```
/*
 * 16x2 LCD library 4 Data 3 Cmd same port
 * one analog input
 * Atmega 128 L at 16Mhz
 * Created: 18-10-2012 22:31:20
 * Author: sergio
 */
#ifndef F_CPU
#define F_CPU 16000000
#endif
#define XTAL 16000000
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>
#include <stdio.h>
#include <stdlib.h>
//PINOS
/***GENERAL START***/
#define TRUE 1
#define FALSE 0
#define GI 7
/***GENERAL STOP***/

/***LCD START***/
//HARDWARE 4 DATA PIN 3 CMD
#define LCD_DDR DDRA
#define LCD_PORT PORTA
#define LCD_PIN PINA
//ASIGN PORT PINS TO LCD
#define RS 0
#define RW 1
#define EN 2
#define NC 3
#define DB0 4
#define DB1 5
#define DB2 6
#define DB3 7
//CMD RS
#define INST 0
#define DATA 1
//PROTOTYPES
void lcd_pulse(void);
void lcd_write(char c, unsigned short D_I);
char lcd_read(unsigned short D_I);
void lcd_string(char *s);
void lcd_init(void);
/***LCD STOP***/

/***ADC_START***/
#define ADC_DDR DDRF
#define ADC_PORT PORTF
#define ADC_PIN PINF
```

```
#define ADPS 0
#define REFS 6
#define MUX 0
#define ADC0 0

unsigned int ADC_value=0;
char ADC_string[20];
unsigned short ADC_flag;

ISR(ADC_vect)
{
        ADC_value=ADC;
        ADC_flag=0;
}

void adc_init(void);
/***ADC_STOP***/

/***MAINMAINMAINMAINMAIN***/
int main(void)
{
  lcd_init();
  adc_init();

  while(1){
    //TODO:: Please write your application code
        if(ADC_flag==0){
        //ADC_value=(ADC_value/1023)*5;
        sprintf(ADC_string,"ADC: %u   ",ADC_value);
        ADC_flag=1;
        }
        lcd_write(0x80,INST);//position
        _delay_us(43);
    while(0x80 & (lcd_read(INST)));//BF check
        lcd_string(ADC_string);
        lcd_write(0xC0,INST);//position
        while(0x80 & (lcd_read(INST)));//BF check
        lcd_string("By: sergio");
        _delay_ms(250);//quatro por segundo
  }
  return 0;
}
/******************SOURCES**********************/

/***LCD START***/
//LCD ENABLE PULSE
void lcd_pulse(void)
{
        LCD_PORT|=(1<<EN);
        //_delay_us(20);
        LCD_PORT&=~(1<<EN);
}
```

```
//LCD WRITE
void lcd_write(char c, unsigned short D_I)
{
	LCD_DDR=(1<<DB0)|(1<<DB1)|(1<<DB2)|(1<<DB3)|(1<<RS)|(1<<RW)|(1<<EN);
	if(D_I==0) LCD_PORT&=~(1<<D_I); else LCD_PORT|=(D_I<<RS);
	LCD_PORT&=~(1<<RW);
	if(c & 0x80) LCD_PORT|=1<<DB3; else LCD_PORT&=~(1<<DB3);
	if(c & 0x40) LCD_PORT|=1<<DB2; else LCD_PORT&=~(1<<DB2);
	if(c & 0x20) LCD_PORT|=1<<DB1; else LCD_PORT&=~(1<<DB1);
	if(c & 0x10) LCD_PORT|=1<<DB0; else LCD_PORT&=~(1<<DB0);
	LCD_PORT|=(1<<EN);
	//_delay_us(20);//180
	LCD_PORT&= ~(1<<EN);
	if(c & 0x08) LCD_PORT|=1<<DB3; else LCD_PORT&=~(1<<DB3);
	if(c & 0x04) LCD_PORT|=1<<DB2; else LCD_PORT&=~(1<<DB2);
	if(c & 0x02) LCD_PORT|=1<<DB1; else LCD_PORT&=~(1<<DB1);
	if(c & 0x01) LCD_PORT|=1<<DB0; else LCD_PORT&=~(1<<DB0);
	LCD_PORT|=(1<<EN);
	//_delay_us(20);//180
	LCD_PORT&=~(1<<EN);
}
//LCD READ
char lcd_read(unsigned short D_I)
{
	char c=0;
	LCD_DDR=(0<<DB0)|(0<<DB1)|(0<<DB2)|(0<<DB3)|(1<<RS)|(1<<RW)|(1<<EN);
	if(D_I==0) LCD_PORT&=~(1<<D_I); else LCD_PORT|=(D_I<<RS);
	LCD_PORT|=(1<<RW);
	LCD_PORT|=(1<<EN);
	//_delay_us(20);//180
	LCD_PORT&=~(1<<EN);
	if(LCD_PIN & (1<<DB3)) c|=1<<7; else c&=~(1<<7);
	if(LCD_PIN & (1<<DB2)) c|=1<<6; else c&=~(1<<6);
	if(LCD_PIN & (1<<DB1)) c|=1<<5; else c&=~(1<<5);
	if(LCD_PIN & (1<<DB0)) c|=1<<4; else c&=~(1<<4);
	LCD_PORT|=(1<<EN);
	//_delay_us(20);//180
	LCD_PORT&=~(1<<EN);
	if(LCD_PIN & (1<<DB3)) c|=1<<3; else c&=~(1<<3);
	if(LCD_PIN & (1<<DB2)) c|=1<<2; else c&=~(1<<2);
	if(LCD_PIN & (1<<DB1)) c|=1<<1; else c&=~(1<<1);
	if(LCD_PIN & (1<<DB0)) c|=1<<0; else c&=~(1<<0);
	return c;
}
//LCD STRING WRITE
void lcd_string(char *s)
{
	char tmp;
	while(*s){
		tmp=*(s++);
		lcd_write(tmp,DATA);
		_delay_us(80);
```

```
        }
}
//LCD INIC
void lcd_init(void)
{
        LCD_DDR=(1<<DB0)|(1<<DB1)|(1<<DB2)|(1<<DB3)|(1<<RS)|(1<<RW)|(1<<EN);
        LCD_PORT=0x00;
        /***INICIALIZACAO LCD**datasheet*/
        _delay_ms(40);

        lcd_write(0x33,INST); //function set
        _delay_us(80);

        lcd_write(0x2B,INST); //function set
        _delay_us(80);

        lcd_write(0x2B,INST); //function set
        _delay_us(80);

        lcd_write(0x0C,INST);// display on/off control
        _delay_us(80);

        lcd_write(0x01,INST);// clear display
        _delay_ms(2.50);

        lcd_write(0x06,INST);// entry mode set (crazy settings)
        _delay_us(80);

        /***INICIALIZATION END***/

        lcd_write(0x1F,INST);// cursor or display shift
        _delay_us(80);

        lcd_write(0x03,INST);// return home
        _delay_ms(2.50);

}
/***LCD STOP***/

/***ADC START***/
void adc_init(void){
        ADC_DDR=(0<<ADC0);
        ADC_PORT=(0<<ADC0);
        ADMUX=(0<<REFS)|(0<<ADLAR)|(0<<MUX);
        ADCSRA=(1<<ADEN)|(1<<ADSC)|(1<<ADFR)|(0<<ADIF)|(1<<ADIE)|(4<<ADPS);
        SREG|=(1<<GI);
}
/***ADC STOP***/
```