Abu Dhabi University

Microprocessors and Firmware Programming

Lab Report 7
Analogue to Digital Conversion

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Section 1

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Abstract

In this Lab we Converted an analogue value from a potentiometer to digital and displayed both values on LCD.

1 Introduction

In this Lab we had to Solve a traffic signal problem wherein we :-

The Question was: To download a Analogue to Digital conversion code from blackboard and test it by uploading the code to AtMega16.

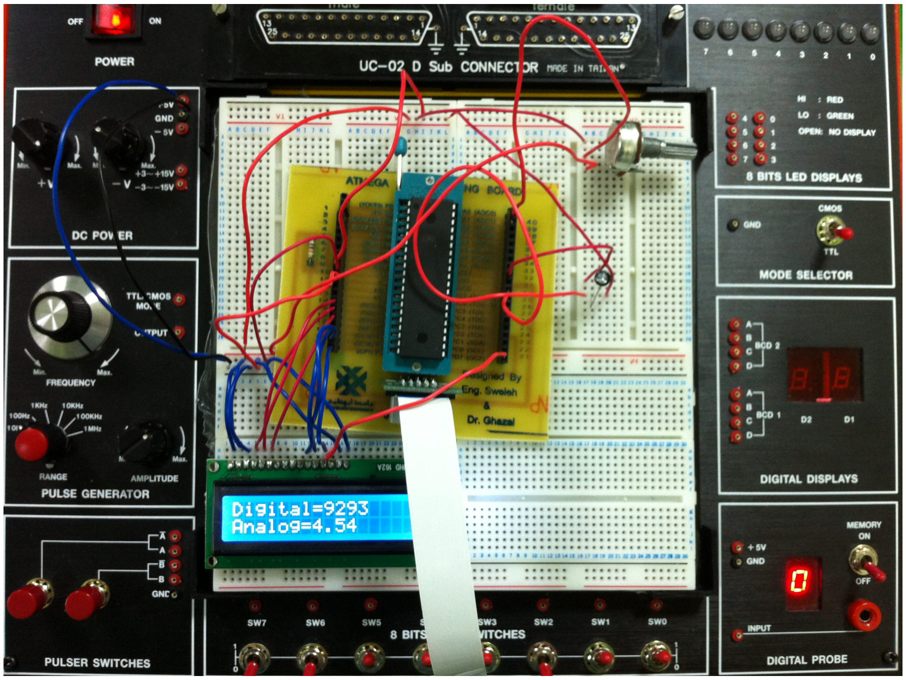


Figure 1: Understanding the situation problem

2 Experiment Set-up

The ATMega16 chip was already mounted on a safety bracket. We had to place the bracket with the micro-controller on to the breadboard. Then we connected the micro-processor to the JTAG MKII programmer,LCD and the potentiometer as shown in the *Figure 2* and *Figure 3*.

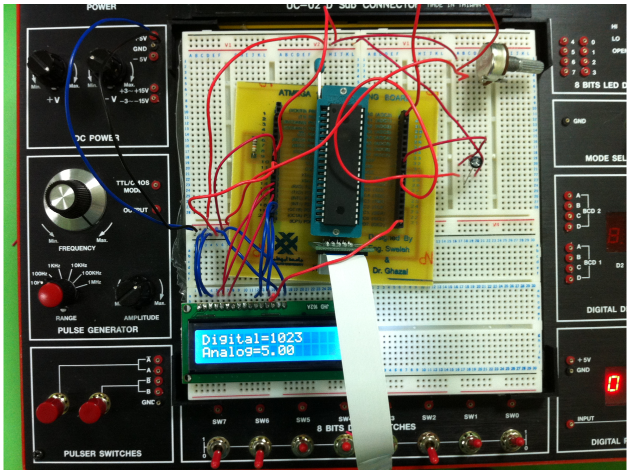


Figure 2: This is how we connect Potentiometer and the LCD to the ATMega16

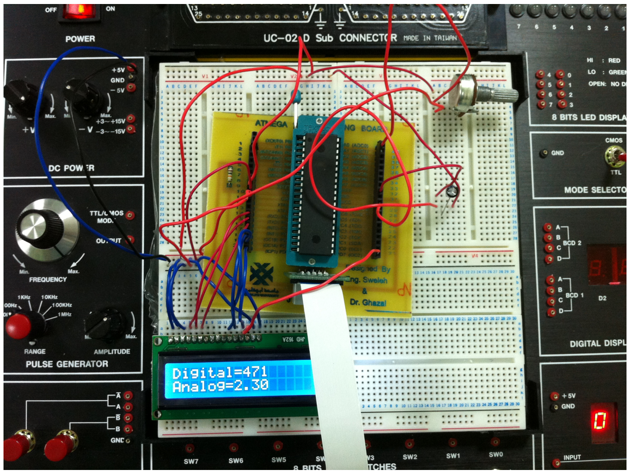


Figure 3: LCD showing both, Analogue and Digital value

3 List of Equipment used

- ATMega16 micro-controller chip.
- JTAG MKII programmer.
- Wires.
- Breadboard.
- Mounting bracket for micro-controller.
- LCD
- potentiometer
- 5V power supply.
- AVR Studio IDE.
- HAPSIM.

4 Procedure

4.1 The Code.

- Start AVR Studio and click on File/New/New Project.

- Write the following code into the AVR .c file.

```
//Program for ADC to read from channel 0 and show the 8 bit o/p on PORTB

#include<avr/io.h>
#include<util/delay.h>
#include <avr/pgmspace.h>
#include "lcd.h"
#include <string.h>
#include <stdlib.h>
#include <stdio.h>

void ADC_init(void);
unsigned int ADC_read(unsigned char);




// ------------------------------------------------
int main(void)
{
                        unsigned int value;
                        DDRB=0xFF;
                        DDRD=0x03;
                        ADC_init(); // Initialization of ADC
                        // ch=0;
                        float voltage;
                        lcd_init(LCD_DISP_ON);
                         lcd_clrscr();

    /* put string to display (line 1) with linefeed */
                            while(1)
                        {
                                value=ADC_read(0);
                                lcd_gotoxy(0,0);
                                uint8_t* line1[16];
                                sprintf(line1,"Digital=%d",value);
                                lcd_puts(line1);

                                uint8_t* line2[16];
                                voltage = ((float)value)/1023*5;
                                sprintf(line2,"Analog=%2.2f",voltage);
                                lcd_gotoxy(0,1);
                                lcd_puts(line2);
                                _delay_ms(500);
                        }
}
//-------------------------------------------------

void ADC_init(void) // Initialization of ADC
{
        ADMUX=(1<<REFS0); // AVcc with external capacitor at AREF
        ADCSRA=(1<<ADEN)|(1<<ADPS2)|(1<<ADPS1)|(1<<ADPS0);
// Enable ADC and set Prescaler division factor as 128
}

unsigned int ADC_read(unsigned char ch)
{
                ch= ch & 0b00000111; // channel must be b/w 0 to 7
                ADMUX |= ch; // selecting channel

                ADCSRA|=(1<<ADSC); // start conversion
                while(!(ADCSRA & (1<<ADIF))); // waiting for ADIF, conversion complete
                ADCSRA|=(1<<ADIF); // clearing of ADIF, it is done by writing 1 to it

                return (ADC);
}
```

4.2 Uploading the code to ATMega16.

- Connect JTAG to the computer through a USB cable and connect the JTAG Pins to the micro-controller.

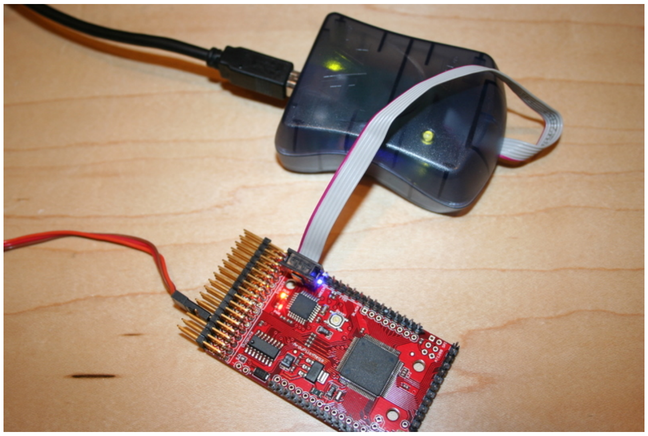
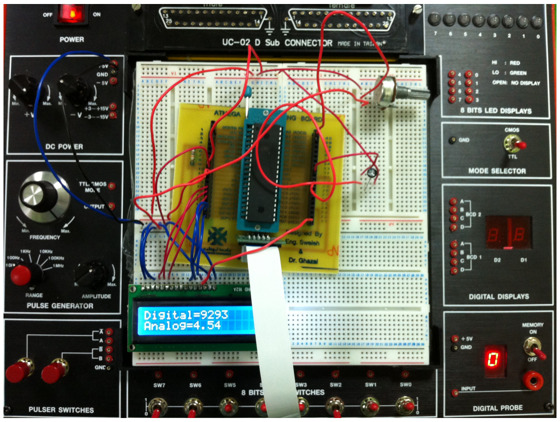


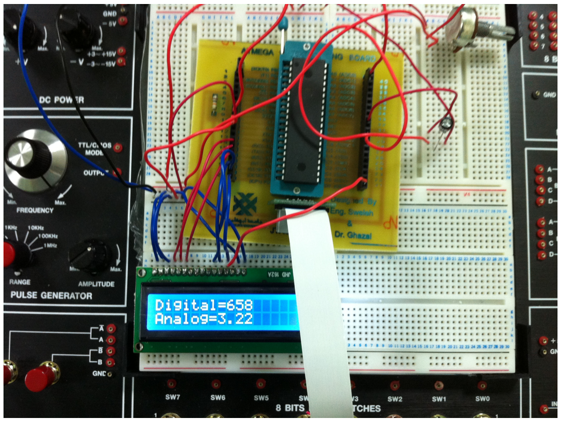
Figure 4: Connecting JTAG MKII to the ATMega 16

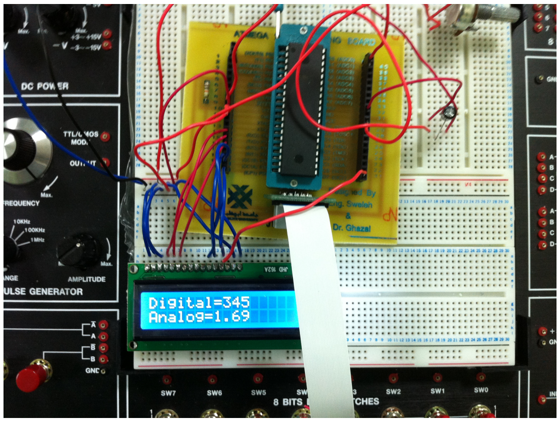
- Click build and compile in AVR Studio.
- Run the code.

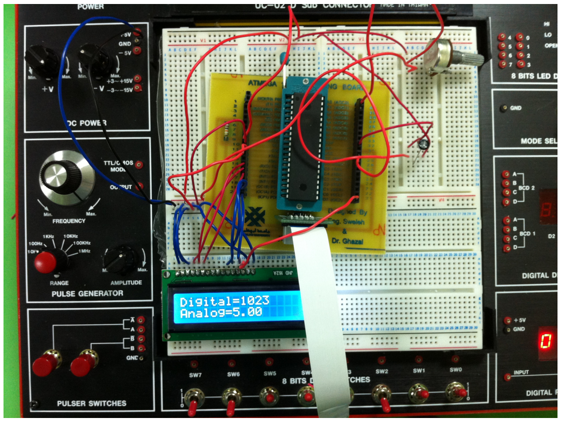
5 Results and Discussions

At the end of these exercises we got the following results:-









- Successful operation of Analogue to digital conversion was achieved.
- Digital value was 8 bit, so it reached up to 1023. while the analogue reached 4.99.

6 Conclusion

- In place of potentiometer, a sensor can be used in a very similar way. eg. temperature sensor.
- Analogue to digital conversion is not always accurate.