AUTOMATIC SOLAR TRACKING SYSTEM USING MPPT

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Abstract

Today the demand of electricity in India is increasing and is already more than the production of electricity whereas the reserves of the fossil fuel are depleting every day Solar tracker and the components which made up Solar Tracker. Solar cells are converters. They take energy from the sunlight and convert that energy into electricity this fact from the electricity-cuts during summer. Luckily sun throws so much energy over India, that if we can trap few minutes of solar energy falling over India we can provide India with electricity for whole year. A solar tracker is a device for orienting a solar photovoltaic panel, day lighting reflector or concentrating solar reflector or lens toward the sun. Solar power generation works best when pointed directly at the sun, so a solar tracker can increase the effectiveness of such equipment over any fixed position. The solar panels must be perpendicular to the sun's rays for maximum energy generation. Deviating from this optimum angle will decrease the efficiency of energy generation from the panels.

In our system there is a special priority to ambulance and fire brigade. A smart card is issued to all the ambulances and the fire brigade buses which will be detected at the signal and will be allowed to pass the signal without any interruption.

Keywords— solar energy ,MPPT,electrical energy, photovoltaic panel

Introduction

Most of the electricity in India comes from fossil fuels like coal, oil and natural gas. Today the demand of electricity in India is increasing and is already more than the production of electricity whereas the reserves f the fossil fuel are depleting every day. We can feel this fact from the electricity-cuts during summer. Luckily sun throws so much energy over India, that if we can trap few minutes of solar energy falling over India we can provide India with electricity for whole year. Most parts of India get 7KWH/sq-meter of energy per day averaged over a year. The main aim of this project is to generate the maximum power from solar panel by continuously tracking the sun rays.The purpose of the project is to implement a system to continuously track the sun rays with the help of the solar panel and grasp the maximum power from the sun by rotating the solar panel according to the sun rays direction. In present situation everyone is facing the problem with power cuts which is creating very much trouble to the people. So, to solve this problem we have a solution that is the sun. By using sun radiation we can get power i.e., the solar energy using which we generate the power

Block Diagram:

An automated solar tracker allows the panel to perform an approximate 3-dimensional (3-D)
hemispheroidal rotation to track the sun's movement during the day in order to maximize in harvesting solar power. Light gathering is dependent on the angle of incidence of the light source providing power (i.e. the sun) to the solar cell's surface. Day sunlight will have an angle of incidence close to 90°in the morning and the evening. At such an angle, the light gathering ability of the cell is essentially zero, resulting in no output. As the day progresses to midday, the angle of incidence approaches 0°, causing a steady increase in power until at the point where the light incident on the panel is closer to perpendicular and maximum power is achieved. From this background, we see the need to maintain the maximum power output from the panel by maintaining an angle of incidence as close to 0° as possible. By tilting the solar panel to continuously face the sun, this can be achieved. This process of sensing and following the position of the sun is known as Solar Tracking. Two LDR light detectors act as sensors to trace the coordinate of the Sunlight by detecting brightness level of Sunlight. ☐ ☐ When LDR1 has higher light intensity than LDR2 then the resistance of LDR1 is smaller than that of LDR2 then voltage at CH-1 is higher than that of CH-2 and the DC motor rotates the solar panel in the counter clockwise direction. When LDR2 has higher light intensity than

LDR1 then the resistance of LDR1 is larger than that of LDR2 then voltage at CH-1 is smaller than that of CH-2 and the DC motor rotates the solar panel in the clockwise direction. The stable position is when the two LDRs

having the same light intensity The system is controlled by a microcontroller as the main processor. When the intensity of Sunlight is decreasing, this system automatically changes its direction to get maximum intensity of Sunlight and generate maximum power at the output
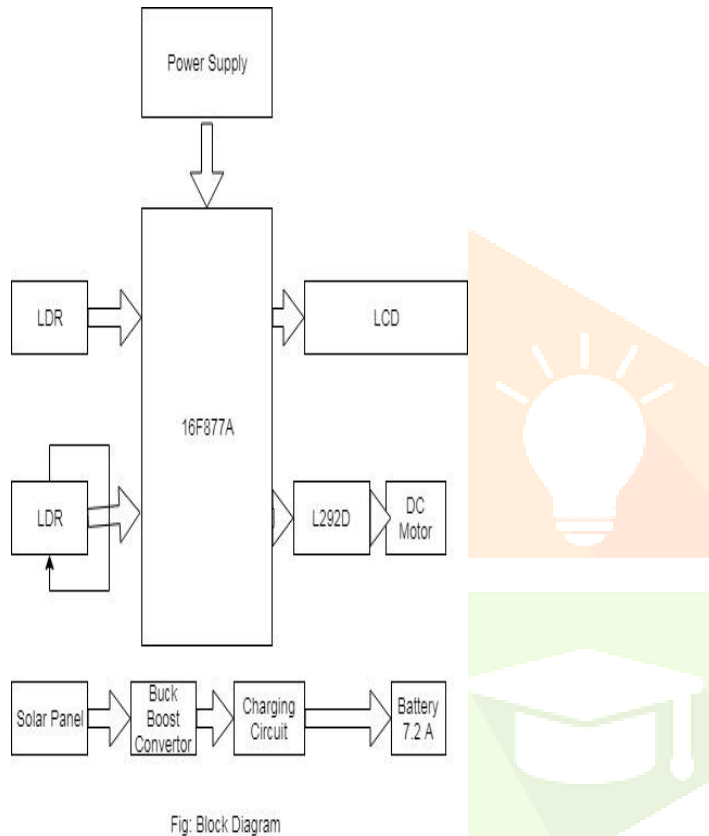

Fig: LCD Display

Fig: Block Diagram

LCD Display:

LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16 X 2 LCD display is very basic module and is very commonly used in various devices and circuits.

A 16 x 2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5 x 7 pixel matrix. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).
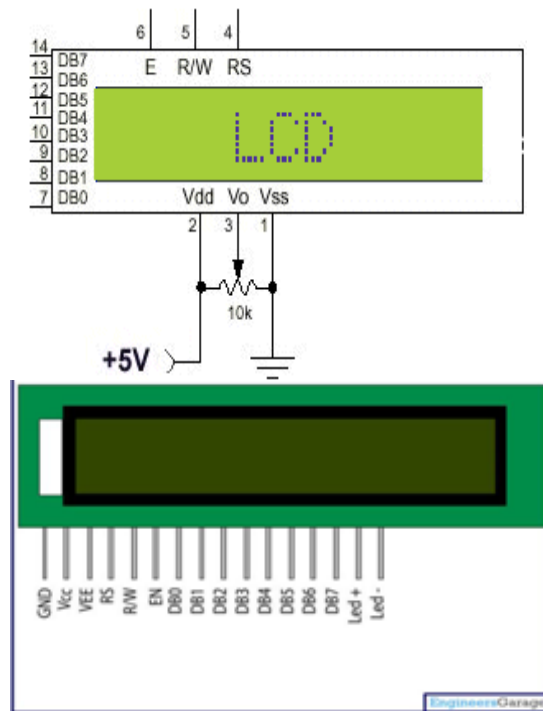
DC Motor:

Fig 4.5: Simple dc motor

The above fig 4.2. shows the simple DC motor. A DC motor is any of a class of electrical machine that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by the magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; linear motor directly produces force and motion in a straight line. DC motor speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

Capacitor C_f is used to prevent oscillation or gain peaking and to set the output bandwidth ($1/2\pi RC$).

Fig: DC Motor

Solar panel

Solar Panel converts solar energy into electrical energy. It works on the photovoltaic principle. It consists of number of solar cells connected in series or in array. As solar ray's falls on the solar panel, solar cells are charged. According to the charging capacity of solar cell, we get voltage at the output of solar panel.

Solar panel conversion efficiency, typically in the 20 percent range, is reduced by dust, grime, pollen, and other particulates that accumulate on the solar panel. "A dirty solar panel can reduce its power capabilities by up to 30 percent in high dust/pollen or desert areas", says Seamus Curran, associate professor of physics at the University of Houston and director of the Institute for Nano Energy, which specializes in the design, engineering, and assembly of nanostructures.

Fig: Solar Panel

Photovoltaic is the field of technology and research related to the application of solar cells for energy production by converting sun energy (sunlight, including sun ultra violet radiation) directly into electricity by the photovoltaic effect. The latter refers to the process of converting light (photons) to electricity (voltage). Solar cells are photovoltaic devices that use semi-conducting materials to convert sunlight directly into electricity. When sunlight is absorbed by these materials, it causes electrons to flow through the material generating electric currents. Solar cells produce direct current electricity. There are two broad categories of solar cells; thin film and crystalline.

The key components of a photovoltaic power system are the photovoltaic cells (also called solar cells) interconnected and encapsulated to form a photovoltaic module (the commercial product), the mounting structure for the module or array (several modules mounted and interconnected together to produce a desired voltage and current (power capacity), the inverter (essential for grid-connected systems and required for many off-grid systems), the storage battery and the charge controller(for off-grid systems only). Solar cells are typically combined into modules that hold up to 40 cells to generate substantial voltages (typically 12 V or 24V) and currents that can be used to power various devices. The power output of a module is measured

under standardized test conditions in Watt Peak .

Solar panels are similar to the windows in your car, home or business. They get dirty from rain, dust, pollen, soot, smog, auto emissions, chimney ashes, bird droppings, leaves and other environmental debris. This dirt and debris blocks sunlight from being absorbed into the panels, decreasing their efficiency. The result is less energy for use in your business or for sale to your utility company.

Buck Boost Convertor:

The basic schematic of a buck-boost converter. Two different topologies are called buck–boost converter. Both of them can produce an output voltage much larger (in absolute magnitude) than the input voltage. Both of them can produce a wide range of output voltage from that maximum output voltage to almost zero.

- The inverting topology – The output voltage is of the opposite polarity as the input

A buck (step-down) converter followed by– boost (step-up) converter. The output voltage is of the same polarity as the input, and can be lower or higher than the input. Such a non-inverting buck-boost converter may use a single inductor that is used as both the buck inductor and the boost inductor.
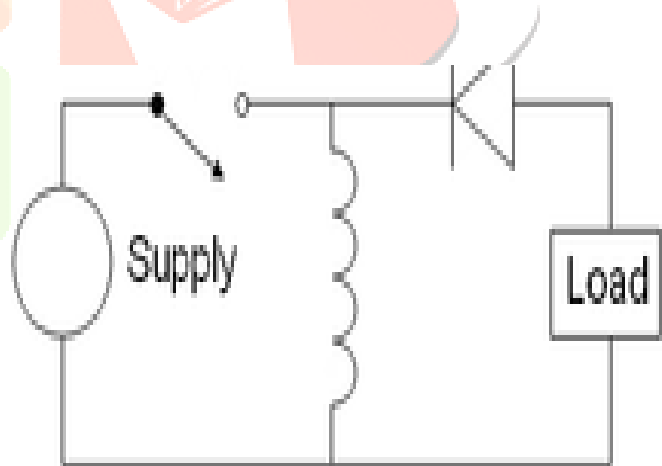

Fig: Buck Boost Convertor.

This page describes the inverting topology. The buck–boost converter is a type of that has an output voltage magnitude that is either greater than or less than the input voltage magnitude. It is a switched-mode power supply with a similar circuit topology to the boost converter and the buck converter. The output voltage is adjustable based on the duty cycle of the switching transistor. One possible drawback of this converter is that the switch does not have a terminal at ground; this complicates the driving circuitry. Also, the polarity of the output voltage is opposite the input voltage. Neither drawback is of any consequence if the

power supply is isolated from the load circuit (if, for example, the supply is a battery) as the supply and diode polarity can simply be reversed. The switch can be on either the ground side or the supply side.

Principle of operation:

The basic principle of the buck–boost converter is fairly simple (see figure 2):

- While in the On-state, the input voltage source is directly connected to the inductor (L). This results in accumulating energy in L. In this stage, the capacitor supplies energy to the output load.
- While in the Off-state, the inductor is connected to the output load and capacitor, so energy is transferred from L to C and R.

Compared to the buck and boost converters, the characteristics of the buck–boost converter are mainly:

•   Polarity of the output voltage is opposite to that of the input;

•   The output voltage can vary continuously from 0 to (for an ideal converter). The output voltage ranges for a buck and a boost converter are respectively 0 to and to

Fig: Principle of operation.

Advantages:

1) Increased reliability
2) Flexibility
3) Redundancy by design
4) Reduced maintenance costs
5) Less expensive parts
6) Ease of expansion
7) Solar trackers generate more electricity.
8) Solar cookers are do not required fuel.

Disadvantages:

High Initial and maintenance cost

Applications:

- Marine application
- Telecommunication protection
- Mining
- prime power
- Grid code
- For street lights.
- Industries.
- School/College.
- Roof top.
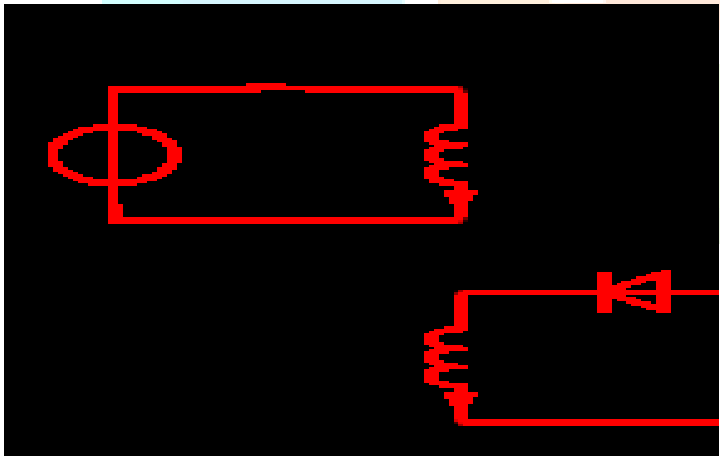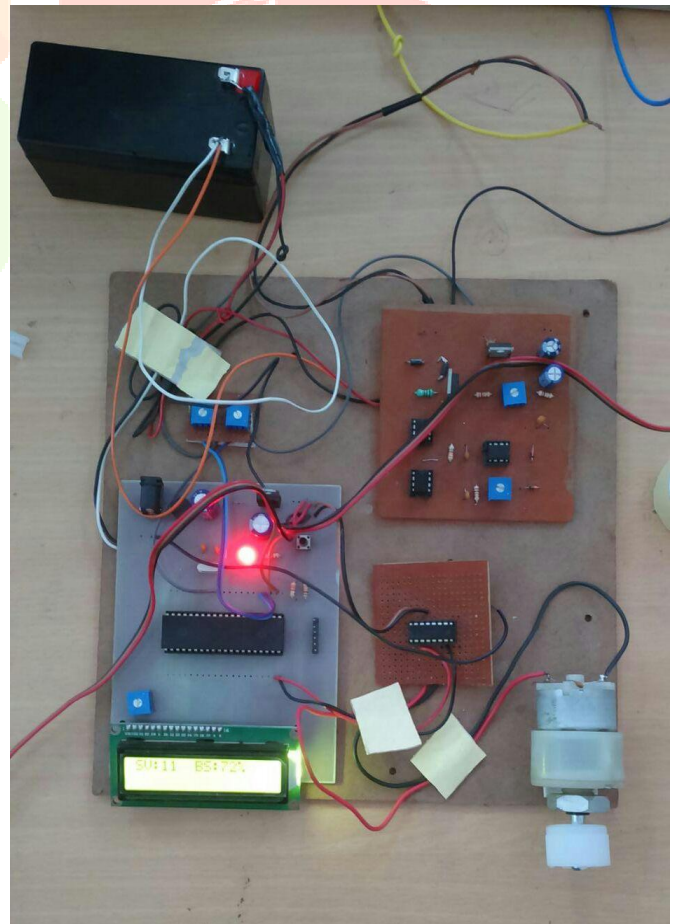- In satellite.
- Agriculture
- Mobile construction

Result:

Future Scope and Conclusion:

We have developed a device in which Voltage and Frequency of two alternators are continuously displayed. And it also shows whether the phase sequence is correct or not. When all conditions of synchronization satisfy, two alternators are synchronized with the help of Contactor. Thus our device can use in power station to synchronize alternator with bus quickly. Future Scope• In Future the conventional energy is not sufficient for use so there is need of use non conventional energy sources .In rural areas where we can use high sensitive solar panels which can work in mild sun light also and by connecting number of solar tracker assemblies we will able to produce sufficient large quantity of power which will be able to supply power to medium size village. We can make use of solar panels in our day to day life for street lighting, in mobile phone chargers, water heaters, etc.

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