LED Playground

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This project introduces LEDs (Light Emitting Diode). After completing this project one should be able to describe, handle, and use an LED. Using an arduino to turn on and off the LED. You will be working with the internal LED and setting up an external LED.

Background

An LED is a very important source of light for projects, and devices. LEDs come in different colors, this depends on "band gap". LEDs are generally found in elctronic components, such as remote controls, microwaves, lamps and many more.

Material

We will assume you are using th duinokit. It may work arduino uno. The duino kit has an instruction booklet

- ☐ Computer
- ☐ Arduino Board, Arduino Nano. (DuinoKit)
- ☐ USB cable
- ☐ Jumper Cables
- ☐ LEDs
- ☐ Internet Connection

1 Tasks

Complete the following tasks. Note that different operating systems require different steps. Make sure to use the following reference Arduino.cc

Task 1

Connect Arduino to computer.

- ☐ Plug USB to arduino and computer.
- ☐ Open Arduino IDE
- ☐ Tools → Board : Arduino Nano (The type of board you are using)
- ☐ Tools → Port : COM5
- ☐ TOols → Processor : Atmega328p (old bootloader)
- ☐ Make sure everything is configured correctly.
- ☐ Optional: Copy Empty.ino onto the IDE, save and upload sketch. An LED will blink, and stop, this shows that sketch is being uploaded.

Listing 1: Empty.ino

```
1 void setup(){
2     pinMode(LED_BUILTIN,OUTPUT);
3 }
4 void loop(){
5 }
```

Task 2

Make internal LED blink using the delay() function

- ☐ Files → Examples → 01.Basics → Blink
- ☐ Save file

- ☐ Upload Sketch
- ☐ Read the code.
- ☐ Play with the code

You may also use Blink.ino
.ino files must be inside a folder to upload.

Listing 2: Blink.ino

```
1 void setup(){
2     pinMode(LED_BUILTIN,OUTPUT);
3 }
4 void loop(){
5     digitalWrite(LED_BUILTIN,HIGH);
6     delay(400);
7     digitalWrite(LED_BUILTIN,LOW);
8     delay(400);
9 }
```

Task 3

Make internal LED blink **without** using delay() function.
Recall that delay() function stop code execution.

- ☐ Load or Copy noDelayLED.ino
- ☐ Upload Sketch

As one can see the results are similar to Task 2. We used the function millis() conditional statements.

Listing 3: noDelayLED.ino

```
1 int previousLEDstate = LOW;
2 unsigned long lastTime = 0;
3 int interval = 400;
4 void setup(){
5     pinMode(LED_BUILTIN,OUTPUT);
6 }
```

```
7  void loop(){
8      unsigned long currentTime = millis();
9      if(currentTime - lastTime >= interval){
10         lastTime = currentTime;
11         if(previousLEDstate == HIGH){
12             digitalWrite(LED_BUILTIN,LOW);
13             previousLEDstate = LOW;
14         }
15         else{
16             digitalWrite(LED_BUILTIN,HIGH);
17             previousLEDstate = HIGH;
18         }
19     }
20 }
```

Task 4

We will connect an external LED using the arduino nano. Making the LED blink using the delay() function.

- ☐ Find Digital Pin 13 (D13)
- ☐ Connect jumper wire from digital pin (D13) to resistor. (duinokit has built in resistor. Connect to positive pin)
- ☐ DuinoKit has (+) anode and (-) cathode labeled. Generally the positive side is the longest leg of LED.
- ☐ The GND (ground) should be connected to the (-) cathode
- ☐ Since (D13) is the LED_BUILTIN. Refer to task 2.
- ☐ If you use a pin other than D13. Change LED_BUITIN to the pin number you are using.
- ☐ extLED.ino assumes we use digital pin 2 (D2). Follow steps above.

Listing 4: extLED.ino

```
1  int LED = 2;
2  void setup(){
3      pinMode(LED,OUTPUT);
4  }
5  void loop(){
6      digitalWrite(LED,HIGH);
7      delay(400);
8      digitalWrite(LED,LOW);
9      delay(400);
10 }
```

You may also use code from task 3 so that delay()is not used.

Task 5

Using PWM - Pulse Width Modulation to dim an LED.
Only certain pins have PWM. Pins 3, 5, 6, 9, 10, and 11.

- ☐ Connect Digital pin 3 (D3) To (+) anode
- ☐ Connect GND to (-) cathode.
- ☐ Load or copy extLEDfade.ino into the Arduino IDE.
- ☐ Upload Sketch

analogWrite() functions will only work on PWM pins.

Listing 5: extLEDfade.ino

```
1  int LED = 3;
2  void setup(){
3      pinMode(LED,OUTPUT);
4  }
5
6  void loop(){
7    for(int i = 0; i < 256; i++){
8      analogWrite(LED, i);
9      delay(5);
```

```
10    }
11   for(int i = 255; i >= 0; i--){
12       analogWrite(LED, i);
13       delay(5);
14   }
15 }
```

Summary

We have defined and introduced functions. In Task 1 we set up the Arduino and made sure it was responding the our computer. In Task 2 the internal LED we programmed the microcontroller to make the LED blink. delay() function stops execution. In Task 3 we made the LED blink withouth the delay() function. In Task 4 we set up an external LED. Task 5 introduced PWM - Pulse Width Modulation, this was used to dim an LED.