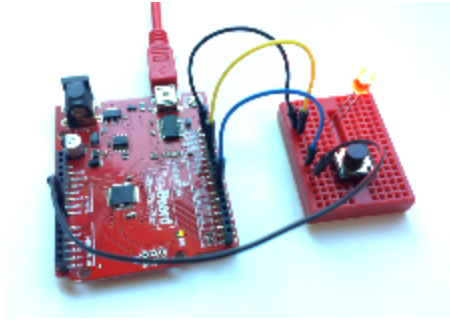


DIY Reaction Timer



Introduction

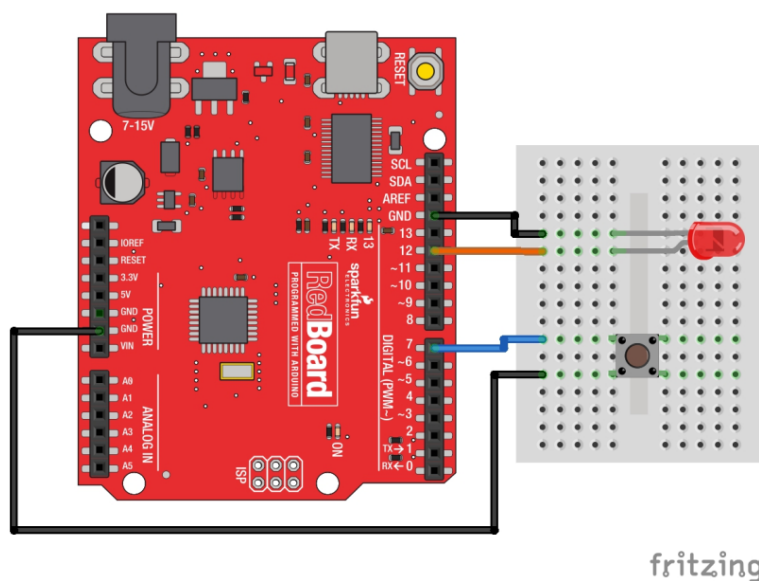
[Mental chronometry](#) is the study of how fast humans react to different inputs. It takes a few hundred milliseconds for the signal to get from your eyes, to your brain, out to your limbs to respond. The reaction timer is a great project to demonstrate this time delay. It also makes for a fun game between friends!

According to the team at Human Benchmark¹, the average human reaction time is about 215 ms. How fast are you?

The principal of the reaction timer is simple: when the user sees the light turn on, press the button! A microcontroller is perfect for this because it can time milliseconds very accurately

For this project, we will use an Arduino to be the time-keeper. An Arduino is a small, low-cost, and fast microcontroller that is capable of performing command / instructions at a rate of 16 MHz or roughly 62.5 ns per instruction.

Wiring / Hook-up Guide (Fritzing)



¹ <http://www.humanbenchmark.com/tests/reactiontime/index.php>

The wiring for this circuit is simple, it requires a single LED and a single button. Connect the LED between pin 12 and GND using the solderless breadboard. Remember that each row of 5 holes are connected together by an internal metal clip. Make sure that the LED leg and the connecting wire are in the same row. Also, LEDs have a polarity. Make sure that the short leg of the LED is connected to GND.

Similarly, connect the button up between pins 7 and GND.

Example Code

<https://codebender.cc/sketch:62303>

```
/*
 * Reaction Timer - Serial Monitor
 *
 * Hardware connections:
 * LED: Pin 12
 * Button: Pin 7
 *
 * Upload this example, open up the serial monitor - set to 9600 bps.
 * Push the button as soon as the light turn on.
 */

int sound = false; // enables the buzzer

/* Pin out definitions */
int ledPin = 12; // connect LED between pin 12 and GND
int buttonPin = 7; // connect push button between pin 7 and GND
int gameNum = 0; // counter for the games played

unsigned long waitTime; // Random "waiting" time before turning on the light
unsigned long zeroTime; // Zero reference time
unsigned long reactTime; // Reaction Time

void setup()
{
  Serial.begin(9600); // setups up communication to talk back to the computer

  pinMode(ledPin, OUTPUT); // sets up the ledPin to be an OUTPUT
  pinMode(buttonPin, INPUT_PULLUP); // Sets the pull-up resistor for the button
  digitalWrite(ledPin, LOW); // sets pin LOW (GND)
  // prints out the header.
  Serial.print("Iter");
  Serial.print("\t");
  Serial.print("React (ms)");
  Serial.println();
  Serial.print("=====");
  Serial.println();
}

void loop()
{
  randomSeed(analogRead(A5)); // Get noise to seed the random number generator
  // Use an un-used pin for the random noise.
  waitTime = random(2000, 3500); // randomTime from 2 to 3.5 seconds
  delay(waitTime); // delay randomTime
  digitalWrite(ledPin, HIGH); // turn on LED!

  zeroTime = millis(); // set zeroTime reference

  while(digitalRead(buttonPin) == HIGH) // holding loop until button is pressed.
  {
  }
}
```

```

    reactTime = millis() - zeroTime; // calculation of reaction time

    digitalWrite(ledPin, LOW);    // turn off LED!

// Display information to Serial Monitor //

    Serial.print(gameNum);
    Serial.print("\t");
    Serial.print(reactTime, 1);
    Serial.println();
    delay(1000);    // short delay before starting again.
    gameNum++;
}

```

After uploading this code to your Arduino, open up the Serial Monitor. When the LED turns on, press the button as fast as you can. You should see your data results show up in the terminal window. This is text that the Arduino is printing / sending back to the computer for display.

The screenshot shows the Serial Monitor window for COM38. The data displayed is as follows:

Iter	React (ms)
1	358
2	350
3	206
4	290
5	215

Labs / Examples / Investigation Ideas

You now have a reaction timer. Great, now what? Here are a few ideas of things to explore:

- **Statistics:**
 - What is your fastest reaction time?
 - What is your slowest reaction time?
 - What is the best measure of your actual reaction time? (Measures of central tendency -- mean, median, mode)
 - How do you identify an “outlier”? What does standard deviation mean?
- **Bio / Social / Other Science:**
 - Does reaction time vary with age?
 - Does reaction time vary with dominant vs. non-dominant hand?
 - Does the color of the light make a difference?
 - Do males vs. females have a difference in reaction time?
 - Internal Clock. How good is yours? How well can you estimate 5 seconds? How about 30 seconds?

Going Further

See if you can add sound to your reaction timer. You’ll need a buzzer and a few extra lines of code. Connect up a buzzer between pins 9 and GND.

In the `setup()`, add a line that reads:

```
pinMode(9, OUTPUT);
```

And, to make a tone, use the command:

```
tone(9, 440); // 9 indicates the OUTPUT pin, and 440 is the frequency
```

To stop the tone, use this command:

```
noTone(9);
```