Intro to Assembly Language Programming on the AVR & Atmel Studio 7

Introduction:

Learning the basics interface of Atmel Studio 7 and how to create a project. Create a delay loop and call it in the main code to blink LEDs. Create a push button function for LEDs to blink on and off.

Equipment:

- Simon Board
- Atmel Studio 7

Procedure:

- Create an Atmel project and select the ATmega324PB under devices.
- Write a simple loop for LEDs to toggle.
- Build the solution and check for errors.
- Toggle debugging mode on and select simulator as the debugger.
- Open the I/O window to view the bits changing on the ATmega.
- Plug the usb in the ATmega and the PC.
- Select the ATmega as the debugger.
- Create a delay loop by creating a function to loop for 560 bits.
- Use the CALL keyword in the main loop to use the loop function.
- Create a function for set the LEDs register in input mode to receive bits from the push.
- Integrate the delay loop with the push button to create a delayed Blink when the button is pressed.

Results:

The code created a delay loop and a push button function for the LEDs to blink on command.

Conclusion:

I learned how to create a project in Atmel Studio 7 and the basic tools used in the program. I also learned how to create a function to call in the main loop to cause a time delay. The code resulted in the LEDs being able to turn on or off by presses the button mapped in the code.

Appendices:

Figure 1 – Main code for time delay function

PushButton.asm | toggleProject | main.asm | ASF Wizard

```
;
; toggleProject.asm
;
; Created: 1/29/2020 10:20:28 AM
; Author : argk4
; Device : ATmega324PB

        LDI R20,0 ; R20 <- 0
        LDI R16,0xFF ; R16 <- 0xFF
        OUT DDRD,R16 ; DDRD <- R16
        LDI R17,0x00 ; R17 <- 0x00
        OUT DDRA,R17 ; DDRA <- R17

L1:     OUT PORTD,R16 ; PORTD <- R16
        CALL QDELAY   ; Calls the QDELAY function
        OUT PORTD,R20 ; PORTD <- R20
        CALL QDELAY
        RJMP L1       ; Jumps to the top of the loop

QDELAY:
        LDI R21, 255 ;
        L2:
            LDI R20, 255
            L3:
                LDI R18, 25
                L4:
                    NOP
                    NOP
                    DEC R18
                    BRNE L4
                DEC R20
                BRNE L3
            DEC R21
            BRNE L2
            RET
```

Figure 2 – first half of push button code

PushButton.asm | toggleProject | main.asm | ASF Wizard

```
/*
 * PushButton.asm
 *
 *  Created: 2/12/2020 11:24:21 AM
 *   Author: argk4
 */

    LDI R16, 0XFF
    LDI R17, 0

    OUT DDRD, R16
    OUT PORTD, R16

    OUT DDRA, R17
    OUT PORTA, R16

MAIN:
    CHECK_SW1:
        SBIC PINA, 0
        RJMP CHECK_SW3
        CBI PORTD, 0
        CALL QDELAY
    LED1_OFF:
        SBI PORTD, 0
    CHECK_SW3:
        SBIC PINA, 2
        RJMP CHECK_SW7
        CBI PORTD, 2
        CALL QDELAY
    LED3_OFF:
        SBI PORTD, 2
    CHECK_SW7:
        SBIC PINA, 5
        RJMP CHECK_SW9
        CBI PORTD, 5
        CALL QDELAY
    LED7_OFF:
        SBI PORTD, 5
```

Figure 3 – Second half of the push button code

PushButton.asm | toggleProject | main.asm | ASF Wiza

```
    LED7_OFF:
        SBI PORTD, 5
    CHECK_SW9:
        SBIC PINA, 7
        RJMP CHECK_SW1
        CBI PORTD, 7
        CALL QDELAY
    LED9_OFF:
        SBI PORTD, 7


QDELAY:
        LDI R21, 255
        L2:
            LDI R20, 255
            L3:
                LDI R18, 25
                L4:
                    NOP
                    NOP
                    DEC R18
                    BRNE L4
                DEC R20
                BRNE L3
            DEC R21
            BRNE L2
            RET
```