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Dual Axis Solar Tracking System with Weather Sensor and Efficient Power Generation

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Abstract:

This paper presents the execution of cheaper automatic and analysis of dual- axis solar tracking system using Arduino Mega. The last word aim of this project is to analyze sense the weather and climatic temperature. This project is split into 2 stages particularly, hardware and computer code software. In hardware development, four lightweight dependent resistors (LDR) were utilized to capture the utmost source of illumination from the sun energy. One servo motor and one DC double-geared motor to rotate the solar array (East-west) and (north-south) direction to most source of illumination location perceived by the LDRs. And advanced level technology to capture most quantities of energy mistreatment sun's radiations. As for the computer code half, the code created by mistreatment C programming language and targeted to the Arduino Mega controller. In this, the voltage is calculated from the panel to panel from time to time in an interval of 1hr and this voltage is employed to sense the weather conditions and display the climatic temperatures.

***Keywords*— Arduino Mega, LDR, electrical phenomenon (PV) panel; star following System; Temperature Sensor; Voltage sensor; Internet of Things.**

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I. INTRODUCTION

The solar panels should be perpendicular to the sun's rays for optimum energy generation. Deviating from this optimum angle can decrease the potency of energy generation from the panels. Many degrees of arrangement can solely because I Chronicles to five of energy loss. The water drops are mechanical devices on electrical devices with the assistance of mechanical device pumps and clean the panel to increase the potency of the panel. This implies that each one degree higher than temperature twenty-five degrees the potency of an electrical device can decrease by zero.38%. Conversely, for each one-degree temperature blow twenty-five degrees the utmost quantity of energy of an electrical device can increase by zero.38% there are 2 main ways in which to mount an electrical device for tracking; single axis and twin axis. Single axis trackers typically use a polar quantity for optimum star potency. Star trackers have one axis aligned to be roughly parallel to the axis of rotation of the planet round the north and south poles. When put next to a set mount, one axis huntsman will increase the output by around half-hour. The second means may be a 2-axis mount wherever one axis may be a vertical pivot and therefore the second axis is horizontal. By employing a combination of the 2 axes, the panel will continually be pointed directly at the sun. This methodology will increase the output by around 12

months compared to stationary panels. Heating of the panels conjointly affects its potency. We will conjointly use the system for weather parameters watching. A star huntsman may be a device for orientating a star electrical phenomenon panel toward the sun. Solar energy generation works best once pointed directly at the sun; therefore, a star huntsman will increase the effectiveness of such instrumentality over any mounted position. The star panels should be perpendicular to the sun's rays for optimum energy generation. Deviating from this optimum angle can decrease the potency of energy generation from the panels. Many degrees of arrangement can solely because I Chronicles to five of energy loss, whereas larger angles of 10° to 20° can considerably decrease the energy generation of up to thirty fifths. AltHough, this loss is additionally passionate about the fabric and pattern of the protecting glass that covers the electrical device. a lively huntsman uses motors to direct the panel toward the sun by wishing on a sensing circuit to discover intensity. There are 2 main ways in which to mount a electrical device for tracking; single axis and twin axis. Single axis trackers typically use a polar mount for optimum star potency. Polar trackers have one axis aligned to be roughly parallel to the axis of rotation of the planet round the north and south poles. when put next to a set amount, one axis huntsman will increase the output by around half-hour the second means may be a 2-axis mount wherever one axis may be a vertical pivot and therefore the second axis is horizontal. By employing a combination of the 2 axes, the panel will continually be pointed directly at the sun. This methodology will increase the output by around 12 months compared to stationary panels. During this project, the performance of the dual-axis star huntsman was analyzed. it absolutely was separated into 3 components that were input, controller and output. The input was from the LDRs, the Arduino because the controller and, the servo motor because the output.

II. OBJECTIVES

i) the most purpose of this is to give an impression system which may cause higher alignment of physical phenomenon (PV) array with sun light-weight and to reap various energy.

ii) The planned solar tracking system changes its all four direction in dual axis and traces the day light

III.NECESSITY

To track the sun ray's movement accurately, the two axis trailing system is critical. The sunshine intensity is compared by software microcontroller and its energy generates the acceptable management signal to maneuver the motors in the correct direction. Therefore, a driver circuit is employed to extend and changes the voltage and current level for the operation of the motors.

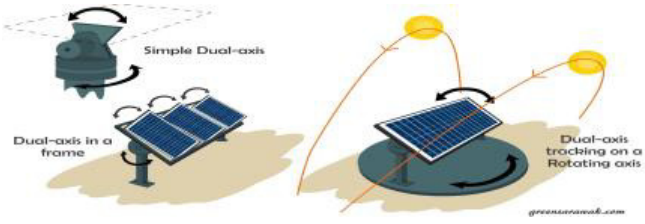

Fig.1 Dual axis solar tracker direction

IV. TRACKING SYSTEM

Over the years, researchers have developed good star trackers for increasing the quantity of energy generation. star trackers depend upon no. of variables

together with the condition of roof, direction of roof faces, material the roof is formed of and the way a lot of land is obtainable. Soil type, aesthetics, personal preference and local-installer capability all inherit play yet. Earlier static star panels were used positioned with an inexpensive tipped angle supporting the latitude of the placement, however to extend potency, completely different star following systems square measure being used. There square measure chiefly 2 forms of star huntsmen on the idea of their movement degrees of freedoms specifically single axis star huntsman and twin axis star tracker. Once more these 2 systems square measure more classified on the idea of their following technologies. use most potency of the sun, whereas twin axis following ends up in 30-40% increase in potency by guaranteeing a cos effectiveness of angle and sin effectiveness of altitude. In continuous or active following, the sensors endlessly sense the position of the sun throughout the day time. These sensors then trigger the mechanism or motor to maneuver the solar module system in order that the solar panels can perpetually face the sun at right angles throughout the day. If daylight isn't perpendicular, there'll be a distinction in intensity of sunshine at the 2 sensors which might be compared and also the would offer to communicate the module to create it perpendicular to the sun. This methodology of sun following in all fairness is correct except that it's onerous to sense the position of the sun throughout terribly cloudy days not an night. Unlike a lively following, passive following determines the position of the sun within the sky, its movement being a supported response to associate imbalance pressure between 2 based on solar panel points at each end of the huntsman. This can be one in all strategies used wherever star heating creates pressure level on a "low boiling purpose gas liquid fluid that's driven to 1 face or the other" that then moves the structure. However, this can not be associated with the economical methodology of direction of sun rays following.

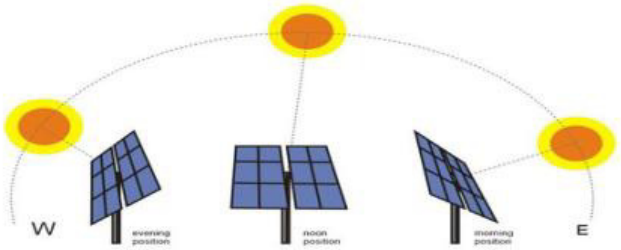

Fig.2 Position of solar panel

V.LIMITATION OF MOUNTED CONFIGURATION

Through the V-I and P-V characteristics of a solar panel in, it is ascertained that the most output power of a solar panel is obtained once the solar array is operated purpose of the knee point. This is often done through the tactic of most outlet following (MPPT) algorithms. But MPPT will solar give most power for mounted position solar panels, it cannot be used once the panel isn't directed towards the sun. so, the following configuration is developed so as to totally maximize the output from the solar panel by continually positioning it towards the sun. An electrical device produces the paper battery that has combined properties of each. The recent developments of the paper batteries utilize CNT as conductor Associate in nursing an integrated style of layer of solution to form a skinny and versatile battery. Fig. three characteristics of solar array V. operating FLOW this system solar to perform with gets the energy from

the daylight with most efficient power. Next, the energy is absorbed by the panels solar with twelve voltage and three current and also the energy is moved to the step-down module charging to urge the five to four voltages and most current to charge the battery poet. Carbon nanotubes (CNTs) consist completely of carbon atoms organized during a series of condensed rings rolled up into a hollow structure. This novel artificial Nano material belongs to the family of fullerenes, the third chemical phenomenon type of carbon in conjunction with atomic number 6 and diamond that measure each natural sp2 (planar) and sp3 (cubic) forms, severally.

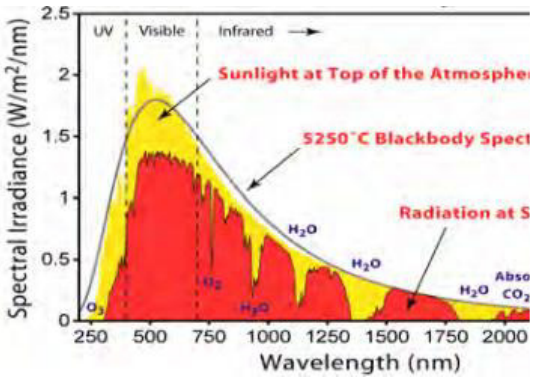

Fig. 3 characteristics of solar panel

V I. WORKING METHOD

This solar tracker system starts to perform and gets the energy from the daylight with most power. Next, the energy is absorbed by the panels star with twelve voltage and three current and therefore the energy is moved to the step down and step up module charging to the five voltage and most current to charge the battery Li Po. Carbon nanotubes (CNTs) consist solely of carbon atoms organized in a very series of condensed benzoyl rings rolled up into a hollow structure. This novel artificial nanomaterial belongs to the family of fullerenes, the third polytropically variety of carbon alongside black and diamond that are each natural sp2 (planar) and sp3 (cubic) forms, severally. Fig.1: Solar electrical phenomenon chase system the battery is stored concerning 2 voltages. So, it's appropriate voltage and current to charge the battery. After that, the launch pad booster is practical to show on and switch off the battery. If turned on, the IOT devices are performed and therefore the sensing elements of the temperature are detected. The information is transferred to the cloud and shows the information of temperature within the MQTT lens. MQTT lenses are often downloaded at the laptop computer or hand phone. The solar chase system is obtaining the energy from the daylight and absorbed by the solar battery. Move to the decrease module charging battery attached to structure of dual axis tracker with 5v and 2A and charge the Li Battery. From that, it'll be charging the IOT device and therefore the Arduino MEGA that is used to regulate the motor for the chase system. After that, from the daylight to the LDRs that attach at either side from the solar battery to make sure to get the nice lighting from the daylight and it'll be sent to the Arduino MEGA.

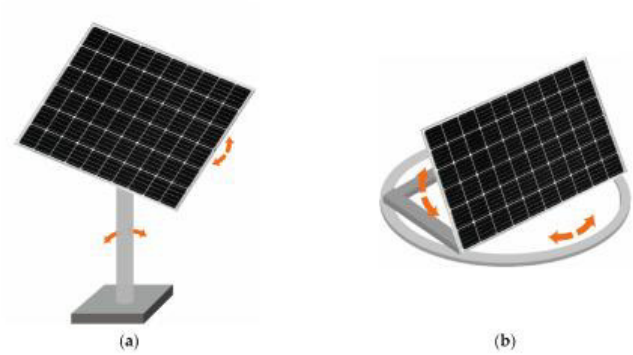

Fig.4 solar tracking panel

A) ***Hardware development-***

The complete technique of hardware development of the paradigm. Once also because the package package and hardware, this board is functioned to protect the electronic devices from downward, storm or any weather problems. This preserver to boot has been created as a result of the system placed out of doors. at intervals this preserver, this technique cannot get any problems and might be safe.

1) LIGHT-WEIGHT DEPENDANT REGISTER ((LDR)-

Photoresist or light-weight dependent resistance (LDR) might be a resistance whose resistance decreases with increasing strength or it's aforementioned that the LDR exhibits electrical conduction. For this project, the intensity of sunshine perceived by the LDR becomes Associate in input to the foremost controller.

2) *SERVO MOTOR*- Servo motor is one in each of the various kinds of DC motors out there in electronic application. This type of motor wants to supply either four.8V or 6V. This motor consists of three wires notably signal, positive and ground wire. It contains several components that unite the motor and shell, position detector, blunder equipment, motor driver and a circuit to decipher the requested position. Servo motor and steeper motor only rotates by the utmost of 100 and eighty degrees. PWM is utilized to control the motor. PWM Analog signal will Associate in nursing electronic circuits and convert the analog signal into a digital signal. PWM in servos is utilized to control the direction and position of the motor. There are a pair of servo motors used during this project for horizontal and vertical axis severally.

3) *STAR PANEL*- solar array, that's to boot referred to as 'photovoltaic', might be a tool that converts light-weight that is light dependent resistor directly into electricity. There are many sorts of solar panels distinguished by their efficiency, price and temperature constant that unit out there inside the market. Variety of them unit monocrystalline, crystalline and thin film. The monocrystalline variety of solar panel was selected for this project as a result of it is the best efficiency compared to totally different varieties.

4) *Wi-Fi Module (ESP 8266)*- The ESP8266 WLAN Module might be a self-contained SOC with integrated TCP/IP protocol stack which is able to supply any microcontroller access to your Wi-Fi network. Its high degree of on-chip integration permits for lowest external equipment, also because the front-end module is meant to occupy the lowest PCB area. To complete this project, it has been used as a pair of package packages to develop the code. it's Arduino IDE package and Energeia version seventeen package. The project paradigm for this project to boot has been built. the package package that has been accustomed turns out to be the chase system. By victimization of Arduino MEGA, only the Arduino IDE package is involved to make the cryptography.

B) Package develop-mend

To complete this project, it has used a pair of packages to develop the code. it's Arduino IDE package and Energeia version seventeen package. The project paradigm for this project to boot has been built. Figure 6 shows the package package that has been accustomed to turn out the chase system. By victimization of Arduino UNO, only the Arduino IDE package is involved to make the cryptography.

VII. COMPARISON OF SINGLE AXIS AND DUAL AXIS

TIME(Hr)	SINGLE AXIS	DUAL A
8:00	04.62	07.1
9:00	06.4	10.1
10:00	07.15	13.9
11:00	09.23	15.7
12:00	10.41	19.2
13:00	13.77	19.7
14:00	14.89	17.4
15:00	15.56	16.8
16:00	15.12	16.2
17:00	13.45	12.4
18:00	05.73	06.8

The above table contents the compassion of single axis and dual axis solar tracking system the voltage and minimum electrical current is calculated to time to time interval and panel to panel calculated from comparison of time interval.

VIII. Design and Implementation process

This project shows most power has been generated from the daylight mechanically. This technique is pursuit for max intensity of sunshine. Once there is a decrease in intensity of light-weight this system mechanically changes its direction to urge most intensity of light-weight. Development twin axis pursuit system used light-weight dependent electrical device (LDR) as sensing element. The resistance of LDR decreases with increasing candlepower. 2 motors square measure used here for rotating the electrical device in 2 completely different axes. During this twin axis we tend to square measure victimization four LDR s for sleuthing the sunshine intensity. To trace the sun movement accurately, the twin axis pursuit system is critical. With the sun invariably facing the panel, the most energy will be absorbed as the panel operates at its greatest potency. The main objective of this paper is to urge the most energy from the sun by correct pursuit of the sun. 2 combine of light-weight dependent resistors (LDR) is used as sensors to trace the sun's actual position One combine senses the position of the sun in vertical and horizontal axis i.e., east and side and different combine in the horizontal axis i.e., north and south facet. This data is then passed to the sunshine comparison unit. the remainder LDR senses the night mode and therefore the signal square measure sent to the sunshine comparison unit. A light-weight dependent electrical device (LDR) is an electrical device whose resistance decreases with increasing incident light-weight intensity. Arduino is the main control unit of this whole system. The output from the sunshine comparison unit involves the input of the Arduino controller that determines the direction of the movement of the motors each in the horizontal and vertical axes. Figure one shows the sensible style of mechanism of dual-axis star pursuit systems.

IX. CIRCUIT DIAGRAM-

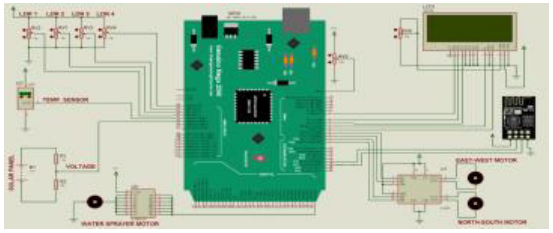

Fig.5 circuit diagram of dual axis solar tracking system

X. EXPERIMENTAL RESULTS

Results taken in month of might were taken leads to 3 cases: A. the primary case mounted star panels the results taken from twelve and a half hours noontide till six pm and it even intervals each quarter-hour. B. The second case following star panels the results taken from twelve and a half hours noontide till 5 o'clock

and forty minutes pm and it even intervals each ten minutes. C. The third case following star panels the results taken from 9 and twenty minutes within the morning till twelve and a half hours noontide pm and it even intervals each ten minutes. For every case we tend to show i-t, v-t, p-t and p-v characteristics curves that planned exploitation of Portus.

The projected pursuit system can follow daylight tons of A resistor accustomed the size down to a really high voltage providing PV panel rotation in dual axis completely completely different axis. In the dual-axis pursuit system optimum power is achieved by following the sun in four directions. Throughout this methodology we tend to be a unit able to capture maximum of sun rays. Movement in two dual axis is explained with the maximum amount of energy and charge the battery use of dual axis solar tracking system.

XI. CONCLUSION:

The paper presented of tracking the sun's positions with the help of Arduino MEGA and LDR sensors. Specifically it demonstrates a working software and hardware solution for maximizing cell energy output by positioning a solar panel at the purpose of maximum strength. The tracker can initialize the starting position itself which reduces the necessity of any longer photo resistors. The attraction of the designed solar tracker is a straightforward mechanism to regulate the system. As alternative energy production is employed in large scale worldwide so, even an increment in efficiency by 1% than a stationary plane will increase the online power production by a great amount. Hence, regardless of by what proportion tracker increases an efficiency it's always welcomed. During a conclusion, this mechanism might be manifested in a wide selection of applications that need solar tracking like parabolic flat plate collector, solar dish, lens and other PV systems to gather maximum radiation from the sun.

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