دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)

دانشکده مهندسی کامپیوتر

گزارش کار آزمایشگاه ریزپردازنده

آزمایش شماره‌ی ۱۲

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بازرگانی

گزارش کار آزمایش جلسه دوازدهم

هدف از این آزمایش کار با مقایسه کننده آنالوگ و مبدل آنالوگ به دیجیتال است

کد آزمایش در زیر آورده شده:

```
/*
   LCD16x2 4 bit ATmega16 interface
   http://www.electronicwings.com
*/



#define F_CPU 8000000UL                 /* Define CPU Frequency e.g. here its 8MHz */
#include <avr/io.h>                     /* Include AVR std. library file */
#include <util/delay.h>                 /* Include inbuilt defined Delay header file
*/

#define LCD_Dir DDRC                    /* Define LCD data port direction */
#define LCD_Port PORTC                  /* Define LCD data port */
#define RS PC1                          /* Define Register Select (data reg./command
reg.) signal pin */
#define EN PC3                          /* Define Enable signal pin */


void LCD_Command( unsigned char cmnd )
{
    LCD_Port = (LCD_Port & 0x0F) | (cmnd & 0xF0); /* sending upper nibble */
    LCD_Port &= ~ (1<<RS);              /* RS=0, command reg. */
    LCD_Port |= (1<<EN);                /* Enable pulse */
    _delay_us(1);
    LCD_Port &= ~ (1<<EN);

    _delay_us(200);

    LCD_Port = (LCD_Port & 0x0F) | (cmnd << 4);  /* sending lower nibble */
    LCD_Port |= (1<<EN);
    _delay_us(1);
    LCD_Port &= ~ (1<<EN);
    _delay_ms(2);
}


void LCD_Char( unsigned char data )
{
    LCD_Port = (LCD_Port & 0x0F) | (data & 0xF0); /* sending upper nibble */
```

```
    LCD_Port |= (1<<RS);                /* RS=1, data reg. */
    LCD_Port|= (1<<EN);
    _delay_us(1);
    LCD_Port &= ~ (1<<EN);

    _delay_us(200);

    LCD_Port = (LCD_Port & 0x0F) | (data << 4); /* sending lower nibble */
    LCD_Port |= (1<<EN);
    _delay_us(1);
    LCD_Port &= ~ (1<<EN);
    _delay_ms(2);
}

void LCD_Init (void)                    /* LCD Initialize function */
{
    LCD_Dir = 0xFF;                     /* Make LCD command port direction as o/p */
    _delay_ms(20);                      /* LCD Power ON delay always >15ms */

    LCD_Command(0x33);
    LCD_Command(0x32);                  /* send for 4 bit initialization of LCD  */
    LCD_Command(0x28);                  /* Use 2 line and initialize 5*7 matrix in
(4-bit mode)*/
    LCD_Command(0x0c);                  /* Display on cursor off*/
    LCD_Command(0x06);                  /* Increment cursor (shift cursor to right)*/
    LCD_Command(0x01);                  /* Clear display screen*/
    _delay_ms(2);
    LCD_Command (0x80);                 /* Cursor 1st row 0th position */
}


void LCD_String (char *str)             /* Send string to LCD function */
{
    int i;
    for(i=0;str[i]!=0;i++)              /* Send each char of string till the NULL */
    {
        LCD_Char (str[i]);
    }
}

void LCD_String_xy (char row, char pos, char *str)  /* Send string to LCD with xy
position */
{
    if (row == 0 && pos<16)
    LCD_Command((pos & 0x0F)|0x80);     /* Command of first row and required
position<16 */
    else if (row == 1 && pos<16)
    LCD_Command((pos & 0x0F)|0xC0);     /* Command of first row and required
position<16 */
    LCD_String(str);                    /* Call LCD string function */
}
```

```
void LCD_Clear()
{
    LCD_Command (0x01);                 /* Clear display */
    _delay_ms(2);
    LCD_Command (0x80);                 /* Cursor 1st row 0th position */
}

int main()
{
    LCD_Init();
    DDRA = 0;
    ADMUX |=(1<<REFS0)|(1<<REFS1);
    ADCSRA |=(1<<ADEN)|(1<<ADATE)|(1<<ADPS0)|(1<<ADPS1)|(1<<ADPS2);

    int16_t COUNTA = 0;
    char SHOWA [3];

    ADCSRA |=(1<<ADSC);

    while(1)
    {
        COUNTA = ADC/4;
        LCD_String ("CIRCUIT DIGEST");
        LCD_Command(0x80 + 0x40 + 0);
        LCD_String ("Temp(C)=");
        LCD_Command(0x80 + 0x40 + 8);
        itoa(COUNTA,SHOWA,10);
        LCD_String(SHOWA);
        LCD_String ("      ");
        LCD_Command(0x80 + 0);

    }
    return 0;

}
```

شکل مدار: