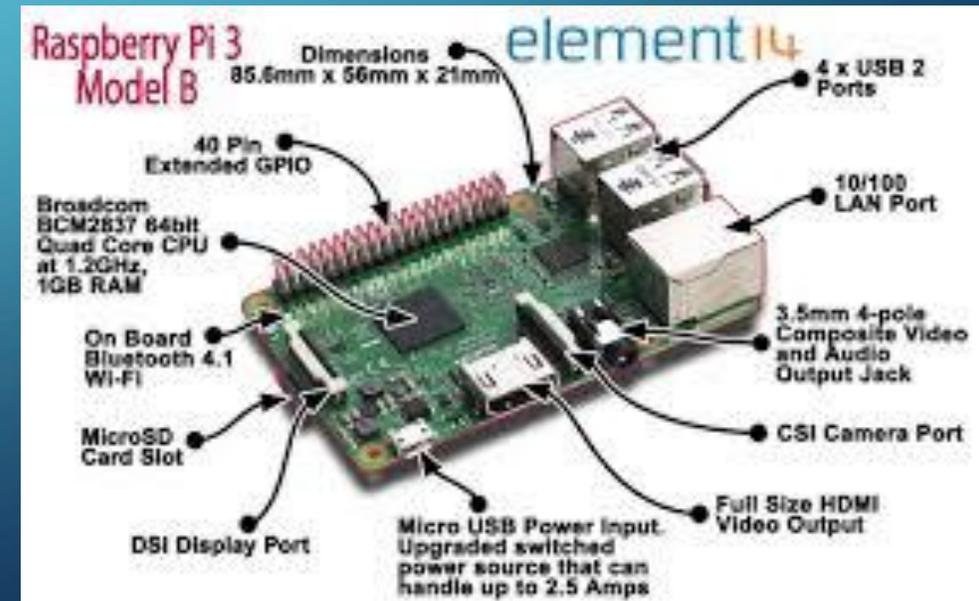


RASPBERRY PI (CON'T.) WEB SITE:

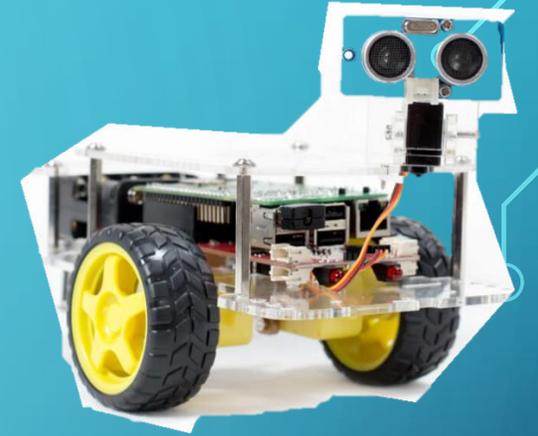
WWW.MAKEUSEOF.COM/TAG/5-WAYS-RASPBERRY-PI-CAN-USED-SCHOOLS/

- The Raspberry Pi is a full function computer with GPIO (General Purpose Input Output) which you can connect things to. Motors, sensors, camera, LEDs, many of the same things you can use with an arduino.
- Its primary programming languages are Scratch and Python. They come as part of initial software.

You can add Java and C++. It uses a Linux operating system and the chip set is an ARM similar to what is found in Smart Phones and Tablets. It can be powered by batteries and newest versions come with wifi and Bluetooth built in. This allows you to connect to it remotely. It is the brains behind many robot kits. For example



RASPBERRY PI (CON'T.) OTHER WEB SITES: DEXTERINDUSTRIES.COM



- The GoPiGo from Dexter Industries. The starter kit range \$209.99-\$214.99. The Starter Kit includes everything you need to get started from scratch including a [GoPiGo2 Base Kit](#), [Raspberry Pi](#), [Mini Wifi Dongle](#), [GoPiGo Servo Package](#), [Ultrasonic Sensor](#), [microSD Card](#) (with our software), [Power Supply](#), and [Ethernet Cable](#). Check out our [colored acrylic bodies](#)

- Last year my robotics class made a case and using the SenseHat shield for the pi we gather weather data up to 300 ft in the air via a drone and took pictures.

