

Solar power parameter calculator

¹Abhishek kumar, ²Abhinav kumar Dwivedi

¹Electronics & Communication Kanpur Institute of Technology Kanpur, India

²Electronics & Communication Kanpur Institute of Technology Kanpur, India

ABSTRACT: As there is wide scope of solar energy in future. In this project we will calculate few solar energy parameters by using various other sensors. This project includes microcontroller PIC 16F877, the software used will be MPLAB IDE. We will calculate various parameters like Intensity, Current, Voltage and temperature. For calculation of intensity we will see LDR sensor for current measurement the current sensor for voltage and temperature calculation we will use voltage divider principle and a temperature sensor representing the whole result of the calculated parameters will be displayed on 16×2 LCD. Which is interfaced with PIC microcontroller for running the whole circuit we will use a 230/12 V step down transformer which reduce the A.C voltage to 12 volt. After that we will use bridge rectifier to convert to 12 V AC to 12V D.C. The D.C voltage will contain some ripples which will be extracted through the filter which is capacitive filter and for the microcontroller operation the whole 12V D.C supply will be reduce to +5V. The solar energy is vast source of energy in the world. It is renewable energy resources thus there is no matter about its consumption.

Keywords: LDR, Microcontroller

I. INTRODUCTION

As the solar radiation is a non-conventional energy resource which is largely used by peoples in past days as well as in present days. The use of solar energy is obtained through two methods.

1. Direct Method

2. P-n junction Method

In P-n junction method the photovoltaic effect is used which was discovered by be quarrel in 1893. But due to some reasons the first photo voltaic cell was developed in 1950. After the invention of this cell the use of solar technologies enhanced up to an effective rate. But the potential obtained through the P-N cell is still less as compared to their resources. But there are much problems are related to solar energy which are capital cost and efficiency there are many circuits which use the photovoltaic principles and tell about the solar radiation direct beam measurement and solar prospecting as present scenario the demand for circuit is raised which is more efficient having low cost and low parasitic losses which can calculate few other parameters. Thus the possible solution is the solar energy parameter calculation. In this project we will calculate the

Intensity, voltage, current and temperature of solar energy by using various sensors and all of them will be displayed on lcd screen by using microcontroller programming.

Intensity-Intensity is the no of photons which are falling on ascertain area within particular time interval is called intensity. The intensity of extra-terrestrial solar radiation is not constant and it varies from 1307 (w/m²) to 1393 (w/m²)

$$I_{on} = I_{sc} \frac{(r)}{(R)^2}$$

Where r-it is the middle distance between earth and sun.

R-instantaneous distance between earth and sun light can be calculated through LDR sensor.

Temperature-As the temperature of solar energy changes the power and output of the solar cell also changes. For temperature calculation we will use the LM35 temperature sensor it directly calibrates to Celsius directly.

Voltage-Voltage it is the electric potential difference between two points for voltage calculation the voltage divider principle will be used.

Current-As the current is the flow of electrons which can be calculated through the current sensor.

II. CIRCUIT CONFIGURATION

Microcontroller (PIC 16F877A)- As we see from the figure the microcontroller used is PIC 16F877A. The operating speed of the microcontroller is DC – 20 m Hz and clock input DC- 200ns instruction per cycle. In PIC 16F877A contains data memory (EEPROM) up to 256×8 bytes, 8k×14 words of flash program memory and 368×8 bytes of data memory (RAM). Recently PIC 16F873A/76A microcontroller is available only in 28 pin but

in present time it is available in 40 pin such type of microcontroller is PIC16F874A/877A. The architecture of the above mentioned microcontroller is same but in case of 28 pin PIC microcontroller the no of interrupts are fourteen but in case of 40 pin PIC microcontroller the no of interrupts are fifteen. It uses the c- mos. technology because of it provides low power, high speed flash / EEPROM technology . The operating voltage range is 2V to 5.5V.

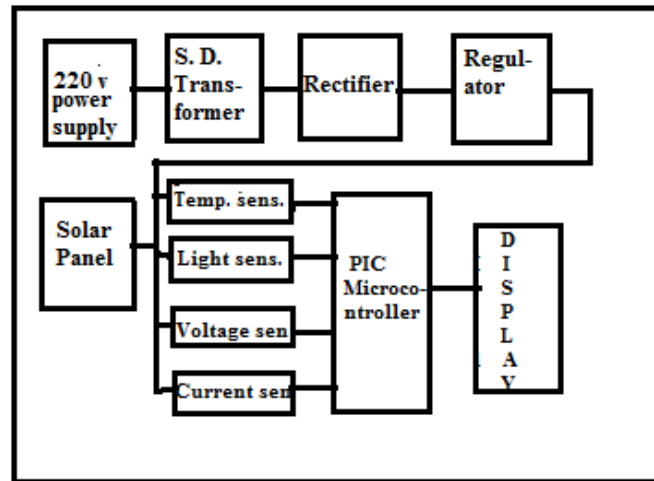


Figure1. Block diagram of solar parameter calculator

Temperature sensor (LM35)- As we know that LM35 is the temperature sensor. The output of such temperature sensor is linearly proportional to the centigrade. We choose LM35 sensor which is calibrated in Celsius over kelvin because in kelvin calibrated sensor there is a requirement of subtract a constant voltage from its output to obtain output in Celsius. In case of LM35 it does not requires timing clock calibration for accuracies. The control circuitry of LM35 is easy. The temperature sensor LM35 can be used with single power supply. The temperature range for operating is -55 to +150 Celsius. The LM35 sensor is suitable for remote applications. Operating voltage such sensor is varies from 4 to 30 V.

LDR(light dependent resistor) - The full name of LDR is light dependent resistor. When the intensity of light is increases then the resistance of LDR is decreases. This is also known as photoconductor. The LDR is made of a high resistance semiconductor when the falling light on the device is of enough frequency then the photons absorbed by the semiconductor. Thus in resulting free electron conduct electricity thereby resistance is decreases.

IV IN4007-The IN4007 is used in rectifier to convert AC to DC. The Important factor is that IN4007 have maximum reverse bias voltage capacity.

III. CODING

```

#include<16f877a.h>
#device ADC=10
#fuses HS,NOWDT
#use delay(clock=4000000)

#bit LCD_RS=0x8.2 //0*5.3 //RA3
#bit LCD_RW=0x8.0 //0*5.2 //RA2
#bit LCD_EN=0x8.3 //0*5.1 //RA1

#byte LCD_DATA=8

#define LCD_STROBE() ((LCD_EN=1),(LCD_EN=0))

Void lcd_string(char*s);
Void lcd_write(unsigned char c);
Void lcd_clear(void);
Void lcd_string(char*s);
Void lcd_character(char c);
Void lcd_chara(unsigned char c);
  
```

```
Void lcd_init( );

int16 value,value1;
float voltage,voltage1,current,current1;
int temp,temp1,total_current,total_voltage;
charw,x,y,z,p,q;
unsigned char str1[ ]="L:";
unsigned char str2[ ]="T:";
unsigned char str3[ ]="V:";
unsigned char str4[ ]="I:";
void main( )
{
set_tris_d(0x00); //set portd as output port
set_tris_a(0x0F); //set a0,a1,a2,a3 as i/p and a4,a5,a6,a7 as o/p port
lcd_init(); //lcdinitialisation

lcd_write(0x80); //select lcd 1st line starting position
lcd_string(str1); //display string on lcd

lcd_write(0x8a); //select lcd 1st line 10th position
lcd_string(str2); //display string on lcd

lcd_write(0xc0); //select lcd 2nd line starting position
lcd_string(str3); //display string on lcd

lcd_write(0xc8); //select lcd 2nd line 9th position
lcd_string(str4); //display string on lcd

while(TRUE);
{
set_tris_a(0x0F); //set a0,a1,a2,a3 as i/p a4,a5,a6,a7 as o/p port

/*light*/
setup_adc(ADC_CLOCK_INTERNAL); //setup adc internal circuit
setup_adc_ports(ALL_ANALOG); //enable analog inputs
set_adc_channel(0); //select channel 0

delay_ms(1000);
value=read_adc( );
value1=value;
z=value1%10;
value1=value1/10;
y=value1%10;
value1=value1/10;
x=value1%10;

lcd_write(0x82);

if(x!=0)
{
lcd_char(x+0x30);
}
lcd_char(y+0x30);
lcd_char('_');
lcd_char(z+0x30);
lcd_char('L');
delay_ms(1000);
```

```
/*temperature*/
setup_adc(ADC_CLOCK_INTERNAL);
setup_adc_ports(ALL_ANALOG);//enable analog input
setup_adc_channel(1);//select channel 1

delay_ms(1000); //delay 1sec
value=read_adc( ); //read value from adc
value1=(5.00*value*100.00/1023.00);//calculate temp

z=value1%10; //convert decimal to bcd
value1=value1/10;
y=value1%10;
value1=value1/10;
x=value1%10;

lcd_write(0x8c);//select lcd 1st line 12th position
if(x!=0)
{
lcd_char(x+0x30);
}
lcd_char(y+0x30);
lcd_char(z+0x30);
lcd_char(223);
lcd_char('C');

delay_ms(1000);

// voltage//
setup_adc(ADC_CLOCK_INTERNAL);
setup_adc_ports(ALL_ANALOG);
set_adc_channel(2);

delay_ms(1000);
value=read_adc( );
value1=(5.00*value*100.00/1023.00);

voltage=(value1/26);
temp1=(int)voltage;
voltage1=(voltage-temp1)*100;
total_voltage=(int)voltage1;

p=temp1%10;
temp1=temp1/10
q=temp1%10

z=total_voltage%10;
total_voltage=total_voltage/10;
y=total_voltage%10;

lcd_write(0xc2);

if(q!=0);
{
lcd_char(q+0x30);
}
lcd_char(p+0x30);
lcd_char('_');
lcd_char(y+0x30);
lcd_char(z+0x30);
```

```
lcd_char('V');

/*current*/
setup_adc(ADC_CLOCK_INTERNAL);
setup_adc_ports(ALL_ANALOG);
set_adc_channel(3);

delay_ms(1000);
value=read_adc();
value1=(5.00*value*100.00/1023.00)+8;
z=value1%10;
value1=value1/10;
y=value1%10;
value1=value1/10;
x=value1%10;
value1=value1/10;
w=value1%10;
lcd_write(0xca);
lcd_char(w+0x30);
lcd_char('_');
lcd_char(x+0x30);
lcd_char(y+0x30);
lcd_char(z+0x30);
lcd_char('A');
delay_ms(1000);
}
}
```

```
Void lcd_write(unsigned char c)
{
Delay_us(40);
LCD_DATA=((c & 0xf0));
LCD_STROBE();
LCD_DATA=((c<<4) & 0xf0);
LCD_STROBE();
}
```

```
voidlcd_char(unsigned char c)
{
delay_ms(300);
LCD_DATA=((c & 0xf0));
LCD_RS=1; //rs=1 for data
LCD_STROBE();
LCD_DATA=((c>>4) & 0xf0);
LCD_RS=1; //rs=1 for data
LCD_STROBE();
}
voidlcd_clear(void)
{
LCD_RS =0; //rs=0 for command
lcd_write(0x01);
delay_ms(2);
}
```

```
/*write a string of chars to the lcd*/
```

```
voidlcd_string(char*s)
{
LCD_RS=1;
```

```
while(*s)
lcd_char(*s++);
}

/*write one character to the lcd*/
voidlcd_character(char c)
{
LCD_RS=1; //write character
lcd_char(c);
}
voidlcd_init()
{
charinit_value;
init_value=0x05;
set_tris_a(0x00);
set_tris_d(0x00);
LCD_RS=0;
LCD-EN=0;
LCD_RW=0;

delay_ms(15);
LCD_DATA=init_value;
LCD_STROBE();
delay_ms(5);
LCD_STROBE();
delay_ms(5);
LCD_STROBE();
delay_us(200);

LCD_STROBE();
delay_us(200);
LCD_DATA=0x02;
LCD_STROBE();
Slcd_write(0x38);
lcd_write(0x0e);
lcd_clear();
lcd_write(0x06);
}
```

IV. CONCLUSION

The power supply which is =5 v is connected to pin no.11 and 32 of microcontroller and GND is connected to its pin no. 12 and 31. Pin no. 2 of microcontroller is connected to LDR sensor.Pin no. 3 of microcontroller is connected to pin no. 2 of LM35 temperature sensor. Pin no. 4 of microcontroller is connected to voltage sensing circuit, Pin no. 5 of microcontroller is connected to current sensing circuit . Solar power parameter calculator is the device to calculate the intensity, temperature, voltage, current and represent them on the LCD screen . Thus by this article we are very close to utilize the solar energy efficiently in those regions in which the intensity, voltage generation is maximum.In present scenario the use of non-conventional energy resources is much profitable and economic friendly. Thus the use of solar devices will be much wide and utilization of sun radiations will become easier. The readings of project at 24 April 2013 in Kanpur.
Intensity- 49.9 lux Temperature- 26 Degree Celsius.
Voltage- 6.30 v Current- 0.0686 ma

V. FUTURE SCOPE

This project will help to varios organizations for establishing their solar plants and to utilize the solar energy efficiently. This project can be modified further for calculating various other parameters like Power consumed by load, Solar Irridance etc. thus the future scope is wide for this project.

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