MICROPROCESSOR LAB EXPERIMENT 5

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Introduction :

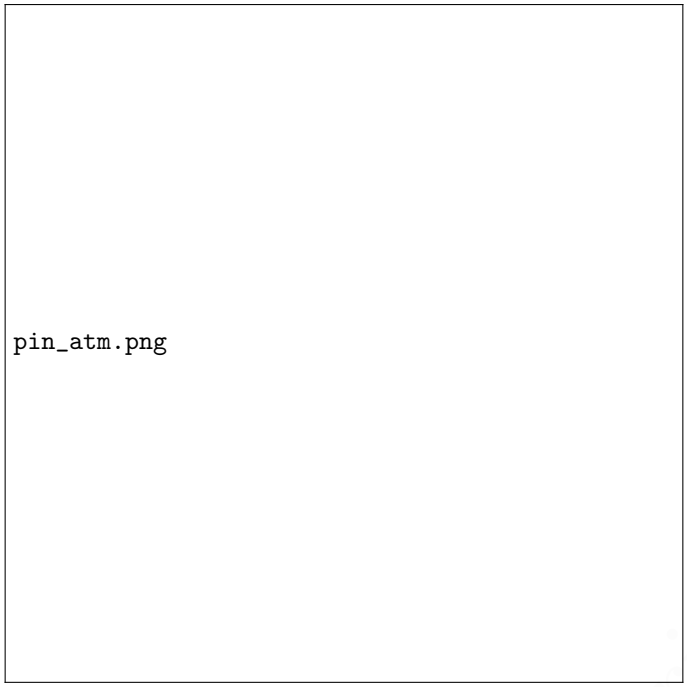
- In this experiment , we are going to learn about interrupts and subroutines in C and Assembly programs using the **ATmega8**.
- This experiment involves ,
  - Introduction to Interrupt handling.
  - Writing a program in C to transfer control from a white LED(turned on) to a blinking LED on a button press
  - Writing a program in Assembly to blink an LED upon receiving an interrupt in the form of a button press
  - Changing the code in the above task to transfer control from a white LED(turned on) to a blinking LED on a button press
- In this report , we have included the code of the tasks and our experience with C and Assembly.

ATmega-8 and Microchip studio :

- Atmega-8 is an 8-bit RISC single-chip microcontroller developed by Atmel.
- The number 8 in its name represents that it can operate 8 bits at a time while processing the information i.e in a way it represents the capacity of the microcontroller.
- Some features of AVR microcontroller are
  - I/O ports.
  - Internal instructions flash memory
  - SRAM upto 16KB
  - Timers
- The AtMega8 microcontroller has a total of 32 8-bit registers and 23 I/O pins.

Atmega8 microcontroller pin diagram :

- The pin diagram of Atmega8 microcontroller is ,



- It has 3 ports PortB,PortC and PortD.
- Each port acts as a bidirectional buffer that could carry both input and output values with specific address.
- The registers that are associated with these ports are
  - **DDRX** - Register to mention whether the particular pin is input/output. Eg : DDRD=0x0F means , first 8 pins are output pins and the rest are input pins.
  - **PORTX** - Register to mention the output to be given through the pin. Eg : PORTC=0xF0 means that the first 8 pins of Port C are set to logic low and the rest of them are set to logic high.
  - **PINX** - Register that is used to store the value thta is given as input in the pins. Eg : a=PINB means that whatever input that is given at port B is given to the variable a.
- In addition to these ports it also supports interrupt operations which is an important instruction in any microcontroller.

Libraries used in the C code

```
#include <avr/io.h>
```

- The above library is used to include standard avr commands like **DDRD , PORTC , PINB**

```
#include <util/delay.h>
```

- The above library is used to include time delays using the function ,

```
delay_ms(100) //includes 100ms delay
```

Interrupts in C

Introduction :

- This task involves writing a C program to transfer control from a white LED(turned on) to a blinking LED on a button press
- pressing a button will send an interrupt signal to the program which will then run the subroutine we have written to turn off the white LED and blink the other LED at a constant frequency.

Code

```
1
2  #define F_CPU 8000000UL
3  #include <avr/io.h>
4  #include<util/delay.h>
5  #include <avr/interrupt.h>
6  int main(void)
7  {
8    DDRB=0x03; // LED connected as output
9    DDRD=0x00; // input
10   GICR=0x40; // setting INT0 interrupt
11   SREG=0x80; // global interrupt enable
12   while(1)
13   {
14     PORTB=0x01; // turning on LED
15   }
16 }
17 ISR(INT0_vect)
18 {
19   cli(); // disabling interrupts
20   PORTB=0x02; // switching LED
21   _delay_ms(100); //blinking logic
22   PORTB=0x00;
23   _delay_ms(100);
24   sei(); //enabling interrupts
25 }
```