

narwhaledu.com for our mailing list

www.youtube.com/watch?v=2v2RA_bAGDU for robot arm drawing a narwhal

narwhaledu@gmail.com

Unit 1: Robot Arms rev2

L1: Intro

Overview (maker movement)

Overview (CNC arm welding)

Simplify the problem (engineering design process)

Demo of robot arm drawing

Install software (arduino)

L2: Quickstart: Build and program a robot arm

Different types of robot arms

Peak at manufacturing processes

Download program

Brief Program Explanation

L3: Programming

Arduino Program Structure

Blink

Challenge: Blink faster and slower (assuming you don't know about loops)

For and while loops

Challenge: Blink faster and slower, with loops

Microcontrollers

L4: Making Things Move

Learn about servos

Things to know about servos: history,

sizes of servos

where to buy

torque ratings

Challenge: Servo sweep

Learn about motors and controlling them

Learn about PWM

Servo choices (torque)

L5: Sensors

Digital and Analog world

What are Potentiometers?

Challenge: Using them to control the servo, flipped!

~~if we have time~~

L6: Engineering Design Process

Keeping a build log

T nut design

What are 1/4-20 screws and why they are called 1/4-20

fab machines

degrees of freedom

L7: Advanced: Math

Trigonometry

Inverse Kinematics

Drawing lines

Challenge: Draw a circle

Further Resources

L8: Processing

Interactive mode!

~~~

L9: The Contest

Yay! share what you built

Unit 1: Robot Arms rev1

L1: Intro

Overview (maker movement)

Overview (CNC arm welding)

Simplify the problem (engineering design process) -- match pictures to stages of the design process

Demo of robot arm drawing

Install software (arduino)

L2: Make it blink

What is a microcontroller?

Cool projects done with microcontrollers

How to download programs

What is an LED?

Make it blink

Blink faster and slower?

L3: Make it blink, Make it Move

For and while loops

Blink faster and slower, pt2

What are servos?

Make servos move

L4: Sensors

Digital and Analog world

What are Potentiometers?

Using them to control the servo

L5: Put together the kit / Mechanical Engineering

What sorts of robot arms are there out there?

Simplify by creating models

Degrees of freedom

Torque calculations

Different iterations of the design that we went through

L6: Program the arm

Let them figure it out. Have fun drawing things!

L7: Inspirational Class!

Cool things built with the same hardware

NYC Maker Faire pictures

Wrap-up -- what did we learn?

What do you want to build next?
Instructional sites out there

ORIGINAL CURRICULUM

Unit 1: Robot Arms

Main Site (5 min)

- NarwhalEdu vision
- Arm module components and prerequisites

L1: Intro (30 mins)

- Overview (CNC arm welding demo; Dane)
- Prerequisites in knowledge and equipment
- Clueless engineering (simplify the problem)
- Demo of robot arm drawing

L2: Hello, Kit (30 mins)

- What's in the box?
- Pre-assembly (board + panel: talk about shorting)
- How to turn on? Power, wall warts, ...

L3: Make It Move (1.5 hour)

- What is a microcontroller?
- IDE / Blinky (reference the arduino site / other online resources)
 - Debugging common errors
- What is a Servo?
- Arduino servo

L4: Mechanical Engineering (2 hour)

- Terminology and definitions (dof, kinematics, linkage, revolute joint)
- Calculating DoF
- Kinematics
- Inverse Kinematics

L5: Kit Design (1 hour)

- Torque Calculations (HTML)
- clips versus pressfit versus bolt and nut design
- MDF versus acrylic (supply chain) Materials!

L6: Robotic Arm (2 hour)

- Modularity: Program the kinematics
- Program straight line
- Program circle

L7: Interactive Arm (2 hour)

- Processing graph mouseX, mouseY
- Serial
- Processing GUI

L8: Drawing Faces (3 hour)

- Edge Detection
- Vectorization
- Faces

Final Project

- Take the arm apart, build your own project, and post it on instructables