CPE301 – SPRING 2019

Design Assignment 2B

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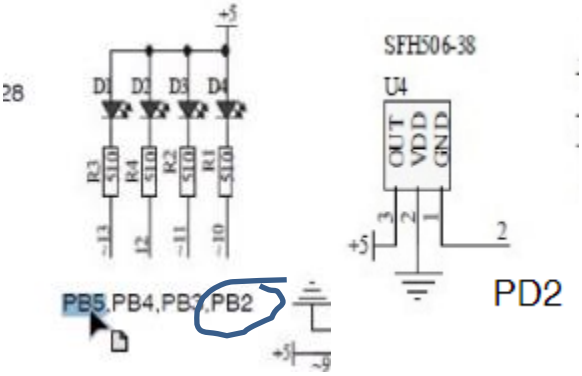
1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS

List of Components used:

- Atmel Studio 7
- Atmega328P
- Xplained mini
- microUsb Cord
- Multifunctional shield
- Switch and LED on board

Block diagram with pins used in the Atmega328P



2.CODE IN ASSEMBLY

```
.ORG 0  ;location for reset
JMP MAIN

.ORG 0x02 ;location for external interrupt 0
JMP EX0_ISR

MAIN:
;initialize stack
LDI R20,HIGH(RAMEND)
OUT SPH,R20
LDI R20,LOW(RAMEND)
OUT SPL,R20
;initialize stack

LDI R16, 0xFF  ;load register to set all leds
OUT DDRB, R16  ;enable output
```

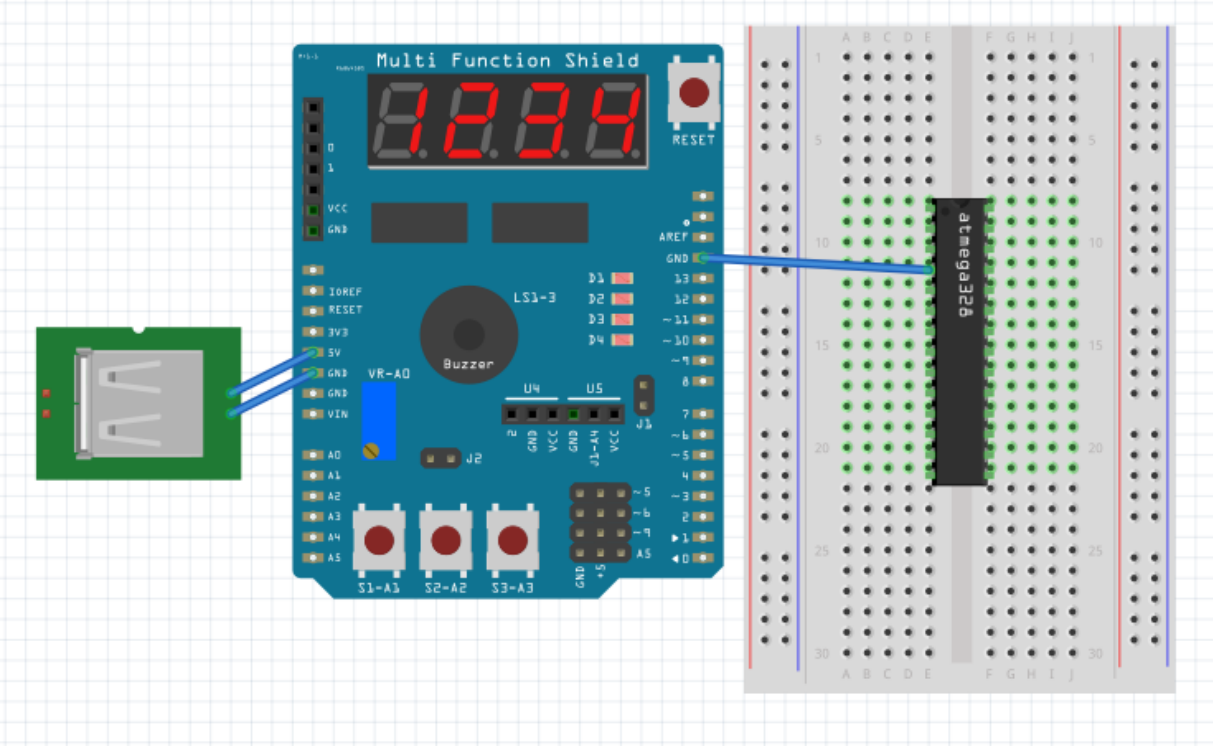
```
OUT PORTB, R16 ;set low
LDI R16, 0x04  ;load in register and will be used later for xor
LDI R21, 56    ;used for xor later
LDI R19, 0xFF  ;used later to set pins to low

LDI R20, 0X2   ;make INT0 falling edge triggered
STS EICRA, R20 ;pull-up activated
SBI DDRB, 2 ;port.2 = output
SBI PORTD, 2 ; pull-up activated
LDI R20, (1<<INT0) ;enable INT0
OUT EIMSK, R20
SEI ;enable interrupts

HERE:
OUT PORTB, R19 ;setting to low
JMP HERE

EX0_ISR:
       EOR R21, R16    ;toggling LEDs
       OUT PORTB, R21       ;ouputs LED

;;;;;Delay subroutine;;;;;;;;;;;;;;;;
       LDI R23, 70
D3:
       LDI R24, 229
D4:
       LDI R22, 249
D5:
       NOP
       NOP
       DEC R22
       BRNE D5
       DEC R24
       BRNE D4
       DEC R23
       BRNE D3
       RETI
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

3.CODE IN C

```
#define F_CPU 16000000UL
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>

int main()
{
       DDRB |= (1<<5);        //PB5 as an output
       PORTB |= (1<<5);  //turn off LED5
       DDRB |= (1<<2);   //PB2 as an output
       PORTB |= (1<<2);  //turn off LED2

       PORTD |= (1<<2);  //pull-up activated

       EIMSK = (1<<INT0); //enable external interrupt 0
       sei(); //enable interrupt
```

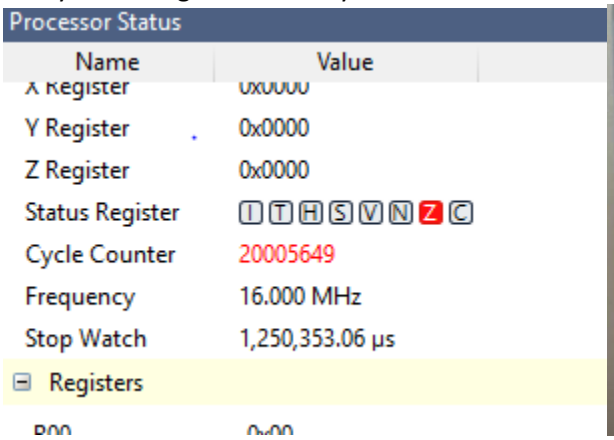
```
        while(1); //wait here
}
//ISR for external interrupt 0
ISR(INT0_vect)
{
        PORTB ^= (1<<2); //toggle PORT.2
        _delay_ms(1250); //delay of 1.25 seconds
        PORTB ^= (1<<2); //toggle PORT.2
}
```

4.SCHEMATIC



5.SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)

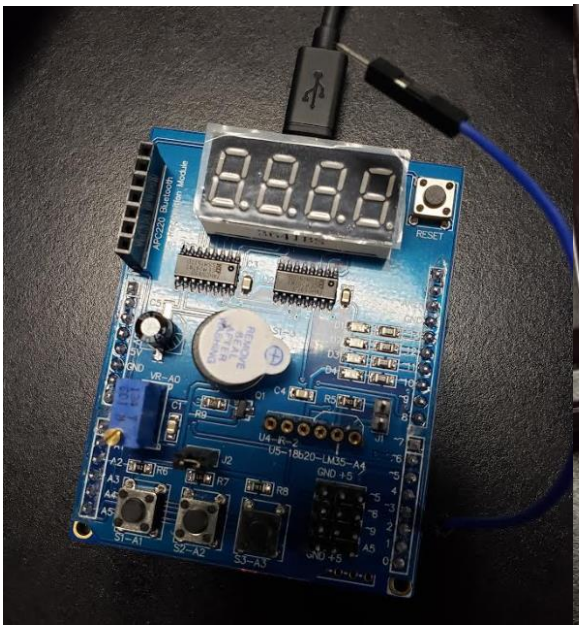
Delay recording for Assembly:

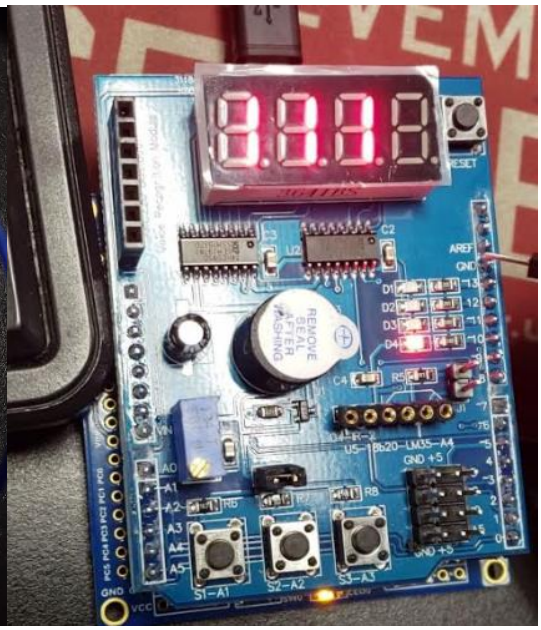


Delay recordings for C:

6.SCREENSHOT OF EACH DEMO (BOARD SETUP)
Both will be setup as below:

Before **After**





4. VIDEO LINKS OF EACH DEMO

C code
https://www.youtube.com/watch?v=46IXtT1coqI

Assembly Code
https://www.youtube.com/watch?v=KAQsZGh4fos

5. GITHUB LINK OF THIS DA

https://github.com/HadidBuilds/hw_sub_da1

Student Academic Misconduct Policy
http://studentconduct.unlv.edu/misconduct/policy.html

"*This assignment submission is my own, original work*".
Itzel Becerril