International Journal of Research Publication and Reviews

Design of a Parabolic Trough Solar Collector Using ARDUINO Microcontroller

Advait Gawande[1], Jay Shinde[1], Shubham Patil[1], Rohan Biradar[1], Prof. Namrata Ranaware[2]

SPPU University, Faculty of Engineering, Department of Mechanical Engineering of Jaywantrao Sawant College Of Engineering Pune,Hadapsar-411028

ABSTRACT :

This paper shows the planning boundaries of a sun based illustrative dish model for natural regions with extraordinary sun oriented irradiance rate accessibility, where have no entrance of power administrations or low-pay individuals makes due to purchase an oven (electric or gas). The sunlight based allegorical dish model means an answer against these kinds of cures and seeks after sun powered light to work. The explanatory dish has a cleaned surface, where the sunlight based radiations fall and gathered at a solitary concentrated point of convergence. Now the gathered type of energy is used to determine distinctive warm applications like as; cooking and warming with single and double pivot plans. This paper examines the significant phases of double pivot model; execution, sun powered area system, the investigation in terms of hypothesis, foundational layout and material. The double pivot model is executed through the assistance of Arduino chipboard thatis effectively in upkeep, alongside that this model is arranged with antilock Hbridge (L298) module to defeat the control circuit intricacy and AVR modules. Two rotational engines of 12V are introduced on 4*4ft planned aluminium outline with a double pivot global positioning framework. The jerks among trackers are likewise decreased with this model which keeps up with the exploratory declination point around 22.47°.To completion, this paper results that explanatory sunlight based dish tracker acquires 3.43% further developed power productivity in correlation of photovoltaic board tracker.

Keywords:Parabolic Trough Collector, ATmega328P microcontroller, Servo Motor, LDRs

1. Introduction :

Energy creation is the primary issue of all evolved nations to accomplish their regard objective with the advancement of energy extraction devices. Sustainable power particularly sun based energyassets are getting force as a substitute wellspring of energy creation because of their high accessibility all over the planet. In spite of the fact that, research track is still keeps on culling out the power from sun based irradiances with two Frameworks; sunlight based photovoltaic andconcentrated sun oriented power advancements .

The sun powered chargers are broadly used to satisfy the necessary power need on a significant and minor level with various controlling plans be that as it may, couldn't meet the timetable because of its low productivity, downsides and normal issues. Along these lines, a ton of examination was performed and still keeps on siphoning up the productivity of sun powered chargers as far as boost of board yield power, the augmentation in sun based cell productivity and utilisation of sun oriented following innovation. From these ideas, the following innovation is demonstrated to be productive for sunlight based charger Frameworks yet couldn't build the sunlight based charger yield power because of associated issues like as the misalignment in situating, residue and sunset issues. The global positioning framework includes two kinds of drives for example a functioning and inactive sort trackings with various modes. The methods of these drives are single pivot and double hub including temperature, sunlight based illumination and introduced framework region factors. The dynamic drive type global positioning framework is a lot embraced drive contrasted with latentdrive with single hub, vertical single pivot and azimuth double hub following Modes. Europe, US, India and China are utilising global positioning framework to improve the proficiency of sun oriented nuclear energy innovation.

Likewise, the illustrative sun oriented dish Systems are additionally carried out for the circuitous age of hotness and power. In this innovation the extraction of power utilising planetary group too tended to with following plan and faces a similar following arrangement and uncontrolled temperature issue that makes the framework low-productive. In this manner, the energy creation increments with following contrasted with non-following planetary groups

2.Literature Survey :

. Design of parabolic solar dish tracking system using Arduino AsifAhmed, MohdNoorAbdullah, DurMuhammadSoomro, This research involves the designing of CSP system with PV module to capture maximum solar irradiation in less brighten areas. Aluminum polished surface parabolic dish with twelve cross sectional view was developed with integration of PV panel to enhance the system output power. The dual axis closed loop tracking mechanism was installed with 4*4ft2 parabolic dish, LDR sensor module, 12 V DC power motors, H-Bridge drive & Arduino Controller. The 10 W

polycrystalline solar panel was used as payload receiver for parabolic dish to generate optimum level of output power. The outdoor experiment was performed to analyse solar PV tracker and proposed parabolic dish tracker. The results show that the average output power of solarPV panel was about 5.78 W while, for the proposed parabolic dish PV system was 9.2515 W. Hence, the output power of the designed parabolic dish PV system is 3.43% more improved than the compared solar PV panel. In future this design can be enhanced by changing controller strategy, by in corporation the overheating protection circuit.

2. Smart Temperature Monitoring System for Parabolic Solar Thermal Collector Integrated-with Membrane Distillation System. Nadzirah Mohd Mokhtar, Muhamad Sukri Hadi

In this work, the temperature of salt solution was successfully monitored using a DS18B20 sensor and displayed on an LCD and through a smartphone via Wi-Fi. A data logging system was applied using a microSD card and Arduino Uno as a microcontroller. The temperatureof salt solution was automatically recorded every 15 minutes when the system initiates operation. An automatic water pump controller was also implemented in this system. At 45°C, the water pump will be automatically switched on and flow the salt solution from the preheated tank into the feed tank. In this monitoring system, the variation of salt solution temperature in the pre-heated tank with respect to time was recorded as and presented in graphical images. In terms performance evaluation, the integrated system did not experience any deterioration in removing salt from the salt solution. A reduction in energy consumptionwas observed as the energy required to heat up the salt solution was much lesser due to supplementary energy supplied by the solar energy system.

COMPONENTS CONFIGURATION :

1.Arduino UNO.

Arduino Uno Pinout
Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroll

Arduino Uno

2.LDR.

The Light Dependent Resistor (LDR) or also popularly known as Photoresistor is just another special type of Resistor and hence has no polarity so they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also. The symbol for LDR is similar to Resistor but includes inward arrows as shown above in the LDR pinout diagram. The arrows indicate the light signals.

Where to use a LDR:

A photoresistor or LDR (Light Dependent Resistor), as the name suggests will change it resistance based on the light around it. That is when the resistor is placed in a dark room it will have resistance of few Mega ohms and as we gradually impose light over the sensor its resistance will start to decrease from Mega Ohms to few Ohms.
This property helps the LDR to be used as a Light Sensor. It can detect the amount of light falling on it and thus can predict days and nights. So if you are looking for a sensor to sense light or to distinguish between days and nights then this sensor is the cheap and modest solution for you.

LDR

3. Servo Motor.

The MG996R is a metal gear servo motor with a maximum stall torque of 11 kg/cm. Like other RC servos the motor rotates from 0 to 180 degree based on the duty cycle of the PWM wave supplied toits signal pin.

Servo Motor

3.1 MG996R Servo Motor Features:

Operating Voltage is +5V typically Current: 2.5A (6V)
Stall Torque: 9.4 kg/cm (at 4.8V) Maximum Stall Torque: 11 kg/cm (6V) Operating speed is 0.17 s/60° Gear Type: Metal
Rotation : 0°-180°
Weight of motor : 55gm
Package includes gear horns and screws

4.Parabolic Trough.

Parabolic trough collects all the sun rays and due to its parabolic nature it reflects rays back to the trough and it helps in increasing the efficiency of the set up.Solar panels are a huge PN junction, which convert solar energy into electricity. As for the monolithic solar battery, it is a small PN junction, in addition to when the sunlight in the above, it can generate electricity, further having all the characteristics of the PN junction. In standard light conditions, its rated output voltage is 0.48V. The solar cell module use of solar lighting is connectedby the multi-plate solar cell constituted. It has a negative temperature

coefficient, and the temperature rises for each degree, the voltage drops 2mV. In use, the open or short circuit of the solar cell is not to be damaged, in fact we also took advantage of this characteristic of the system battery charge and discharge control.
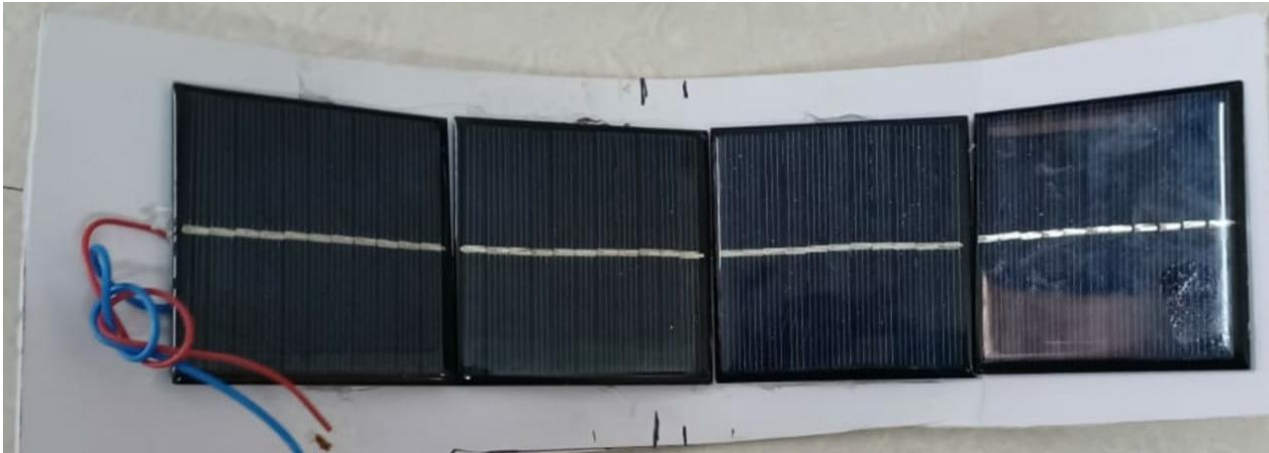
Parabolic Trough

Conclusion:

- An Arduino solar tracker was designed and constructed in the current work. LDR light sensors were used to sense the intensity of the solar light occurrence on the photo-voltaic cells panel. Conclusions of this project is summarised as ,the existing tracking system successfully sketched the light source even it is a small torch light, in a dark room, or it is the sun light rays.

- The cost and reliability of this solar tracker creates it suitable for the rural usage. The purpose of renewable energy from this paper offered new and advanced idea to help the people.

- It has been proved through previous research that solar tracking system with single- axis freedom can increase energy output by approximately 20% Therefore, this work in this project is to develop and implement a solar tracking system with parabolic trough and the detection of the sunlight using sensors.

- The control circuit for the solar tracker is based on a ATmega328 P microcontroller. This PIC is the brain of the entire tracking system, and it is programmed to detect the sunlight through sensors and then actuate the motor to position where maximum sunlight could be illuminated onto the surface of the solar panel. After many setbacks in testing of the solar tracker, a lot of time is needed to be set aside for verification and testing due to the unpredictability of the weather and debugging of errors.

- This tracking implementation is successfully achieved with complete design of two degree of freedom using the PIC microcontroller. Suitable components and gear dc motors are used for the prototype model, which exhibit a clear, stable and precise movement to face the sun.

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