

Arduous Arduinos

How can we make useful things?

Before we begin...

- * Is there a need?
- * How do we fill this need?
- * Is technology appropriate for this need?

Example: Pulse Ox

- * Is there a need?
- * How do we fill this need?
- * Is technology appropriate for this need?



the pulse oximeter: how does it work?

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The pulse oximeter how does it work?

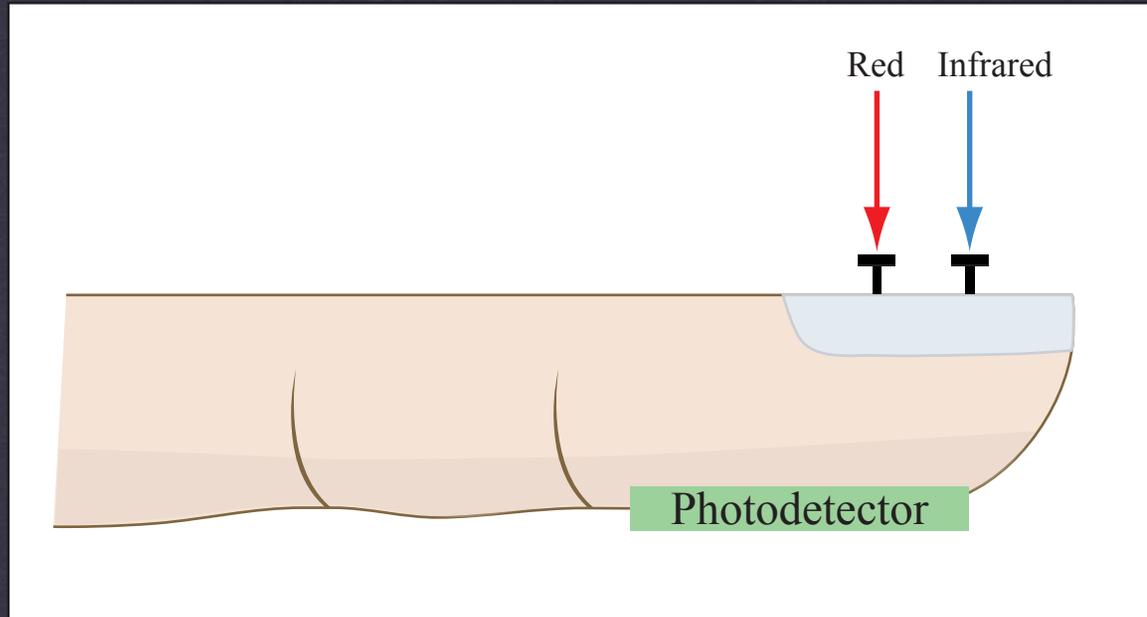


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The pulse oximeter

how does it work?

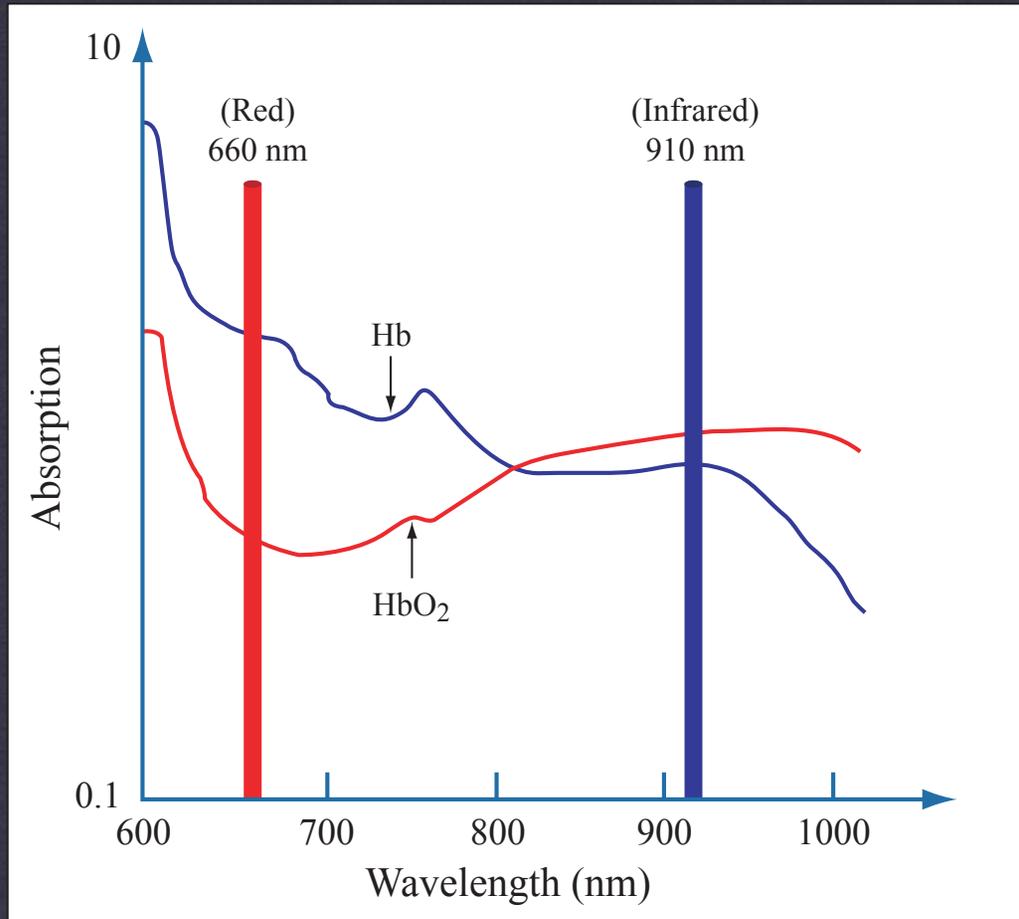


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The pulse oximeter

how does it work?

How does it work?

- * Shines light through a finger
- * Measures light intensity
- * Converts intensity into blood oxygen level

So what do we need?

- * We need to shine a light through a finger
- * We need to measure light intensity
- * We need to display and record the collected data
- * We need to convert intensity into blood oxygen level

Display and record?

- * The world is complicated
- * We can break complicated systems down into easier problems
- * We can use same data for multiple projects

The pulse Oximeter

how we did it

So what do we need?

- ✱ We need to shine a light through a finger

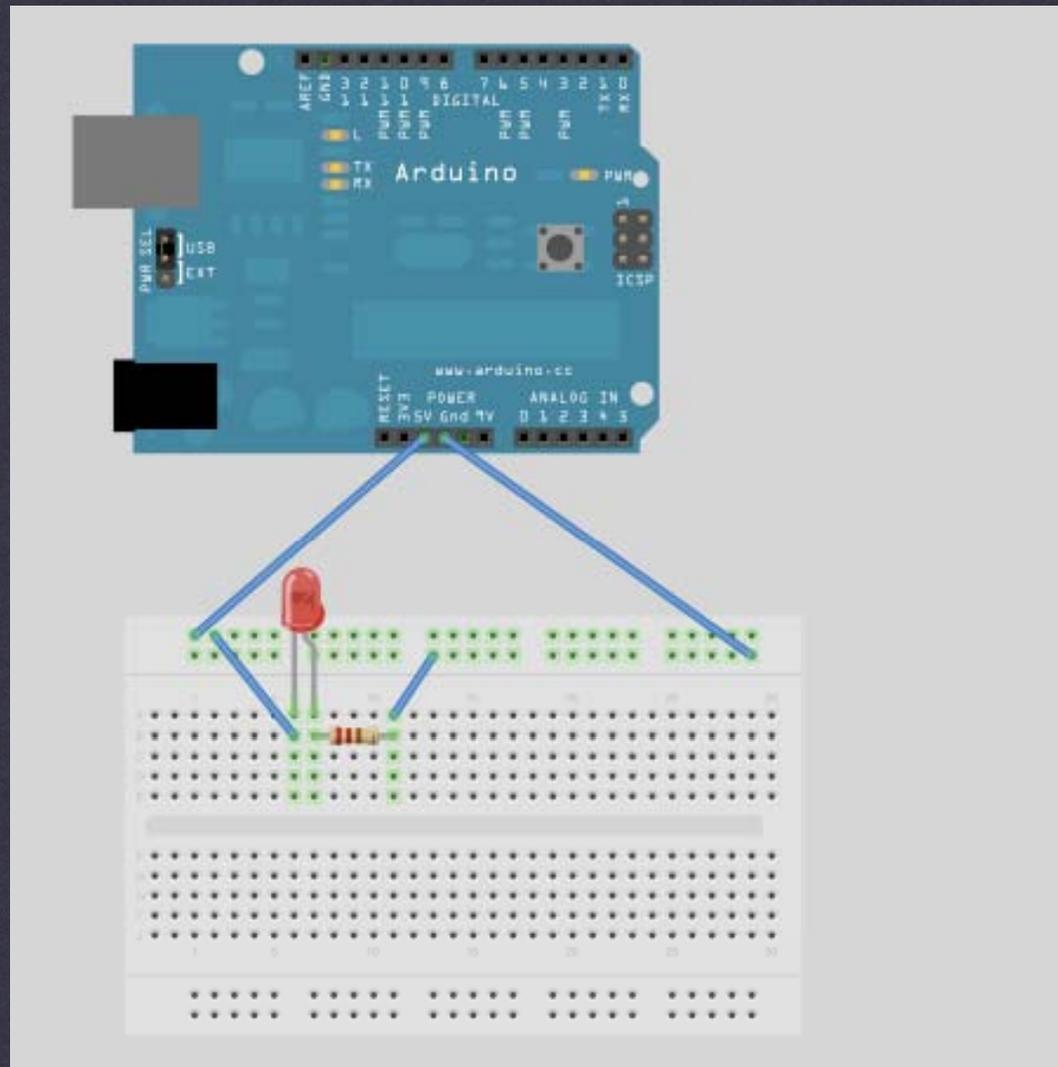
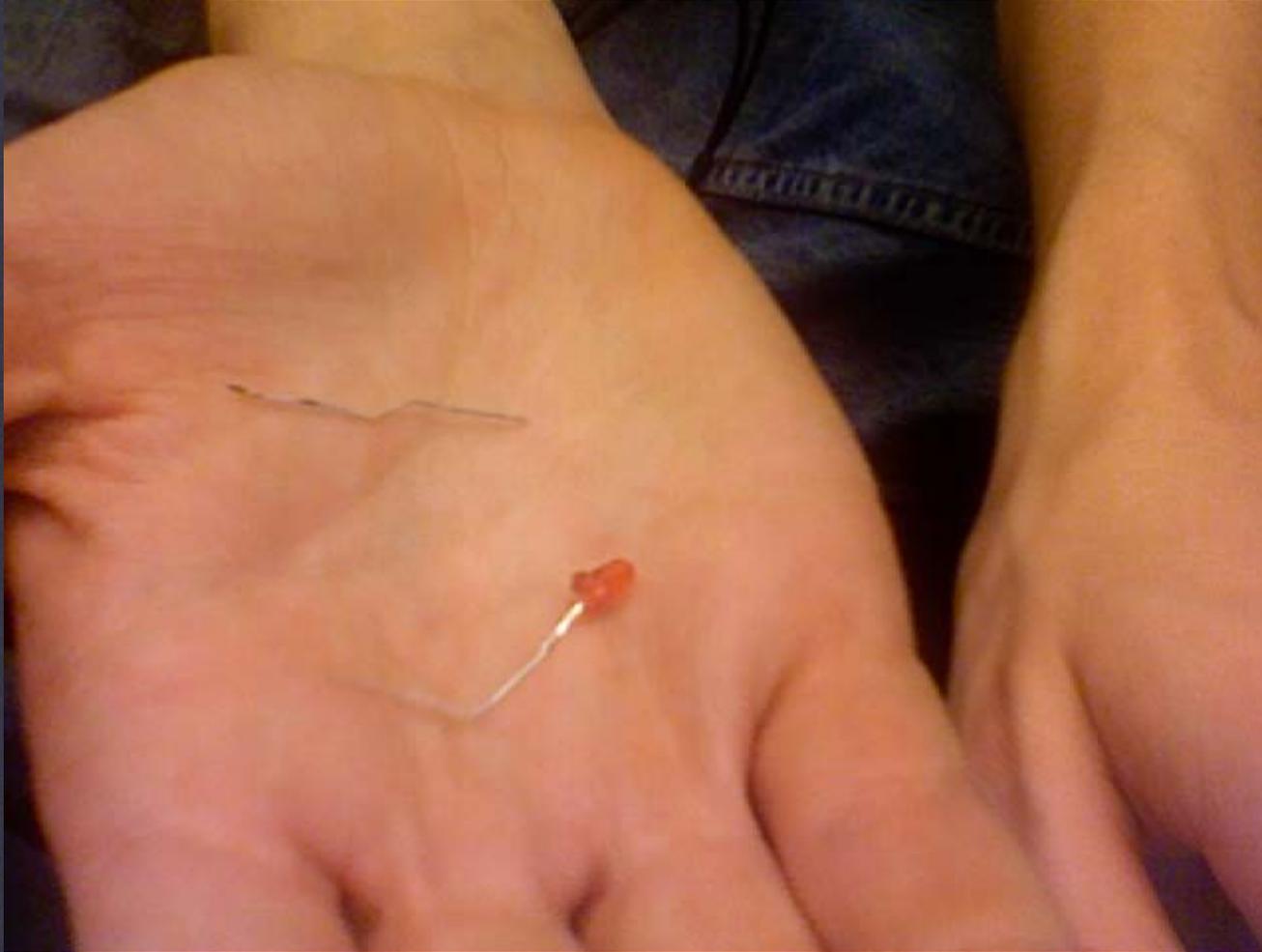


Image made using <http://fritzing.org/>

light through a finger

how we did it



burn Through a finger
how We screwed up

So what do we need?

- * We need to shine a light through a finger
- * We need to measure light intensity

sparkfun ELECTRONICS

AUTONOMOUS VEHICLE CONTEST 2010
THE POND WILL BE THERE. WILL YOU?
BOULDER, COLORADO
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Product Info
Reli5 ✓
Light Intensity to Frequency IC
 sku: SEN-08940

Descriptions: This is a programmable light to frequency IC from TAOS that outputs a pulse train or a square wave (50% duty) with the frequency that is directly proportional to the incident light intensity. Uses a simple TTL output for easy interfacing to a microcontroller.

Three different sensitivity selections and four different frequency scaling parameters.

Features:

- Supply voltage 3.7 - 5.5VDC
- 320nm - 1050nm response range
- 2mA supply current in power on mode
- 50A current in power down mode mode
- Temperature compensated for UV to visible range

Pricing
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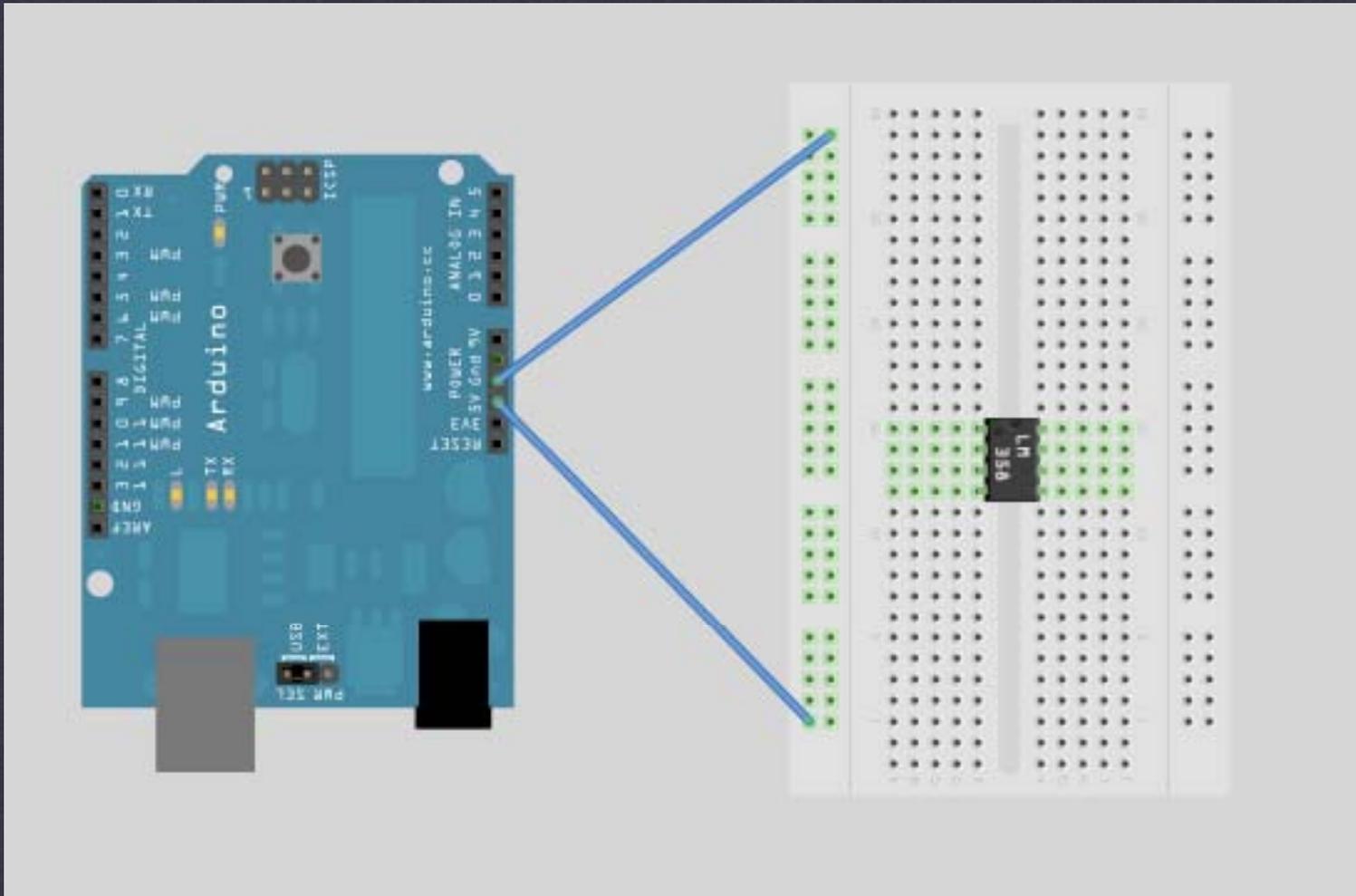
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Measuring the light

how we did it



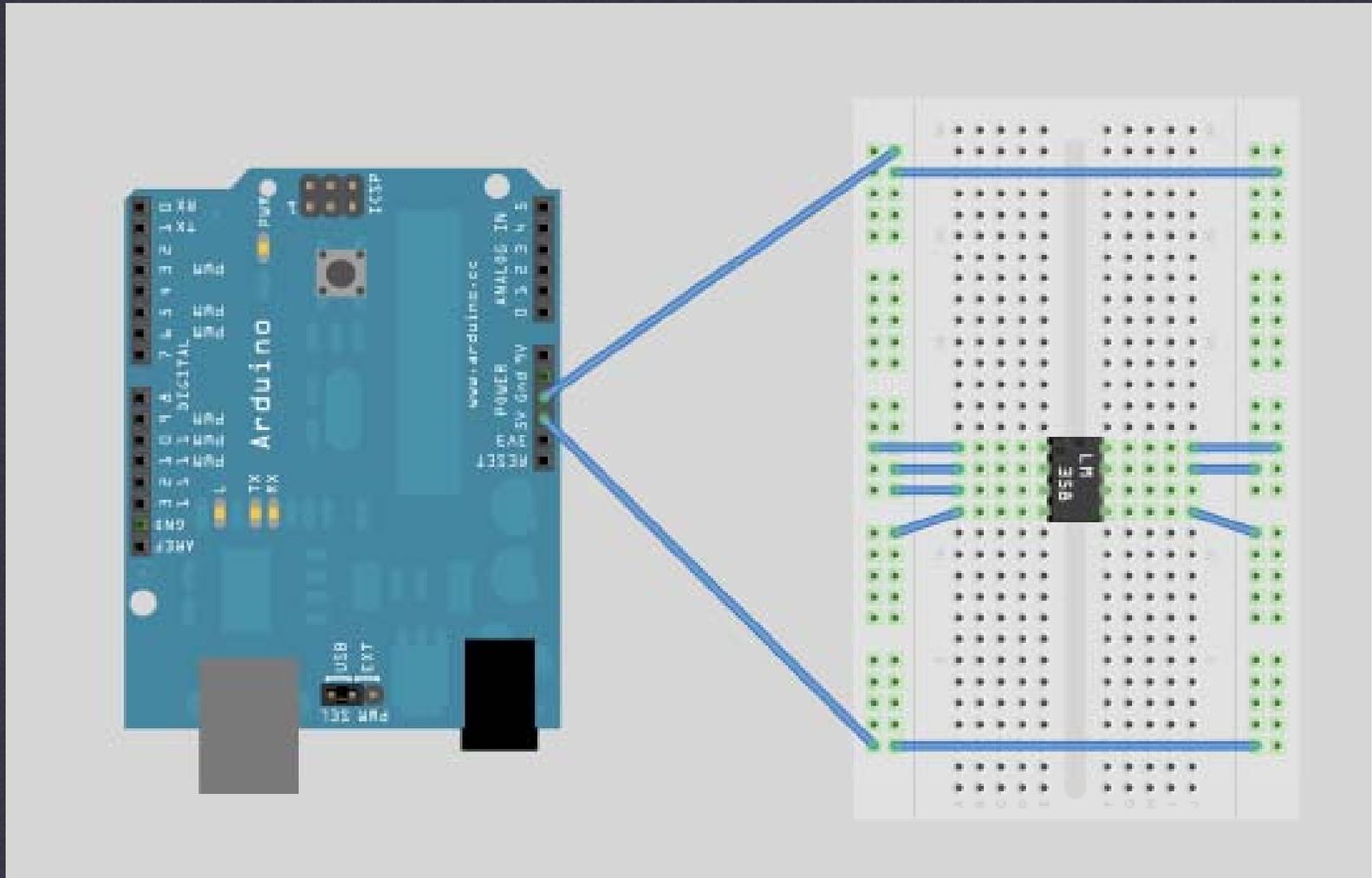
Measuring the light

how we did it

Excerpts from TAOS Inc. product spec sheets removed due to copyright restrictions.
See Programmable Light-to-Frequency Converters spec sheets TSL230R-LF, TSL230AR-LF, and TSL230BR-LF.

Measuring the light

how we did it



Measuring the light

how we did it


```
pulse_ox_light_measurement 5  
  
float val;  
  
void setup() {  
}  
  
void loop() {  
  val = pulseIn(2, HIGH);  
}
```

Done Saving.
Binary sketch size: 3876 bytes (of a 30720 byte maximum)

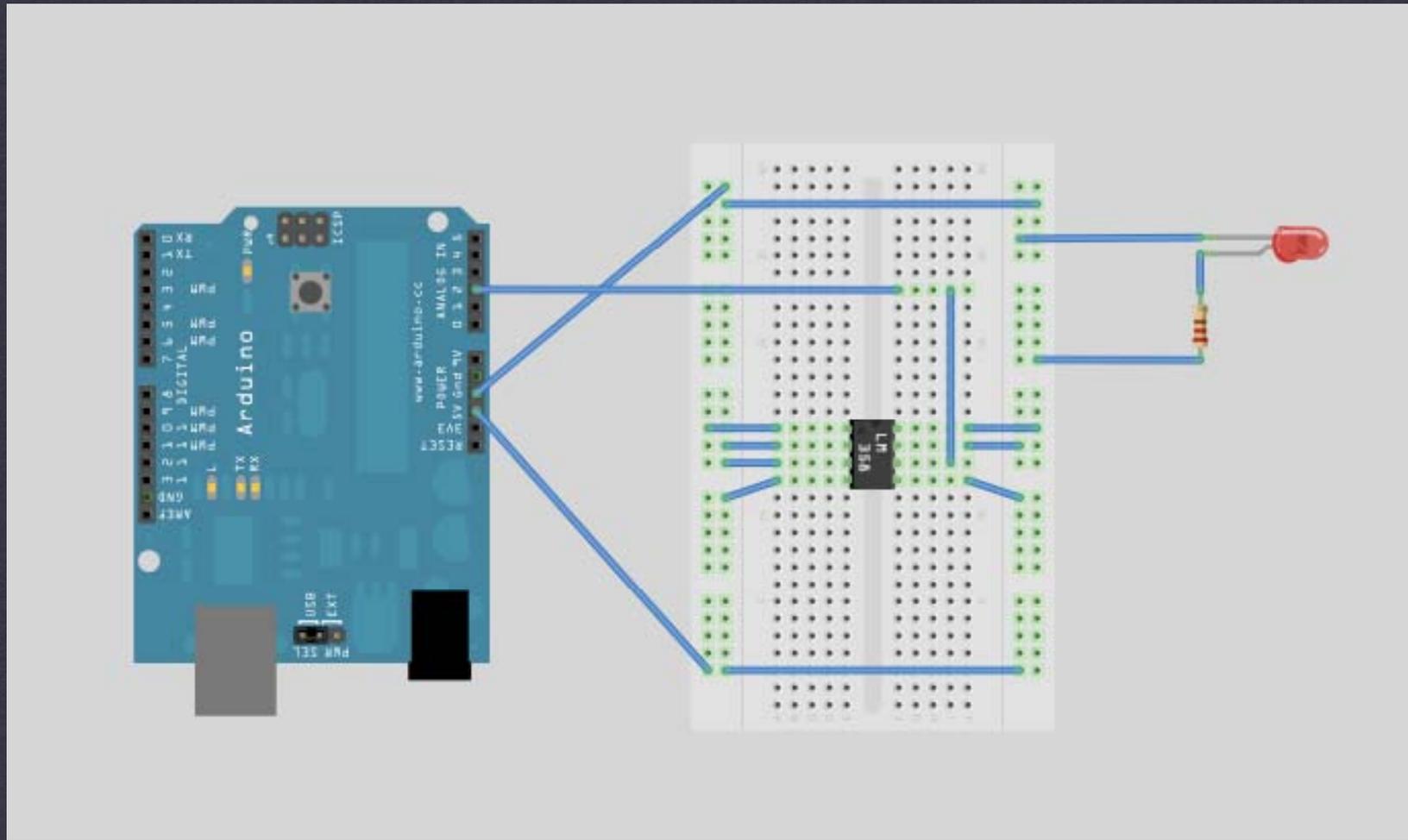
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Measuring the light

how we did it

So what do we need?

- * We need to shine a light through a finger
- * We need to measure light intensity
- * We need to display and record the collected data



graphing and storing
how we did it

```
float val;

void setup() {
  Serial.begin(115200);
}

void loop() {
  val = pulseIn(2, HIGH);
  Serial.println(val);
}
```

Done Saving.
Binary sketch size: 3876 bytes (of a 30720 byte maximum)

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graphing and storing

how we did it

```
pulse_ox_meas

pulse_ox_measurement_graphing $

import processing.serial.*;

Serial myPort;      // The serial port
int xPos = 1;      // horizontal position of the graph

void setup () {
  // set the window size:
  size(800, 600);

  // List all the available serial ports
  println(Serial.list());
  // I know that the first port in the serial list on my mac
  // is always my Arduino, so I open Serial.list()[0].
  // Open whatever port is the one you're using.
  myPort = new Serial(this, Serial.list()[0], 115200);
  // don't generate a serialEvent() unless you get a newline character:
  myPort.bufferUntil('\n');
  // set initial background:
  background(150, 150, 150);
}

void draw () {
  // everything happens in the serialEvent()
}
```

graphing and storing
how we did it

```

void serialEvent (Serial myPort) {
  // get the ASCII string:
  String inString = myPort.readStringUntil('\n');

  if (inString != null) {
    // trim off any whitespace:
    inString = trim(inString);
    // convert to an int and map to the screen height:
    float inByte = float(inString);
    inByte = map(inByte, 0, 1023, 0, height);
    inByte = inByte/60;
    // draw the line:
    stroke(255,0,0);
    strokeWeight(4);
    strokeJoin(ROUND);
    strokeCap(ROUND);
    line(xPos, height - inByte, xPos, height - inByte);

    // at the edge of the screen, go back to the beginning:
    if (xPos >= width) {
      xPos = 0;
      background(150, 150, 150);
    }
    else {
      // increment the horizontal position:
      xPos++;
    }
  }
}

```

Done Saving.

```

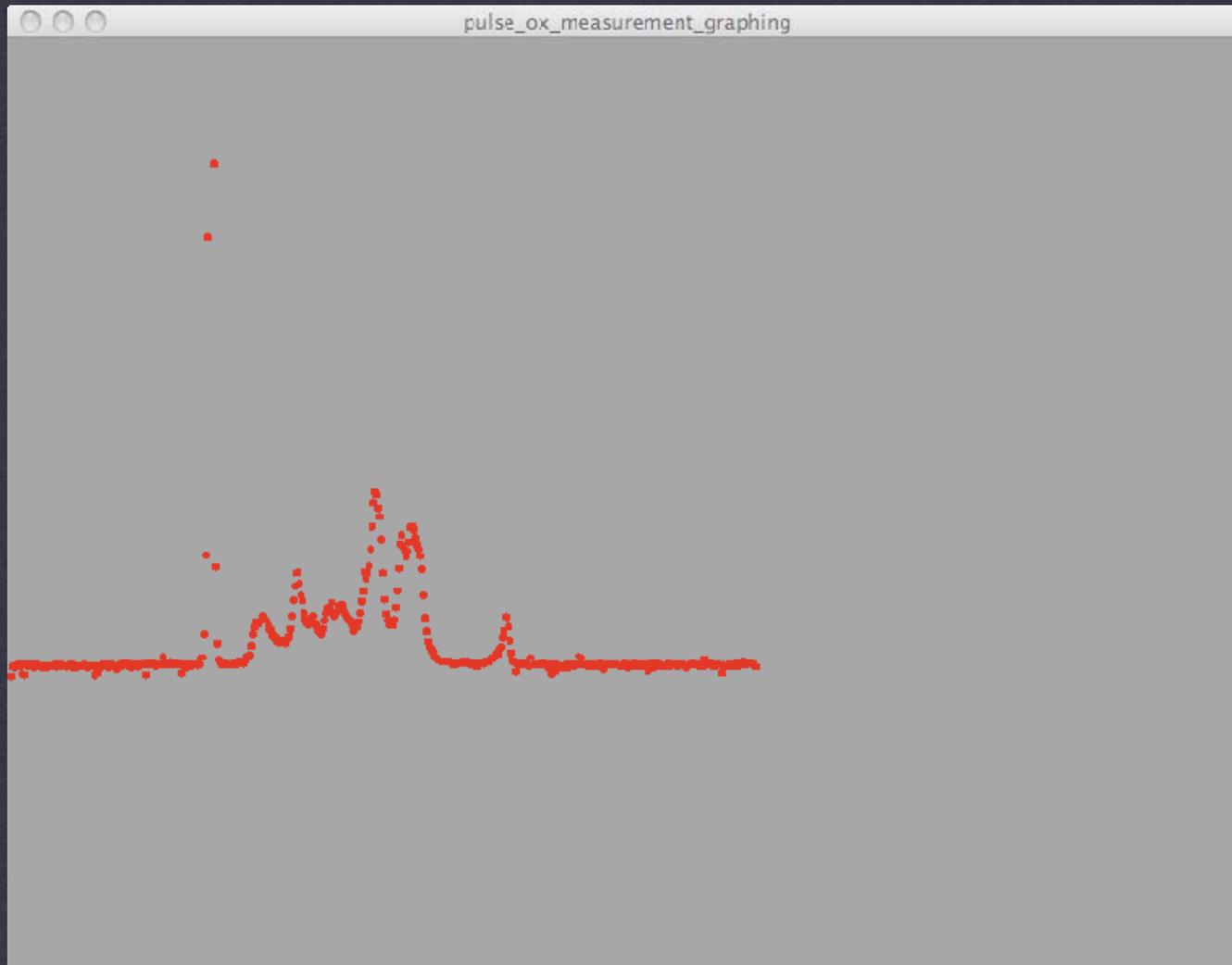
[4] "/dev/tty.Bluetooth-Modem"
[5] "/dev/cu.Bluetooth-Modem"
Experimental: JNI_OnLoad called.

```

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graphing and storing

how we did it



graphing and storing

how we did it

So what do we need?

- * We need to shine a light through a finger
- * We need to measure light intensity
- * We need to display and record the collected data
- * We need to convert intensity into blood oxygen level

How do we get the blood oxygen level?

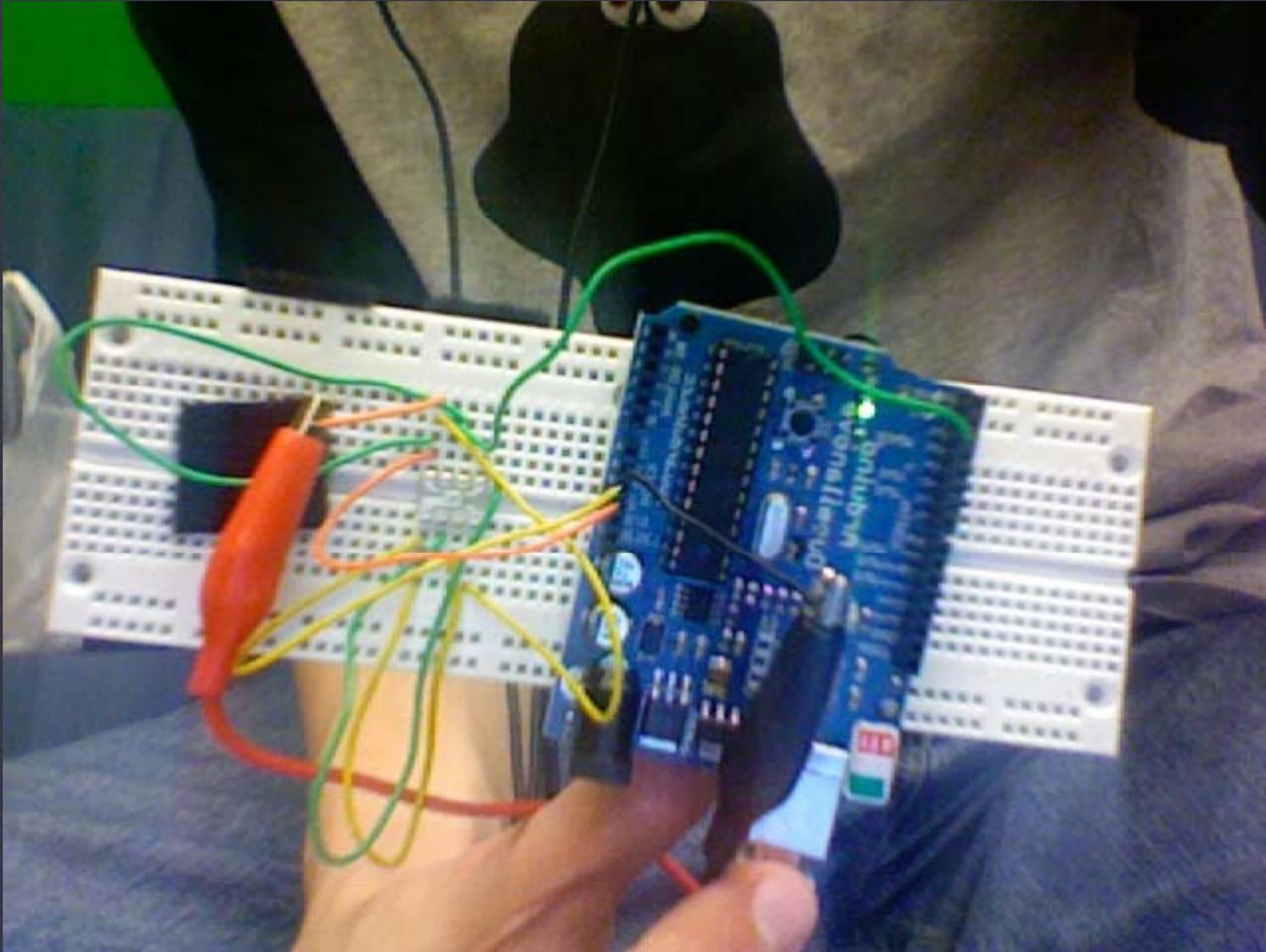
- * Process the data!
- * Conditional statements (if)
- * Control statements (while, for)
- * Translating the abstract problem into a logical one

How can I learn about programming?

- * Websites (Processing, Python, C)
- * Books (O'Reilly collection is free!)
- * Ask a friend

Main Ideas

- * Understand the problem
- * Break down the problem
- * Design each block
- * Experiment!



Questions?

I can't have possibly explained everything in the right way to everyone

SURPRISE!

Now you have to build the system

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EC.710 D-Lab: Medical Technologies for the Developing World
Spring 2010

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