DIY Robotic Hand Shadow
PART NO. 2192093

The kit is for beginner DIY'ers who want to start building robotics but think its to complicated to make cool projects right off the bat.

When you get the kit you simply solder the components on to the PCB and connect the servos that will be connected to the hand (hand/glove not included), and plug in the flex sensors (which will be on the glove).

After it's all done and over you calibrate the sensors (bend your fingers all the way close and open them). After you calibrate the sensors, you end up with a cool robotic hand that shadows you just like from real steel :) but not quite as cool.

Also it is based on the popular arduino platform so if you have an Arduino already just connect reset of arduino to reset on PCB, tx to rx, and rx to tx. So it is easily hackable.

Time Required: 3-4 hours depending on experience

**Experience Level: Beginner**

Required tools and parts:
Soldering iron
Glove
Robotic hand
Pliers or sharp scissors

Bill of Materials:

Qty	Jameco SKU	Component Name
5	150551	Flex Sensor
measures finger bend		
5	2150416	Sub Micro Servo
for the robot hand		
6	691104	10k Resistor
2	690700	220 ohm Resistor
1	2129334	ATmega 328 w/arduino bootloader
Needs to have a program burned into it before distibution.		
1	137891	Crystal oscillator
2	15405	22pf capacitor
1	151116	0.1 uf capacitor
1	160882	male headers
20 individual pieces		
2	333851	LED
1	216144	Battery holder

Step 1 - Examine the PCB

Have a look at the PCB that comes in the kit.
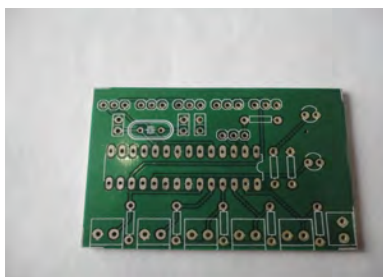
Step 2 - Soldering the ATmega chip

Have a look at the brain of the whole project it is called a ATmega 328.

Step 3 - Soldering the ATmega chip part 1

If the leads (legs) of the chip don't fit into the PCB; put them sideways against the table and push gently until they are 90-95 degrees to the body of the chip. The reason you do this is because the chips legs are angled when you buy it.
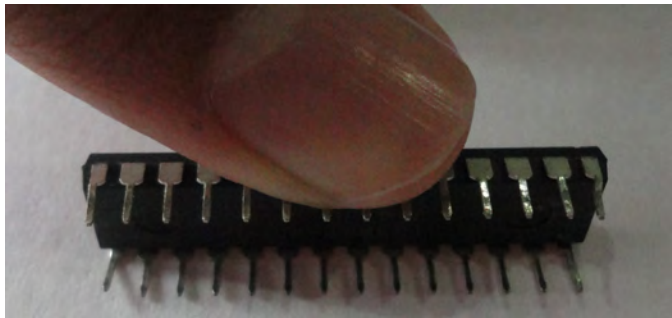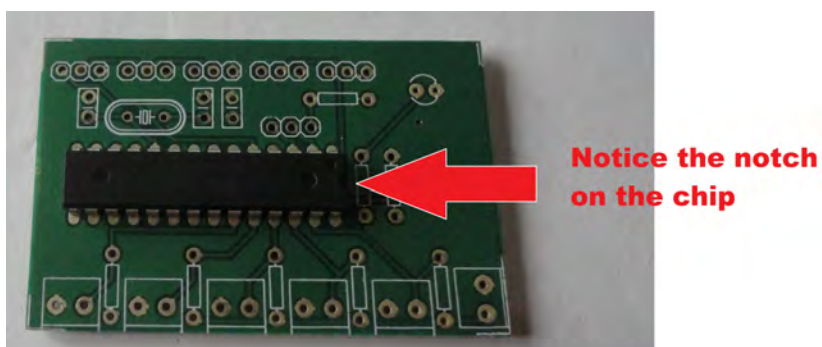

Step 4 - Soldering the ATmega chip part 2

Like the picture says make sure the notch on the chip aligns with the notch on the PCB. I cannot stress how important this is.

Make sure the notch on the chip aligns with the notch on the PCB
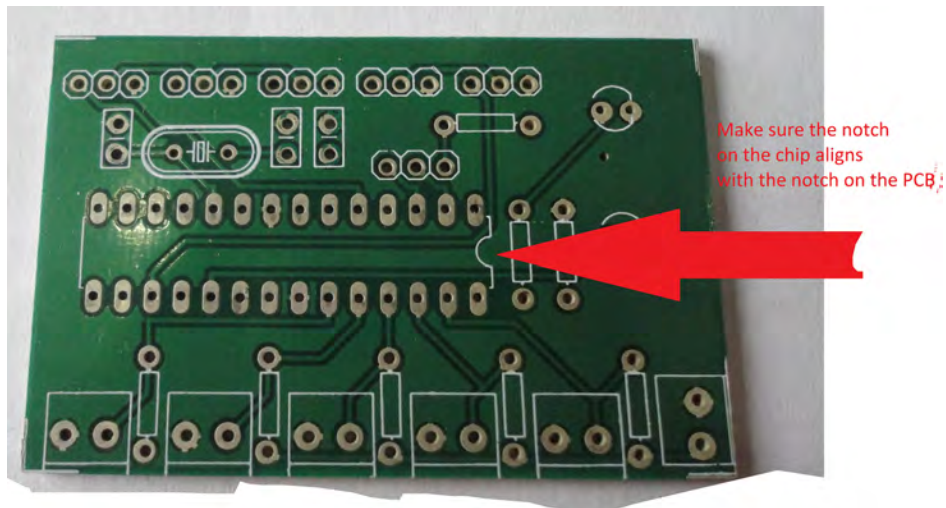
Step 5 - Soldering the ATmega chip part 3

Place the ATmega(chip) leads into the PCB and solder.
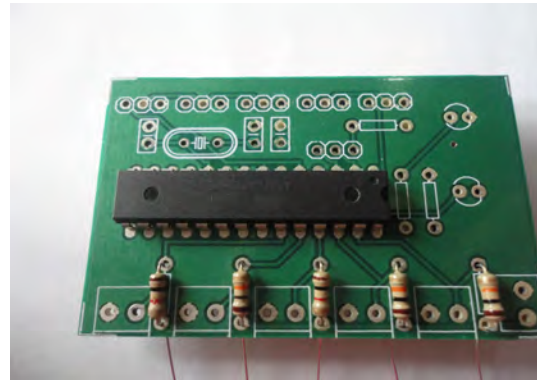

Notice the notch on the chip

Step 6 - Soldering resistors

Now we have to solder the 10k resistors. They are the resistors which have brown, black, orange, gold stripes(bands) on them.

Step 7 - Solder resistors part 1

Place the 10k resistors over here and solder them and trim leads.

Step 8 - Solder the 330ohm resistors.

Now we have to solder the 330 ohm resistors they have an orange, orange, brown, gold stripe pattern there are only 2 of them.
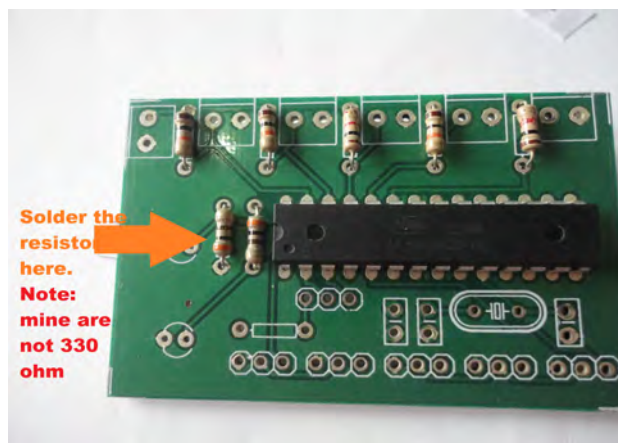
The resistors are for the LED's.

Note: I am using 300 ohm resistors so don't look at the color code on the resistors in the picture.
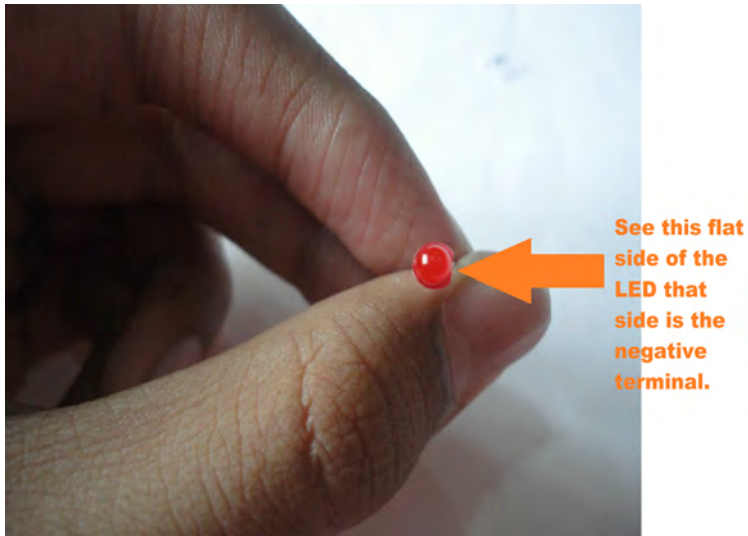

Step 9 - Solder the 330ohm resistors part 1

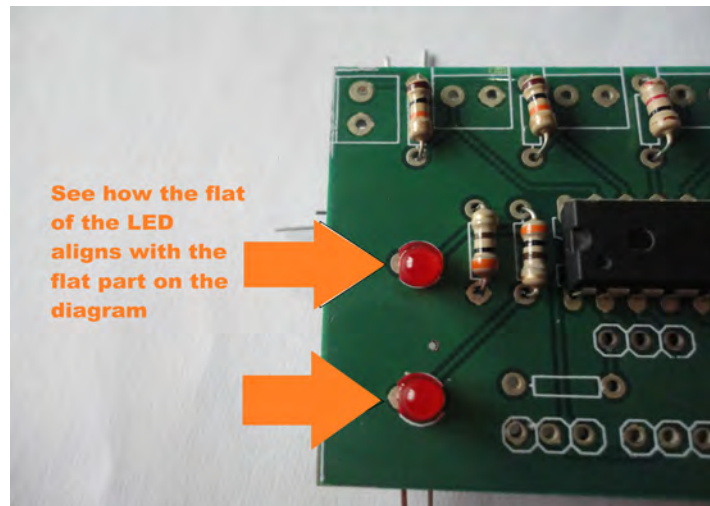Place the 2 resistors properly and solder.

Step 10 - Soldering LED's part 1

We have to solder the LED's properly. The flat side of the LED has to be aligned with the PCB drawing.

See this flat side of the LED that side is the negative terminal.

Step 11 - Soldering LED's part 2

Place the LED's here and solder them on.

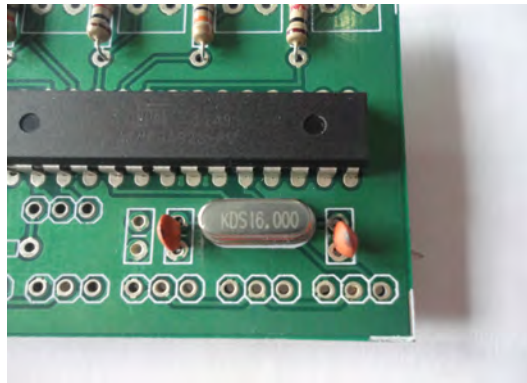See how the flat of the LED aligns with the flat part on the diagram

Step 12 - Soldering crystal and capacitors

Take a look at the parts needed. The parts will look like a silver oval shaped box with 2 leads and a ceramic capacitor with the number 22 on it.
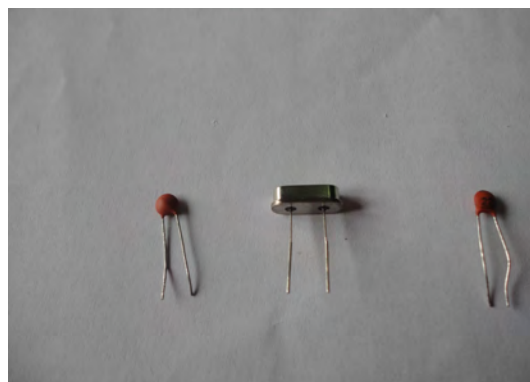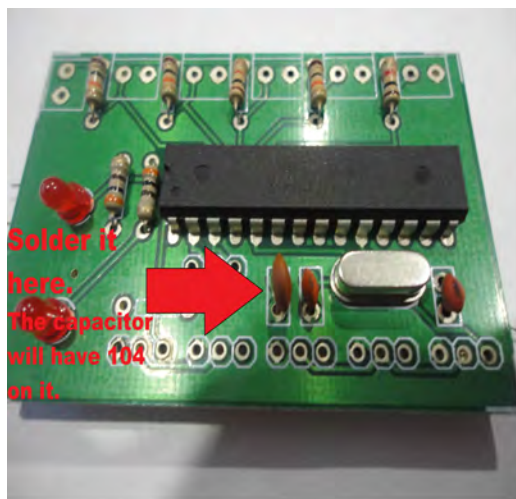
Step 13 - Soldering crystal and capacitors

Solder the capacitors and crystal here you can place them anyway you want.

## Step 14 - Soldering the capacitor for analog input

Now you have to solder the last capacitor it will have the number 104 on it.


Step 15 - Solder the male headers

The headers look like a row of tiny metal rods with a small plastic housing. You need 15 or 18 individual pieces. The headers will come in a long row, so you need to cut these into 5 sets of 3 each and solder it into the place shown. These headers are for the servos.

NOTE: cut the header with pliers or scissors.
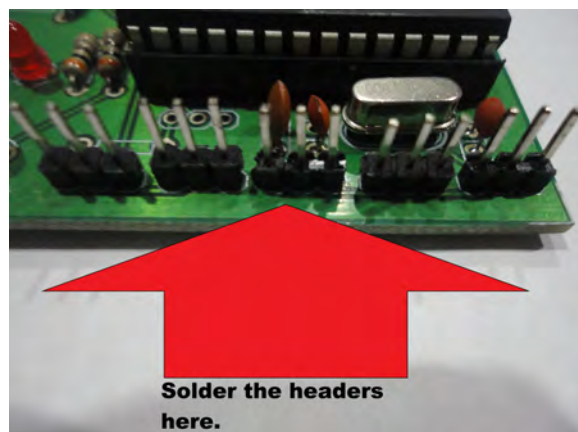
Step 16 - Soldering flex sensors

You need to solder the wires to the flex sensors; make sure that they are long.
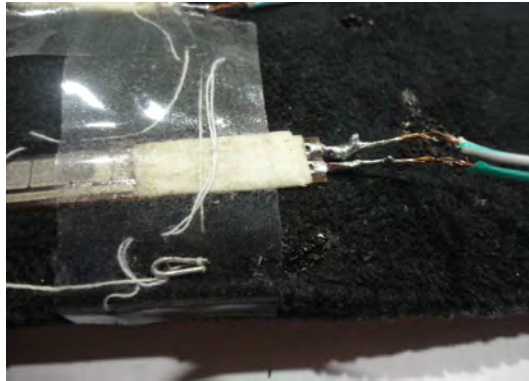
Step 17 - Soldering flex sensors part 1

These are the connections you have to make. The servos for each finger should be connected to the pins the picture shows.

Note: Each finger is connected to the 2 opposite connectors.

Step 18 - Soldering flex sensors part 2

This is how mine is connected. The wires from each finger MUST be connected to the corresponding places shown in step 19. The wires can be connected any way.

Step 19 - Connect robot hand

This is how my robot hand looks. It doesn't matter how yours looks, but the connections you make do matter. You have to make the robot hand yourself since its hard to find an out-of-the-box solution. Don't worry, it's easy. Use this instructable to make one:
http://www.instructables.com/id/Simple-Animatronics-robotic-hand/
You can use straws too or you can buy one from the link below:
http://www.ebay.com/itm/Build-Robotic-Hand-Kit-by-4M-Toysmith-Christmas-Toy-Craft-Science-Fair-Project-/121107553942?pt=Educational_Toys_US&hash=item1c32929e96 and simply attach the wires to the servos.

Step 20 - Connect robot hand part 1

Connect the Servos as the photo shows.

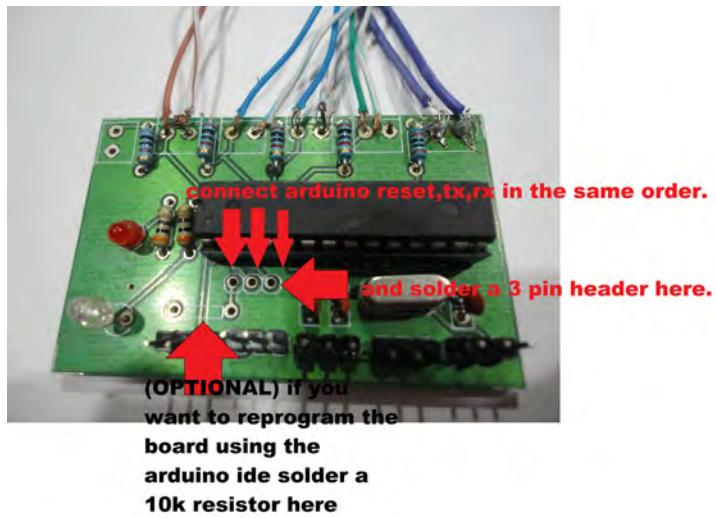Note: Remember connect the corresponding finger servos to the correct places shown in step 19.
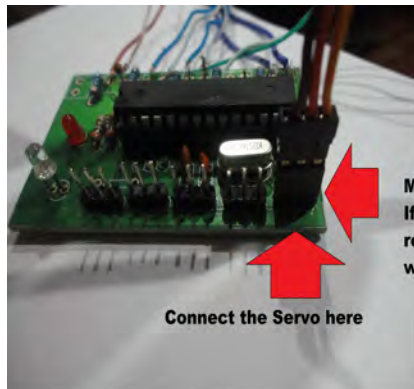
Make sure orange wire is outside.
If your wires are different colors just
remember ground(black or brown or white)
wire is on the left most side.

Connect the Servo here

Step 21 - very important additional notes.

If you want to reprogram the board with the Arduino IDE, solder the additional components and connect to the reset, tx, rx pins of the arduino board. Remember to remove the chip on the arduino board otherwise we would be programming the chip on the arduino.

IMPORTANT NOTE: remember to select arduino uno as the board.

connect arduino reset,tx,rx in the same order.

and solder a 3 pin header here.

(OPTIONAL) if you want to reprogram the board using the arduino ide solder a 10k resistor here

Step 22 - VERY IMPORTANT - How to use the robot

One of the LED's tells us if the board is on/off another signals the calibration period.
When you start the robot the power LED will turn on and the calibration LED will turn on for 5 seconds during the calibration period you clench your fists (not to hard) and open them repeat it 2-3 times. Be fast because the calibration period lasts for 5 seconds. The calibration is MANDATORY; if you do not do it the robot will not work. After the calibration the robot is fully functional and it will shadow/mirror your fingers.

I have made these instructions dead simple if you have questions contact me on club jameco or email me at anshulsanam@gmail.com. If you want to program the board with the arduino ide contact me and I will send the code which was used. Thank you for viewing this hit.

This LED is the signal for the calibration period.

This LED is to tell if the board is on/off.