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Solar Energy Measurement System

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Abstract: *The point of this arranged work is to sum sunlight based cell requirements through various sensor information picking up. In this undertaking, a sun oriented board is utilized that spares nursing the daylight. Here various elements of the sun oriented board like light quality, voltage, current and the warmth are checked and are alluded to a separated PC utilizing a RF 2.4 GHz sequential connection. Microcontroller reused here is from PIC16F8 family*

Keywords - *P-solar panel, PIC-programmable industrial controller, LCD-liquid crystal display and LED-light emitting diode.*

I. Introduction

The sun oriented vitality bazaar is a standout amongst the most quick growing sustainable power source advertises in the United States. As of now we have seen a noteworthy increment in solicitations for remote nursing and control hardware for sun oriented vitality applications. Regardless of whether you are estimating a site's inert for sunlight based power age, observing execution of existing sun based establishments, or progressed sun oriented nursing, solid and exact limits are critical. They help in result creation, creation improvement, framework care and in numerous different ways. Common meteorological estimations including wind speed, wind heading, relative dampness, barometric weight and downpour, all have their utilization in sun based solicitations. Obviously, sun based radiation estimations are particularly imperative and sensors are accessible for estimating all parts of sun powered radiation. The primary fair of this arrangement is to plan a sun powered vitality estimation framework for estimating sun based cell breaking points, for example, voltage, current, hotness and light force through various sensors. The light force is checked utilizing a LDR sensor, voltage by voltage divider code, current by arrangement resistor and temperature by hotness sensor. Every one of these information are appeared on a 16X2 LCD interfaced to PIC microcontroller and is additionally sent to a remote PC overexcited terminal for presentation utilizing a 2.4 GHz sequential connection.

The future framework utilizes a PIC16F arrangement family microcontroller and an amended power source. In this work, a sun based board is utilized to spare a track on observing the daylight. In this framework, measure of sensors is associated with the microcontroller with a 8-divert in-assembled ADC gadget for nursing the parameter of the sunlight based board like voltage, current, temperature and light quality. A 16x2 LCD show is connected to the microcontroller for appearing material. The sunlight based board is nourished to the microcontroller through a conceivable divider to gauge voltage – a little burden through which current is moderate. The temperature and light power is checked through predictable sensors. Every one of these points of confinement are shown on the 16x2 LCD interfaced to the PIC microcontroller.

II. Block Diagram

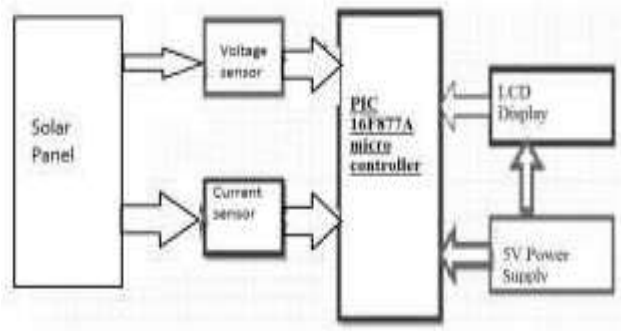

Fig1.Block diagram of solar energy measurement system

As Shown in fig.1Block drawing is shown and latter that all the purpose of equipment's are defined The light intensity is monitored using an LDR sensor, voltage by voltage partition principle, current by series resistor and hotness by hotness sensor.

All these data are showed on a 16X2 LCD interfaced to PIC microcontroller and is also sent to a remote PC hyper fatal for display using a 2.4 GHz serial link. In the block drawing, voltage sensor and current sensor are used to amount voltage and current smooth to load from solar panel. As we know, solar panels are dc power bases. Liquid mineral display is used to show the value of current, voltage and power of solar panel. 5 volt dc power is recycled to provide working voltages to microcontroller and liquid crystal display.

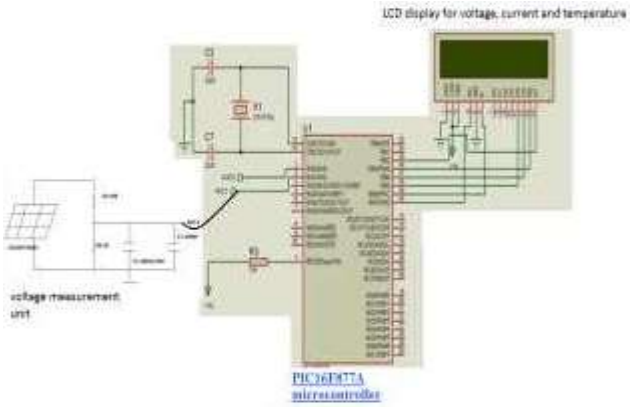

Fig 2. Circuit diagram for solar energy measurement system

As appeared in Fig 2.Circuit chart, the voltage segment is utilized to isolate voltage to sub-par than 5 volt. Since microcontroller can not peruse voltage in excess of 5 volt. So voltage parcel is used to bring down voltage under 5 volt. Polar and nonpolar capacitors are reused to dispense with music and to convey interminable voltage to ADC stick of microcontroller. Polar capacitor is utilized to maintain a strategic distance from voltage variance and non-polar capacitor is utilized to evacuate music.

We can utilize LM35 hotness sensor which is directed in Celsius over kelvin since in kelvin aligned sensor there is a necessity of subtract a consistent voltage from its yield to is simple. The temperature sensor LM35 can be utilized with single power supply. The hotness extend for working is - 55 to +150 Celsius. The LM35 sensor is appropriate for remote applications. Working voltage such sensor is changes from 4 to 30 V. At the point when the power of light is upsurges then the obstruction of LDR is diminishes. This is otherwise called photoconductor.

A LDR (light ward resistor) is made of a high clash semiconductor when the falling light on the gadget is of enough recurrence then the photons consumed by the semiconductor. In this way in resultant free electron lead vitality in this way opposition is decreases. IV IN4007-The IN4007 is utilized in rectifier to change over AC to DC. The Important factor is that IN4007 have incomparable inverse inclination voltage limit.

A shunt resistor of .05 ohm is utilized in arrangement to stack. Voltage drop crossways shunt rheostat used to gauge current. Here shunt resistor is utilized as a transducers which changes over current into voltage, as microcontroller can't peruse current constant. Creation of shunt resistor is nourished to change enhancer. Distinction speaker venture up the voltage. If there should be an occurrence of low-threw current, little voltage will appear crosswise over shunt resistor and microcontroller can't peruse voltage not as much as its determination. Followings are the primary parts: Current sensor, voltage sensor, PIC16F877A microcontroller, LCD show, Power supply

2.1 Ac Voltage Measurement Unit:

As indicated by voltage sensor equation ,for sun based board of 24 volt estimations of voltage divider resistors are R2 = 10K and R4 2K. The reason I have utilized voltage divider on the grounds that the most extreme info voltage to Analog to advanced converter can never be more noteworthy than 5 volt. Be that as it may, I determined these resistor esteems as indicated by 4 volt to build exactness of estimation and to safeguard assurance of ADC if there should be an occurrence of more prominent voltage fluctuation.[5]

2.2 Current sensor circuit diagram:

The following is a circuit graph of current estimation circuit. I have utilized distinction intensifier to enhance voltage showing up crosswise over shunt resistor. Since current esteem might be excessively high and excessively low in various timings and diverse voltage will produce crosswise over shunt resistor. So it is

unimaginable to expect to utilize voltage divider as we don't have a clue about the estimations of current. A present sensor is a gadget that recognizes and changes over current to an effectively estimated yield voltage, which is relative to the current through the deliberate path.[5],[6]

At the point when a present courses through a wire or in a circuit, voltage drop happens. Likewise, an attractive field is created encompassing the current conveying conductor. Both of these wonders are made utilization of in the plan of current sensors. In this way, there are two kinds of current detecting: immediate and circuitous. Direct detecting depends on Ohm's law, while roundabout detecting depends on Faraday's and Ampere's law.As appear in fig.3 Shunt resistor in arrangement to sun oriented board.

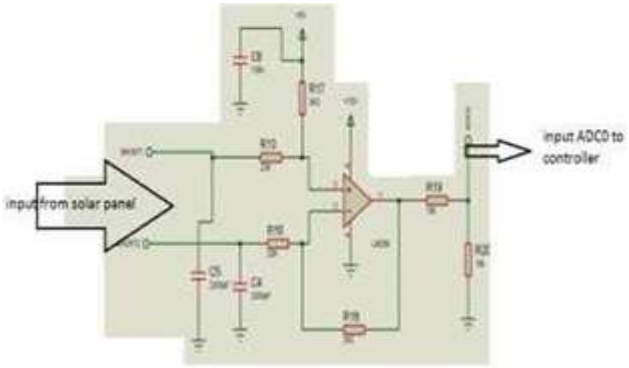

Fig3. Shunt resistor in series to solar panel

2.3 Passive Element Based Current Sensing Techniques:
-Sense Resistors
-Low value in order to minimize power losses.
-Low inductance because of high di/dt.

III. Working

The power supply which is =5 v is associated with stick no.11 and 32 of microcontroller and GND is associated with its stick no. 12 and 31. Stick no. 2 of microcontroller is associated with LDR sensor. Stick no. 3 of microcontroller is associated with stick no. 2 of LM35 temperature sensor. Stick no. 4 of microcontroller is associated with voltage detecting circuit, Pin no. 5 of microcontroller is associated with current detecting circuit. Sun powered power parameter number cruncher is the gadget to compute the force, temperature, current and voltage speak to them on the LCD screen [5] .We can utilize LM35 temperature sensor which is adjusted in Celsius over kelvin in light of the fact that in kelvin aligned sensor there

3.1 Comparative Study Of Power–Voltage Characteristics:

Pooja Sharma, Siddhartha P. Duttagupta, and Vivek Agarwal established the Contrast of Power–Voltage Characteristics for Flat and-FPV Modules.[1],where adaptable photovoltaic (FPV) modules is portrayed. The information were gathered for FPV modules introduced at different bend edges. Fig. 6(a)– (c) demonstrates the records of the power– voltage attributes for three instances of bend edges (0◦, 15◦,and 22◦) with the time and for a scope of sun powered light conditions. The fundamental perceptions of the accounts are abridged here.

3.2 Definition of ESA:

The assessed sun oriented edge (ESA) is equivalent to the hour edge, which fluctuates from 0 ◦ to 180 ◦ from dawn to nightfall, as shownin Fig. 4. In this way, contingent on the length of the day (180◦ regarding edge), which shifts consistently, ESA canbe determined on an every moment premise, as given in the accompanying equation:[3],[4]

$$ESA = (tP - tR) \times 60 \times 180\ tL\ ,$$

Where

tR is the sunrise time,
tP is the present instant of time for which ESA is calculated, and
tL is the length of the day, which
Is given by:

$$tL = (tR - tS) \times 60 \text{ (min)}$$

Where *tS* is the sunset time.

1) At the beginning of the day, multiple peaks are visible[see Fig. 4.(a)]in the power–voltage characteristics of the FPV modules curved at 15◦ and 22◦. The FPV module
without curving ($\theta c = 0◦$) shows single-peak characteristics.[1]

2) The manifold peaks vanish by around 9:30 A.M. for the FPV module curved at $\theta c = 15◦$ and a little later by about 10:30 A.M. for $\theta c = 22◦$. The next 4–5 h are dominated by single-peak characteristics with the power yield of the curved modules remaining close to the flat ($\theta c = 0◦$) units [see fig 4.(b)].[1]

3) Multiple peaks start appearing again after around3:00 P.M. and are chief experiential in FPV units curved at$\theta c = 22◦$. Multiple peaks for the 15◦ curving case appears short while later after around 4:00 P.M. [see Fig. 4(c)] [1]. It is also experiential in power–voltage characteristics that the power change between the flat unit (θc =0◦) and the curved FPV module is important during low solar angle positions. For high solar angle positions, this difference is insignificant. [1]

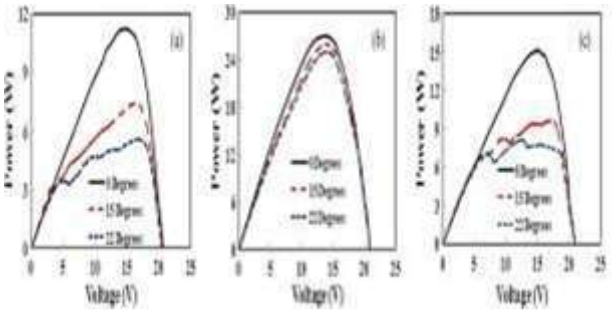

Fig. 4. Comparison Of Pv Characteristics Of Flat And Curved

Fpv Modules At Different Times And Corresponding Esa Of Theday. (A) AT 8:00 A.M., 27◦. (B) AT1:00 P.M., 95◦. (C) AT 4:15 A.M., 140 With above motherboard we are annoying to achieve about the same values of power-voltage graph.

IV. Conclusion

In this paper we attempted to quantify parameters of sunlight based boards, for example, Voltage, current, power, temperature and force of light utilizing PIC16F877A microcontroller. Digital show can be utilized to show estimations of these parameters. PIC microcontroller can be utilized to quantify simple estimations of these detected parameters and simple to computerized to converter which is in worked in PIC microcontroller can be utilized to gauge estimations of these parameters. There are numerous approaches to detect voltage. Be that as it may, in this proposed work we can without much of a stretch measure voltage of sun based board utilizing voltage divider. Two capacitors are associate parallel to voltage estimation resistor to stay away from voltage variance and dodge sounds to go into ADC of PIC microcontroller Here we have utilized differential intensifier to enhance voltage showing up crosswise over shunt resistor, since current esteem might be excessively high and excessively low in various timings.

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