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Nocturnal Solar Energy Harvesting Using Conventional Photovoltaic (PV) Panel and IR Transmitter

J.Ramesh[1], Assistant Professor[1],
P. Denish Arokiya raj[2], P.Pasupathi[3], R. Rajkumar[4],
G. Amithan[5] , UG Students [2, 3,4,5]
Department of Electrical and Electronics Engineering,
. R Radhakrishnan[6], Assistant Professor, Department of Electronics and communication Engineering,
St. Anne's College of Engineering & Technology, Panruti.
rameshbluesky@gmail.com[1]

Abstract:

Solar energy has the sources of renewable energy. Its latent is 178 Billion MW that is concerning 20,000 times the world's demand. Solar power is that the most plentiful stream of energy. During this work we have a tendency to use the solar power for production of voltage, by victimization the solar cells. The solar cells receive the solar power. The solar cells operate the photo-electric energy by victimization solar cells principle. The energy from the photo voltaic cells is employed to change on the lights [2]. To introduce the solar pursuit to the prevailing fastened solar panels, so we have a tendency to square measure maintaining the constant most power output. At the present solar power production systems square measure having fastened solar panels whose potency of production is a smaller amount. So by victimization this pursuit system we will increase the conversion potency of the solar power production and IR transmitter and receiver is employed to come up with the wattage with the assistance of solar array once sun light-weight isn't on the market. For this pursuit purpose we have a tendency to use a detector and therefore the input from the detector is given to the Arduino microcontroller and in keeping with the program the panel is fastened to the utmost intensity position.

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Keywords: **Solar PV, Photovoltaic, Nocturnal, IR transmitter.**

I. INTRODUCTION

Sun is that the main supply of Energy. A number of the solar power causes evaporation of water, foremost to rains and creation of rivers etc. a number of it's utilized in chemical action that is crucial for sustenance of life on earth. Man has tried from past times to harness this infinite supply of energy. the world receives sixteen x 1018 units of energy from the sun annually, that is twenty,000 times the necessity of group on the world. However has been able to faucet solely a negligibly fraction of this energy until nowadays.

The broad classes of attainable massive scale applications of solar energy square measure the heating and cooling of economic and residential buildings.

The Biological and chemical conversion of organic material to liquid solid and gaseous fuels.

Transfer of solar energy to Electricity.

In this project we use the solar energy for the production of electrical energy, by using solar cells.

The solar cell receives the solar energy. The solar cells operate on the principle of photovoltaic effect, by using solar cells. Basically the cells are placed in an open and fixed manner.

1.1. Energy Scenario

Forceful changes in energy conversion system square measure anticipated thanks to shortage of typical fuels. Fuel deposit within the world can shortly spend by the tip of 2020. The most reasons for the on top of square measure thanks to increasing demand for electricity, rising population, fast advance in technology.

It's worthy to say here that indiscriminate use of economic energy has cause serious atmosphere issues like air and water pollutions. Man, once he's embarking on use of alternate sources of energy ought to bear in mind, his atmosphere. The creation of latest supply of perennial environmentally acceptable, low price current as a replacement for energy from chop-chop depleting resources of fossil fuels is that the basic would like for the survival of group [3].

1.2 Solar Energy Operations

Solar power has the best potential of all the sources of renewable energy and it'll be one among the foremost vital sources of energy particularly once alternative sources within the country have depleted. Solar power may provide all the current and future energy wants of the globe on a connecting basis. This makes it one among the foremost promising of the nonconventional energy sources. Solar power may be a significant supply of power. Its potential is 178 billion MW that is regarding 20,000 times the worlds demand. The energy radiated by the sun on a bright sunny day is some 1kw/m2.

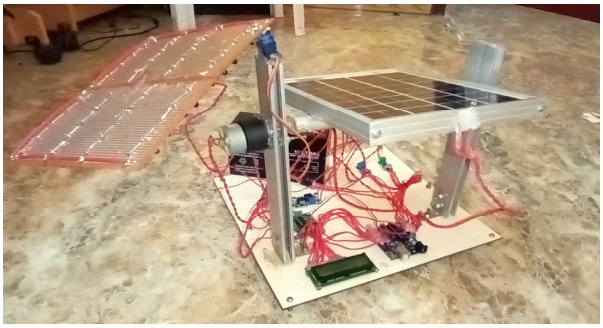


Fig.1.2 solar tracking system

The problem associated with the use of solar energy is that its accessibility varies widely with time. The variations in availability occur daily, because of the day-night cycle and also seasonally because of Earth's orbit around the sun. Consequently the energy collected with the sun is shining must be stored for use during periods when it is not available. In addition variations occur at a specific location because of local weather conditions.

1.3. Photo Voltaic Effect on Semiconductors

Semi conductor's used to measure materials that square measure neither conductors nor insulators. The picture voltaic result may be ascertained in nature in an exceedingly type of materials however semiconductors has shown best performance.

Once photons from the sun square measure captivated in an exceedingly semiconductor they produce for electrons with higher energies than the electrons which offer the boarding within the base crystal.

Once these electrons square measure created, there should be an electrical field to induce these higher energy electrons to emanate of the semiconductor to try to to helpful work. The electrical field in most star cells is provided by a junction of materials that have completely different electrical properties.

1.4 Purification and Reformation into Wafers

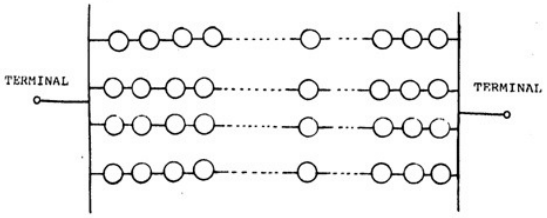
The purification process basically entails high temperature melting of the sand and simultaneous reduction in the presence of hydrogen. There are two methods namely czochralski growth method and film fed growth. The former method produces single, cylindrical crystals and later produces continuous ribbon of silicon crystals this leads to an awfully pure crystalline kind of chemical element. Ensuing step is to reform this chemical element into one crystal and so cut the crystal into one crystal and so cut the crystal into individual wafers.

Then this cylindrical crystal and ribbon crystal is remodeled into disc formed cells and rectangular cells by slicing. Then one facet is doped by exposure to heat phosphorus, forming a skinny layer of N sort material. Likewise p sort is created. Electrical contacts square measure applied to the 2 surfaces, Associate in Nursing anti-reflection coating is value-added to the complete surface and therefore the entire cell is then sealed with protecting skin.

1.5 Anti reflective Coating

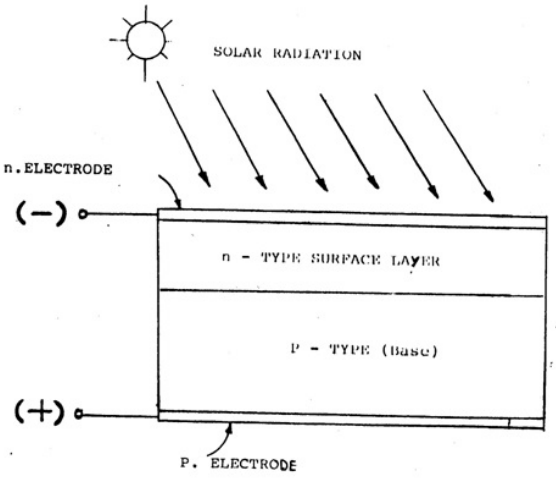
Anti reflective coating (arc) is an significant part of a solar cell since the bare silicon has a reflection coefficient of 0.33 to 0.54 in the spectral range of 0.35 to 1.1 cm. The arc not only reduces the reflection losses but also lowers the surface recombination velocity. A single optimal layer of ARC can reduce the reflection to 10 percent and two layers can reduce the reflection up to 3 percent in desired range of wavelengths.

Generally, Arc's are produced on the solar cell by vacuum evaporation process and the coatings which are tried are SiO_2, SiO, Al_2O_3, TiO_2, Ta_2O_5 and Si_3N_4. Alternative ways of deposition square measure sputtering, spin-on, spray-on or screen printing. Solely the vacuum evaporation sputtering provides smart results however square measure overpriced.



SOLAR CELL ARRANGEMENTS IN SERIES AND PARALLEL

Fig1.5 reflective coating

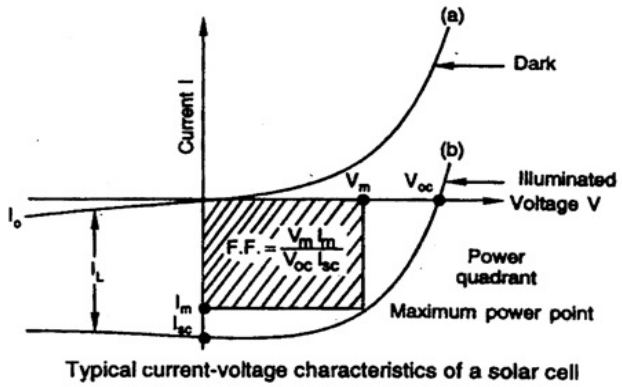


A TYPICAL n – on – p – Photovoltaic

Fig 1.5 Anti reflective

The average reflection can be further reduced by using two antireflective coatings instead of one where the outside (exposed side) coating has an index of refraction 1.3 to 1.6 and therefore the second layer between chemical element and therefore the initial layer has Associate in Nursing index of refraction two.2 to 2.6. This 2 layer ARC offers a much better electrical resistance match between the index of

chemical element and therefore the index of air.



Typical current-voltage characteristics of a solar cell

Fig1.5

II COMPONENTS AND THEIR FUNCTION

The various components of a typical photovoltaic power production system are
Solar photovoltaic array
Battery Bank
Charge Controller
IR Sensor
LDR sensor

2.1 Solar Photovoltaic Array

The solar photovoltaic array consists of a proper number of solar cells associated in series and or parallel to provide the required current and voltage. The array is so tilting as to collect the maximum solar radiation throughout the year.

There may be tracking arrays or modules or fixed arrays. A tracking array is defined as one which is always kept mechanically at right angles to the sun array line so that all times it intercepts the utmost isolation. Such arrays must be physically movable by a suitable prime mover and are generally considerably more complex than fixed arrays. A fixed array is usually oriented east west and tilted up at an angle approximately equal to the latitude of the site. Thus the array design falls into two broad classes.

(I) Flat Plate Arrays

Wherever in solar cells square measure connected with an appropriate adhesive to some quite substrate structure typically semi rigid to stop cells being cracked.
This technology springs from the house connected electrical phenomenon technology and lots of such arrays are in-built varied power sizes.

(II) Concentrating Arrays

Where suitable optics, e.g. Fresnel lenses, parabolic mirrors are combined with photovoltaic cells in an array fashion. This technology is relatively new to photovoltaic in terms of hardware development and comparatively fewer such arrays have really been built.

2.2 Battery Bank

In most alone PV power systems, storage batteries with charge regulators need to be incorporated to produce a backup power supply in periods of low star irradiance and night. Many varieties of accumulator square measure on the market within the marketplace for use in PV power systems. The main requirements to be met by an accumulator for solar power system are,
Ability to withstand several charge/discharge cycle.
A low self discharge rate
Little or no need for maintenance.
The capacity of a battery is the total amount of electricity that can be drawn from a fully charged battery at a fixed discharge rate and electrolyte temperature until the voltage falls to a specified minimum. It is expressed in ampere hour. The capacity of the battery also depends upon the temperature and age of battery [10].

The batteries in most PV systems are of lead acid type consisting of one or more 2v cells. Each cell has a positive plate of lead peroxide and a negative plate of sponge lead. The electrolyte is dilute sulphuric acid. During discharging when current is drawn from it, the material of both plates' changes to lead sulphate and water content in the electrolyte increases thereby reducing its specific gravity.

Once the battery is charged by passing current through it within the other way, the reverse chemical process takes place. The cell voltages square measure usually two.4v and 1.9v for absolutely charged and deeply discharged battery severally. Lead acid batteries self discharge slowly once not in use.

2.3 Charge Controller

Due to the overcharging of some batteries leads to loss of electrolytic, corrosion, plate growth and loss of active material from the plates, inflicting reduction in battery life. Also, the perennial failure to succeed in full charge conjointly ends up in stratification of solution [6].

Thus, there's a desire of charge regulators to optimize the battery life. Most charge regulators begin the charging method with a high current and cut back it to a awfully low level once a definite battery voltage is reached. A digital primarily based charge regulator monitors the battery current, and voltage computes the amount of charge and regulates the input and output currents therefore on avoid each overcharging and excessive discharge.

2.4 Design and Fabrication

The planning and fabrication of a typical star power-driven fan may be explained with the assistance of a diagram. The diagram describes a straightforward star power-driven fan with a manual. allow us to study the diagram intimately by classifying it into 3 sections.
I) Input Section
a) Photovoltaic array

II) Storage Section
a) Battery bank
III) Output Section
Charge controller

i) Input Section

The input section includes photovoltaic arrays consisting of solar cells. The solar cells are connected in parallel to get the maximum current.

The characteristics of the solar cell array are as below:
Type of semi conductor used for cell : silicon
Number of arrays : 1
Power : 3w = 3 watt
Open circuit voltage : 11v

ii) Storage Section

The storage section includes a battery.

The characteristics of the battery are as below:
Type : Lead acid tubular battery
Ampere hour efficiency : 90 to 95%
Watt hour efficiency : 70 to 80%
Capacity: 4.5*2=9 AH, 12V.

The characteristics of controller are as below:
Low voltage cut off
Over charge indication

(iii) Output Section

Output system includes various devices and equipments used for the distribution of the power.

III TESTING

3.1 Conversion Efficiency and Power Output

For each sensible and theoretical reason, not all of the radiation energy falling on a electric cell may be regenerate into current. a particular quantity of energy is needed to provide a electron and a hole in an exceedingly semiconductor. Consequently actinic ray of longer wavelength has no electrical phenomenon result and energy radiation with shorter wavelength cannot be fully utilized [5].

The maximum energy in radiation that's capable of manufacturing free electrons and holes in chemical element is just regarding forty fifth. The utmost sensible potency for conversion of solar power into current in an exceedingly chemical element electric cell is calculable to be regarding 10 percent. The facility output of any generator of electricity, as well as a cell is adequate the merchandise of the voltage and current.

The power output of any generator of electricity, including a photovoltaic cell is equal to the product of the voltage and current.

Theoretically, a silicon solar cell should have a voltage of 1.1 volts, from 1.1 electron volts energy of the free electrons produced. In practice, however, the maximum voltage is about 0.6 volt and this occurs on open circuit, when no power is produced.

The maximum power of a silicon solar cell occurs at an output voltage of approximately 0.45 volt. In full sunlight, the current from a commercial cell is then roughly 270 amperes per sq.m of exposed surface. The power is thus about 0.45x270 = 120 watts. The electric power output of a photovoltaic cell is roughly proportional to the rate at which solar radiation falls on its surface [9].

Most of the solar energy that is not transformed into electricity in a photovoltaic cell is absorbed as heat. In commercial single crystal silicon cell, with a conversion efficiency of about 12 percent, more than 80 per cent of the incident solar energy appears as heat in cell. High conversion efficiencies have been reported with cells made from combination of gallium aluminum and gallium arsenide.

The following specifications are noted down:

- Solar isolation = 800 w/m2
- Ambient temperature = 34oc
- Open circuit voltage = 11V
- Short circuit current = 3.42 ampere

3.2 Circuit Operation

The circuit is intended for 12V chargers with a utmost capacity of about 7a. The essential ingredients are a voltage regulator, 7805, if the set values are exceeded, the charging current is interrupted, and a LCD display to tell you that something is missing. Interestingly, the diode also allows the existing bridge rectifier in the charger to be skipped, and the inputs of the upgrade circuit to be linked directly to the SOLAR POWER PANEL. The diode is followed by two large reservoir capacitors, 1000MF/25V and 1000MF/25v, which smoothes the direct voltage.

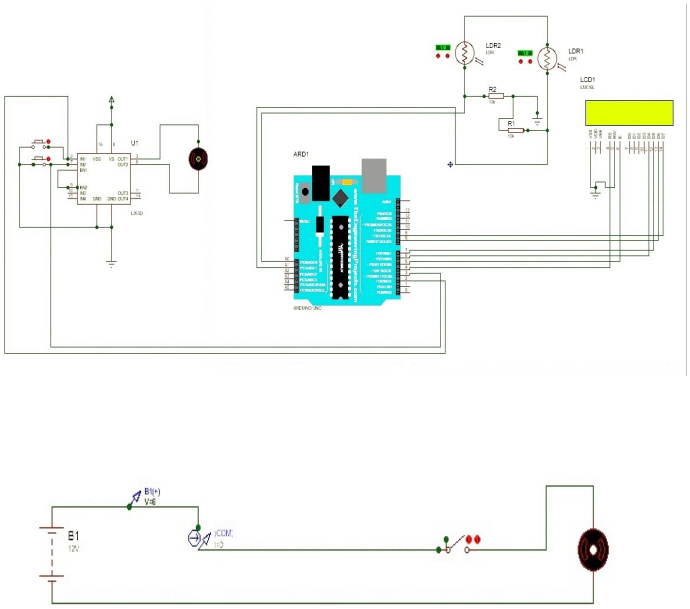


Fig. 3.2 Schematic Diagram

IV SIMULATION RESULTS

To check the presentation of proposed cells and think them with past works, we realized a 128kb group using each cell. Since all of the cells which have been broke down are slanted to form trouble issue, the bunch was created in an exceedingly non-interleaved arrange while not space choose instrumentation. The cluster contains four 32kb sub-prevents every with 1024 cells for every space and a 32-piece word size. Fast restricted Switch Dynamic Logic (LSDL) was utilized to fabricate the pre decoders and decoders. 10 space bits weren't used as commitments to form cardinal NOR primarily based pre- decoders, whose yields were then used as self-arranged pulses to drive the decoder-driver for each phase. Completely different leveled-Word-Decoding (HWD) realizes lower management usage likewise, speedier time interval conversely with Divided-Word line-Deciphering (DWD). this is often in light-weight of the actual fact that the HWD building executes further degrees of word- lines to reduce the overall capacitance per phase choose manner.

V CONCLUSION

In this work which was improved with the capacity of conserving the conventional fuels is successfully completed. The main aim to extend the usage of renewable energy supply for power production is totally enforced. Taking into thought the long run energy situation within the world, solar power would be a significant energy supply. we have a tendency to want that our project would be a mini index for people who wish to place into observe the on top of system.

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AUTHOR PROFILE

J. Ramesh[1]

Assistant Professor in Department of Electrical and Electronics Engineering, St.Anne’s College of Engineering & Technology,
Panruti, India
rameshbluesky@gmail.com[1]