DUAL AXIS SOLAR PANEL

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Abstract:

This basic idea gave birth to the project dual axis solar tracking system. The tracking system can track loads of daylight in actual reality by solar panel rotation in several axis. In dual axis system we can track the sun in four directions as a result we will succeed a lot of energy from the solar panel. Throughout this emerge, we have a tendency to square measure able to put behind bars further sun rays. The servo motor is performing operate to following path of the sun. The two servo motor and four LDR sensors are interfaced with a micro-controller that's scheming servo motor on the bottom of sensor's input. Sun light sense by LDR sensors and give the signal to Arduino micro-controller. The micro-controller received signals from LDR sensors and its deciding rotation direction of servo motors. Dual Axis tracking following system explained with the assistance of diagram shown in above block diagram.

Keywords:
Power supply, Solar panel, LDR sensor, Servo motor, L293D motor driver, DC-DC Buck converter, Battery, LED indicator.

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1. Introduction:

The history of solar energy is as old as humankind. In general, solar energy is radiant light and heat from the sun harnessed using a range of technologies such as photovoltaic and concentrator. In the last two centuries we started using sun energy directly to make electricity.
In 1819, ALEXANDRE EDMOND BECQEREL discovered that certain materials produced small amount of electric current when exposed to light, when WILLIAM GRYLLS ADAMS and his student, RICHARD EVANS DAY, discovered that an electric current could be started in selenium solely y exposing it to light, they felt confident that they had discovered something completely new. Werner von Siemens, a contemporary whose reputation in the field of electricity ranked him alongside Thomas Edison, called thediscovery"scientifically of the most fa reaching importance." This pioneering work portended quantum mechanics long before most chemists and physicist had accepted the reality of atoms.

In our project we make use of the tracking system which can track loads of daylight in actual reality by solar panel rotation in several axis. In dual axis system we can track the sun in four directions as a result we will succeed a lot of energy from the solar panel. Throughout this emerge, we have a tendency to square measure able to put behind bars further sun rays. The dual-axis in service is pretty much as good on single axis but it captures the solar energy a lot of productively by rotating at intervals the horizontal moreover as a result of the vertical axis. Four LDR sensors, two servo motor and Arduino micro-controller consists our tracking system. One rest of sensors and one motor is employed to incline the tracker in sun's east – west route and the alternative rest of sensors and also the opposite motor that's mounted at the bottom of the tracker is employed to tilt the tracker at intervals the sun's north-south route.

2. LITERATURE SURVEY:

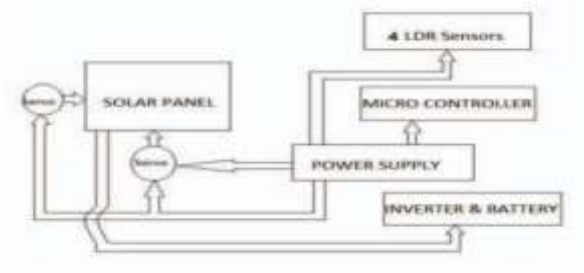
V sundara Siva Kumar and S Suryanarayana [12] proposed a dual axis tracking system to implement and develop a simple and efficient control scheme with only single tracking motor. Their main motive is to improve the power gain by accurate tracking of the sun. In this paper they successfully designed, built and examined dual axis sun tracking system and received best result. They concluded saying that this tracking technology is very simple in design, precise in tracking and inexpensive.

Dhanalakshmi.V, Lakshmi Prasanna H.N [13] presented a smart dual axis solar tracker. They used arduino Uno for the development of their proposed model. After the experiment, they observed that maximum voltage was tracked about 25% to 30%and the generating power increased by 30%compared to static system.

M.Kacira[14] overlooked the cause of a dual axis solar tracking with development of power energy compared to a fixed panel in Sanliurfa, Turkey. They found that everyday power gain is 29.3% in solar radiation and 34.6% in power generation for a particular day in the month of July. In 2017,

Chaitali Medhane, Tejas Gaidhani[15] implemented a microcontroller based dual axis model working on a solar panel. Through this model, they observed that the solar panel extract maximum power if the solar panel is aligned with the intensity of light receiving from the sun. It improves the power output and also precaution necessary for the system from rain and wind.

3. HARDWARE IMPLEMENTATION:



3.1 Block Diagram of Dual Axis Solar Panel

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4. Related Work:

The brief introduction of different modules used in this project is discussed below:

4.1. AVR microcontroller:

Fig: Arduino Microcontroller

The Arduino Uno is an open-source micro controller based on the MicrochipATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and anal input/output (I/O) pins that may be interfaced to various expansion boards(shields) and other circuits. The Uno is a huge option for your initial Arduino. It consists of 14-digital I/O pins, where 6-pins can be used as PWM(pulse width modulation outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more.

4.2. LDR sensor:

Fig: LDR sensor

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices. Light dependent resistors have a lower sensitivity than photo diodes and photo transistors. Photo diodes and photo transistors are true semiconductor devices which use light to control the flow of electrons and holes across PN-junctions, while light dependent resistors are passive components, lacking a PN-junction. If

the light intensity is kept constant, the resistance may still vary significantly due to temperature changes, so they are sensitive to temperature changes as well. This property makes LDRs unsuitable for precise light intensity measurements.

4.3. Solar Panel:

Fig: Solar Panel

A standard solar panel (also known as a solar module) consists of a layer of silicon cells, a metal frame, a glass casing, and various wiring to allow current to flow from the silicon cells. Silicon (atomic #14 on the periodic table) is a nonmetal with conductive properties that allow it to absorb and convert sunlight into electricity. When light interacts with a silicon cell, it causes electrons to be set into motion, which initiates a flow of electric current. This is known as the "photovoltaic effect," and it describes the general functionality of solar panel technology.

The photovoltaic process works through the following simplified steps:

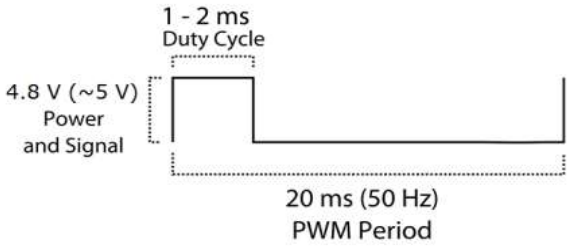
1. The silicon photovoltaic solar cell absorbs solar radiation.
2. When the sun's rays interact with the silicon cell, electrons begin to move, creating a flow of electric current
3. Wires capture and feed this direct current (DC) electricity to a solar inverter to be converted to alternating current (AC) electricity

Aside from their silicon solar cells, a typical solar module includes a glass casing that offers durability and protection for the silicon PV cells. Under the glass exterior, the panel has a layer for insulation and a protective back sheet, which protects against heat dissipation and humidity inside the panel. The insulation is important because increases in temperature will lead to a decrease in efficiency, resulting in a lower solar panel performance. Solar panels have an anti-reflective coating that increases sunlight absorption and allows the silicon cells to receive maximum sunlight exposure. Silicon solar cells are generally manufactured in two cell formations: monocrystalline or polycrystalline. Monocrystalline cells are made up of a single silicon crystal, whereas polycrystalline cells are made up of fragments or shards of silicon.

4.4 SG 90 MICRO SERVO MOTOR:

Fig : servo motor

SG90 is a **low cost and high output power servo motor.** It can rotate up to 180 degrees and each step can be of maximum 90 degrees. Moreover, it is small enough that it can easily fit into your robotics ARM or obstacle avoidance robotics projects. On top of that, it requires only one output pulse signal to control its movement.



From the picture we can understand that the PWM signal produced should have a frequency of 50Hz that is the PWM period should be 20ms. Out of which the On-Time can vary from 1ms to 2ms. So when the on-time is 1ms the motor will be in 0° and when 1.5ms the motor will be 90°, similarly when it is 2ms it will be 180°. So, by varying the on-time from 1ms to 2ms the motor can be controlled from 0° to 180°

4.5 L293 MOTORDRIVER SHEILD

Fig : Motor driver

The Arduino L293D motor driver shield guide is a robotics project that involves driving various types of motors. The most common types used for robotic applications include DC, servo, and stepper motors. However, these motors typically cannot be driven directly by Arduino or another microcontroller. This is because of their higher current and power ratings, so motor shields or driver ICs are used instead. These shields or ICs isolate a motor's power supply and use control logic from the microcontroller circuitry. One of the most popular motor driver shields used with Arduino is the L293D. The full-featured L293D motor driver shield can control up to four bi-directional DC motors with 8-bit speed selection, two stepper motors, and two servo motors.

4.6 DC to DC BUCKCONVERTER

Fig: DC-DC Buck converter

The **DC to DC Buck converter** converts high **DC** solar generated voltage to a 12V output. This Modular -Level power electronic (MLPE) device performs as a solar charge controller for small lithium-ion batteries. The **working of Buck converter** is slightly similar to that of PWM 'dimming'. We've all heard of lights being dimmed by a PWM signal. A small duty cycle means that the average voltage seen by the load is small and when the duty cycle is high the average voltage is high too.

Working: The switch turns on and lets current flow to the output capacitor, charging it up. Since the voltage across the capacitor cannot rise instantly, and since the inductor limits the charging current, the voltage across the cap during the switching cycle is not the full voltage of the power source. The switch now turns off. Since the current in an inductor cannot change suddenly, the inductor creates a voltage across it. This voltage is allowed to charge the capacitor and power the load through the diode when the switch is turned off, maintaining current output current throughout the switching cycle. These two steps keep repeating many thousands of times a second, resulting in continuous output.

5. CONCLUSION:

The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with Arduino. The Presence of each and every module has been reasoned out and placed very carefully. Dual axis tracker totally aligns with the sun route and tracks the sun movement in a very a lot of cost-efficient and includes a fabulous performance upgrading. The investigation outcomes clearly show that dual axis tracking is good enough than single and fixed solar systems. The proposed system is price effective collectively as a stroke adjustment in single axis hunter provided notable power increase among the system. Through our experiments, we've got found that dual axis tracking can increase energy by concerning 40% of the fixed arrays. With heaps of works and better systems, we have a tendency to tend to believe that this figure will raise additional.

6. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future..

7. RESULTS:

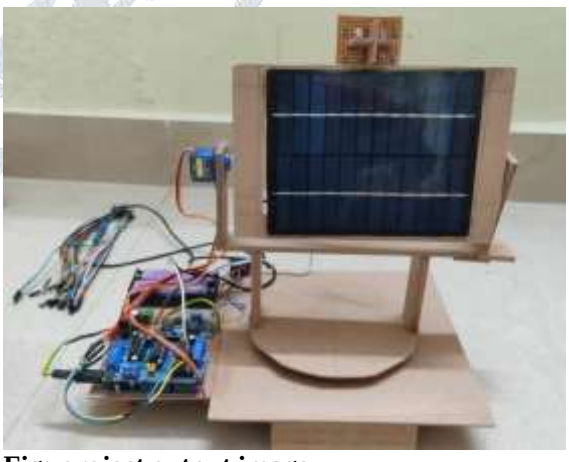


Fig: project output image

Initially LDR monitor the solar emission and it sends the data to the microcontroller and then it passes to the servo motors. Here in this project we are using to servo motors to make the solar panel to rotate 4 directions so lot of power is required to handle the motor. So here in our project we are using motor driver shield to handle the servo motors. At the preliminary

stipulation two servo motor begins running. Since the sun amendment its location device detects the position of the sun and it takes few minutes. When the sun moves from east to west, second servo motor will clean up that situated in vertically within the star hunter. The second servo motor can begin running if through the sun moves to the north or south .The second servo motor won't run if there's no seasonal change. The movement of the solar panel towards in vertical and horizontal on angle and altitude angle is taken as a reference. The solar elevation approach is distinct for the explanation that the angle situated stuck between the horizontal and as a result the line linking to the sun. At nightfall or break of day distance from the bottom approach is 0° and at one time the sun is at the top the height higher than water level angle relics 90°. Hence the contributing to the best working unit for "**DUAL AXIS SOLAR PANEL**" has been designed perfectly

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