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Solar Panel Tracker Using PIC Microcontroller 16F628A

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Abstract: *Energy sources are of two types renewable and non-renewable. 'Renewable' resources are those that recover their capacity in a time significant by human needs. Examples are sun light or wind power, when natural phenomenon that are the primary source of energy are going and not depleted by human demands. Now days, sometimes we complete our demand of electricity with the help of solar energy. This is done with the help of solar panels. By maintaining the solar panel always perpendicular to the incident sun rays we can receive maximum amount of energy. For this purpose, we have to set the tracker below the solar panel which always sets the panel orientation towards maximum intensity.*

Keywords: Solar Panel Tracker.

I. INTRODUCTION

Generally, the technology elaborates most of the concept from physics branch. By using the simple concepts of physics, we design application-based circuits for day-to-day life. In this project I focused on PIC microcontroller IC 16F628A, which gives low power consumption and high speed with voltage comparator.

Energy sources are of two types renewable and non-renewable. 'Renewable' resources are those that recover their capacity in a time significant by human needs. Examples are sun light or wind power, when natural phenomenon that are the primary source of energy are going and not depleted by human demands. Now days, sometimes we complete our demand of electricity with the help of solar energy. This is done with the help of solar panels. But main fact is that, only in the day time, hardly for 8 hours we can store maximum up to 40 percent of incident light falls on the panels. By maintaining the solar panel always perpendicular to the incident sun rays we can receive maximum amount of energy. For this purpose, we have to set the tracker below the solar panel which always sets the panel orientation towards maximum intensity.

With the help of newly designed "pic basic pro" language and PIC microcontroller series we can co-design hardware and software. We can easily design the small scales sensing circuit with the help of PIC microcontroller. With the help of PIC microcontroller, we can design the small scales embedded systems.

II. OBJECTIVES

1. To find out the appropriate sensor for the detection of small variation in light intensity and easily convert into electrical signal.
2. To study Pic basic pro language for interfacing the hardware parts using pic microcontroller.
3. To construct the circuit which can be easily detect the maximum light intensity and automatic track towards maximum intensity.
4. Using this technique, we can easily capture maximum intensity in same time as done in early method. This method is eco-friendly and convenient too.

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III. METHODOLOGY

This research work was totally laboratory work. The research work was completed by following methods:

- Selection method: An appropriate sensor was selected. A Light Dependent Resistor (LDR) with voltage divider mode was selected for light sensing purpose. And for tracking purpose stepper motor was selected with 7.5^0 angle.
- Microcode Studio was downloaded and installed with appropriate version as per report. With help of pic basic pro programming the working of software was monitored by simple program.
- IC-16F628A was selected as microcontroller. Because it has inbuilt oscillator, therefore no need to install extra oscillator crystal for processing purpose. Also, This IC provides 2 comparators. I used this IC because PIC 16F628A has 2 analog comparator and there are 8 comparator configurations according to content of CMCON register.
- The microcontroller circuit was constructed /soldered on PCB along with driver IC ULN-2003 for stepper motor. Separate sensor circuit was soldered.
- Then with appropriate program IC 16F628A was burned with the help of PIC KIT and Melabs programmer.
- Then Burned IC of pic microcontroller was connected in soldered circuit.

IV. EXPERIMENTAL

4.1 Operation of Instruments

1. All instruments were arranged in proper manner in such a position to detect the intensity of source of light.
2. Ensured the proper connection of the circuit as per the circuit diagram.
3. Make the power supply ON for the instruments and all sources and relevant IC's terminal properly grounded.
4. It is observed that, panel moved towards high intensity of light.

4.2 Working of Microcontroller

The microcontroller used in the present experiment is 16F628A. This consists of analog to digital converters which converts the analog voltages in the digital form. The analog signal connected to pin AN2 and reference signal is connected to pin AN1.

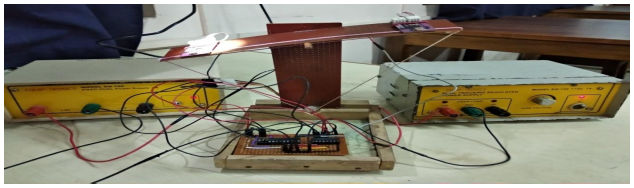
When light intensity is high (i.e. the measured voltage variable is higher than reference voltage) then Bit 1 of CMCON will be set. If the intensity of light is low than the reference voltage then Bit 0 of CMCON will be set.

The stepper motor used has programmed in such a way that if comparator signal is 1 then the stepper motor moved forward which will rotate the panel in the direction of light having higher intensity. If the digital signal is 0 bit then stepper motor will move in reverse direction indicating that the measuring light is having low intensity than reference signal.

Index Position	Y2	Y1	X2	X1
1	1	0	0	1
2	1	0	1	0
3	0	1	1	0
4	0	1	0	1

This is the sequence for stepper motor to move clockwise direction with 7.5 degree per step.

When tracker moving towards high intensity:



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4.3 Applications

1. Maximum power output from solar panel is desirable to increase efficiency. In order to maximize power output from the solar panels, one needs to keep the panel aligned with the sun. As such, a means of tracking the sun is required. This is far more cost-effective solution than purchasing additional solar panel. It has been estimated that the yield from solar panels can be increased by 30 to 60% by utilizing tracking system instead of stationary array. This project can be developing an automatic tracking system which will keep the solar panel aligned with the sin in order to maximize the efficiency.
2. We use high sensitivity light sensor that sensor should detect the light intensity in longer distance.
3. To move the robot, we can use such automatic system.

V. CONCLUSION

This project will provide cheap circuit for solar panels for tracking purpose. This circuit will elaborate the use of Pic microcontroller in small scale embedded systems. This project will show the co-designing of hardware and software to develop electronic firm.

VI. FUTURE ENHANCEMENT

1. The stepper motor move with the angle of 7.5 degree at each step. The accuracy of movement of stepper motor can be increased by increasing the number of steps in 7.5 degree movement.
2. We can use another IC of greater efficiency.
3. We can use photo diode instead of LDR.

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