Shake, Rattle and Roll Building Bots with a Sense of Balance

Instructor: Aatish Bhatia

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What's an Arduino?



Arduino is an open-source electronics prototyping platform .. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

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What's an Arduino?

Arduino can sense its environment, and affect its surroundings





A very simple circuit primer

- Voltage, current and resistance: a flowing analogy
- ► Voltage: Volts, Current: Amperes, Resistance: Ohms



A very simple Arduino circuit



Arduino has digital and analog pins. Can be Input or Output.



How does it work?

- Wire up your inputs and outputs
- Download the software and plug in Arduino



Write Code and Upload



An example: Blinking Light

void setup() { // initialize the diaital pin as an output. // Pin 13 has LED connected on most Arduino boards SETUP: HAPPENS ONE TIME WHEN pinMode(13, OUTPUT): PROGRAM STARTS TO RUN void loop() { digitalWrite(13, HIGH): // set the LED on delay(1000); // wait for a second digitalWrite(13, LOW); // set the LED off LOOP: REPEATS OVER AND delay(1000): // wait for a second OVER AGAIN A SKETCH, LIKE A PROGRAM WRITTEN IN ANY LANGUAGE. IS A SET OF INSTRUCTIONS FOR THE THESE ARE BOTH BLOCKS OF CODE CALLED COMPUTER, IF WE LOOK CLOSELY AT THE BLINK FUNCTIONS THAT EVERY SKETCH WILL HAVE. THEY SKETCH, WE SEE THERE ARE 2 MAJOR PARTS. ARE BLOCKED OUT BY CURLY BRACES { }. SETUP AND LOOP UTTP://ARDUINO.CC/EN/REFERENCE/HOMEPAGE void setup() { //DECLARES BLOCK OF CODE pinMode(13, OUTPUT): //SETS PIN 13 TO OUTPUT //END BLOCK OF CODE void loop () { //DECLARES BLOCK OF CODE Θ digitalWrite(13, HIGH); //SETS PIN 13 HIGH delay(1000); //PAUSE 1 SECOND digitalWrite(13, LOW); //SETS PIN 13 LOW Language Reference delay(1000): //PAUSE 1 SECOND //END BLOCK OF CODE CHECK OUT THE ARDUINO WEBSITE FOR THE ARDUINO REFERENCE GUIDE AND MANY OTHER FOR NOW, LET'S LOOK AT THIS SIMPLE SCRIPT LINE RESOURCES TO LEARN THE LANGUAGE. BY LINE & SEE WHAT EACH LINE DOES.

What is it good for? Absolutely Everything.

TED talk by Massimo Banzi: How Arduino is open-sourcing imagination

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Goals of the course

- Learn to program physical devices
- ...that can sense the world
- ..and respond to their senses (feedback)

Project: Build a two wheeled, stable, dynamically balancing robot.

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- Learn to program physical devices
- ...that can sense the world
- ..and respond to their senses (feedback)

Project: Build a two wheeled, stable, dynamically balancing robot. Parts List:

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- Arduino Uno
- 2 Motors and Wheels
- ▶ 3 DOF accelerometer, 2 DOF gyroscope
- Motor Shield

Work in teams of 4 to build stable robots.



An algorithm for balancing a stick



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Examples of Stabilizing Systems

Bipedal animals:

Standing upright and balancing is a deceptively simple activity that belies the underlying complexity of neuromuscular feedback loops that continually stabilize what is an unstable, nonlinear mechanical system.

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Examples of Stabilizing Systems

Some insects have halteres: vibrating gyroscopes



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Airplanes, Segways, etc.