Ideas with IMPACT

idea packet

Become a Robotics Expert Easily

Become A Robotic Expert Easily
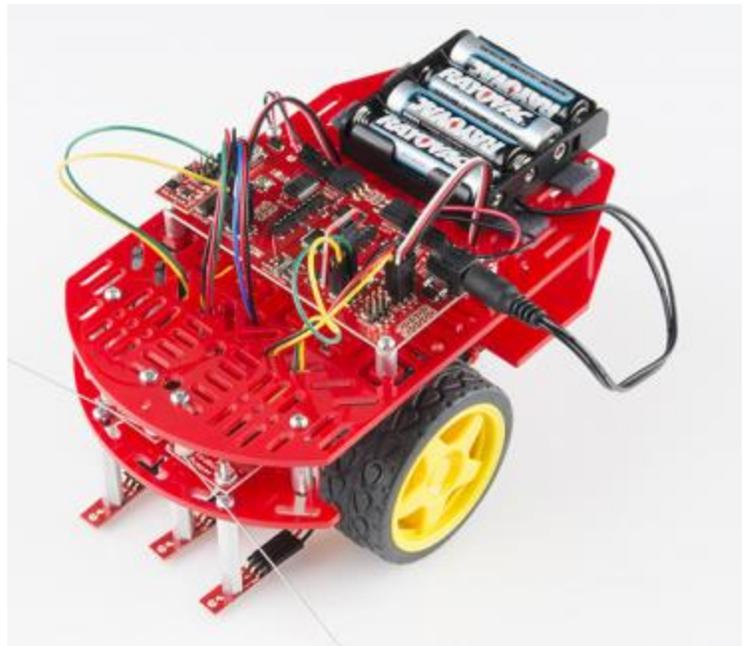
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Learning Goals:

This project is a great way to get students' feet wet in the world of robotics. The project is designed to introduce teachers/students to the various ways to code a robot beyond drag and drop. Using motor robotics and sensor integration this modular robotic development platform works with the Arduino IDE for teachers/students to easily program with written code to command various motions. The Robot Dance Party is designed to provide an engaging way for students to demonstrate mastery of the various coding programs through creating "steps" motions of a "dance" and/or code the song. The Robot Dance will be video recorded with the music and shared with others.
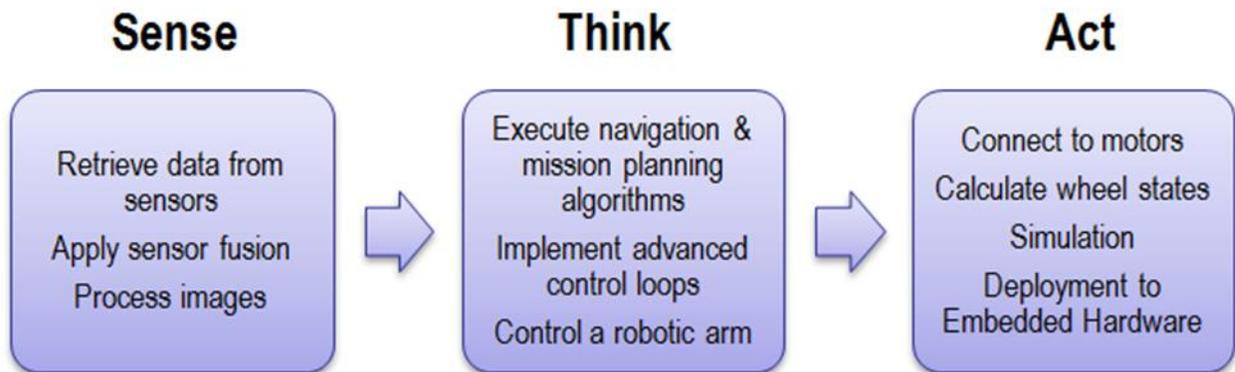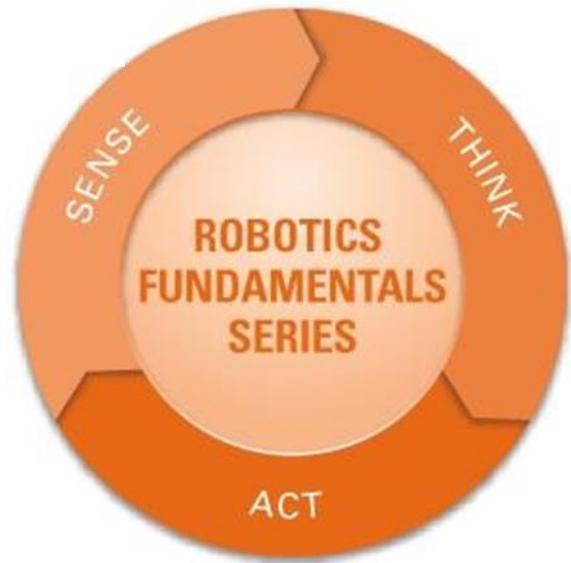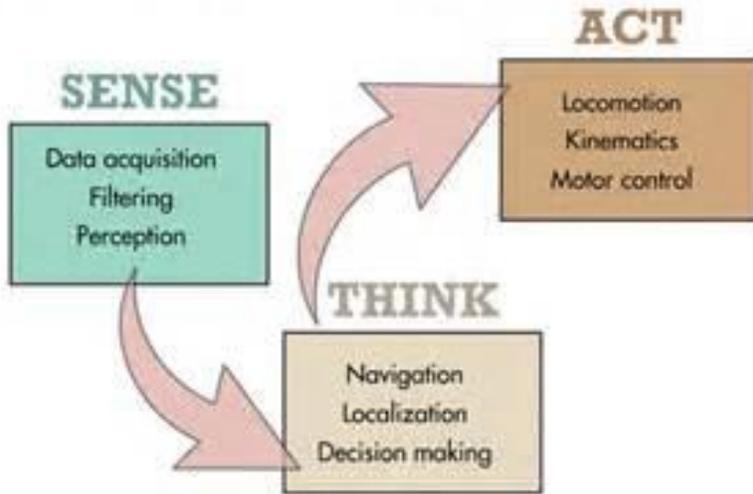
Florida Standards:

- SC.912.CS-CP.1.4: Collect real-time data from sources such as simulations, scientific and robotic sensors, and device emulators, using this data to formulate strategies or algorithms to solve advanced problems.
- SC.912.CS-CS.6.7: Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.
- SC.912.CS-CS.4.1: Describe a software development process that is used to solve problems at different software development stages (e.g., design, coding, testing, and verification).
- SC.35.CS-CS.6.3: Explain that computers model intelligent behavior (as found in robotics, speech and language recognition, and computer animation).
- SC.912.CS-CS.6.4: Explain the notion of intelligent behavior through computer modeling and robotics.

What is a robot?

Ask a bunch of robotics experts, and you will get a bunch of answers. Instead let's ask, what is robotics technology? Robotics technology consists of machines that can:

- Sense - Sensors, or feedback devices, allow information about the machine's surroundings to be recorded as electronic values.
- Think - This electronic data is then used in complex circuits programmed to produce signals at the other (output) end of the circuit.
- Act - Acting is the most obvious part of robotics technology. The electronic signals that were produced as a result of sensing and thinking then control whatever the robot is designed to do, like lift a sick person, make a facial expression, or control the motors that allow it to navigate around an obstacle.

OVERVIEW OF A SIMPLE MOBILE ROBOT

SENSE

Data acquisition
Filtering
Perception

ACT

Locomotion
Kinematics
Motor control

THINK

Navigation
Localization
Decision making

ROBOTICS FUNDAMENTALS SERIES

SENSE

THINK

ACT

Sense

Retrieve data from sensors

Apply sensor fusion

Process images

Think

Execute navigation & mission planning algorithms

Implement advanced control loops

Control a robotic arm

Act

Connect to motors

Calculate wheel states

Simulation

Deployment to Embedded Hardware

Project Description:

The RedBot is a modular robotic development platform that works with the Arduino IDE. The RedBot is a motor driver and Ardiuno combination with various headers and connections to get desired functions. The students will simply connect a USB mini-B cable, and they will be able to program it in the Arduino IDE using the example code, and then their own. The students will have a guide that will go through nine different experiments, ranging from learning how to drive your RedBot to using an accelerometer to trigger your RedBot to move. Working in pairs the students can pick and choose as they feel the need to complete their own Robot Dance. Since coding is new for many students and very few have coded, some have cognitive/ learning disabilities, Limited Language Proficiencies and anxiety/issues/fear of coding = Ozobot Bit could be used to provide a differentiated way for them to comfortably be engaged in the learning and project. The Ozobot is a right brain – left brain integrating robot that builds both creativity and coding skill. Once students feel comfortable with this intuitive programming they can advance from the basic color coding to intermediate block-based programming.

Once they have mastered the desired experiments and coding, the students can take what they've learned and apply it to creating the Robot Dance video. For the Robot Dance Party, the students will need to program the "steps" (movement) to a song (whether pre-made or they code their own) and video tape it to share.

Sample Schedule:
Engineering Fridays- For 9 days (one day per week) in the classroom, the students will be able to go through nine different guided experiments to learn the various commands and code for their final project. (introduction to basic skills, drive forward, turning, push to start & making sounds, bumpers, line following with IR sensors, encoding, accelerometer, remote control)

Differentiated: Ozobot Bits will be used for a simpler style of programming for students with disabilities, Limited Language Proficient and anxiety/issues of coding

Days 10-14 Project coding, reviewing, practice, recoding and video taping

Assessment: Students will program the "steps" (movement) to a song (whether pre-made or they code their own) and video tape it to share.
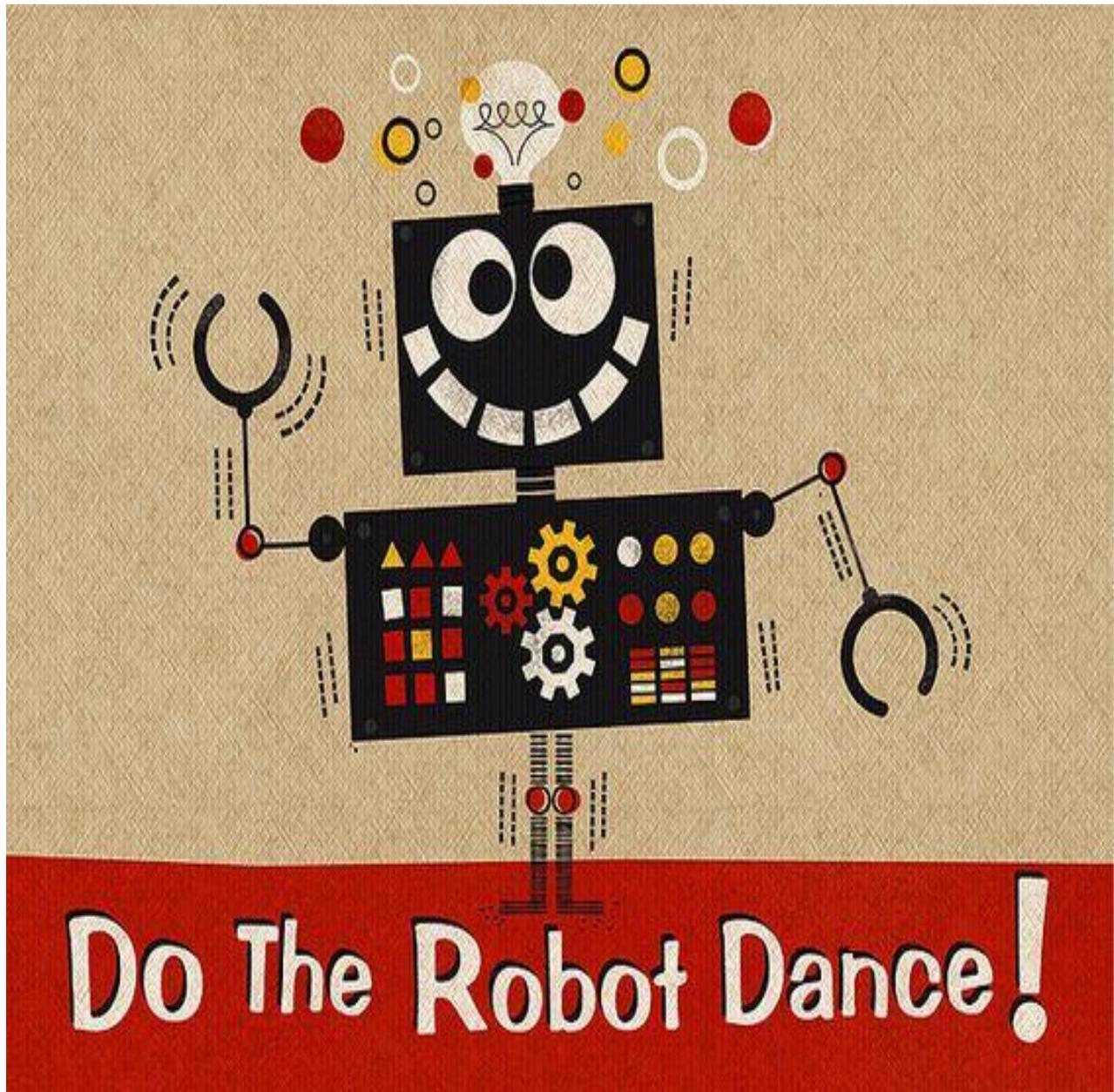
Experiment List:

Here is a breakdown of each experiment presented in the Redbot tutorials.

https://learn.sparkfun.com/tutorials/experiment-guide-for-redbot-with-shadow-chassis?_ga=2.198584175.1124826314.1500309915-1929374537.1487105187

Students can do them in order or jump to a section, or continue reading to learn more about the hardware and library before starting on Experiment 1.

1. Software Install and Basic Test
2. Drive Forward
3. Turning
4. Push to Start & Making Sounds
5. Bumpers
6. Line Following with IR Sensors
7. Encoder
8. Accelerometer
9. Remote Control

Each experiment tutorial provides:
- description of experiment
- example of code/sketch to copy into coder (Arduino.cc software)
- what the Arduino circuitry board looks like
- going further
- other related experiments
- write your own sub-routine
- data table
- trouble shooting

SparkFun Inventor's Kit for RedBot
https://learn.sparkfun.com/tutorials/experiment-guide-for-redbot-with-shadow-chassis/introduction

Teacher Prep (prior to students using the robots)

(see Software Install and Basic Test)

Install Arduino IDE

In order to get your RedBot up and running, you'll first need to download the newest version of the Arduino software from www.arduino.cc This software, known as the Arduino IDE (Integrated Development Environment), will allow you to program the board to do exactly what you want. It's like a word processor for writing programs.

***If you are not familiar with Arduino IDE then ask for support or please visit the Installing Arduino IDE tutorial for step-by-step directions on installing the Arduino IDE on the Sparkfun site or Arduino.cc site.

Intro to Arduino

SINCE MARCH 2015, THE ARDUINO IDE HAS BEEN DOWNLOADED 8,538,562 TIMES. IMPRESSIVE! THIS IDE IS NO LONGER JUST FOR ARDUINO AND GENUINO BOARDS. HUNDREDS OF COMPANIES AROUND THE WORLD ARE USING IT TO PROGRAM THEIR DEVICES, INCLUDING COMPATIBLES, CLONES, AND EVEN COUNTERFEIT. YOU CAN HELP ACCELERATE THE DEVELOPMENT OF THE ARDUINO IDE BY CONTRIBUTING TOWARDS THE EFFORT OF MAKING IT BETTER.

Options for programming

Arduino IDE / Programming Environment
(open-source, free, community supported)

codebender.cc
(on-line, cloud-based, "google-docs"-esqe)

Intro to Basic Robotics
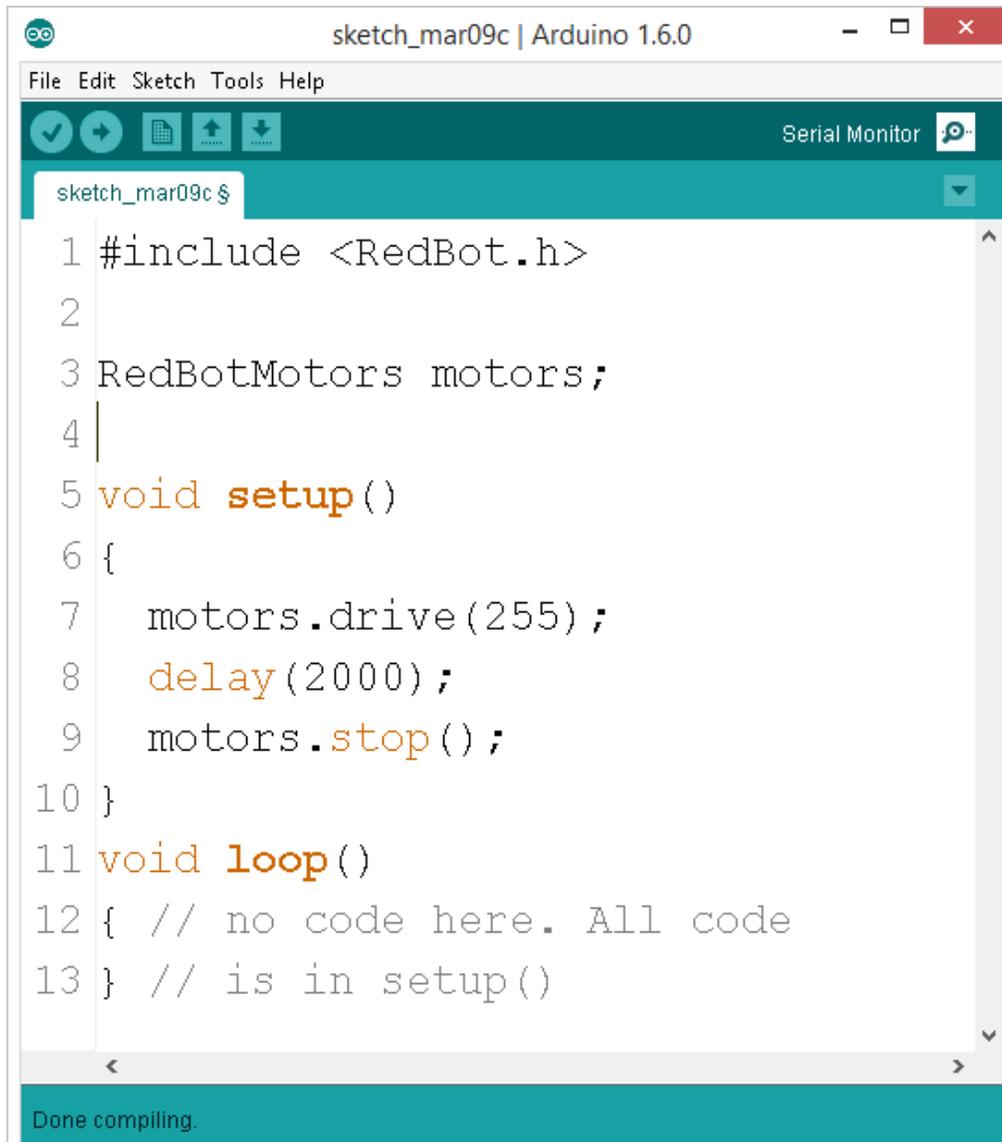
```
sketch_mar09c | Arduino 1.6.0

File  Edit  Sketch  Tools  Help

                                          Serial Monitor

sketch_mar09c §

 1 #include <RedBot.h>
 2
 3 RedBotMotors motors;
 4
 5 void setup()
 6 {
 7   motors.drive(255);
 8   delay(2000);
 9   motors.stop();
10 }
11 void loop()
12 { // no code here. All code
13 } // is in setup()

Done compiling.
```

Remember coding is a sequencing of commands. Make sure that they are in order.

```
1   void setup()
2 ▾ {
3       pinMode(13, OUTPUT);
4   }
5
6   void loop()
7 ▾ {
8       digitalWrite(13, HIGH);
9       delay(1000);
10      digitalWrite(13, LOW);|
11      delay(1000);
12  }
```

Setup () this is an area for 1 time commands or to label where the circuits are located (pin)

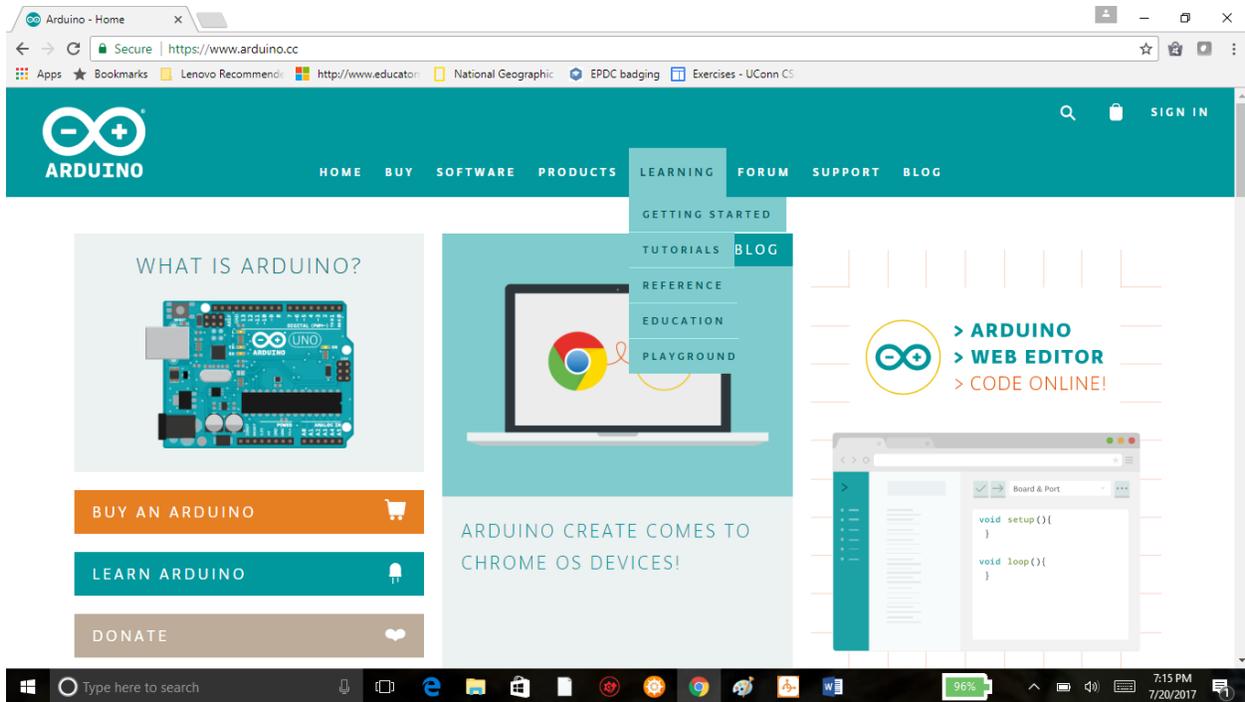loop () this is an area for repeatable commands or to decide what will happen.

Digital (pin) is either ON (HIGH) or OFF (LOW)

Analog has various ranges

{

}

Encapsulated an area that has the coded commands (must have)

**www.arduino.cc has a reference library to decide what commands/ codes to use**

Arduino programs can be divided in three main parts: *structure*, *values* (variables and constants), and *functions*.

Connect your RedBot to your computer Use a USB miniB cable to connect the RedBot to one of your computer's USB inputs. Make sure you have the four AA batteries in the battery holder.

Install FTDI drivers
Depending on your computer's operating system, you will need to follow specific instructions. Please go to How to Install FTDI Drivers for specific instructions on how to install the FTDI drivers onto your RedBot.

Install the RedBot library
A library in Arduino is a set of files containing prewritten code that simplifies instructions and commands to perform certain tasks. We have written a specific library for the RedBot. Make sure you install the RedBot library. You will need it for all the example code. (SPARKFUN REDBOT LIBRARY)
Unzip the downloaded file. Copy/Move the SparkFun RedBot Library folder to the libraries folder into your Arduino Documents folder. If you need a refresher on how to install an Arduino library, please see our library tutorial.

Example Code

Included in the library are a set of examples for the 9 RedBot experiments. Click on File > Examples > SparkFun RedBot Library, you should see a list of the 9 main Examples and 4 secondary examples we have created.
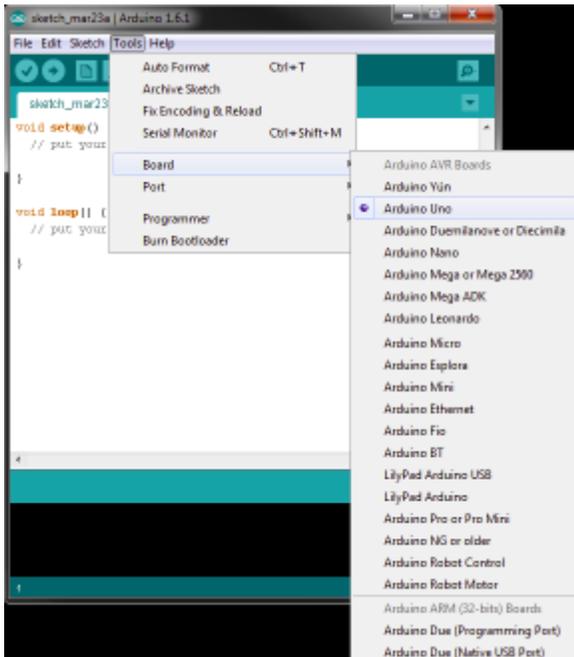
Open the Arduino IDE and select the board:

Open the Arduino IDE software on your computer. This step is to set your IDE to identify your RedBot. You will want to select the board, Arduino Uno. To do this, go to Tools > Board > Arduino Uno.

Description:

The SparkFun Inventor's Kit for RedBot is a great way to get started with two motor robotics and sensor integration using the Arduino programming language. The SIK for RedBot includes everything you need to complete nine circuits that will teach you how to drive your RedBot, have it follow lines, control it remotely, and more. This kit doesn't require previous programming or electronics experience but it is recommended that you possess an understanding of or desire to learn about robotics.

The SparkFun RedBot is a great way to get your feet wet in the world of robotics. However, once you have assembled your RedBot, you may be at a loss as to where to go from there. The on-line SIK for RedBot Digital Guide (in the *Documents* section below) contains step by step instructions of how to connect each circuit and assemble the kit into a full-fledged robot with all of the included parts. Full example code is provided and explained and even includes troubleshooting tips if something goes wrong. Once you've mastered each experiment, you can take what you've learned and apply it to creating your own robot platform.

The kit does not require any soldering and is recommended for anyone curious about robotics or if you have used the original SparkFun Inventor's Kit and are looking for the next step in programming education.

Kit Includes ($120.00):

- 1x SparkFun RedBot Mainboard
- 1x Shadow Chassis
- 1x SparkFun RedBot Sensor - Accelerometer
- 2x SparkFun RedBot Sensor - Mechanical Bumper
- 3x SparkFun RedBot Sensor - Line Follower
- 1x SparkFun RedBot Buzzer
- 2x Hobby Gearmotor - 140 RPM
- 2x Wheel - 65mm (Rubber Tire)
- 1x Wheel Encoder Kit
- 5x Jumper Wire - 3-pin, 6"
- 1x SparkFun USB Mini-B Cable - 6 Foot
- 1x SparkFun Mini Screwdriver
- 4x AA Alkaline Battery - 1500 mAh

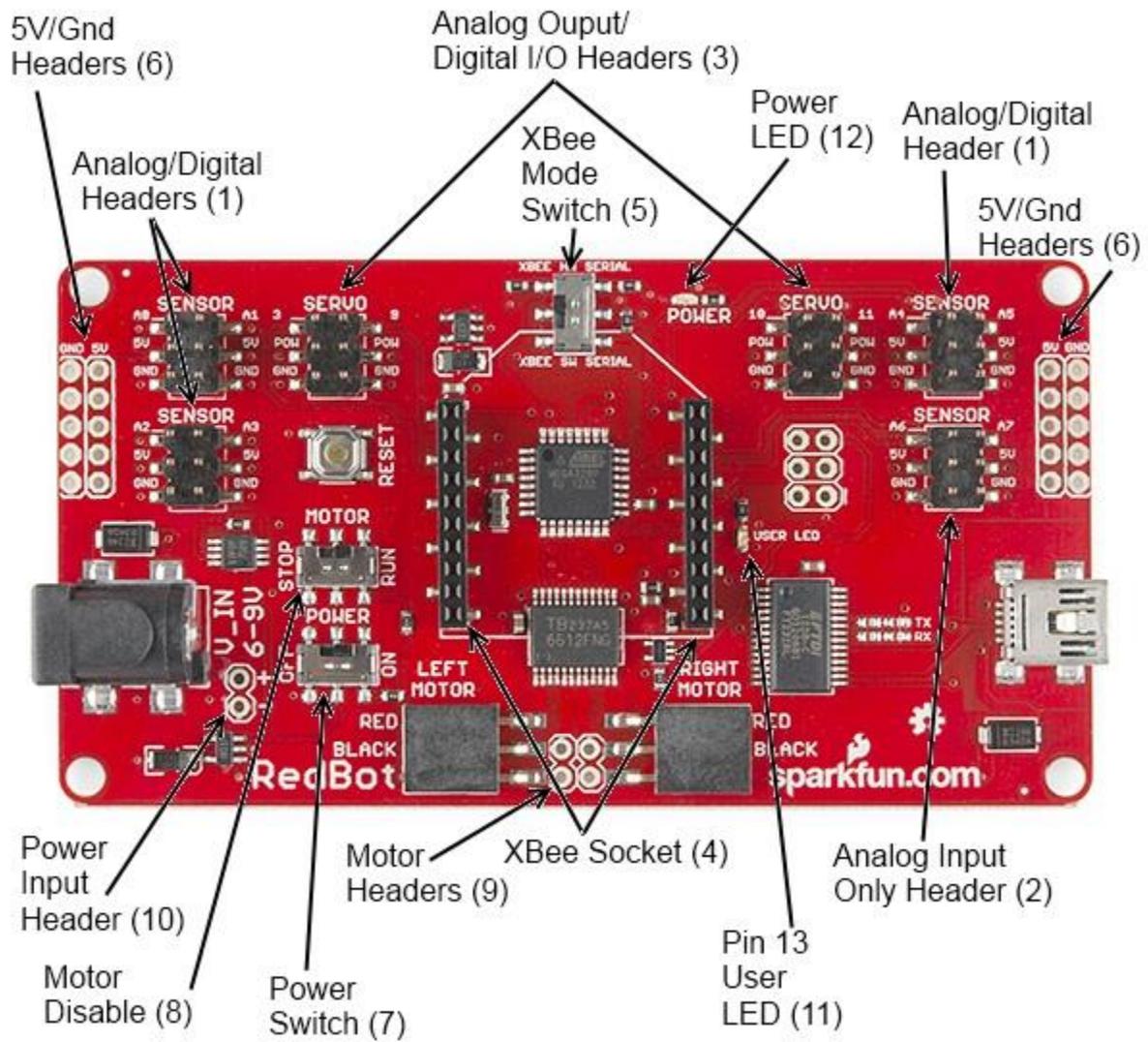## Documents (links):

- Eagle Files
- RedBot Arduino Library

- Shadow Chassis Assembly Guide
- SparkFun Inventor's Kit for RedBot Experiment Guide
- Wishlist
- GitHub
- GitHub Library

Extra Supplies Needed

- 4x AA batteries (if not using the SIK for RedBot)
- USB miniB cable
- Tape, paint, markers, pencils, etc for IR Sensors

Suggested Reading (links)

- What is an Arduino? - Since the RedBot is based off the Arduino platform, it's a good idea to understand what that means.

- Installing the Arduino IDE - If you don't have the Arduino software installed, this guide will help you out.

- Installing an Arduino Library - To get the most out of the RedBot, you'll want to install our RedBot library. This tutorial will show you how to install any library.

- Accelerometer basics - One of the core sensors for the RedBot is an accelerometer. To find out more about accelerometers, check out this guide.

- Analog to digital conversion - Many useful sensors for the RedBot will be analog. This guide will help you interface with them and make the most of the data you get back.

- Pulse width modulation (PWM) - The RedBot includes two headers with PWM signals, and uses PWM to control the speed of the motors. It's probably a good idea to be familiar with the concept.

- I^2C - The RedBot Accelerometer, which ships with the RedBot kit, uses I^2C to communicate with the RedBot. While the accelerometer is accessible through the library with no knowledge of I^2C required, if you want to get more out of it, you can check out this tutorial.

5V/Gnd Headers (6)

Analog/Digital Headers (1)

Analog Ouput/ Digital I/O Headers (3)

XBee Mode Switch (5)

Power LED (12)

Analog/Digital Header (1)

5V/Gnd Headers (6)

Power Input Header (10)

Motor Disable (8)

Power Switch (7)

Motor Headers (9)

XBee Socket (4)

Analog Input Only Header (2)

Pin 13 User LED (11)

Sparkfun Contact & Support

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Ideas with IMPACT
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- Open to all K-12 M-DCPS teachers, counselors, media specialists
- Quick and easy reporting requirements
- Grants range from $150 - $400
- Grant recipients recognized at an Awards Reception

To apply, you must contact the teacher who developed the idea before submitting your application. Contact can be made by attending a workshop given by the disseminator, communicating via email or telephone, by visiting the disseminator in their classroom, or by having the disseminator visit your classroom.

Project funds are to be spent within the current school year or an extension may be requested. An expense report with receipts is required by Friday, June 1, 2018.

APPLICATION DEADLINE:
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For more information, contact:
Edwina Lau, Program Director
305.558.4544, ext. 113
elau@educationfund.org

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