Textile Sensor Indulgence

October 24-26 2018, 17-20:00, at ČIPke in Ljubljana, Slovenia

In this 3-evening workshop we will introduce a palette of conductive fabrics, fibers and threads from which you can construct all kinds of textile sensors. We will demand you be rigorous about investigating the conductive, resistive and piezoresistive properties of these materials. We will challenge you to hone your craft skills by producing well-made replicas of select designs. Finally, we will ask you to be inventive and produce and document a textile sensor design of your own.

During this workshop each participant will compile a swatch-book of the experiments, copies and new designs they produce.

KOBAKANT
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www.kobakant.at
www.howtogetwhatyouwant.at

Things are never so simple. We are surrounded by complicated structures and ambiguous situations. Something that seems wonderful may contain a harmful side on the other end. Trying to do good, can end up bad.

Yet, we can not give up. We live in a wicked world filled with wicked problems… with a wicked fabric in our hands.

Copper Conductive Fabric
Corrosion proof copper-silver plated polyamide ripstop fabric

Producer: Statex

0.03 ohm/sq

note:

Silver Stretch Conductive Fabric
Silver plated knitted fabric, 78% Polyamide + 22% Elastomer plated with 99% pure silver

Producer: Statex

1 ohm/sq

note:

RIPSTOP SILVER FABRIC
Silver plated nylon

Vendor: lessEMF

0.25ohm/sq

note:

SOFT&SAFE
70% bamboo fiber and 30% Silver. woven fabric

Vendor: lessEMF

1ohm/sq

note:

VeilShield
Polyester plated with Zinc/Nickel/Copper. 70% light transmission. 0.1 Ohm/sq resistivity

Vendor: lessEMF

0.1ohm/sq

note:

High Flex 3981
Fine copper fiber plied with synthetic fiber core. Solderable
Producer: Karl Grimm

5cm ohm/cm

note:

High Flex 3981 silver 14/000
Fine silver plated copper fiber plied with synthetic fiber core. Solderable
Producer: Karl Grimm

5cm ohm/cm

note:

Elitex
235/34 Polyamid plated with silver
Producer: Imbut GmbH

5cm ohm/cm

note:

Eeonyx Resistive non-woven
Resistive material, non woven coated with organic conductive polymers. Can be used for making pressure or bend sensor
Producer: Eeonyx

20k ohm/sq

note:

Eeonyx Resistive Stretch
Resistive material, knit/ jersey coated with organic conductive polymers. Stretch in both direction. Can be used for makingz pressure or stretch sensor
Producer: Eeonyx

20k ohm/sq

note:

Velostat
Carbon impregnated black polyethylene film.

producer: 3M

500 Ohms/cm

note:

Bekinox W 12/18
Wool 82% stainless steel fiber 18%. Resistive material. Suitable for felting

Producer: Bekaert

ohm/sq

note:

Shieldex
Silver Plated synthetic thread
Producer: Statex

5cm ohm/cm

note:

25% Metal Egypto Color Gold Gimp
very heavy in weight but supresingly fluide in working
Vendor: Bart and Francis

5cm ohm/cm

note:

Conductive Yarn
Nm10/3 conductive yarn, 80% polyester 20% stainless steel, light grey
Producer: plug and wear

5cm ohm/cm

note:

Tilt Switch

digital sensor

Tilt Switch

digital sensor **2018**

Contact Switch detects if two contact points are touching or not. By extending one of the contact points with conductive thread and metal bead with weight, you can create a sensor that detects tilting direction. The metal bead swings with gravity and touches with open contact as it gets tilted.

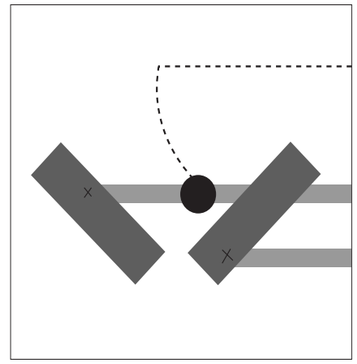
Materials: cotton fabric, copper thread (Karl-Grimm), copper conductive fabric, fusible interfacing, metal bead, galss/plastic bead

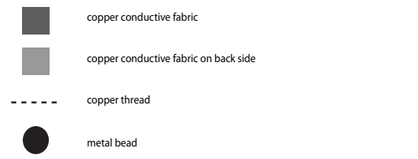
Tools: scissors, iron, sewing needle

Techniques: fusing, sewing

Tilt Sensor:

>> http://www.kobakant.at/DIY/?p=201





Fabric Push Button

digital sensor

Fabric Push Button

digital sensor **2018**

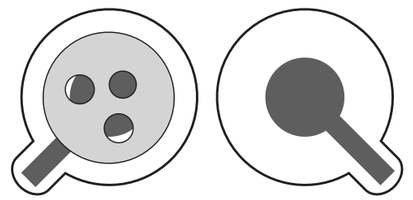
Push button is one of the simplest form of sensors. It is a contact switch separated with a spacer. You can use any conductive material such as conductive fabric and thead to make two contact point separated with spacer made out of sponge, felt or any squishy material. You can make several holes on the spacer material if needed. Make sure the two contacts are not touching unless pressed.

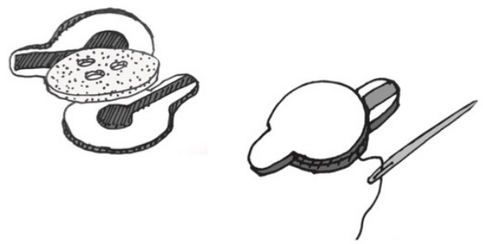
Materials: neoprene (or other fabric), stretch conductive fabric (or non-stretch, depending on previous listed fabric), fusible interfacing, foam, thread

Tools: Scissors, hole maker, cutting mat, sewing needle,iron

Fabric push button:

>> http://www.kobakant.at/DIY/?p=48





Button Switch

digital sensor

Button Switch

digital sensor **2018**

A metal button sewn on with conductive thread and a button-hole edged with conductive thread form the two sides of a switch. When the button is closed, the switch is closed. When the button is open, the switch is open.

Materials: thick conductive thread, metal button, non-stretch non-conductive base fabric

Tools: sewing needle, scissors

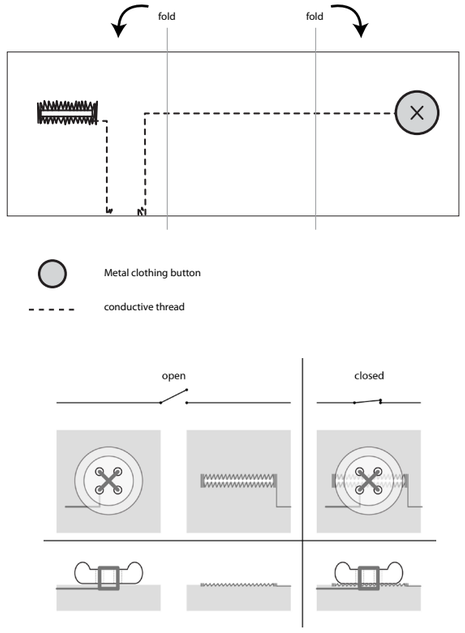
Techniques: button sewing, buttonhole sewing

Button Switch:

>> >> http://www.kobakant.at/DIY/?p=7349

Inspired by Ricardo O'Nascimento's Textile Button:

>> http://etextile-summercamp.org/swatch-exchange/button-switch/



Textile Slider

analog sensor

Textile Slider

analog sensor **2018**

Fusing a u-shaped strip of resistive fabric to a strap, adding copper tape (or conductive fabric) to an 8-ring that runs along the strap. The 8-ring works as a conductive-wiper does inside a potentiometer know, bridging contact between the legs of the "u" and causing the total resistance across the total "u" to vary based on where the 8-ring sits on the strip.

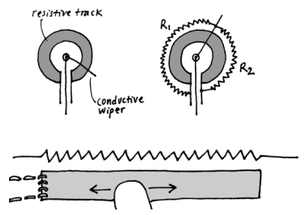
Materials: resistive fabric (velostat, eeonyx non-woven), plastic 8-ring with conductive fabric (silver stretch, copper/silver ripstop) or copper tape, or metal 8-ring

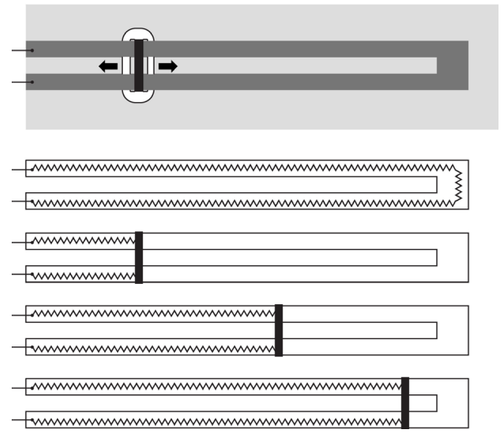
Tools: scissors, iron

Techniques: fusing, sewing

Adjustable Slider:

http://www.kobakant.at/DIY/?p=6886





Felt Squeeze Sensor

analog sensor

Felt Squeeze Sensor

analog sensor **2018**

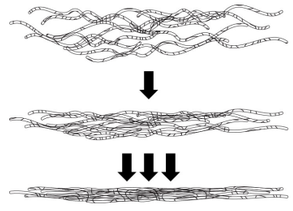
Conductive wool (80% wool, 20% stainless steel) felted onto base synthetic felt material with needle felting technique. The sensor reacts to pressuring and squeezing of the wool.

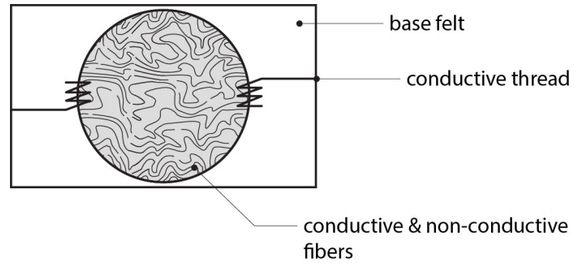
Materials: conductive wool (80% wool, 20% stainless steel) Bekaert, non-conductive wool roving, conductive thread, base felt

Tools: felting needle, scissors, sewing needle

Techniques: needle felting, sewing, cutting

Needle felting conductive wool:
>> http://www.kobakant.at/DIY/?p=3089





Knit/Crochet Stretch

analog sensor

Knit/Crochet Stretch Sensor

analog sensor **2018**

Conductive yarn knit into tubular knit with 4 needle knitting mill. It lowers its resistance across the two end as it gets stretched.

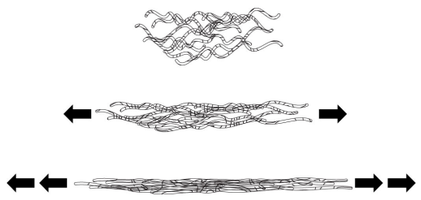
Materials:

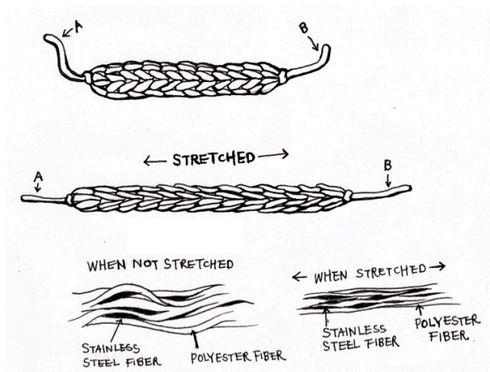
Plug and wear Conductive yarn (polyester 80% Stainless steel 20%), non-conductive yarn

Tools: knitting mill, crochet hook, scissors

Techniques: knitting with 4 needle knitting mill

Circular knit stretch sensors:
>> http://www.kobakant.at/DIY/?p=2108





Neoprene Bend Sensor

analog sensor

Neoprene Bend Sensor

analog sensor **2018**

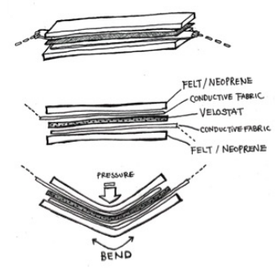
This bend sensor actually reacts (decreases in resistance) to pressure, not specifically to bend. But because it is sandwiched between two layers of neoprene (a thick, sturdy material), pressure is exerted while bending, thus allowing one to measure bend (angle) via pressure.

You can make this sensor with any piezoresistive material, such as velostat, eeonyx non-woven or eeonyx stretch as middle material.

Materials: neoprene, conductive thread, piezoresistive material (velostat, eeonyx non-woven or eeonyx stretch), conductive fabric (silver stretch), fusible interfacing

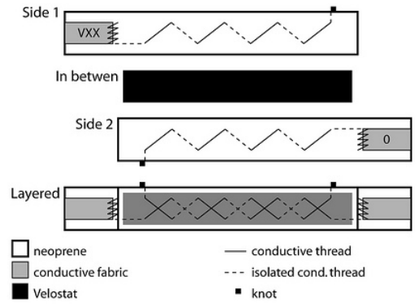
Tools: scissors, sewing needle, iron

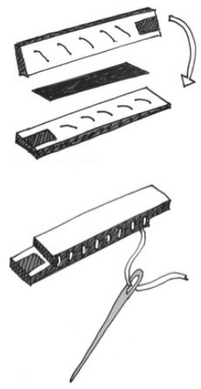
Techniques: cutting, fusing, layering, sewing



Neoprene Bend Sensor:

>> http://www.kobakant.at/DIY/?p=20





Pressure Sensor

analog sensor

Pressure Sensor

analog sensor **2018**

Stitching conductive thread into neoprene to create a pressure sensitive pad. This sensor is very similar to the Fabric bend sensor or vis-versa. The conductive surface is minimized by stitching only a few stitches on either side with conductive thread. This creates a good fingertip pressure range.

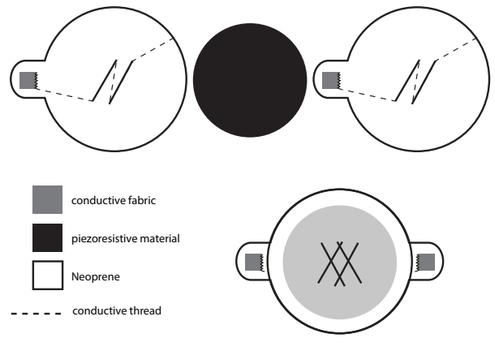
Materials: neoprene, conductive thread, piezoresistive material (velostat, eeonyx non-woven or eeonyx stretch), conductive fabric (silver stretch), fusible interfacing

Tools: scissors, sewing needle, iron

Techniques: cutting, fusing, layering, sewing

Neoprene Pressure Sensor:

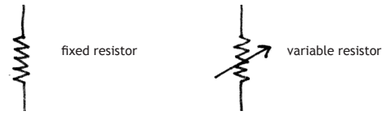
>> http://www.kobakant.at/DIY/?p=65



OHM's LAW

variable resistors, voltage dividers, analog to digital conversion (ADC)

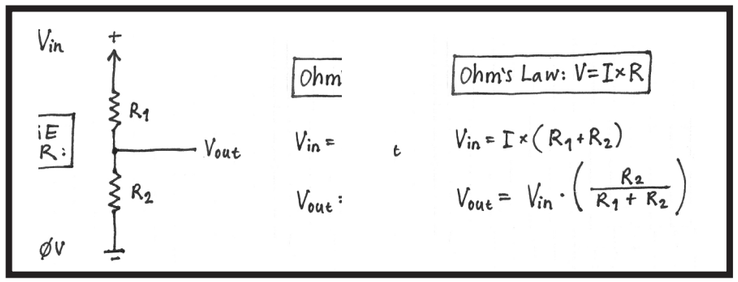
The analog sensors we will construct in this workshop all work as **variable resistors**, meaning their electrical resistance changes under the circumstances of what they can sense.



A **voltage divider** allows us to convert resistance into voltage. Connect two resistances in series, apply a voltage across them and measure the voltage at the point inbetween them - V(out).

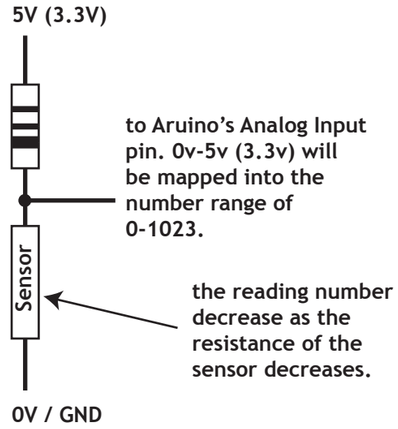
Using Ohm's law you can calculate how much voltage will be at V(out).
If one of these resistors were to vary their resistance, V(out) would also vary.

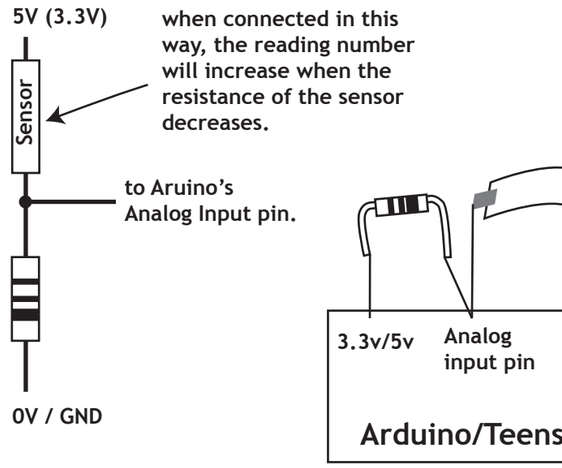
Because the ADC (Analog to Digital Converter) of the Arduino microcontroller reads voltage (not resistance), you will need to create a voltage divider for every sensor that you want to read.



Reading Analog Sensors with Arduino

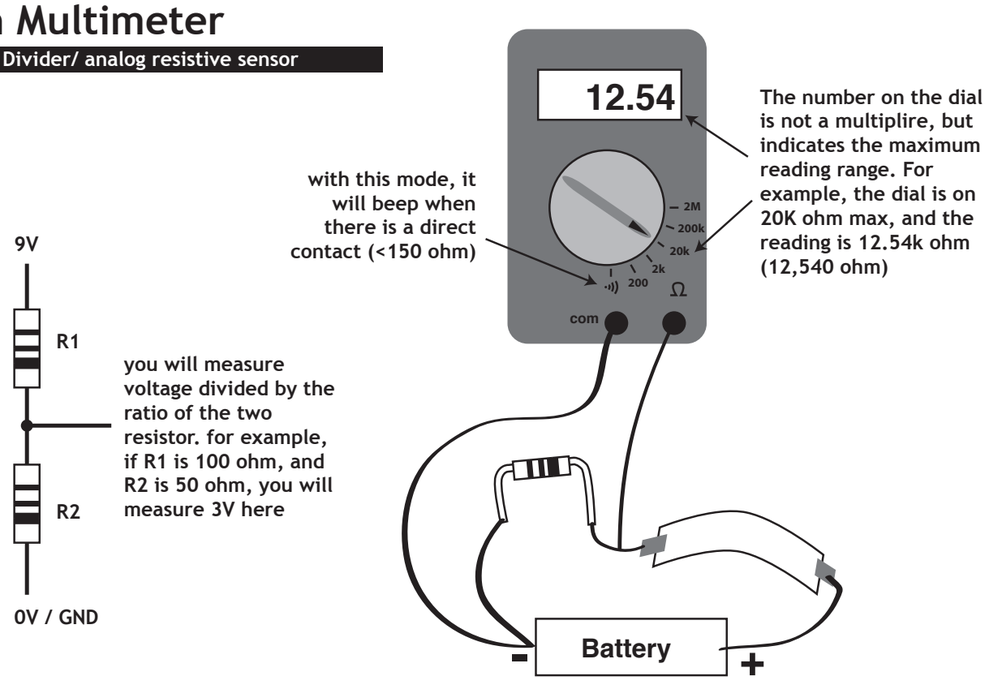
Voltage Divider/ analog resistive sensor





Reading Analog Sensors with Multimeter

Voltage Divider/ analog resistive sensor



Worksheet

enter your sensor's resistance range, select your voltage divider, measure the voltage

	sensor		*voltage divider*	*sensor*	
SENSOR NAME	MIN resistance Ω	MAX resistance Ω	**MEAN resistance Ω**	MIN voltage V	MAX voltage V