ARDUINO BASED DUAL AXIS SOLAR TRACKING SYSTEM

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Abstract - *The utilization of non-renewable energy sources and the ozone depleting substances emanation is a developing worry of the universal group. Thus, the innovative work of elective sources are constraining down the expenses related with sustainable power sources. Photovoltaic vitality creation is the best case of these exponential developing rates at the most recent years. Be that as it may, the yield control gave through the photovoltaic change process relies upon sun based illumination, and the day by day and occasional developments specifically influence the force of radiation got in the sun oriented gatherers. Keeping in mind the end goal to enhance the vitality creation, this paper depicts the advancement of a minimal effort, double tomahawks sunlight based tracker (DAST) with low power utilization. The work envelops the outline, development, get together of the whole mechanical structure, electrical frameworks and gadgets and the elaboration of the control rationale in charge of all the development of the module to look through the situation of greatest sun based illumination. The following is composed using LDR sensors in charge of giving the info flag to a microcontroller. The PV board pivots consequently in view of the sun irradiance amid the day while during the evening, the board stays in a flat position to ensure the mechanical structure against severe climate. The proposed framework likewise has an advancement of a 12V battery charging framework utilized for module development and as a power hotspot for electronic gadgets. Results demonstrate that a framework with the planned DAST can diminish in 8% the payback of a solitary PV establishment when contrasted and a settled structure, considering the sun oriented irradiance accessible in the locale of Serra Gaúcha in South Brazil.*

1. INTRODUCTION

The interest for power worldwide is expanding fundamentally over the most recent couple of years. In Brazil, between 20062015 there was a 34% expansion in power utilization and 38.7% in the creation of electric vitality [1].With this developing requirement for vitality and the danger of a dangerous atmospheric devation, it is vital to scan for sustainable power sources that can take care of worldwide power demand. As per an examination by the European Renewable Energy Council (EREC) in association with the NGO Greenpeace, sustainable power source, combined with reasonable and effective utilization of vitality will have the capacity to meet portion of the world's vitality request by 2050 [2]. Among sustainable power sources, sun oriented photovoltaic vitality (PV) has been expanding as of late particularly due the sunlight

based radiation in Brazil and direction impetuses, for example, impose exception connected to power dispersion account in a few states.

Brazil had a hop of in excess of seven thousand new network associations in 2016, a large portion of that from private and business customers, and that is only the starting, the sun oriented photovoltaic vitality investment on the Brazilian vitality framework is incite to increment altogether on the following years [1]. Nonetheless, in spite of the massive potential and motivating force arrangements, Brazil is still a long way from the main nations in the photovoltaic vitality creation division. The nation has an introduced limit of 21MW [1], speaking to just 0.02% of the Brazilian vitality framework front more than 50.8GW from China, the world pioneer in this perspective. Before the finish of 2015, photovoltaic offices represented 242 GW of introduced control around the world. [3]. Other than being an awesome contrasting option to expand the Brazilian vitality framework, PV can likewise be a decent method to create vitality in troublesome access places or without access to power. Accordingly, it is intriguing to consider approaches to amplify vitality generation of the photovoltaic modules. At the point when mounted over settled structures the effectiveness of photovoltaic frameworks isn't completely used. The best approach to enhance this generation is using a sun oriented following framework, which guarantees the most extreme rate of sunlight based radiation on the modules, subsequently expanding the vitality creation of the framework. Recreations through SAM (System Advisor Model) programming, to the city of Santa Maria in South Brazil, demonstrate that is conceivable to increment in around 30% the measure of vitality created amid a year utilizing a business polycrystalline sun powered board, when it is mounted over a DAST. There are a few conceivable outcomes to the introduction of DAST frameworks exhibited in the writing. Some depend on input signals, as the compelling sunlight based rate estimated by light depended resistors (LDR), or open circle control in light of sun powered maps or heuristic situating calculations [4-6]. This work exhibits the plan and viable execution of a minimal effort DAST framework that works in view of the sun oriented occurrence estimated by an arrangement of LDR. The plan has two noteworthy objectives: supportable activities, which implies a following framework with most minimal vitality utilization conceivable, self-sufficient task, which implies no human obstruction is essential if there should arise an occurrence of environmental change conditions or low power in the battery set, and utilization of ease

segments to streamline the payback of the DAST framework by the augmentation of the power generation.

1.1 Problem Statement

A sunlight based tracker is utilized as a part of different frameworks for the change of saddling of sun powered radiation. The issue that is postured is the usage of a framework which is fit for improving creation of energy by 30-40%. The control circuit is actualized by the microcontroller. The control circuit at that point positions the engine that is utilized to situate the sun oriented board ideally.

1.2 Objectives

The venture was completed to fulfill two fundamental destinations:

- ✓ Design a framework that tracks the sunlight based UV light for sun oriented boards in double pivot.

- ✓ Prove that the following in reality expands the proficiency impressively. The scope of increment in proficiency is relied upon to be in the vicinity of 30 and 40 percent.

1.3 Scope Of The Project

The sun powered undertaking was actualized utilizing a DC engine. The decision was educated by the reality. That the engine is quick, can maintain high torque, includes exact pivot inside restricted point and does not create any clamor. There is the implanted programming segment where the Atmega 328 is modified utilizing the C dialect before the chip expelled from the Arduino board. The Arduino UNO was utilized for the coding. It is then utilized as an independent unit on a PCB amid creation and show. in the tropics, the sun position shifts significantly amid specific seasons. There is the outline of an information arrange that encourages transformation of light into a voltage by the light ward resistors, LDRs. There is correlation of the two voltages, and after that the microcontroller utilizes the distinction as the blunder. The servo engine utilizes this blunder to turn through a relating plot for the modification of the situation of the sunlight based board until such a period, to the point that the voltage yields in the LDRs are equivalent. The distinction between the voltages of the LDRs is gotten as simple readings. The distinction is transmitted to the servo engine and it in this way moves to guarantee the two LDRs are an equivalent slant. This implies they will get a similar measure of light. The method is rehashed for the duration of the day.

2. LITERATURE REVIEW

[1]. This paper describes the development of a low-cost, dual axes solar tracker (DAST) with low power consumption. The work encompasses the design, construction, assembly of the entire mechanical structure, electrical systems and devices and the elaboration of the control logic responsible for all the movement of the module to search the position of maximum solar irradiation. The tracking is designed through the use of LDR sensors responsible for providing the input signal to a microcontroller. The PV panel rotates automatically based on the sun irradiance during the day while at night, the panel remains in a horizontal position to protect the mechanical structure against inclement weather. The proposed system also has a development of a 12V battery charging system used for module movement and as a power source for electronic devices. Results show that a system with the designed DAST can reduce in 8% the payback of a single PV installation when compared with a fixed structure, taking in account the solar irradiance available in the region of Serra Gaúcha in South Brazil.[2]. The proposed system changes its direction in two axis to trace the coordinate of sunlight by detecting change in light intensity through light sensors. Hardware testing of the proposed system is done for checking the system ability to track and follow the sunlight in an efficient way. Dual axis solar tracking system superiority over single axis solar tracking and fixed PV system is also presented.

[3]. The demand for electricity worldwide is increasing significantly in the last few years. In Brazil, between 2006-2015 there was a 34% increase in electricity consumption and 38.7% in the production of electric energy.[4]. The author describes a dual axis tracking system by placing four photo resistors on the modules and compares the potential difference between the photo resistors and moves the solar module according to the value of the potential difference.[5]. Reference is based on electro-optical based trackers which use light dependent resistors to detect the point of maximum insulation. In the use of photo resistors, since the sensor is exposed outside, it is vulnerable to physical damages, and environmental factors like temperature, rains etc.[6]. Single axis sun trackers tracks the sun only by varying the azimuth angle, while keeping the tilt angle fixed. These systems, though they are more efficient than fixed photovoltaic (PV) systems, doesn't utilize the available solar energy to maximum extent and has less efficiency when compared to dual axis trackers.

3. BLOCK DIAGRAM
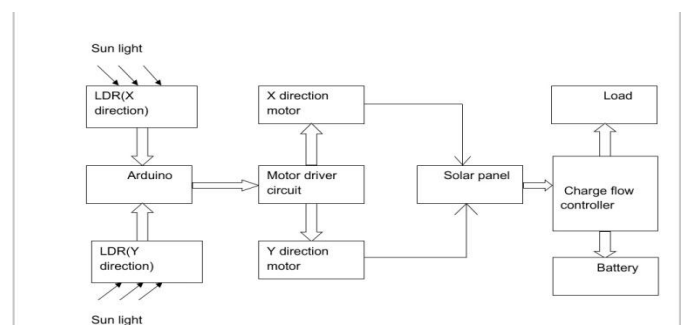
3.1 WORKING PRINCIPLE

The proposed following framework does following of daylight all the more adequately by giving PV board revolution in two diverse pivot. DC engines are essentially performing capacity of sun following. Upper board holder dc engine tracks sun directly and base stepper engine tracks the allegorical uprooting of sun. These dc engine and sensors are interfaced with a microcontroller which is controlling dc engines based on sensors input. LDR sensor sense the light and sends flag to microcontroller. Microcontroller is doing correlation of signs got from LDR sensors and based on more grounded signals it is choosing pivot heading of dc engine. Double hub tracker control is clarified with the assistance of piece chart appeared in figure. The square outline demonstrating that LDR sensors subsequent to detecting the light forward the flag to Arduino. Arduino is astute gadget which is taking activities based on sensor information and initiating engine drivers circuit as needs be. Presently assume if sun changes its area and moves from east to west, it will make light force be diverse on one sensor when contrasted with other one. Based on light force contrast on sensor, controller enacts driver circuit and moves dc Motors new position where light falling on sensor sets is same. A similar procedure is keep on with on changes suns area in the sky. Therefore this proposed demonstrate can catch more sun beams and frameworks sun powered vitality transformation ability is enormously improved**.**

4. BRIEF ABOUT EACH COMPONENTS

- ✓ Solar Cell
- ✓ Arduino UNO
- ✓ LDR
- ✓ LCD
- ✓ DC Motor
- ✓ L293D Motor drive
- ✓   Solar Charge Controller

4.1 SOLAR CELL

A photovoltaic cell, regularly known as a sun based cell, is the innovation utilized for transformation of sun oriented specifically into electrical power. The photovoltaic cell is a non mechanical gadget made of silicon amalgam. One cell can however deliver just 1 or 2 watts that isn't sufficient for generally machines. Execution of a photovoltaic cluster relies upon daylight. Climatic conditions like mists and mist essentially influence the measure of sun oriented vitality that is gotten by the exhibit and in this manner its execution. The vast majority of the PV modules are in the vicinity of 10 and 20 percent effective.

4.2 ARDUINO UNO

The Arduino Uno is a microcontroller board in light of the ATmega328 (datasheet). It has 14 computerized input/yield pins (of which 6 can be utilized as PWM yields), 6 simple information sources, a 16 MHz artistic resonator, a USB association, a power jack, an ICSP header, and a reset catch. It contains everything expected to help the microcontroller; basically interface it to a PC with a USB link or power it with an AC-to-DC connector or battery to begin. The Uno contrasts from every previous board in that it doesn't utilize the FTDI USB-to-serial driver chip. Rather, it includes the Atmega16U2 (Atmega8U2 up to variant R2) customized as a USB-to-serial converter.

4.3 LDR (LIGHT DEPENDENT RESISTER)

The least difficult optical sensor is a photon resistor or photocell which is a light touchy resistor these are made of two kinds, cadmium sulfide (CdS) and gallium arsenide (GaAs). The sun tracker framework outlined here utilizations two cadmium sulfide (CdS) photocells for detecting the light. The photocell is a latent part whose protection is contrarily relative to the measure of light power coordinated towards it. It is associated in arrangement with capacitor. The photocell to be utilized for the tracker depends on its dim protection and light immersion protection. The term light immersion implies that further expanding the light power to the CdS cells won't diminish its protection any further. Light power is estimated in Lux, the brightening of daylight is roughly 30,000 lux.

4.4 LCD (LIQUID CRYSTAL DISPLAY)

Fluid gem show screen is an electronic show module and locate an extensive variety of uses since they are effortlessly programmable; have no restriction of showing unique and even custom characters (dissimilar to in seven portions), live lines et cetera Character and graphical LCD's are most regularly utilized. Character LCD's showcases characters, numbers, unique characters ASCII character and so on. A 16x2 LCD implies it can show 16 characters for every line and there are 2 such lines. This LCD has two registers, in particular, Command and Data. The summon enroll stores the order directions given to the LCD. A summon is a guideline given to LCD to complete a predefined errand like instating it, clearing its screen, setting the cursor position, controlling showcase and so forth. The information enroll stores the information to be shown on the LCD. The information is the ASCII estimation of the characters to be shown on the LCD.

4.5 L293D MOTOR DRIVE

L293D is a double H-connect engine driver coordinated circuit (IC) Motor driver L293D has 4-half H-connect drivers, which can be utilized to drive 2-DC engines bi-directionally. Engine drivers go about as ebb and flow enhancers since they take a low-ebb and flow control flag and give a higher-ebb and flow flag. This higher current flag is utilized to drive the engines. As a rule, a transistor can go about as a switch and play out this undertaking which drives the engine in a solitary course.

4.6 SOLAR CHARGE CONTROLLER

The most fundamental sun oriented charge controller just:

•Monitors the battery voltage

•Opens the circuit •Stopping the charging, when the battery voltage ascends to a certain Level.

•Prevent the DC power streams back to sun based board - during the evening, when sun based boards are not producing power, power can really stream in reverse from the batteries through the sunlight based boards, depleting the batteries.

More seasoned sun based charge controllers utilized a mechanical hand-off to open or close the circuit, ceasing or beginning force heading off to the batteries

5. INDIA'S LARGEST PHOTOVOLTAIC (PV) POWER PLANTS

1. Dependence Power Pokaran Solar PV Plant, Rajasthan, 40MW 02011-06 June 2011 Commissioning in March 2012.

2. AdaniBitta Solar Plant, Gujarat, 40MW 02011-06 June 2011 to be Completed December 2011.

3. Moser Baer - Patan, Gujarat,30MW 02011-06 June 2011 Commissioned July 2011.

4. Sky blue Power - Sabarkantha, Gujarat, 10MW 02011-06 June 2011 Commissioned June 2011.
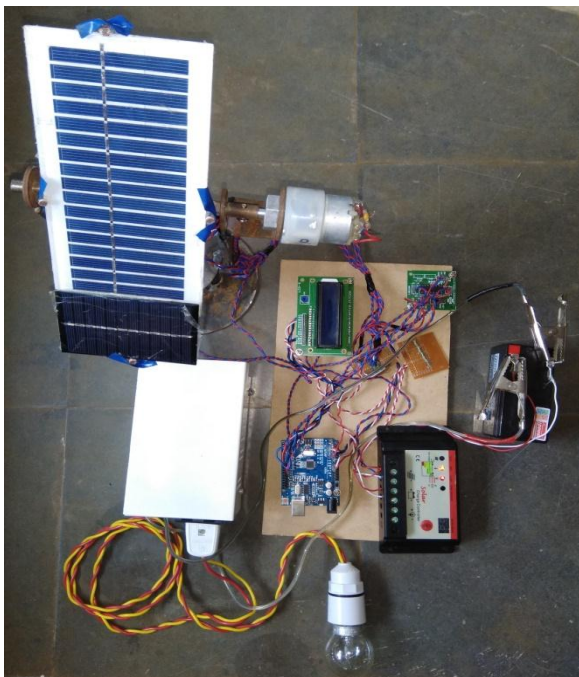
6. FINAL EXPERIMENTAL SETUP
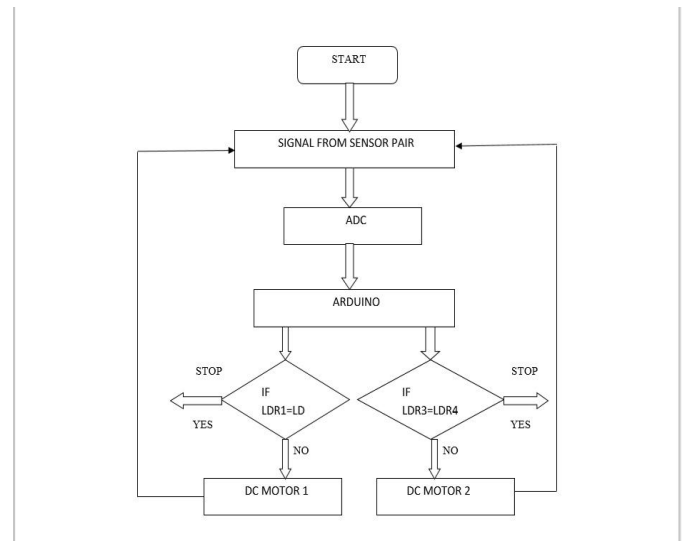

Fig. Final model

7. FLOW CHART

Fig. Flow chart

8. TESTING RESULT

Time (hrs)	Single axis(volts)	Dual axis (volts)
8 am	8.2	10.7
9 am	9.4	12.2
10 am	12.5	14.6
11 am	15.8	17.3
12 pm	17.9	19.8
1 pm	18.5	21.2
2 pm	16.4	17.9
3 pm	14.3	16.7
4 pm	12.1	13.8
5 pm	10.5	12.1

9. CONCLUSION

Double hub tracker flawlessly lines up with the sun heading and tracks the sun development in a more productive manner and has an enormous execution change. The test comes about plainly Show that double pivot following is better than single hub following and settled module frameworks. Power Captured by double hub sun based tracker is high amid the entire perception day and age and it augments the change of sun based irradiance into electrical vitality yield. The proposed framework .Is savvy additionally as a little alteration in single hub tracker gave conspicuous power rise. In the framework. Through our examinations, we have discovered that double pivot following can build vitality by around 40% of the settled exhibits. One of the vital empowering influences to accomplish this goal is to ideally use the accessible assets, quite land and transmission framework.

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