INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
EMBEDDED SYSTEM LAB REPORT
Course Code – EE39004

Experiment - Filtering real-time signal with Interrupt method using Arduino UNO hardware

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Experiment 5:

1. Aim of the Experiment:

To Program ATMEGA328p in Arduino Uno to filter the input real-time signal received in the ADC port of the microcontroller and gives a filtered output which we can observe in the serial plotter as a virtual output.

2. Requirements:

1. Arduino Uno Board
2. USB A to USB B cable
3. Arduino IDE
4. Male to Female jumper wire

3. Procedure:

To generate the real-time signal we need to connect the Male to Female jumper wire at the input port of the ATmega328p board and write the following code in Arduino IDE to filter the signal.

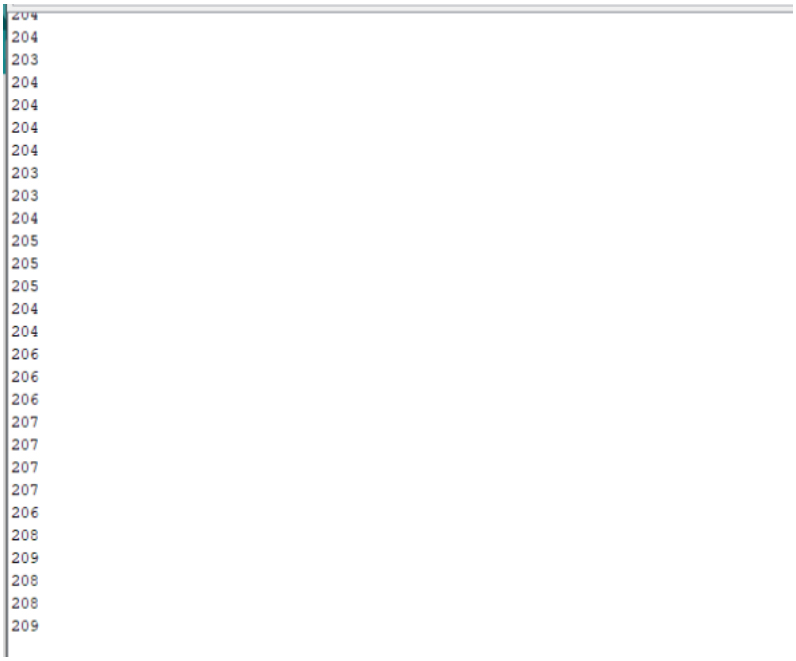
Code for real-time signal filtering with interrupt method:

```
#include<avr/io.h>
// initializing ADC high and ADC low
int ADC_h = 0x00;
int ADC_l = 0x00;
int ADvalue = 0;
int readFlag = 0;

void setup()
{
  Serial.begin(9600); // initialize serial communication with 9600 bits per second
```

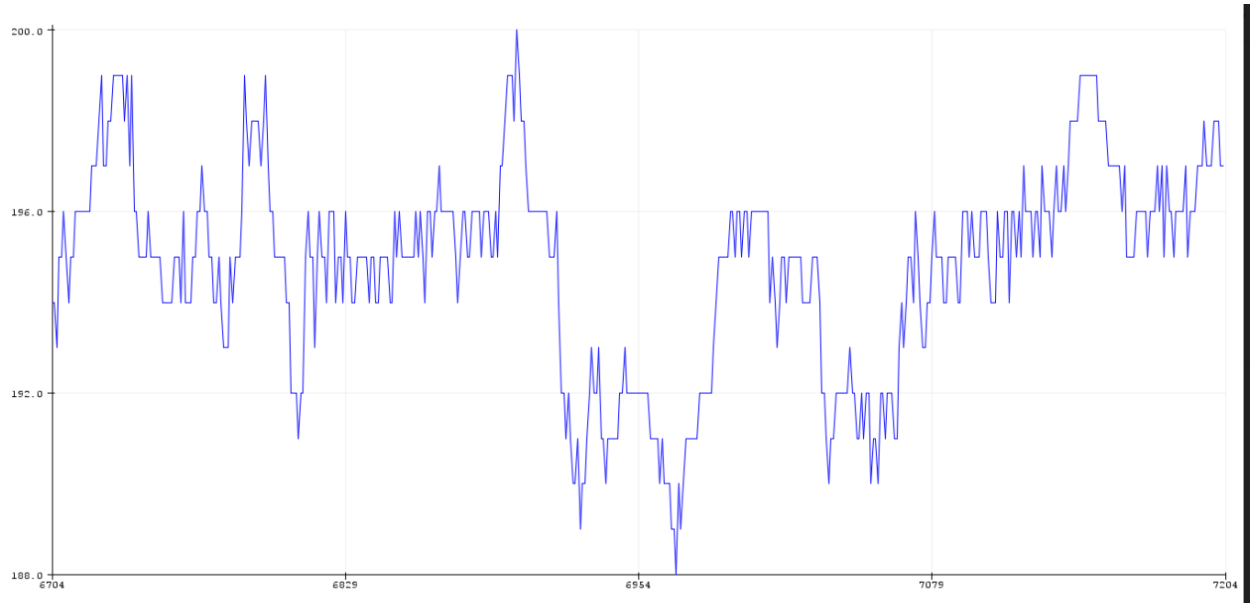
```
  ADMUX = 0x40; // ref voltage = Vcc (01); right adjusted ADLAR = 1; A0 (00000)
  ADCSRA = 0xff; // ADEN = 1, ADSC = 1, ADATE = 1, ADIF = 1, ADIE = 1, ADPS2:0 = 111
  ADCSRB = 0x00; // analog comparator not used; free running modw

  sei();

}
void loop()
{
  if(readFlag == 1)
  {
    int val = ADvalue;
    Serial.print(val);
    readFlag = 0;
  }
}

ISR(ADC_vect){
  readFlag = 1;
  ADC_l = ADCL;
  ADC_h = ADCH;
  ADCSRA |= 0x40;
  ADvalue = ADC_h * 256 + ADC_l;
  Serial.println(ADvalue);
  }
```

4. Results:

The output of the Serial Monitor is:



The output of the Serial Plotter:



5. Discussions:

i) The real-time signal can be produced by swirling the open terminal of the Male-to-Female jumper wire where the generated signal is basically noise. We can also generate real-time signals using a potentiometer.

ii) The interrupt method is beneficial over the polling-based method because in the interrupt method the processor can execute its code without checking for the

completion flag in regular intervals. When the filtering is complete, the interrupt signal is sent to the CPU and the CPU executes the necessary ISR while storing the previous PC location at the stack. Thus computational time is saved.output pin to D5, +ve terminal to 3V, and -ve pin to ground.