Arduino 101
Hands-on: LED Level from Light

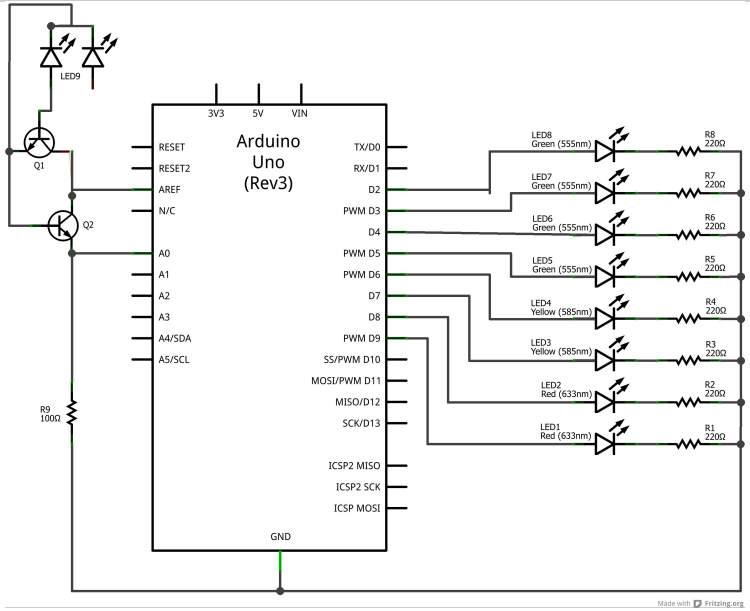
Project Description

In this project we're going build an ambient light meter, using an LED as a photocell. The LED Level meter built in previous projects will reflect the brightness of light detected by the LED.

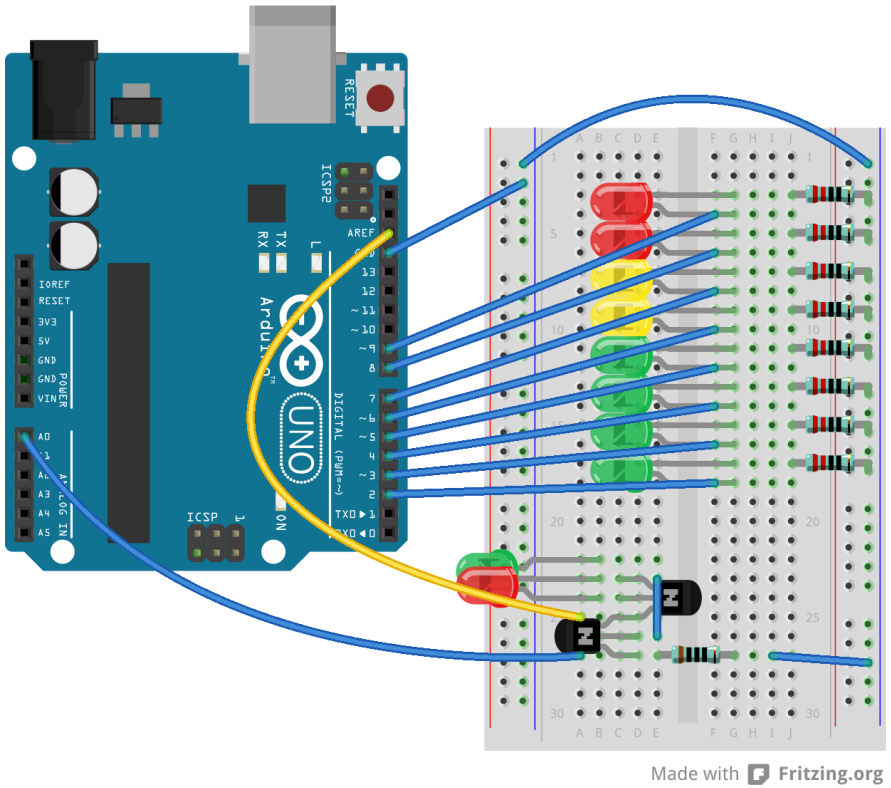
Required Parts

2 red LEDs
2 yellow LEDs
4 green LEDs
1 RED-GREEN LED
2 PN2222A Transistors
8 220Ω Resistors (red, red, black, black)
1 10kΩ Resistor (brown, black, black, red)

Schematic



Circuit



NOTES: This build starts with the same LED circuit as in previous projects. The light detector circuit made up of the LED and transistors is a little difficult, so if you're unsure what a wire is connecting to, just check the schematic to see where parts connect. Although the perspective of the diagram makes the flat faces of the transistors look like they are facing each other, they will actually be facing opposite each other on the board. For the RED-GREEN LED, make sure the longest lead is the one connected to the emitter of the transistor. You'll have to spread the leads apart a little to make it sit correctly on the board.

Code

```
// LED Level from Potentiometer Sketch for Arduino 101
// by Nick Borko

// function to set the LEDs to a specific level
void setLed(int level) {
  // iterate through the pins
  for (int pin = 2; pin <= 9; pin += 1) {
    // compare the pin to the level...
    if (pin < level + 2) {
      // LED is on
      digitalWrite(pin, HIGH);
    } else {
      // LED is off
      digitalWrite(pin, LOW);
    }
  }
}

void setup() {
  int pin;
  // initialize pins 2-9 to be output pins
  for (pin = 2; pin <= 9; pin += 1) {
    pinMode(pin, OUTPUT);
  }
}

void loop() {
  // read the value from the potentiometer
  // this will be a value from 0-1023
  int raw = analogRead(A0);
  // we add one to the reading to make it an even 1-1024,
  // then divide this value by 128 since we have 8 LEDs
  int scaled = (raw + 1) / 128;
  // set the LED Level
  setLed(scaled);
  // smooth out the reading a bit
  delay(50);
}
```

Discussion

You'll notice that the sketch we're using is the one we used for the potentiometer. That's not a mistake; we're still measuring the analog input on **A0** to display the reading on the LED level meter. The only difference is the hardware we're using to get an input signal.

A **Light Emitting Diode**, or LED, is a special diode that converts current to visible light. All diodes are capable of this, depending on the types and ratios of chemicals used in the construction of the diode. Although most “regular” diodes are encased in plastic, even if they weren't the kind of light they give off are not visible to the human eye. Some colors are easier to produce than others, with red and green being the easiest (and therefore the cheapest) sorts of LEDs. LEDs are also produced in the infrared variety, like the kind used in your TV remote control, and even in the ultraviolet range.

In this circuit, though, we're using an LED to detect light. How is that possible? Well, any diode that can produce light from current can also produce current from light! It's extremely inefficient, though, and the amount of current produced is extremely small. We're using the RED-GREEN LED because it has a more transparent dome than our colored LEDs, and therefore can collect more light to convert into current.

Even so, the amount of current it produces is still too small for the Arduino to read. That's why we're using transistors to amplify the signal using a circuit called a **common emitter amplifier**. However, one transistor isn't enough to amplify the tiny signal, so we need 2 transistors in a **Darlington configuration**. In this circuit, a second transistor is fed the output signal from the first, increasing the amplification enough for us to get a proper analog reading on **A0**.

You don't need to worry about understanding the amplifier circuit, but it's good to know some terms in case you hear them again.