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ENERGY PRODUCTION IN SMART HOUSES

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Abstract - *Solar photovoltaic panels penetrates Indian market at large extent. Even though the metering and advanced control system has been developed, energy storage part needs more attention. In the present grid system there is darkness on using these powers during the interruption of grid power. This is a method for replacing the conventional energy storage mechanism. Renewable energy is an energy which is most efficient and it often we reuse the product in any places. Solar energy which is enormously available in nature. But there will be chances for the reduction of intensity in solar radiation due to various reasons like shading, raining etc. maximum radiation is absorbed by solar tracking system. Which is included in the system. The radiation obtained by the solar panel is converted into electrical energy and it stored in a battery. A dc motor operates by the power in the battery and it lifts the water into storage tank. Micro hydro turbine connected in the pipe line from the storage tank. As the water flows turbine rotates, the kinetic energy of water is converted into electrical energy by the generator and it stored in the same battery. The power for the household application is taken from the battery. These conversion process is fully eco friendly and full fill green building technology.*

Keywords: *solar PV panel, DC motor, micro hydro turbine and generator*

1. INTRODUCTION

Renewable energy is an energy which is most efficient and it often we reuse the product in any places. These energy which normally low cost and it gives surplus amount. It will give low cost because it is all in nature. This renewable energy which will give more helpful for the villages, cities and all. Solar energy is suitable for this system which is enormously available in nature.

Solar energy which gives heat energy into electric energy by photo voltaic conversion through solar PV panel. DC motor will be operated by this energy. But solar energy absorbed by the panel is not sufficient to operate the DC motor. For the maximum Absorption, a solar tracker is added to the system. Still there will be variation of power so the obtained power is stored in the battery. The power for the motor is delivered by this battery. Dc motor lifts the water into over head tank in our home. This water gives to the house hold purposes, by this time the micro hydro turbine connected in between overhead tank and pipe. As the water flows the blades of micro hydro turbine rotates hence the kinetic energy of water is converted into mechanical motion. The mechanical motion of the blade is converted to electrical energy by the generator coupled to the turbine. This electrical energy is stored in the same battery. The power stored in battery can be taken to house hold electrical activities.

This energy production process is renewable way of production hence it has less effects on environment. Initial cost for the process will be higher but it can be compensated by the reduction of electricity consumption cost during every month, power interruption and power quality issues. This is an experiment which has been doing this process and it is very useful to middle class families.

2. LITERATURE REVIEW

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3. SOLAR PHOTOVOLTAIC SYSTEM

Out of renewable source of energy, solar energy has gained more attention due to its availability without any cost, cleanness, requirement of less maintenance and monitoring, inexhaustible nature and can be generated locally for use which in turn avoids long transmission lines for power transfer. Hence, SPV system has been commercialized around the globe for its long term prospects and more importantly, concerns over the environment. Solar energy is radiated out of the sun as a byproduct of nuclear fission. The amount of energy produces by sun as a result of fission per day is greater than the energy used by the whole world per year. Nuclear fission reaction happens at the inner core of the sun. Speed of solar radiation is equal to the speed of light and 8 minutes required to reach on earth surface from sun. Only a part of solar energy produced by the sun reaches at the surface of earth, it is called terrestrial solar radiation. Part of solar which won't reach the earth surface is called as extra terrestrial solar irradiation. The amount of solar irradiation reaching the earth surface is constant and it is termed as solar constant. It is the maximum possible energy received over unit area in unit time which is kept just outside the atmosphere perpendicular to incident solar radiation at a mean distance from earth to sun. Typical value of solar constant is about 135 Wb/m^2. Solar irradiation falling on the earth surface can be divided into two components. Solar irradiation, which falls on earth surface directly without undergoing any change in the route from sun to earth termed as beam radiation. The solar radiation which falls on the earth surface after undergoing reflection and refraction by the particle present in the atmosphere is termed as diffused radiation.

3.1. Solar cell

Basic component of PV panel is solar cell, which is mainly made from pure silicon wafer. Solar cells works on the principle of photovoltaic effect, the phenomenon by which incident solar radiation are converted into electrical energy directly. In order to create a p-n junction, two different layers of silicon wafer is doped with agents known as impurity atoms. Top layer is doped with n-type dopant such as phosphorus. Outer most shell of phosphorus atoms contains five electrons, out of these five electrons, four combines with silicon atom and remaining move freely in the lattice. Base layer of silicon wafer is doped with p type dopant such as boron. Outer shell of boron consist of three free electrons, these three electrons combines with silicon atom leaving a hole, a positive charge electron from the neighboring bond jumps to the hole, leaving behind a positive charge; hence positive charge moves freely in the crystal lattice. When p type and n type layer join together, electrons diffuse across the junction and create a barrier which prevents further electron flow. The junction formed is PN junction. An electric field is produced at PN junction due to imbalance in electric charge, which in turn restricts further diffusion in charges. Then the silicon cell is coated with antireflective coating to enhance the absorption of solar irradiation. Grid lines are drawn across the cell to collect electrons, which are released from the valance shell absorbing solar irradiation. These grid lines are connected to metallic contacts provided at both ends of the solar cell. Metallic contacts act as the end terminals for external connection to load. When solar irradiation falls on the surface of panel, few of the photons get reflected from grid lines and surface of cell. Remaining photons will penetrate into substrate; those with less energy will pass the substrate without having an impact. Those photons with energy greater than band gap dislodge electrons from the valance band and create electron hole pairs. On both sides of PN junction electron hole pairs are created. Electron hole pairs diffuse across the junction and swept away in the opposite direction by electric field across the junction and are fed to the load. If the incident solar radiation is more, more number of electron hole pairs will be created; hence more current will be generated by the panel. Typical solar contact with metallic contacts and external circuitry is shown in figure.

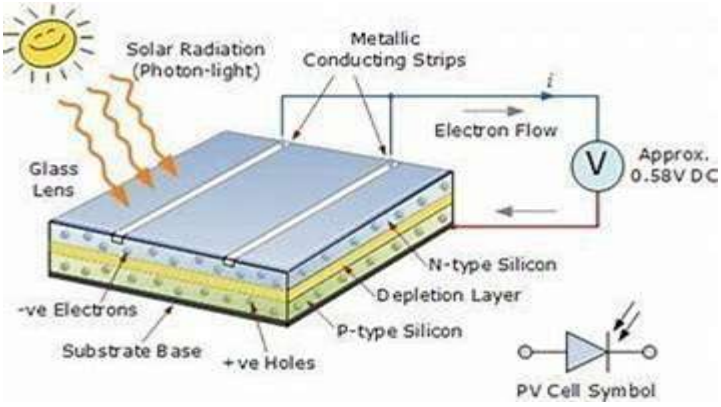

Fig.1: Functioning of solar cell

Table.1: Types of solar cells

Solar cell technology	Characteristics
 Monocrystalline	Structure: Formed from single crystal of silicon Typical Module Efficiency: 13% - 20% Typical Module Price /Wp: Rs.75 – Rs.100
 Polycrystalline	Structure: Formed from multiple crystals of silicon Typical Module Efficiency: 14% - 16% Typical Module Price/Wp: Rs.50 – Rs.75
 Thinfilm	Structure: Formed from amorphous silicon Typical Module Efficiency: 6% - 12% Typical Module Price/Wp: Rs.40 – Rs.55

4. SOLAR TRACKER

For the most part our common every day solar cells run at a efficiency of 18-20% meaning they convert 18-20% of the every they receive into electricity. While this is far better than the 3- 6% efficiency that most green plants end up with, it doesn't quit meet our power needs. To bring in enough power we either need to improve the efficiency of solar panel or find ways getting more from our current solar panels. Every panel is in fixed position most likely facing south at 45° angle. While this approach is extremely simple and meets the needs of most small applications, it isn't producing as much energy as it could be. The single most simple way of getting more energy out if a solar panel is to have it track the sun create around 30% more energy per day than a fixed panel.

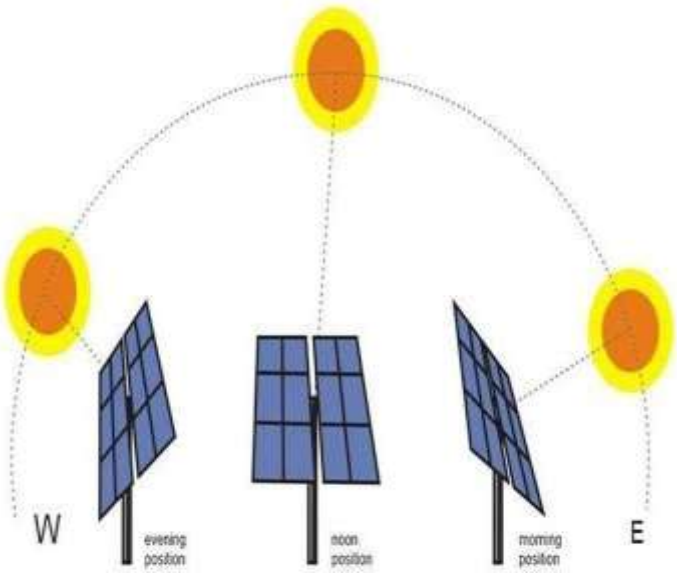

Fig.2: Solar tracking

4.1. Types of solar tracker

i) Single axis or dual axis

Dual axis tracker, meaning it tracks in both X and Y. To put it into even more simple terms, it goes left and right, up and down. This means that it will never need to change or adjust anything, since anywhere the sun moves your tracker will follow. This method gives the best result for power generation. Typically people make an X axis (left to right) tracker and then just set their panel 45° for Y. This will gives really high amount of power generation while at the same time eliminating half of the moving part.

ii) Active tracking or scheduled tracking

Active tracker which is controlled by computer program (via Arduino).this means that the sensors is to find the brightest source of light at all times. The sun is highly predictable. The system uses a computer program that changes the angle of panel on date and physical location.

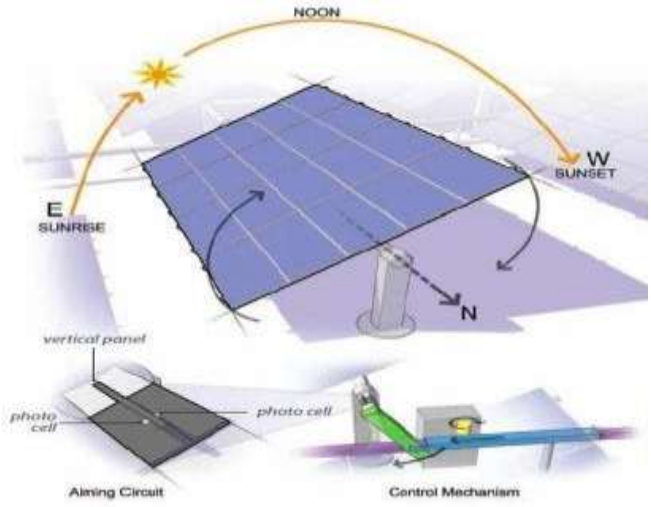

Fig.3: Solar tracker mechanism

5. WORKING OF SOLAR TRACKER

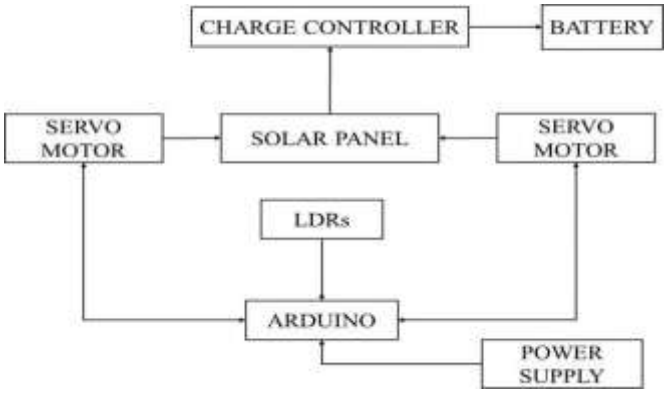

Fig.4: Basic block diagram of solar tracker

The solar panel is initially placed flat on the mechanical structure. The panel captures the entire light incident on it and converts it into electrical energy with the help of semiconductor layers. The charge controller, connected directly to the panel, stabilizes the electrical output in order to minimize any fluctuations in the voltage and current values. The charge controller feeds the battery which is charged to its maximum potential. The Arduino is responsible for all the logical calculations that are required for the system to perform as expected.

A 7 or 9 Volt battery is used to power the Arduino, which takes analog input from LDRs and provides power to the servomotors. Depending upon the position of the sun, the Arduino analyses the signals received from the LDRs. Depending on which of the two LDRs has more light incident on it, its resistance and hence the magnitude of current flowing into the Arduino will vary. This variation is then translated into the input signals for the motors. The servomotors, which are connected to the shaft that has the panel mounted on it, are responsible for dual-axis movement of the panel. This causes the panel to tilt in the direction of the LDR offering the least resistance and thus, ensures that there is maximum light incident on the panel. This significantly increases the quantity of light energy captured and converted into electricity.

5.1. Algorithm

Step1: start

Step2: Initialize all necessary inputs and outputs to zero.

Step3: Assign analog LDR outputs and PWM servomotor inputs to Arduino Uno.

Step4: If center LDR = 0, then delay (longer).

Step5: Check alignment (Simultaneously for north-south and east- west)

Step6: If up (LDR) greater than center and down (LDR) lesser than center, then increase position of servomotor1 by 1 unit. Give delay.

Step7: Else if up (LDR) lesser than center and down (LDR) greater than center, then decrease position of servomotor1 by 1 unit. Give delay.

Step8: (Simultaneously along with step6) If right (LDR) greater than center and left (LDR) lesser than center then increase the position of servomotor2 by 1 unit. Give delay.

Step9: Else if right (LDR) is lesser than center and left (LDR) greater than center then decrease position of servomotor2 by 1 unit. Give delay.

Step10: Go to Step 5. Step11: End.

6. HYBRID SYSTEM

The future of solar PV installations is very bright on a worldwide basis, which will be a boon to reduce greenhouse gas (GHG) emissions. Solar systems, ensuring uninterrupted power generation with a minimum of downtime, which has been a common problem. In order to reduce the problem associated with interrupted power supply on night times and during rainy season, a hybrid technique has to be invented. The technique should be eco friendly also it should be available in domestic applications. Such a system is shown below.

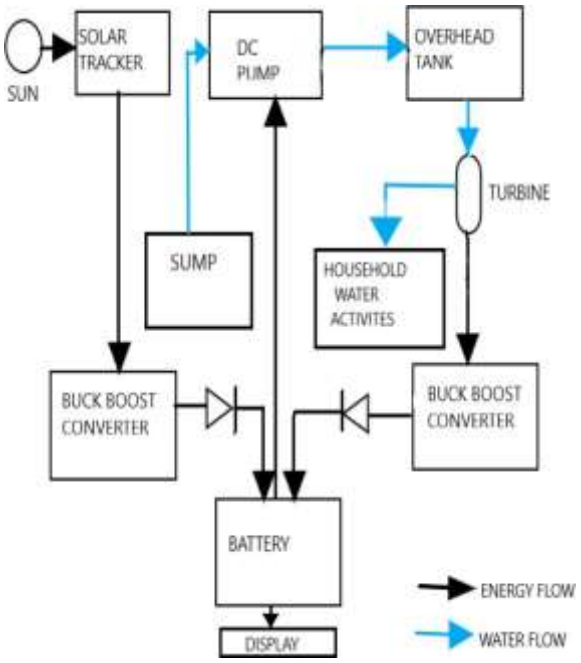

Fig.5: Main block diagram

The system is a hybrid technique, which is a combination of both solar and hydro electric power. The radiation from the sun is absorbed by the solar panel. Fixed solar panel is not sufficient to provide the power for this system. So solar panel is fixed on a solar tracker, it will track the sun according to the radiation. By this tracker 30% more energy can be gained than fixed solar panel. The energy from the solar tracker is fed to a battery which is regulated by a buck converter. A DC motor will be operated by the energy stored in the battery. It will lift the water from the sump (under ground water storage like well) to overhead tank. Water for the household activities is taken from this tank. When water for the house hold activities drawn from the Tank, micro hydro turbine will rotate. Which is connected in between overhead tank and pipe. As the water flows kinetic energy of water is converted into mechanical energy by the micro hydro turbine also the mechanical energy is converted into electrical energy by the generator coupled with the turbine. Electrical energy from the turbine is fed to the same battery through the voltage regulator normally a buck boost converter. A display is connected to the battery to analyze the amount of energy obtained from solar as well as from the turbine.

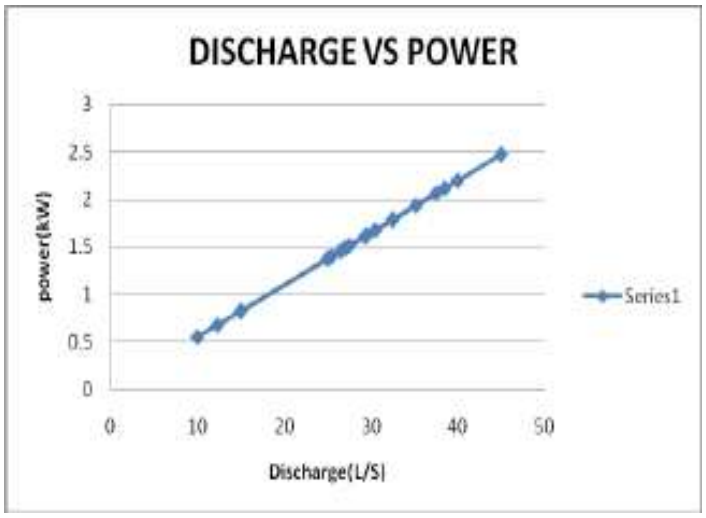

Chart.1:Discharge v/s Power

7. CONCLUSION

Due to the world's largest demand of energy sources, it has to be enhanced year by year so; all the people must generate their energy needs from the home itself by means of renewable energy sources utilization. This type of energy are inexhaustible , eco- friendly and natural regenerative, in near future all must do this type of self equip nature ,our energy demand may be stepped down and quite suitable for all domestic needs. The government will give all its support for the technical requirements and the economical burden of fund allotment also reduced accordingly.

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