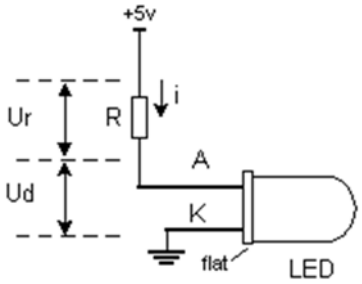
CS
IT

Lecture (03)

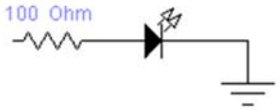
Dr. Ahmed ElShafee

Connecting led

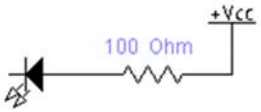
- Two types based on its diameter, which is usually 3 or 5 mm
- working current which is usually about 10mA
- current-limiting resistor must be the correct value so that the LED is not damaged or burn out (overheated).
- The voltage drop will range from 1.2v to 1.6v depending on the color of the LED.



- LEDs are connected to a microcontroller in two ways.
- One is to switch them on with logic zero, and other to switch them on with logic one.
- The first is called NEGATIVE logic and the other is called POSITIVE logic.
- The optimum value for limiting resistor is 330Ω, 220 Ω or 100Ω



Active high led indicator



Active Low led indicator

- Calculating limiting resistor value
- optimum LED forward voltage is 1.6V (data sheet)

$$V_f = 1.6V$$

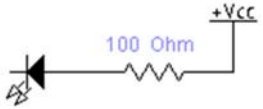
- The total voltage applied to both LED and limiting resistor is 5V
- Then the voltage drop over limiting resistor is

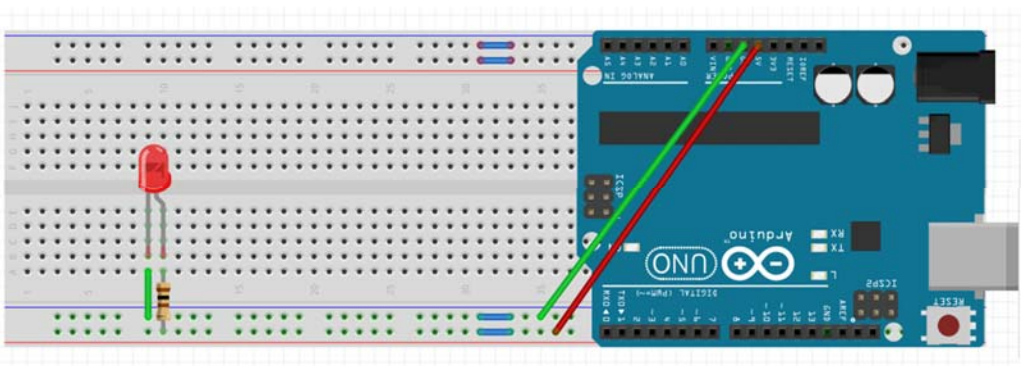
$$V_r = V_{cc} - V_f = 5 - 1.6 = 3.4 \text{ volt}$$

- Optimal led current is 25mA (data sheet)

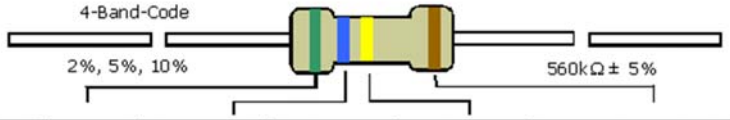
$$I = 25 \text{ mA}$$

$$R = V_r/I = 3.4/(25*10^{-3}) = 136 \text{ ohm}$$





Resistor color code



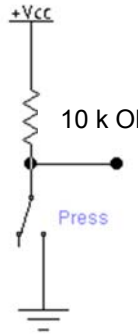
COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	±0.5% (D)
Blue	6	6	6	1MΩ	±0.25% (C)
Violet	7	7	7	10MΩ	±0.10% (B)
Grey	8	8	8		±0.05%
White	9	9	9		
Gold				0.1	± 5% (J)
Silver				0.01	± 10% (K)

- 100 Ω 
- 220 Ω 
- 330 Ω 
- 1 K Ω 
- 10 k Ω 
- 100 k Ω 

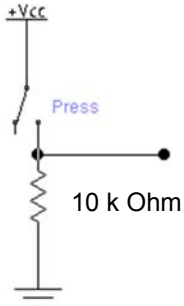
Connecting Press

- Buttons that are used here are also called “press-buttons".
- A pull-up resistor is needed to avoid producing short circuit between Vcc, and Gnd
- There are two possible connections as shown
  - Active high
  - Active low
- The average current cosumed by resistor

  Ir = Vcc / R = 5 / (10*1000) = 0.5 mA

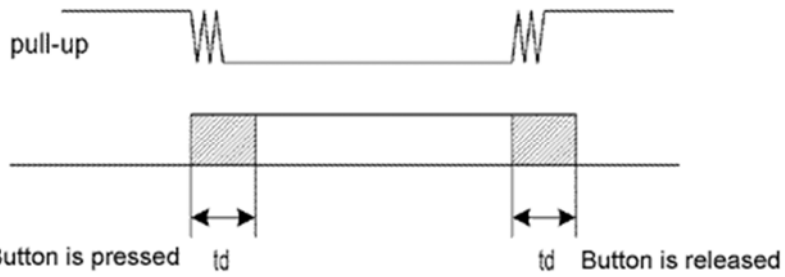


Active high input press



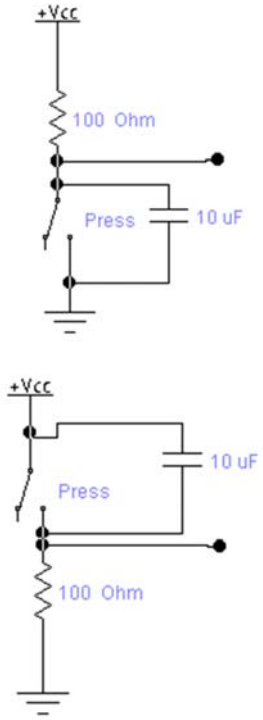
Active Low input press

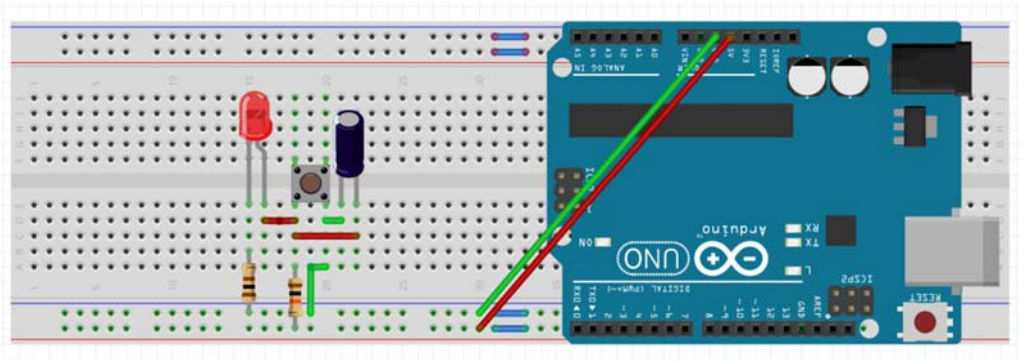
- there is a short time period when vibration (oscillation) can occur as a result of unevenness of mechanical contacts, or as a result of the different speed in pushing a button (this depends on person who pushes the button).
- this phenomena is called SWITCH (CONTACT) DEBOUNCE.

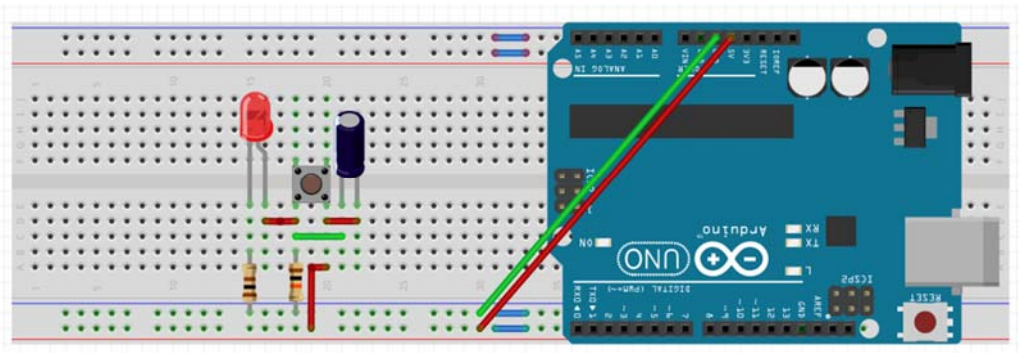


- If this is overlooked when program is written, an error can occur, or the program can produce more than one output pulse for a single button push.
- to avoid this, we can introduce a small delay when we detect the closing of a contact.
- This will ensure that the push of a button is interpreted as a single pulse.

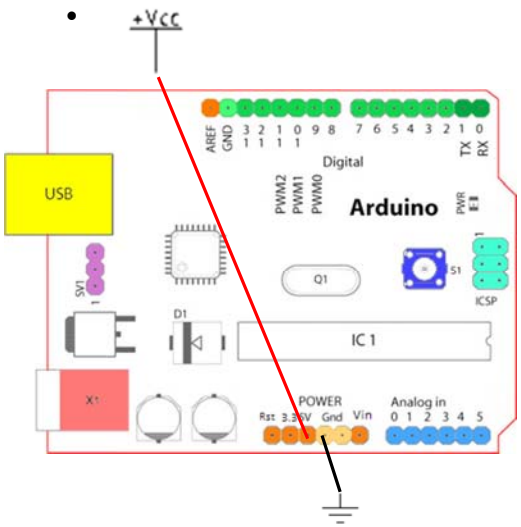
- The problem can be partially solved by adding a capacitor across the button, but a well-designed program is a much-better answer.
- The program can be adjusted until false detection is completely eliminated.

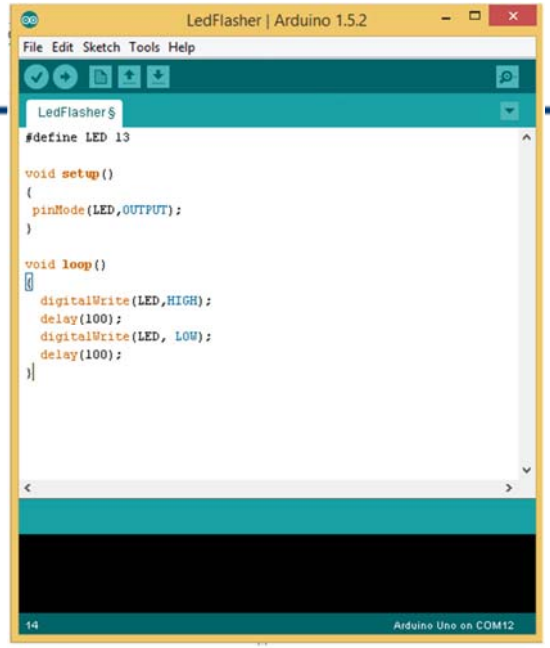


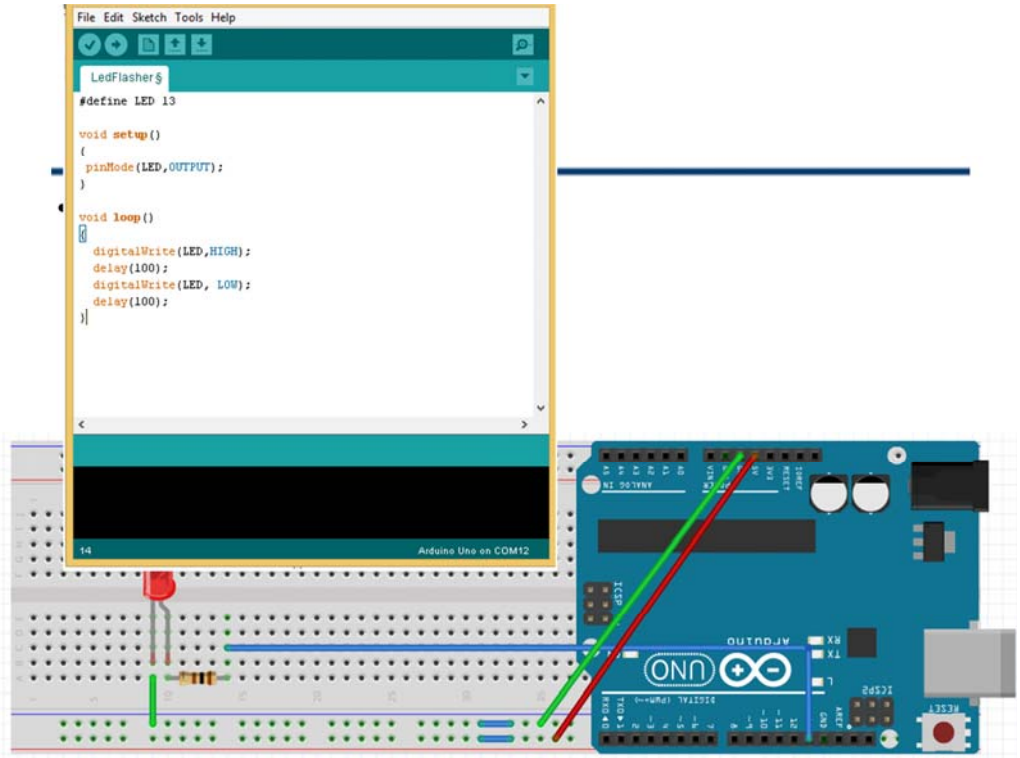




Led Flasher

- 
+Vcc
USB
Digital
Arduino
Q1
IC 1
POWER
Analog in

- 
LedFlasher | Arduino 1.5.2
File Edit Sketch Tools Help
LedFlasher§
#define LED 13
void setup()
{
pinMode(LED,OUTPUT);
}
void loop()
{
digitalWrite(LED,HIGH);
delay(100);
digitalWrite(LED, LOW);
delay(100);
}
14
Arduino Uno on COM12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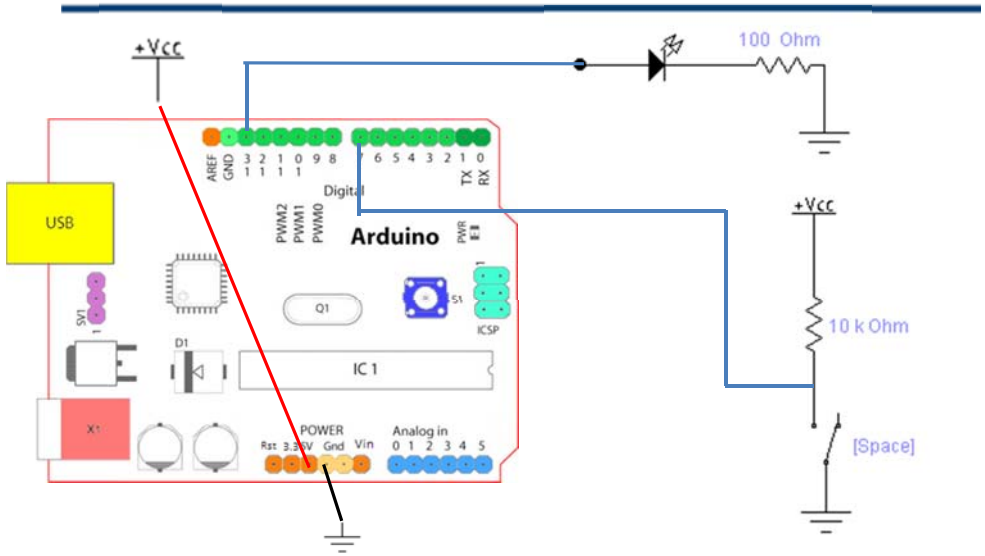
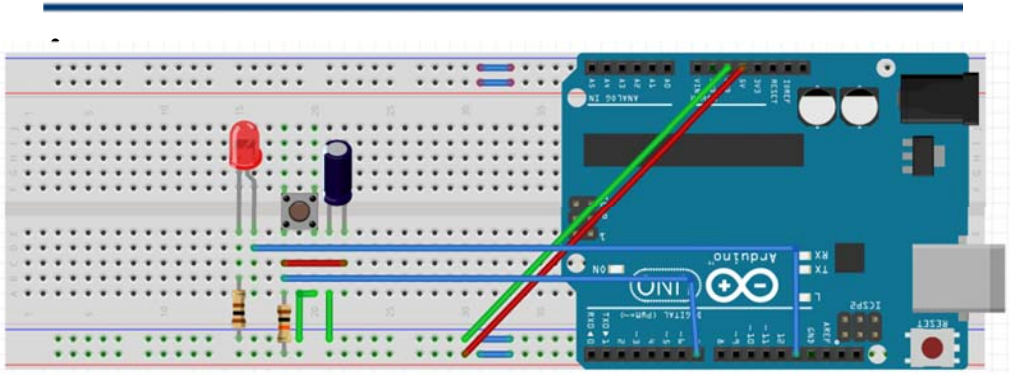
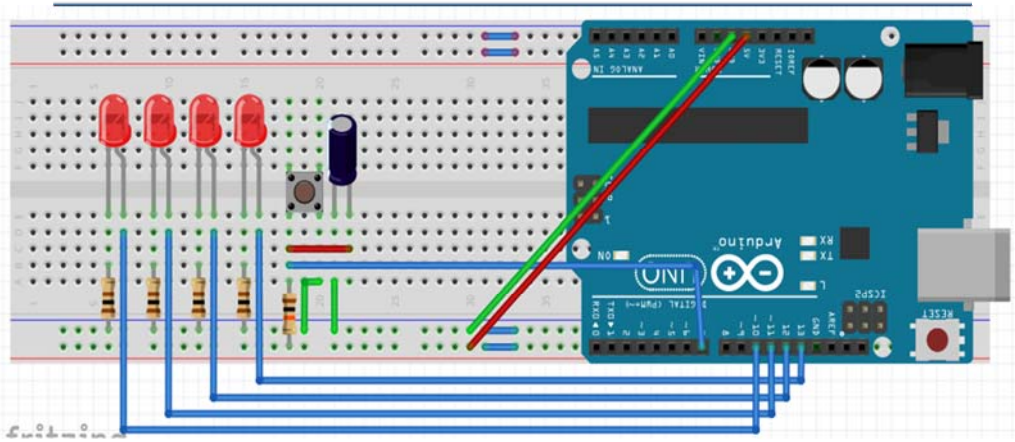
Arduino Uno on COM12

PressControlledFlasher





4 Leds In Action 1



```
#define Led4 13
#define Led3 12
#define Led2 11
#define Led1 10
#define button 7
int led4_status = 0;
int led3_status = 0;
int led2_status = 0;
int led1_status = 0;
int status = 0;
int direction = 1;
void setup()
{
  pinMode(Led1, OUTPUT);
  pinMode(Led2, OUTPUT);
  pinMode(Led3, OUTPUT);
  pinMode(Led4, OUTPUT);
  pinMode(button, INPUT);
}

void loop()
{
  if(digitalRead(button)==LOW)
  {
    if(status == 0)
    {
      led1_status = LOW;
      led2_status = LOW;
      led3_status = LOW;
      led4_status = LOW;
    }
    else if(status == 1)
    {
      led1_status = HIGH;
      led2_status = LOW;
      led3_status = LOW;
      led4_status = LOW;
    }
    else if(status == 2)
    {
      led1_status = HIGH;
      led2_status = HIGH;
      led3_status = LOW;
      led4_status = LOW;
    }

   else if(status == 3)
    {
      led1_status = HIGH;
      led2_status = HIGH;
      led3_status = HIGH;
      led4_status = LOW;
    }
  else if(status == 4)
    {
      led1_status = HIGH;
      led2_status = HIGH;
      led3_status = HIGH;
      led4_status = HIGH;
    }
    digitalWrite(Led1, led1_status);
    digitalWrite(Led2, led2_status);
    digitalWrite(Led3, led3_status);
    digitalWrite(Led4, led4_status);
    delay(100);
    if(status == 4)direction = -1;
    if(status == 0)direction = 1;
    status = (status + direction);
  }
  else
  {
    status=0;
    direction = 1;
  }
}
```


Thanks,

See you next Week, isA