SOLAR ENERGY MEASUREMENT USING PIC MICROCONTROLLER

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Abstract - *The main goal of the project to develop a solar energy measurement system that use multiple sensors to determine solar array parameter such as current and voltage this project uses solar panel that continuously monitor sunlight it uses microcontroller from PIC16f8 family*

1.INTRODUCTION

Now in few days,the solar energy market is fastest renewable energy market I the world. We are currently increasing the need for remote monitoring and control equipment for solar energy 'and whether they are likely to create field potential ,regardless of whether they are likely to create field potential 'monitoring ,reliability and accurate measurement it is important .

Common whether measurements including wind speed ,wind direction , relative humidity and pressure ,precipitation are all used in solar field .of course, measuring isolation is especially important and, there are sensors that measuring all aspects of isolations. Voltage according to the principle of voltage divider ,current according to series resistance and temperature according to temperature sensor.all these dara displayed on 16*2 LCD connected to the PIC microcontroller and also send to remote PC hyperterminal for display using 2.4 GHz serial communication the goal of this project is to develop a solar energy measurement system for measuring solar cells .parameter such as voltage,current,tempreture and light intensity through the multiple sensors.

1.1BLOCK DIAGRAM

This project is aimed to realize greater accountability in alternative energy generation, wherein the conditions that affect the energy generation like temperature, intensity are continuously monitored together with voltage generation factor. the sunshine intensity is

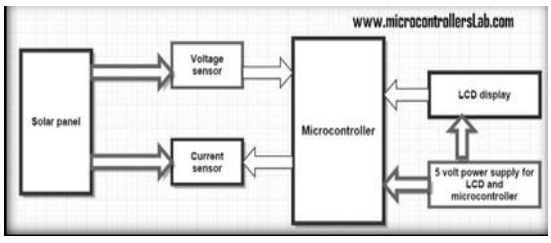

Fig 1: block diagram of solar energy measurement system

monitored using an LDR sensor, voltage by resistance principle, current by series resistor and temperature by temperature sensor. of these data are displayed on a 16X2 LCD interfaced to PIC microcontroller and is additionally

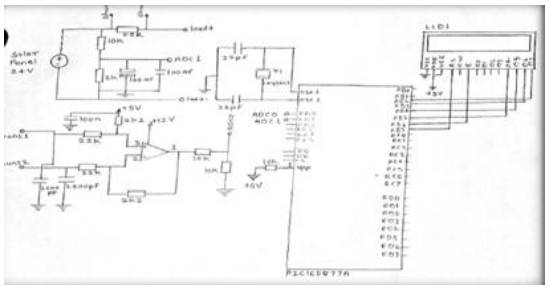

Fig 2 : circuit diagram of solar energy measurement system

sent to an overseas PC hyper terminal for display employing a 2.4 GHz serial link.

1.2 CIRCUIT DIAGRAM

As pictured 2.schematic,voltage devider is used to devide voltage below 5 volt this is because the microcontroller Cannot read voltage above 5 volt.so , voltage devider is used to step down the voltage below 5 volt.polar and non polar capacitor are used to reject harmonics and provide a constant voltage to the adc pins of the microcontroller .the polarized capacitor are used to prevent voltage fluctuations ,and non polarized capacitors are used to cancel harmonics

2.Objectives:

The main purpose of this solar power measurement system project is to style a solar power measurement system for determiningthe electriccell parameterslikecurrent,voltage, temperatureand also strength through multiple sensorsThe solar power marketplace is one in all the foremost quickly growing renewable energy advertise within the u. s.. Currently,wehave seen a crucial enhancement in requirements for remote monitoring and equipment control for various applications of solarenergy. Whether you're assessed a sites potential for alternative energy generation, monitoring act of accessible solar installations, orsuperior solar monitoring, consistent and precise measurements are crucial. they assist in higher cognitive process, development of theproduct, maintenance of the system and in many other

ways. General meteorological measurements with wind direction, wind speed, ratio, atmospheric pressure and rainfall, all have theyre applied in solar applications. Of course,the alternativeenergymeasurements are particularly significant and sensors are accessible for measuring all features of radiation
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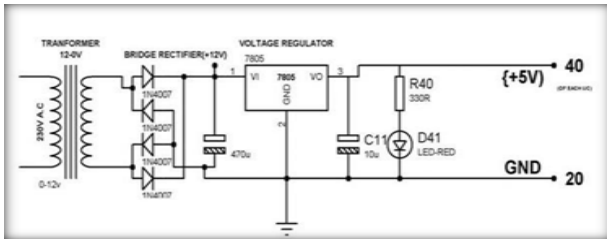


3. Power Supply

The power supply consist of a230/12v step down transformer that steps the voltage down to 12 volt AC.is is converted to direct current by using bridge rectifier .the ripple is removed with a capacitive filter and then adjusted to +5 volt with a7805 voltage regulator required to the operation of microcontrollers and other circuitry.

4.PIC microcontroller

PIC (PIC16F877A):

- High-Performance RISC CPU
- Only 35 single-word instructions.
- All single cycle instruction axept program beanches that consist of 2 cycles
- Operating speed DC -20 MHz clock input DC 200 ns command cycle
- Upto 8k *14 word program flash , upto 368 *8 bytes of data memory (RAM).
- Upto 256*8 bytes of EEPROM data memory
- Pin out is compatible with other 28 pins or 40/44 pin PIC16cxxxx AND PIC16Fxxx microcontrollers

5.Voltage Measurement unit:

- According to the voltage sensor formula ,for 24 volt solar panel,the voltage devider resistor value are R2-10K and R4-2K.the reason for using voltage devider is that the maximum input voltage of the A/D converter cannot express 5 volt .however ,to increase the measurement accuracy and ensure that the ADC is protected from high voltages.

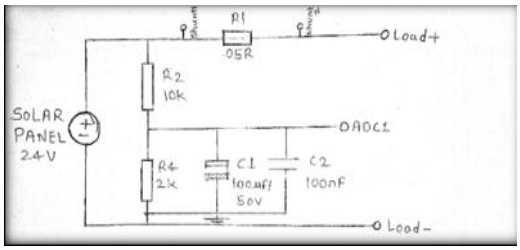


Fig 4: voltage measurement unit

6.Current Measurement unit-

Here is a schematic of the current sensor circuit where the differential amplifier ,amplifies the voltage across the shunt resistor .at the different time the current value may be too high or low and a different voltage value will be created across the shunt resistor so we cant use use a voltage devider because we don't know current value current sensor is device that senses current and convert it into an easily Fig

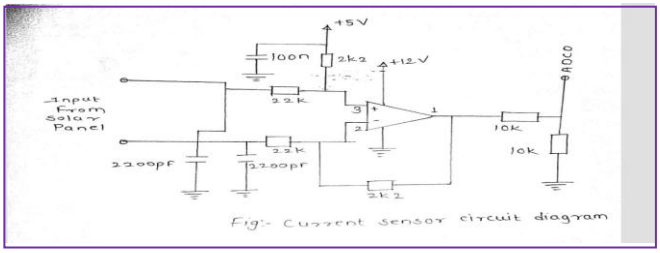


fig 5: Current measurement unit

measurable voltage output propotional to the current in the measured path.

Direct measurement are based on ohm s law and indirect measurement are based on faraday and ampere s law when current flow through a wire or circuit , a voltage drop accurs also a magnetic field is created around a conductor through

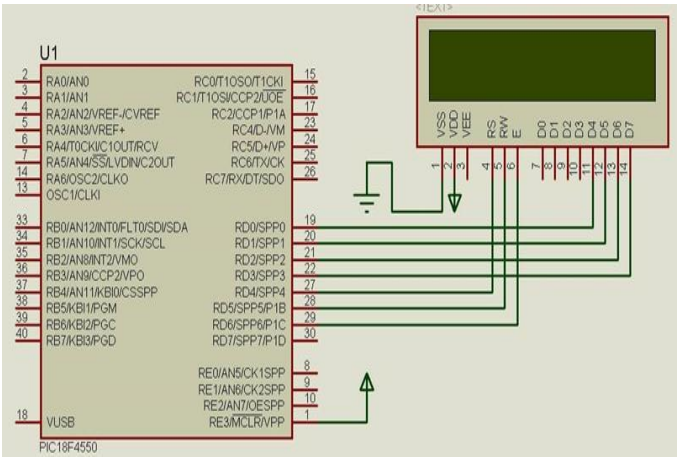
which an electric current flows.this two phenomenon are used in development of current sensors . therefore there are 2 types of current measurement direct and indirect.

7.FUTURE SCOPE

Solar energy is used as an efficient energy source in modern days and generation of solar energy is quickly growing in every country. Solar panels are used to convert solar energy into electricity to power house lighting, appliances etc. The main purpose of this project is to design a system to determine solar cell parameters like current, voltage etc. So, this has very good scope in the near future in various industries.They aid in decision making, product development, system maintenance and in many other ways. Common meteorological measurements including wind speed, wind direction, relative humidity, barometric

pressure and precipitation, all have their use in solar applications.

8.INTERFACING CIRCUIT



9.LCD Commands

We use #define directives to define commands that are used for various control functions of the 16×2 display.

// Command set for Hitachi 44780U LCD display controller

#define LCD_CLEAR 0x01 // It clears everything's

#define LCD_HOME 0x02 // set the cursor to first line and first row

#define LCD_CURSOR_BACK 0x10 // moves cursor one position back

#define LCD_CURSOR_FWD 0x14 //moves cursor one position forward

#define LCD_PAN_LEFT 0x18 // used to scroll text left side to scroll text

#define LCD_PAN_RIGHT 0x1C // used to scroll text right side to scroll text

#define LCD_CURSOR_OFF 0x0C // stops display cursor on screen

#define LCD_CURSOR_ON 0x0E // turns on cursor display

#define LCD_CURSOR_BLINK 0x0F // cursor keeps blinking

#define LCD_CURSOR_LINE2 0xC0 // move cursor to second line or second row

// display controller setup commands from page 46 of Hitachi datasheet

#define FUNCTION_SET 0x28 // 4 bit interface, 2 lines, 5x8 font

#define ENTRY_MODE 0x06 // increment mode

#define DISPLAY_SETUP 0x0C // display on, cursor off, blink off

10. CONCLUSIONS

In this paper we tried to measure solar panel parameter such as voltage,current,power using the PIC16F877A microcontroller .a digital display can be used to show the values of these parameter .a PICmicrocontroller can be used to measure the anolog value of these measurement parameter and A/D converter built to the PIC microcontroller can be used to measure the value of this parameter .there are several ways to determine the voltage .however in this purposed work,we can easily measure the solar panel voltage using the voltage devider.to avoid voltage fluctuation and harmonics entering the ADC of the PIC microcontroller ,two capacitor are connected to the voltage sensor resistor

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