GPS BASED SOLAR TRACKING SYSTEM

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Abstract

The aim of the project is to develop a GPS based system interfaced with the ATMEGA328P micro-controller to determine the exact position of the Sun, which will be then used as the input to determine position of the solar panel. The solar panel converts the energy from the Sun into the electric signal which is then used to charge a 12V Lithium battery.

Keywords: Solar panel, ATMEGA328P micro-controller, Azimuth angle, MG 996R, Charge-controller.

1. INTRODUCTION

Since the ancient time, humans have been fascinated by the sun. In the Indian culture the sun is worshipped as a god. Agriculture totally relies on the sun. To utilize the solar power, photovoltaic panels are being used.

Solar power is a form of energy harnessed from the power and heat of the sun's rays. It is renewable, and therefore a "green" source of energy.

The most common way of harnessing energy from the sun is through photovoltaic (PV) panels – those large, mirror-like panels you've likely seen on rooftops, handheld solar devices, and even space crafts. These panels operate as conductors, taking in the sun's rays, heating up, and creating energy (and electricity). On a larger scale, solar thermal power plants also harness the power of the sun to create energy. These plants utilize the sun's heat to boil water and, in turn, power steam turbines. These plants can supply power to thousands of people.

A solar tracker is a device that orients a payload toward the Sun. Payloads are usually solar panels, parabolic troughs, Fresnel, reflectors, lenses or the mirrors of a heliostat. For flat-panel photovoltaic systems, trackers are used to minimize the angle of incidence between the incoming sunlight and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity.

In concentrator photovoltaic (CPV) and concentrated solar power (CSP) applications, trackers are used to enable the optical components in the CPV and CSP systems. The optics in concentrated solar applications accept the direct component of sunlight light and therefore must be oriented appropriately to collect energy. Tracking systems are found in all concentrator applications because such systems collect the sun's energy with maximum efficiency when the optical axis is aligned with incident solar radiation.

The conventional systems are designed using the LDR sensor interfaced with the micro-controller. The LDR sensor senses the intensity of the light rays falling on it to carry out its calculation. The major disadvantage of the system designed using LDR sensor lies in the fact that, there is a continuous change in the intensity of the light because of the various obstructions in its path.

This continuous change is sensed by the LDR sensor resulting in the continuous change in the position of the solar panel. Thus consuming more power and increasing the chances of the wear and tear of the system.

To overcome the disadvantages of the above system, a better and a more efficient system is designed using the GPS module along with the ATMEGA328P micro-controller. This new and more efficient system now determines the position of Sun using GPS module, instead of using the LDR

sensors. As a result, the system is stable even though there is a change in the intensity of the Sun. The new system consumes less power and gives better stability.

2. Design and Implementation

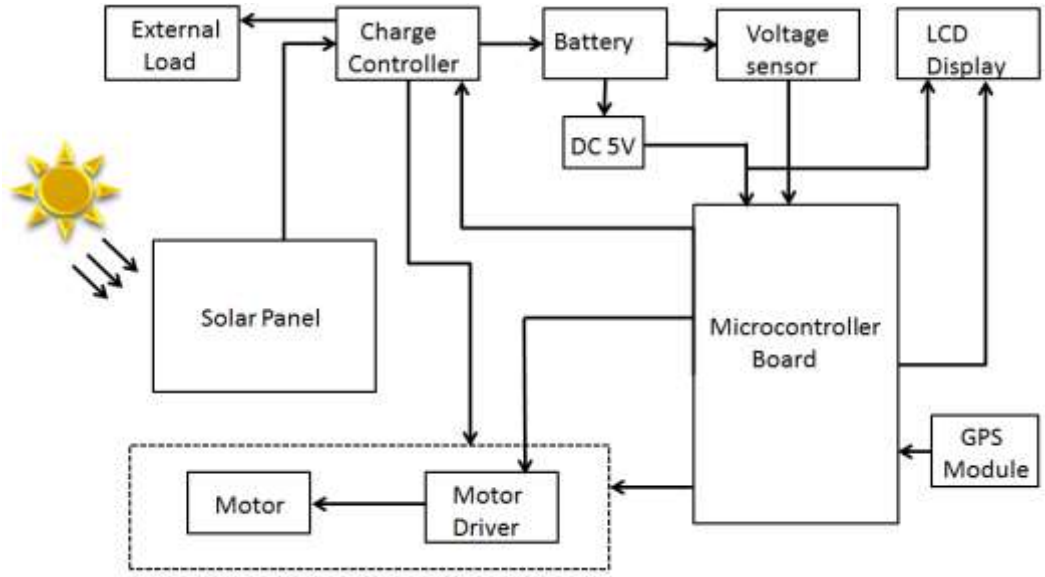

Figure 1. Block Diagram of GPS based Solar Tracking system

Hardware used in the GPS Based Solar Tracking System following is listed below:

- Voltage regulator
- Microcontroller (ATMEGA328P)
- Motor driver
- Servo motor(MG996R)
- GPS module(NEO-6 u-blox 6 GPS Modules)
- Battery(12 V)
- Charge controller
- Voltage sensor
- 20x4 LCD
- Solar panel

The above system works as below:

Very first the GPS will track the position of the sun. This information is received by the GPS module which we are using in our system. The information collected is sent to the micro-controller ATMEGA328P. Microcontroller will know the current position of the sun and thus will send the control signal to the motor driver for driving the servo motor. Solar panel is fitted in the way that the motor is able to move it horizontally in the appropriate position every time. The reason for using servo motor is its high torque and its ability to move for desired angle.

Microcontroller will also send various information like time, position of the solar panel in degrees to the LCD to display it.

Solar panel will convert the solar energy into 10 Watt electric power. The voltage and current from the solar panel is variable. To charge the battery from this we need to stabilize the voltage by keeping the incoming power constant. This will be done by the buck boost converter. To avoid the overcharging and deep discharging of battery we are going to use the charge controller. This will increase the life expectancy of the battery. Voltage sensor will sense the voltage and give the information to the microcontroller according to which the microcontroller will generate the control signal for the charge controller. The power from the battery is used by microcontroller, LCD, Motor. We will also use this power for other applications.

3. Advantages

- It conserves the non-renewable energy resources.
- The amount of waste and pollution is decreased.
- System using trackers generates more electricity than stationary solar panels.
- Use of GPS increase the life expectancy of solar panel.

4. Limitations

- It does not track the sun in the vertical axis.
- It takes more time to install.

5. Conclusion

In conclusion, we come to know that solar system with tracker will generate more power than conventional solar system without trackers.

A system to detect the position of the Sun using the GPS module along with ATMEGA328P micro-controller has been designed. The model so designed is far more efficient and reliable than the system designed using the LDR and microcontroller. The position of the solar panel will change depending upon the position of Sun tracked by GPS module along with the microcontroller.

This will drastically improve the life expectancy of the solar panel as well the overall efficiency of the system. The output of the system i.e. the battery charged with the power obtained from the solar panel can be used in applications depending upon the need of the end user.

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References

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[2] Dhanabal, Bharati, Ranjitha, Ponni,Deepthi, and Mageshkannan, “Comparison of Efficiencies of Solar Tracker Systems with static panel Single-Axis Tracking System and Dual-Axis Tracking System with Fixed Mount,” International Journal of Engineering and Technology, vol. 5, no. 2, pp. 1925, May 2013.

Datasheets

[1] 20 x 4 Character LCD
[2] NEO-6 u-blox 6 GPS Modules
[3] IRF9540N
[4] IRFZ44
[5] MG996R