Hands on activities 5 - Interrupt and Timer

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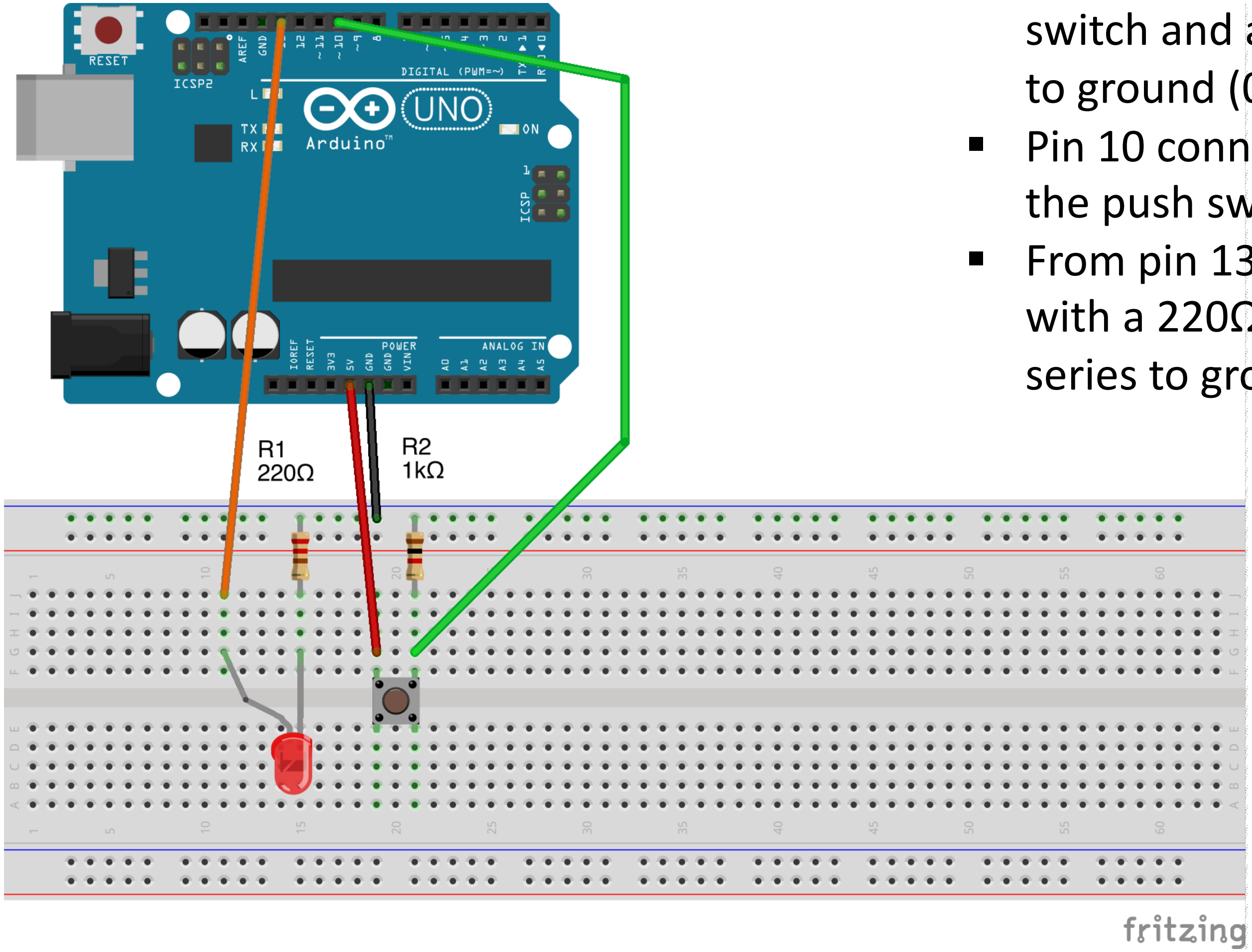
Example 1: PCINT interrupt

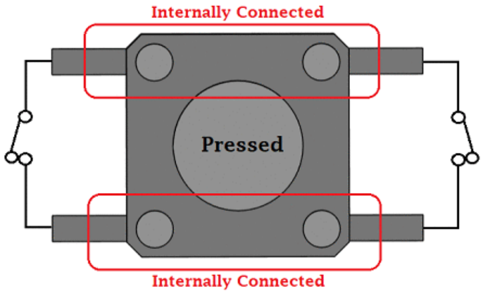
```
#include <avr/interrupt.h>
#include <avr/sleep.h>

void setup() {
  cli(); // Clear global interrupt

  // Set Pin 13 as output and 10 as input
  DDRB |=  B100000   ;
  DDRB &= B111011    ;

  // Control regs for PCINT
  PCICR |=  B00000001 ; // Enable PCINT0
  PCMSK0 |=  B00000100  ; // Select PCINT0 mask

   // Serial.begin(9600); // Only for debug

 // Use an appropriate sleep mode
 set_sleep_mode(SLEEP_MODE_PWR_DOWN);

 sei(); // Set global Interrupt
}
```

```
// ISR for pin change interrupt capture
// Note: triggers both on rising & falling
ISR(PCINT0_vect) {
  // Display in serial monitor for debug
  //  Serial.println(“Switch pressed”);

  // Toggle the LED
  PORTB ^= B100000 ;
}

// Main loop
void loop() {
  // Display in serial monitor for debug
  //  Serial.println(“Main loop”);

  // Do nothing!
  // Put MCU to sleep
  sleep_mode();
}
```

Hardware setup:



- From Vdd (5 V), connect a push switch and a 1kΩ resistor in series to ground (0V)
- Pin 10 connects to the midpoint of the push switch and 1kΩ resistor
- From pin 13, connect an LED (red) with a 220Ω (or 330Ω) resistor in series to ground



Example 2: Timer Interrupt

```
#include <avr/interrupt.h>
#include <avr/sleep.h>
void setup () {
  cli(); // Disable global interrupt - atomic
  DDRB |=  B100000; // Pin 13 output
  // Set timer 1 to normal mode
  TCCR1A = B00000000;
  // Set pre-scaler to 1024
  TCCR1B = B00000101;
  // Turn ON OVF
  TIMSK1 = B00000001;
  // Initial Timer1 value for 1 sec count
  TCNT1 = 0xC2F6;

// Use an appropriate sleep mode
  set_sleep_mode(SLEEP_MODE_IDLE);

  sei(); // Enable global interrupt
}
```

```
// Timer1 ISR
ISR(TIMER1_OVF_vect) {
  // Toggle output pin each 1 sec
  PORTB ^= B100000;
  // Reset counter value for next
  TCNT1 = 0xC2F6;
}

// Main loop
void loop () {
  // Do nothing
  // If including sleep mode, ensure
  // timer1 is ON while sleep
  sleep_mode();
}
```

Hardware connection:

- Connect pin 13 to an LED in series of 220 Ω or 330 Ω resistor to ground.

Calculation:

Internal clock = 16 MHz

As the needed time is large, use maximum pre-scaler of 1024

Clock cycles needed = 16 *10^6 / 1024 = 15,625

Timer1 is 16-bit, so maximum value (i.e. 0xFFFF) = 65,535

So, Timer1 count value needed = 65,535 – 15,625 = 49,910