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SOLAR TRACKING CHARACTERIZATION OF SOLAR PANEL- AN OVERVIEW

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ABSTRACT:

The solar tracking system keeps a solar collector with its responsive surface normal to the solar rays. It consists of a shaft supported for rotation approximately an axis parallel to the north-south axis of the earth, a stepper motor for intermittent rotation of the shaft at an average rate equal to rate of rotation of the earth. A solar collector securing assembly is placed on one side of the shaft and consists of a bracket, collars securing the bracket to the shaft, a guide for fixing a solar collector pivoted to the bracket about a pivotal axis transverse to the shaft to differ the inclination of the support relative to the shaft and remains among the support and the bracket to hold the support at an adjusted inclination. A counter balancing system includes an arm secured to the shaft and extending regular thereto and far from the assembly and a weight adjustably installed on the shaft. This system counter balances the assembly and a solar collector fixed thereto no matter the rotational position of the assembly about the shaft and the inclination of the support relative to the shaft. Preferably, solar collectors are installed on the shaft, one being an array of solar cells feeding a battery which in turn feeds a stepper motor driving the shaft through a step down gear box. The sun shadow of a pointer normal to the solar collector panel serves to correctly align the panel. Alternately, the current generated through the solar cells is measured and its maximum shows that the solar panel is well aligned with the solar.

KEYWORDS: Solar tracking, collector, PV, solar cells etc.

INTRODUCTION:

The quantity of electricity produced by a solar panel is decided by the quantity of sunlight that hits it, and at what angle the light hits the panel. With a fixed panel there may be most effective a small quantity of time at some point of the day where the panel is generating at maximum power. For that reason solar monitoring systems are carried out to make a solar panel follow the sun at some stage in the day decreasing the misalignment perspective of the panel, and generating maximum power for an extended period of time. My senior design project is a single axis tracker that rotates about the vertical axis. The design is completely computerized, so as soon as it is installation the person does not want to monitor it, or provide any input. To obtain this design a microcontroller, stepper motor, and sensors made were used. This is just a evidence of concept type layout, and matters including the motor would need to be bulked up for this system to function outdoors, in a windy surroundings. This design can be used to increase the quantity of power that can be taken from a solar panel over a complete day.

OPERATION OF THE SOLAR CELL:

Solar cells are made out of different semiconducting materials. Semiconductors are materials, which turn out to be electrically conductive when provided with light or warmth; however which work as separators at low temperatures. More than 95% of all the solar cells delivered worldwide are made out of the semiconductor material Silicon (Si). As the second most plenteous component in earth outside layer, silicon has the favorable position, of being accessible in adequate amounts, and moreover preparing the material does not load nature. To deliver a solar cell, the semiconductor is sullied or "doped". "Doping" is the deliberate presentation of synthetic elements, with which one can get an abundance of either positive charge carriers or negative charge carriers from the semiconductor material. In the event that two diversely semiconductor layers are joined, then an alleged p-n-intersection comes about on the limit of the layers. The solar cell works in a few stages: Photons in sunlight hit the solar board and are consumed by semiconducting materials, for example, silicon. Electrons are energized from their current molecular/atomic orbital. Once energized an electron can either disperse the energy as warmth and come back to its orbital or go through the cell until it achieves a terminal. Current courses through the material to cross out the potential and this electricity are caught. The substance obligations of the material are imperative for this procedure to work, and for the most part silicon is utilized as a part of two layers, one layer

fortified with boron, alternate phosphorus. These layers have distinctive electric charges and henceforth both drive and direct the current of electrons.

Solar modules utilize light energy (photons) from the sun to produce electricity through the photovoltaic impact. The lion's shares of modules utilize wafer-based crystalline silicon cells or thin-film cells in view of cadmium telluride or silicon. The basic (load conveying) individual from a module can either be the top layer or the back layer. Cells should likewise be shielded from mechanical harm and dampness. Most solar modules are inflexible, yet semi-cuneifor conductor ones are accessible, in view of thin-film cells. These early solar modules were initially utilized as a part of space in 1958. Electrical associations are made in arrangement to accomplish a craved yield voltage and additionally in parallel to give a coveted current ability. The directing wires that take the current off the modules may contain silver, copper or other non-magnetic conductive move metals. The cells must be associated electrically to each other and to whatever remains of the framework. Remotely, prevalent earthbound utilization photovoltaic modules utilize MC3 (more seasoned) or MC4 connectors to encourage simple weatherproof associations with whatever is left of the framework. Bypass diodes might be utilized remotely, if there should be an occurrence of incomplete module shading, to boost the yield of module segments still illuminated.

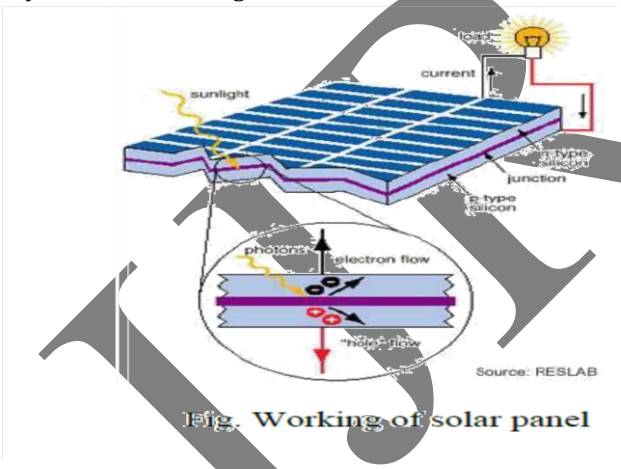

Fig. Working of solar panel

The usable voltage from solar cells relies on upon the semiconductor material. In silicon it adds up to around 0.5 V. Terminal voltages is just pitifully reliant on light radiation, while the present force increments with higher glow. A 100 cm^2 silicon cell, for instance, achieves a greatest current force of around 2 A when transmitted by 1000 W/m^2.

The yield (result of electricity and voltage) of a solar cell is temperature subordinate. Higher cell temperatures prompt to lower yield, and thus to lower productivity. The level of proficiency shows the amount of the transmitted amount of light is changed over into useable electrical energy.

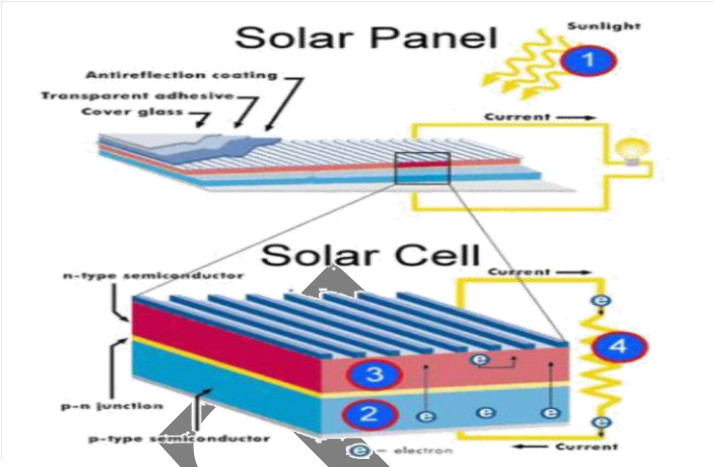

Fig. A solar cell working

DESIGN CONCEPT:

Sunlight has two segments, the "direct beam" that conveys around 90% of the solar energy, and the "diffuse sunlight" that conveys the rest of the diffuse part is the blue sky on a crisp morning and increments proportionately on overcast days. As most of the energy is in the immediate shaft, boosting gathering requires the sun to be obvious to the boards to the extent that this would be possible. The energy contributed by the immediate pillar drops off with the cosine of the edge between the approaching light and the board. What's more, the reflectance (found the middle value of over all polarizations) is roughly consistent for edges of occurrence up to around 50°, past which reflectance corrupts quickly. Solar flux striking a gatherer will be a blend of direct-bar radiation that goes in a straight line through the environment to the beneficiary, diffuse radiation that has been scattered by particles and pressurized canned products in the climate, and reflected radiation that has bobbed off the ground or other surface before the authority (Fig. 7.18). The favored units, particularly in solar–electric applications, are watts (or kilowatts) per square meter. Different units including British Thermal Units, kilocalories, and langleys may likewise be experienced. Transformation considers between these units are given in Table 7.5. Solar gatherers that concentration sunlight more often than not work on simply the shaft part of the approaching radiation since those Sunlight has two components, the "direct beam" that carries about 90% of the solar energy, and the "diffuse sunlight" that carries the remainder - the diffuse portion is the blue sky on a clear day and increases proportionately on cloudy days. As the majority of the energy is in the direct beam, maximizing collection requires the sun to be visible to the panels as long as possible. The energy contributed

by the direct beam drops off with the cosine of the angle between the incoming light and the panel. In addition, the reflectance (averaged across all polarizations) is approximately constant for angles of incidence up to around 50°, beyond which reflectance degrades rapidly. Solar flux striking a collector will be a combination of direct-beam radiation that passes in a straight line through the atmosphere to the receiver, diffuse radiation that has been scattered by molecules and aerosols in the atmosphere, and reflected radiation that has bounced off the ground or other surface in front of the collector (Fig. 7.18). The preferred units, especially in solar–electric applications, are watts (or kilowatts) per square meter. Other units involving British Thermal Units, kilocalories, and langleys may also be encountered. Conversion factors between these units are given in Table 7.5. Solar collectors that focus sunlight usually operate on just the beam portion of the incoming radiation since those rays are the only ones that arrive from a consistent direction. Most photovoltaic systems, however, don't use focusing devices, so all three components—beam, diffuse, and reflected—can contribute to energy collected. The goal of this section is to be able to estimate the rate at which just the beam portion of solar radiation passes through the atmosphere and arrives at the earth's surface on a clear day. Later, the diffuse and reflected radiation will be added to the clear day model.

Beams are the main ones that touch base from a reliable course. Most photovoltaic frameworks, in any case, don't utilize centering gadgets, so every one of the three parts—pillar, diffuse, and reflected—can add to energy gathered. The objective of this segment is to have the capacity to gauge the rate at which simply the bar bit of solar radiation goes through the air and touches base at the world's surface on a sunny morning. Later, the diffuse and reflected radiation will be added to the crisp morning model.

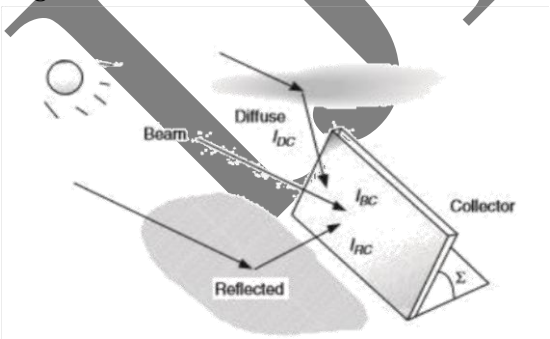

Fig. Components of solar radiation

From fig. Solar radiation striking a gatherer, Ic, is a blend of direct beam, IBC, diffuse, IDC , and reflected, IRC . To plan the entire set up for checking the execution of the solar board, a circuit is planned which is like the circuit of load test. Assessment of the execution of the board should be possible concentrate the yield got and the charts drawn from the accessible test outcomes. To outline a solar tracker and a DC water pump, taking after square chart were planned and the set up were developed by the attributes of the segments. Evaluations of the segments were chosen by the application. A 60 W solar board were intended to create power. Subsequently by concentrate the yield bends a 12 V DC water pump was intended for pumping application. Outline of solar tracker is comprises of the control get together and servo engine which will pivot the authority in bearing of the sun.

DESIGN OF SOLAR TRACKER:

AUTOMATION IN SOLAR TRACKER:

Close loop control framework is created to track the sun consequently. Light depending resistors (LDR) are utilized for detecting the force of light. LDR's are put in a manner that variety in sun light can detect by this LDR's. LDR is gadget which change over light into proportionate simple voltage. So when sun ventures, radiation on both LDR' won't be same because of this voltage additionally contrast. This distinction in voltage of two LDR is utilized as inciting sign. Customarily microcontroller is utilized for controlling reason. Be that as it may, programming of microcontroller is a troublesome errand. One needs to know the assembly language programming keeping in mind the end goal to smolder the longing operation in microcontroller. To maintain a strategic distance from this trouble in programming of microcontroller, some different options are required for the disentanglement in controlling. This model uses Arduino as a controlling gadget. Fundamentally Arduino is a propelled sort of microcontroller which can be programmed by straightforward language. Excellent dependability and precision are the principle elements of arduino. Arduino has a simple and computerized input pins. Yield gadget or actuator can be associated with arduino with the assistance of yield pins. Simple flag from LDR's are given to simple information pins of ardiuno.

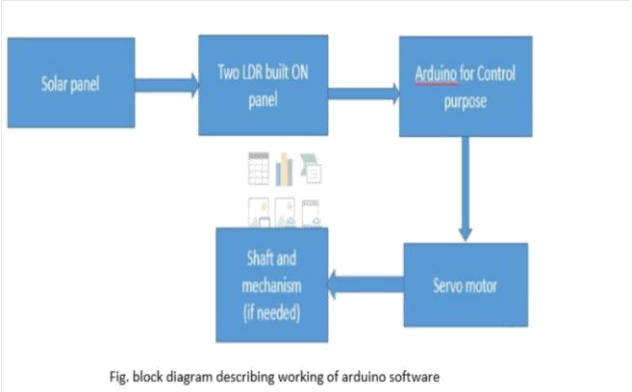

Fig. block diagram describing working of arduino software

Above block diagram gives the correct thought of the working of an Arduino based solar tracker. A servo engine gets motion from yield stick of the Arduino and according to the got flag servo engine pivots the solar board in opposite to the sun. LDR's sense the sunlight power and change over's it into voltage source. According to the necessity of the strength of the turning board, a chain or normal shaft is utilized for all boards so that the outer natural components like wind won't influence its revolution. Huge assembly framework doesn't get influenced though for a solitary board tracker wind influence is watched.

CONCLUSION:

As of late the generation of electricity utilizing solar innovation has seen a colossal development, specifically due to the financial contemplations and smooth operation of the solar boards. Despite the fact that the underlying expense is high, however operation expenses and support expenses are low. Solar energy is effortlessly accessible and can be specifically used to generate electricity. With regards to mount the board on rooftop beat or on the plane ground, the execution of the board at different tilt angles is checked. This execution testing gives a tilt angle which generate most extreme yield for that solar tracker in that specific area. Portrayal of the solar board is the investigation of conduct of solar gatherer at different angles and different climate conditions. From the diagrams acquired from the readings taken, it is exceptionally very much clarified that when the sky is clear and the board is mounted at 200 concerning level, confronting the south bearing, the yield got is most extreme. Tilt angle of 200 gives greatest yield. As the climate condition changes from clear sky to shady climate, the yield begins to diminish. Henceforth it clears up that shadow on the board diminishes the yield by noteworthy esteem. Shading is the significant issue which lessens the yield of the board as meager shade on the solar cell, diminishes the generated energy. In India, sun's development is in south bearing that implies the sun is in south course at more often than not of the day. Henceforth the solar authority must be put in North-south course where board confronts the south heading. Portrayal of solar power concentrates the structure of board. It elucidates the thoughts with respect to the choice of board for a specific application, its mounting and its conduct for different test conditions. The relative increment or lessening in solar board yield when the ecological condition changes & is contemplated with the assistance of portrayal of solar board. How the yield of the board changes when outside variables like tidy, shading, cloud sky happens on the board is all around portrayed by the diagram. A solar tracker is propelled innovation in range of solar energy generation. With appropriate sensors and control assembly, a solar gatherer can consequently change its position in opposite to the position of sun whenever of the day. As the board is in 90 degree positions with the sun, the got yield is constantly most extreme at that time. From the perception table and chart drawn, it exceptionally well expresses that, with the utilization of solar tracker, yield of the system is expanded by 15-20 %. Solar tracker requires less territory than the settled mounted board system. Henceforth, in the metropolitan urban areas where rate of the land is high, solar tracker gives most extreme yield in fewer zone, consequently cost of the land is spared.

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