DESIGN AND SIMULATION OF SUN TRACKING SOLAR POWER SYSTEM

Mahesh obannavar[1], Bhutharaju M[2], Shreedhar B[3] Channamma[4], Akshatha M[5]

[1]Assistant Professor, EEE Dept. PDIT Engineeering College, Hosapete, Karnataka,

[2]Student, Final Year, EEE Dept., PDIT Engineeering College, Hosapete, Karnataka,

[3]Student, Final Year, EEE Dept., PDIT Engineeering College, Hosapete, Karnataka,

[4]Student, Final Year, EEE Dept., PDIT Engineeering College, Hosapete, Karnataka,

[5]Student, Final Year, EEE Dept., PDIT Engineeering College, Hosapete, Karnataka.

I. ABSTRACT:

Global energy consumption is increasing dramatically due to higher standard of living and the increasing world population. The world has limited fossil and oil resources. As a consequence, the need for renewable energy sources becomes necessary factor. With the fast development of renewable energy technology, it proposes increasing demand for the higher education.

As part of the objectives of the project, a solar energy tracking rotational panel for power generation will be designed and developed as tool for power consuming loads. This paper describes the design of a solar energy tracking rotational panel for power generation. The design consists of four modules: solar energy tracking panels, signal conditioning circuit, Arduino, and motor. The design provides an excellent platform for undergraduate engineering technology students to study the concept of solar energy and alternate source for energy saving.

***KEYWORDS**: Arduino, Renewable energy Solar tracker, Sensors, .Servo motor.*

II. INTRODUCTION:

Solar energy is heat and radiant light from the sun that is imparted using a range of emerging technologies such as solar heating, photo voltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.

It is an important factor of renewable energy and its applications are broadly characterized as either passive solar or active solar based on how they capture and distribute solar energy or convert it into solar power (1).

Active solar technology includes the use of photovoltaic's concentrated solar power and water heating by solar to impart the energy. Passive solar technology includes exploring building to the Sun, selecting materials which support thermal mass or light-dispersing characteristics, and designing factors that circulate natural air.

The solar energy tracker follows the sun rays from east to west during the day time. More energy is collected by the solar panel like a sunflower with 0 to 180^0.

The efficiency of the photovoltaic (PV) system depends on the climate criteria of solar radiation, temperature and wind speed, matching of the Photovoltaic system with the load factor and placement of the solar panels appropriately (2). Most of solar panels what we use today are stationary based and they do not posses consistently for maximum power output. A solar energy tracker will track the sun rays throughout the day and adjust the angle itself

automatically to make the sun rays available to the solar panels at all times.

The rotation of the solar panels increase the efficiency of the energy conversion from 20% to 50%. When the sun rays are exactly normal to solar panel maximum energy generated and respond The The main components in the solar system are photovoltaic solar panels (PV), rechargeable battery, Arduino, Servo motor, sensors.

IV. OBJECTIVES OF THE PROJECT:

The proposed project has a set of objectives which are as follows:

solar rays as time lapses hour by hour. The Arduino gives an output to the servo motor based on the difference of voltages move the solar panel to be normal toward maximum sun rays.

III.PROPOSED BLOCK DIAGRAM

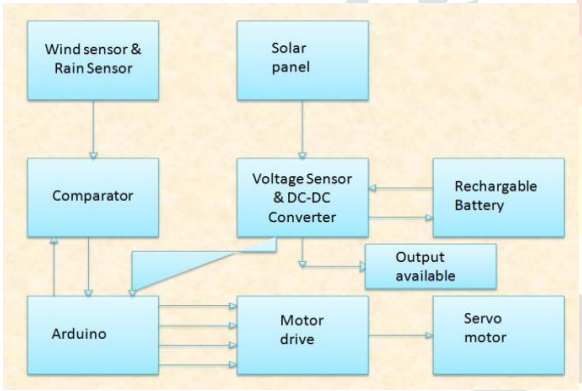


Fig: Block diagram of proposed project

How the Tracker follow the Sun?

A.Sunrise "Wake- Up:

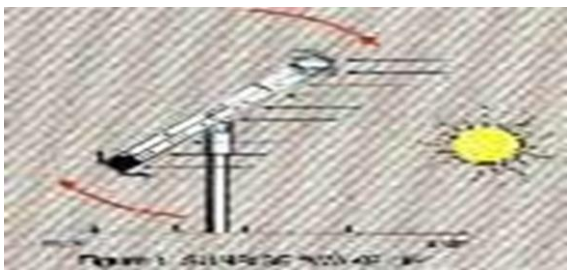


Fig: Sunrise "Wake- Up direction

- To increase the solar power output to a range of 30 to 80% by using a sunflower model
- To use direct DC power from Solar PV Power Source to run the motor since there is continuous supply and can be converted to AC power by using inverter.
- To conserve the AC energy from generating power of the grid
- To implement automatic switching mechanism from DC to AC during inadequate supply of DC

V. METHODOLOGY

- We use a revolving sunflower solar panel, light detecting sensor and Arduino will efficiently generate power throughout the day and increase the power efficiency up to 90%
- Solar tracker tracks maximum solar energy. This energy can be used by converting it into other forms.
- Solar tracker is the device which orients solar panel towards the Sun.

The Solar Track Rack begins the day facing west. As the sun rises during morning, the sun radiation falls on the solar panel, arduino will detect voltage and sends informational signal to servo motor to rotate towards the east (3).

B. Mid-Morning:

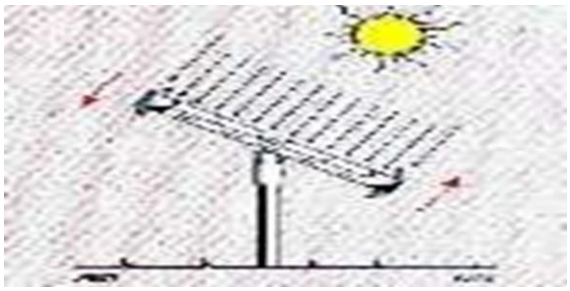


Fig: Mid-Morning direction

As the sun rises, the solar energy tracking panel also detect the angle, where its gets maximum energy absorption and accordingly turn towards that direction.

C. Mid-Afternoon:

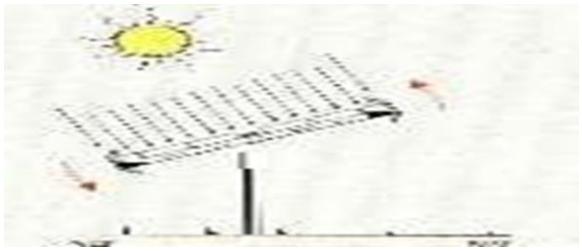


Fig: Mid-Afternoon direction

The Sun energy tracking Rack follows (at approximately 15^{o} per hour), continually moving from one side to another as per sun radiations.

D. Sunset:

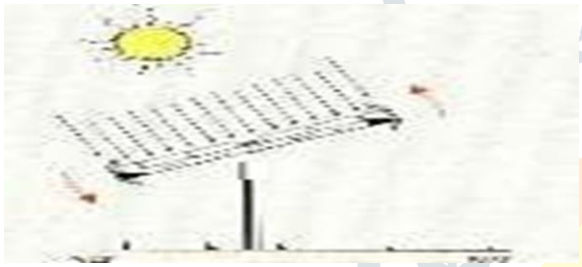


Fig: Sunset direction

The Sun energy tracking Rack completes its rotation cycle facing west. It remains at this position for whole night until it is "awakened" by rising sun.

Three solar panels are used for solar energy absorption and obtain information on the sun angle. Accordingly rotate the solar panels towards the where high sun rays available. The solar panel provides all the power for the system and charges the battery (4).

They are mounted on 45 degrees to detect the particular angle in which the solar energy tracking panel must face to gain power output as maximum as possible (5).

VI. OUTCOME OF THE PROJECT:

- At the end, this system gives alternate way for renewable energy source.
- The solar energy tracking rotational panel for power generation will be operated based on climate conditions using smart technology.
- The life span of solar energy tracking rotational panel can be increased by operating according to climate condition.
- The efficiency of solar panel can be increased up to 90% by sunflower model.

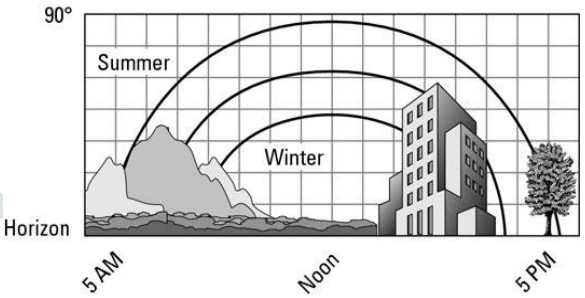
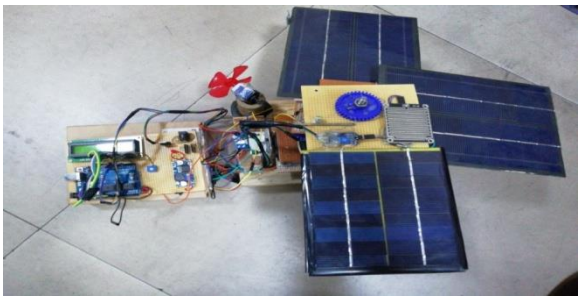


Fig: Graphical representation of sun intensity in different region

VII. APPLICATIONS OF THE PROJECT:

- Solar Tracker produces up to 45% more energy than a fixed roof system
- Street light applications without using normal power supplies.
- In Remote areas implementing a small power systems units at each home.
- Using this system to getting continuous hot water due to rotating solar panels .

VIII. FINAL DESIGN OF THE PROJECT



IX. CONCLUSION:

In this paper, we introduce a low maintenance and effective utilization of renewable energy system using arduino and sensors and by this concept we can fulfill the energy demand, saving of more space, The energy can generated throughout the day, The generated additional energy can be connect to the grid system.

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Fig: Final design of the Solarflower project

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