University of Montenegro
Faculty of Electrical Engineering
Podgorica

Laboratorijske vježbe iz predmeta Industrijska elektronika

Hardverski interapti – Arduino, primjeri
Hardware Interrupts on Arduino, examples

(Vježba 2)

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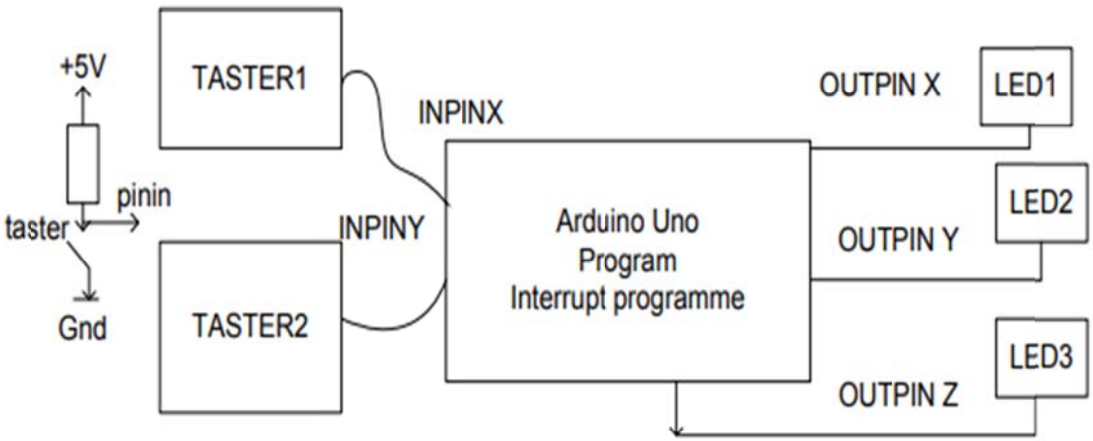
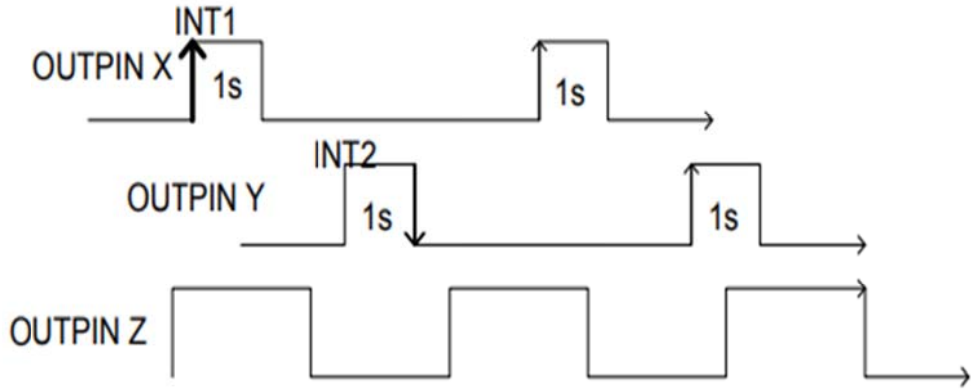
Zadatak:

Povezati Taster1 i Taster2 na ulazne pinove Arduina. Dati tasteri generišu hardverske interapte INT1 i INT2 koji pale LED1 ili LED2 u trajanju 1s na interrupt nivou, bez obzira da li je LED3 upaljena ili ugašena. LED3 se pali iz glavne petlje programa u trajanu 2s sa periodom 4s.





Abstract:

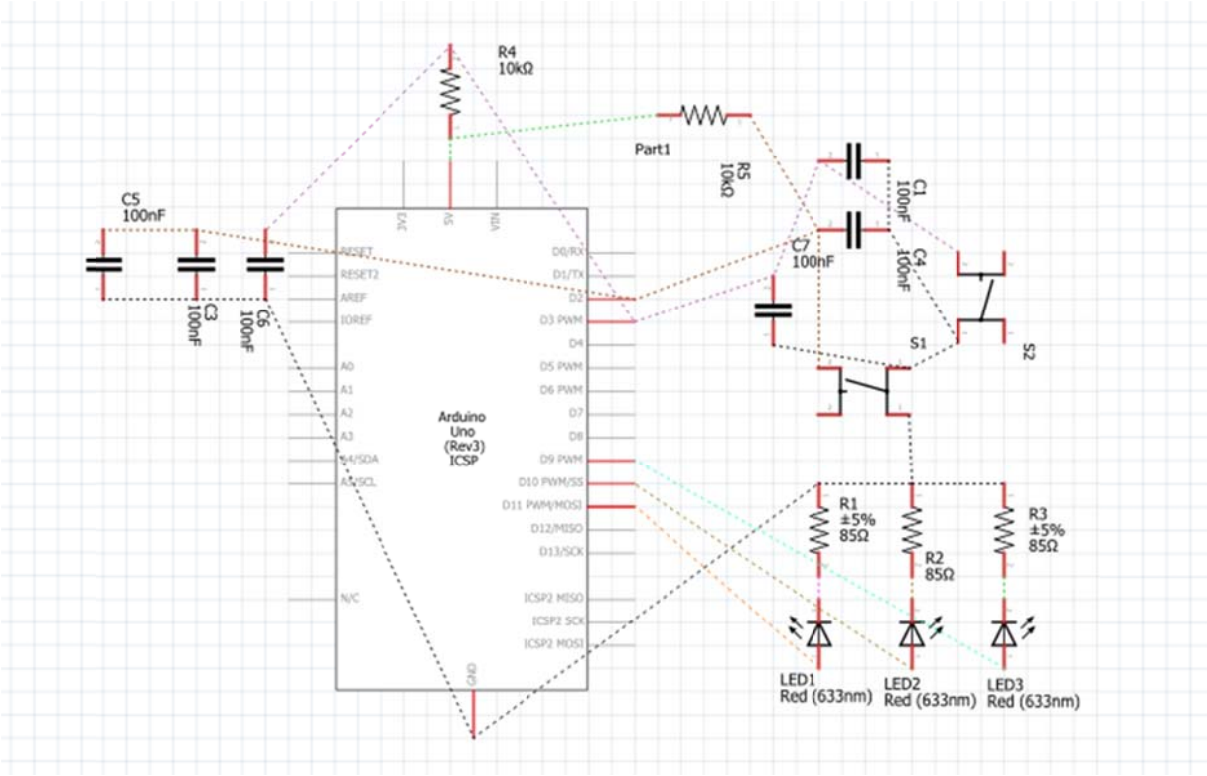
Interrupts are useful for making things happen automatically in microcontroller programs, and can help solve timing problems. Typical microcontrollers such as Arduino has a number of interrupt sources most of them tied into internal hardware modules such as timers and comparators, while some are tied into external hardware pins.

Most Arduino boards have two external interrupts: INTR0 (on DP2) and INTR1 (DP3). Both INTR0 (DP2) and INTR1 (DP3) both have their own separate ISR routines ISR0() and ISR1() respectively.

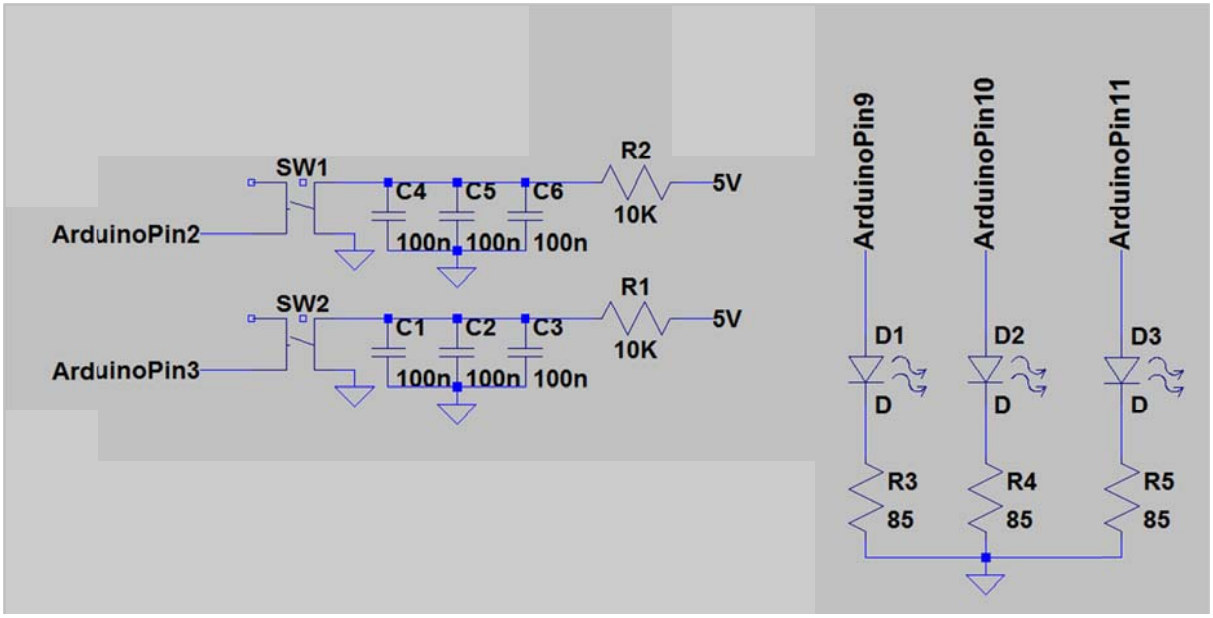
In this exercise we generate hardware interrupts by pressing button SW1 and button SW2. The LED1 or LED2 are being turned on by pressing SW1 and SW2, respectively. Duration of interrupt is 1s, apart from LED3 state. The state of LED3 is being controlled from main loop, with 4 s period.

In setup() we come to the function attachInterrupt(interrupt, function, mode) where "interrupt" is number; "function" is known as the interrupt service routine or ISR a function address pointed to by the interrupt vector location; "mode" configures the hardware electrical characteristics for an interrupt. This is done internally by the compiler and hidden from the user. So in this case of attachInterrupt(digitalPinToInterrupt(SW1), ISR1, FALLING) SW1 corresponds to interrupt 0 on DP2, ISR1() is the ISR routine at the bottom of the program, and FALLING means when an electrical signal goes from 5V to 0V the ISR1() ISR performs its function - what started as state = LOW is now state = HIGH and vise-versa. The right "}" is considered the "return" command - in fact "return;" placed after "state = !state;" is ignored and won't produce an error.

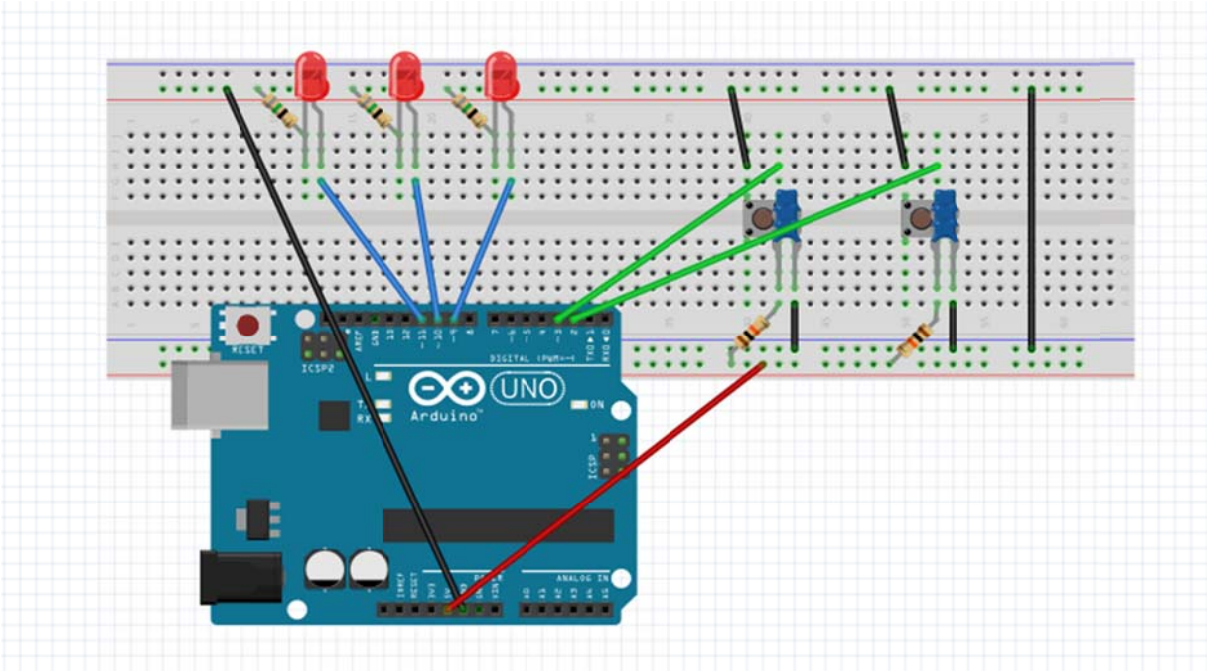
Naše rješenje prethodnog zadatka prikazano je na sledećim slikama:



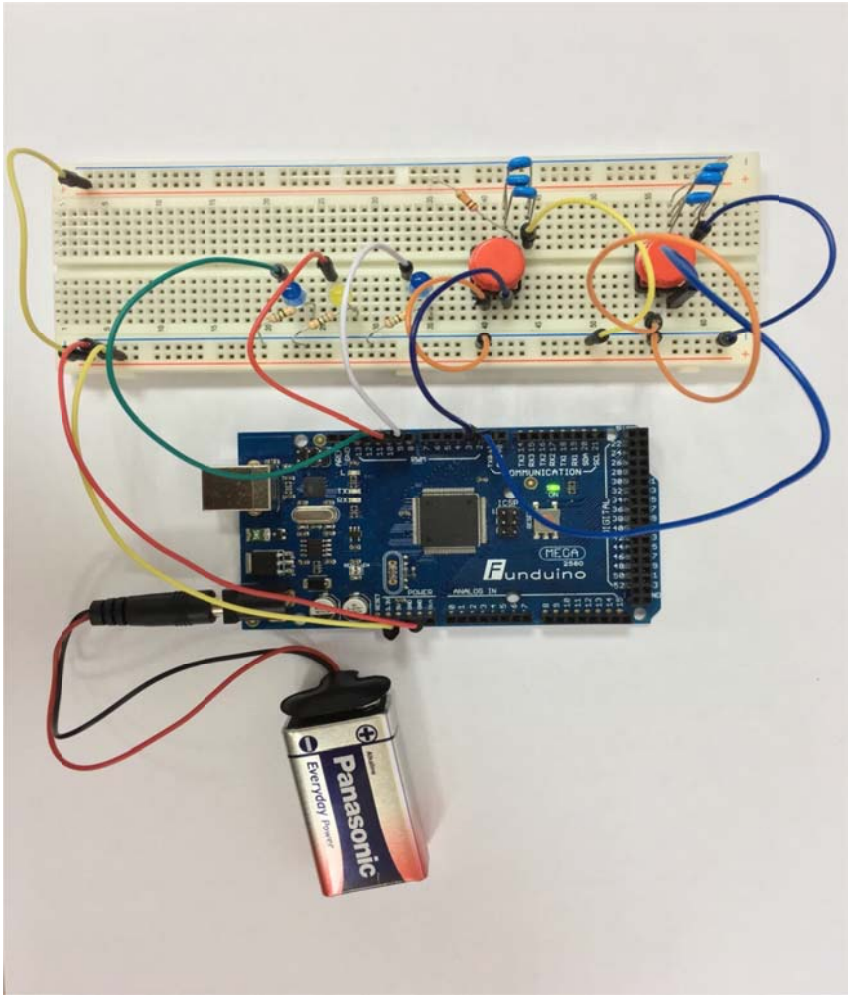
Slika1. Kompletna šema rađena u Fritzing-u



Slika2. Šema. LT Spice



Slika3. Kompletna šema. Fritzing.

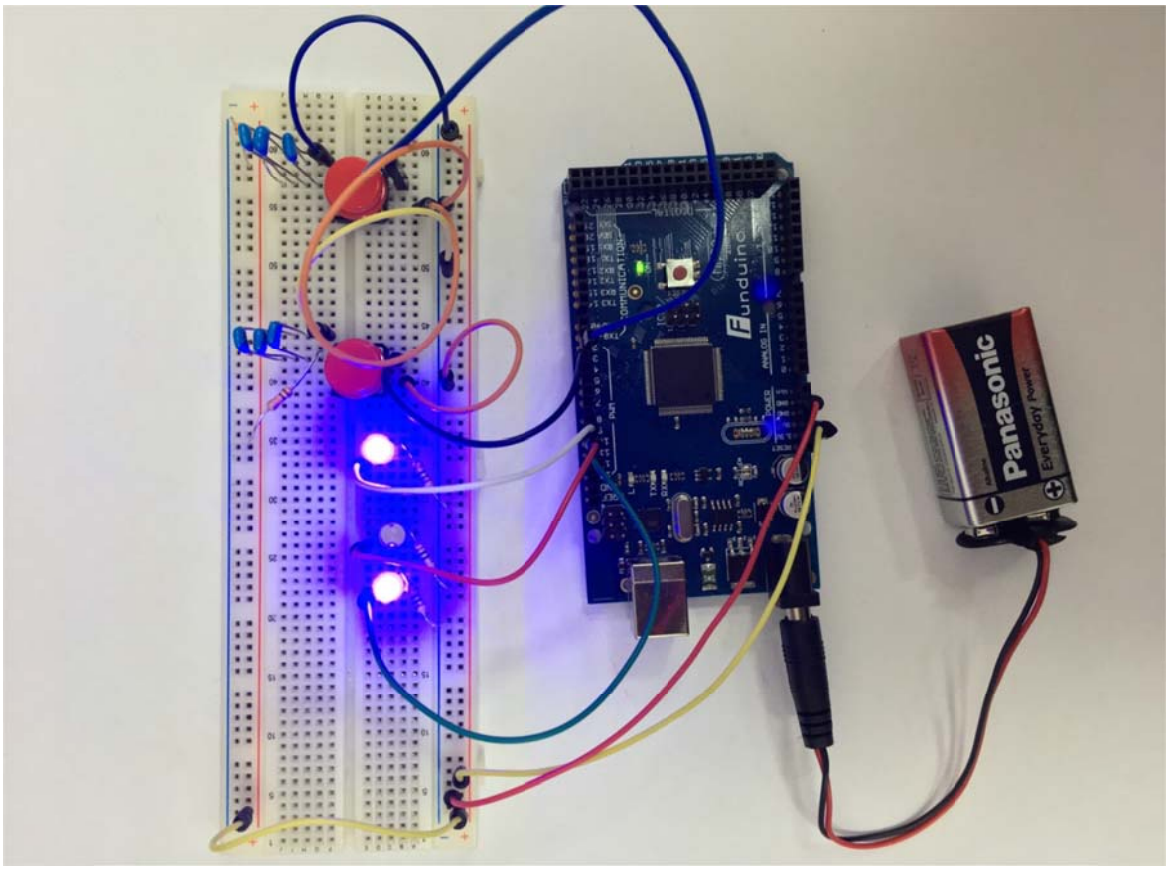


Slika4. Koristili smo Funduino Mega i Arduino razvojno okruženje.

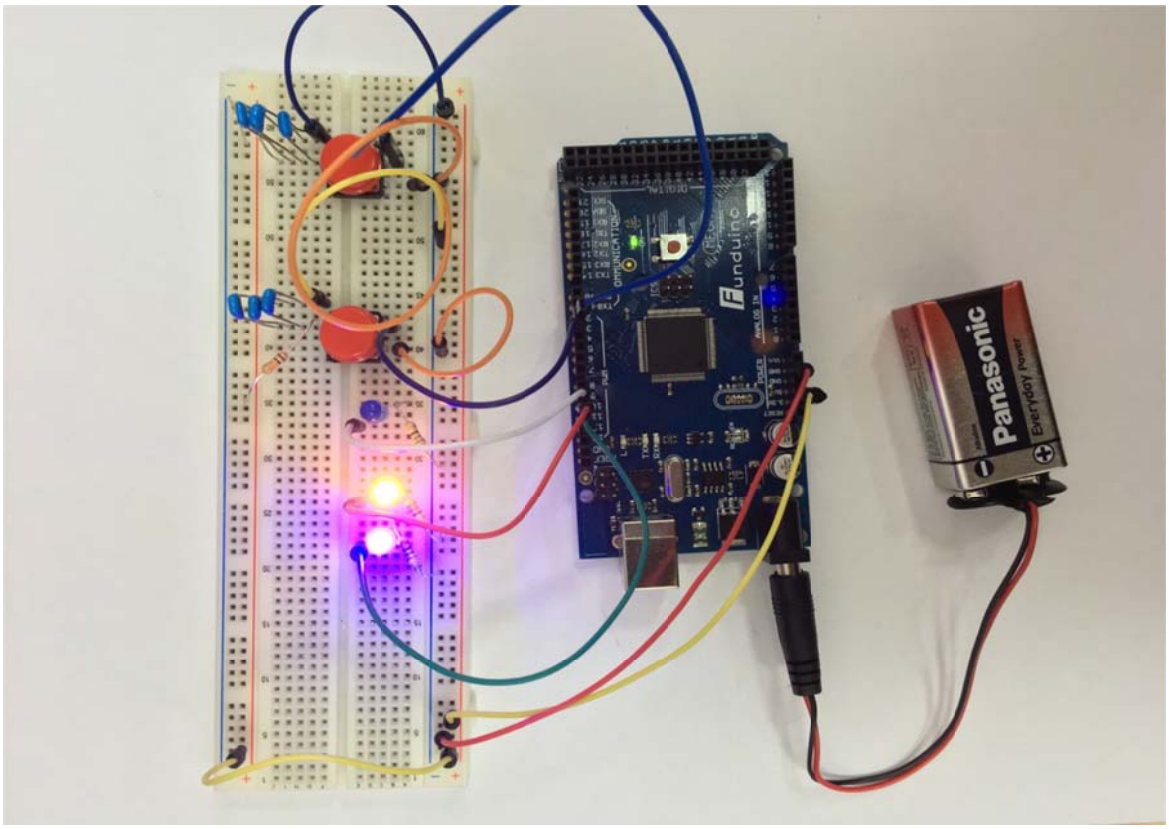
Kod:

```
#define LED1 9
#define LED2 10
#define LED3 11
#define SW1  2
#define SW2  3

volatile byte flag1 = LOW; // declare IRQ flag
volatile byte flag2 = LOW; // declare IRQ flag
volatileint count = 0;
volatileinta,b = 0;
unsigned long previousMillis = 0;
volatile long interval = 680;
intledState = LOW;
int j=1;
int k;
// change state of an output pin
void toggle(byte pinNum){
bytepinState = !digitalRead(pinNum);
digitalWrite(pinNum, pinState);
}
void setup() {
  // put your setup code here, to run once:
Serial.begin(9600);
pinMode(LED1, OUTPUT);
pinMode(LED2, OUTPUT);
pinMode(LED3, OUTPUT);
digitalWrite(LED1, 0);  // LEDs off.
digitalWrite(LED2, 0);
pinMode(SW1, INPUT);
pinMode(SW2, INPUT);
attachInterrupt(digitalPinToInterrupt(SW1), ISR1, FALLING);
attachInterrupt(digitalPinToInterrupt(SW2), ISR2, RISING);
}

void loop() {

for(k=j; k<=interval; k++){
Serial.print(k);
delayMicroseconds(1000);
    }
ledState = !ledState;
digitalWrite(LED3, ledState);
Serial.println("");
   j=0;
 }

voidmyDelay(int x)   {
```

```
for(unsigned int i=0; i<=x; i++)     {
k++;
Serial.print(k);
delayMicroseconds(1000);

if(k==interval){
ledState = !ledState;
digitalWrite(LED3, ledState);
Serial.println("");
   k=0;
   j=0;
   }
else{j=k;}
    }
}

void ISR1(){

toggle(LED1);
myDelay(380); // 1 sec.
toggle(LED1);
 flag1 = 0; // clear flag
}

void ISR2(){
toggle(LED2);
myDelay(380); // 1 sec.
toggle(LED2);
 flag2 = 0; // clear flag
}
```



Slika5. Uključene diode LED3 i LED1



Slika6. Uključene diode LED2 i LED3

Literatura:

1. T. E. Kissell, Industrial Electronics, Third edition, Prentice Hall, 2003
2. S. A. Karr, T. E. Kissell, R. C. Overstreet. T.W. Wylie, Laboratory Manual to accompany Industrial Electronics, Third edition, Prentice Hall, 2003
3. http://apeg.ac.me/nastava/Arduino%20Hardware%20Interrupts%20Tutorial.pdf