International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-06, Issue-05, Aug 2020

Hydraulically Controlled Tracking System for Solar Panel

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Abstract - The generation of power from the reduction of fossil fuels is the biggest challenge for the next half century. The idea of converting solar energy into electrical energy using photovoltaic panels holds its place in the front row compared to other renewable sources. But the continuous change in the relative angle of the sun with reference to the earth reduces the watts delivered by solar panel. In this context solar tracking system is the best alternative to increase the efficiency of the photovoltaic panel. A sunlight based global positioning framework expands your close planetary system's power creation by moving your boards to follow the sun for the duration of the day, which upgrades the point at which your boards get sun based radiation. Sun based trackers are ordinarily utilized for ground-mounted sun based boards and enormous, unsupported sun based establishments like sunlight based trees. They are commonly not utilized in most private sun powered ventures, however have a spot in the utility-scale and business/modern sunlight based market.

Keywords — Solar panel, tracking system, hydraulic system, Solar trackers.

I. INTRODUCTION

Around 25% of the world's people live without electricity. This lack of light tends to keep them in poverty. The earth receives 84 Terawatts of power from sun and our world consumes about 12 Terawatts of power per day. Only 12% to 18% of the sun's solar energy is converted to electrical power by the silicon in a solar panel, so more panels are installed to produce the total kilowatts of solar power needed. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of the sun is important. With this System up to 40% more energy will produce than solar panels without tracking systems.[1][7]

II. PROBLEM SPECIFICATION

Sun based trackers are commonly intended for atmospheres with almost no snow making them a more practical arrangement in hotter atmospheres. Fixed racking obliges harsher natural conditions more effectively than global positioning frameworks. Fixed global positioning frameworks offer more field flexibility than single-hub global positioning frameworks. Repaired frameworks can by and large oblige to 20% slants in the E/W heading while at the same time global positioning frameworks regularly offer to a lesser degree a slant convenience as a rule around 10% in the N/S bearing.[2]

III. MATERIAL AND TOOLS

HYDRAULIC POWER PACK

Hydraulic power pack (sometimes referred to as a hydraulic power pack) is a self-contained system that generally includes a motor, a fluid reservoir, and a pump. It works to apply the hydraulic pressure needed to drive motors, cylinders, and other complementary parts of a given hydraulic system.

HYDRAULIC ACTUATOR

A hydraulic actuator is a hydraulic chamber or hydraulic engine that changes over hydraulic force into valuable mechanical work; the mechanical movement created might be linear, rotary, or oscillatory.

Fig:1 Hydraulic Actuator

Standard sizes and weight of solar panels

Sr. No	Solar Panel Manufacturer	Solar Panel Dimensions	Solar Panel Weight
1	Solar world	65 x 39 x 2 in	18-21 kg
2	LG	65 x 39 x 1.5 in	17 .5 kg
3	Canadian Solar	65 x 39 x 1.5 in	18-21 kg
4	Hyundai	65 x 39 x 2 in	17-18.5 kg
5	Sun Power	65 x 39 x 1.5 in	15-18.5 kg

Table No 1

 DOI : 10.35291/2454-9150.2020.0567

4CH 5v DC Relay

The 4 Channel Relay Module is an advantageous board which can be utilized to control high voltage, high current burden, for example, engine, solenoid valves, lights and AC load. It is intended to interface with microcontroller, for example, Arduino, PIC and so forth. The transfers terminal (COM, NO and NC) is being carried out with screw terminal.[4]

Fig:3 4CH 5v DC Relay

ARDUINO NANO

The Arduino Nano is a little, complete, and breadboard-accommodating board dependent on the ATmega328 (Arduino Nano 3. x). It has pretty much a similar usefulness of the Arduino Duemilanove, yet in an alternate bundle. It needs just a DC power jack, and works with a Mini-B USB link rather than a standard one. [3][8]

Fig:2 Arduino Nano

FRAME

The solar panels are fitted with aluminum frames which provide mounting attachment points and protection for the edges of the glass laminate. [9]

Fig:4 Solar Panel Frame

IV. DESIGN OF THE COMPONENTS USED IN THE TRACKING SYSTEM.

1. Hydraulic Actuator

Dimensions:
Stroke of Actuator = 50mm
Bore of Actuator = 40mm
Overall size of Actuator = 50mm x 50mm x 800mm
Area of Cylinder = $\pi D^2/4$
= $(\pi \times 40 \times 40)/4$
= 1256 mm^2
Volume for 1 mm = 1256 mm^2 x 1 mm
= 1256 mm
Flow for 1 mm extension = 1.256 cc

So this are some of the calculation which we used to find out the correct flow rate for the cylinder for the extension of 1 mm with the help of the power which were going to use for the project

2. Hydraulic Pump

Specification:

RPM = 1400
Flow = 0.8 cc/rev
Q (Flow Volume) = $\frac{Volume \times RPM \times Volumetric\ efficiency}{1000}$
= 0.8 x 1400 x 0.85 /1000
= 0.952 lit/ min

Therefore for full extension of stroke of cylinder it take 3.95 seconds. So for 1 mm stroke the time calculated will be 0.065 seconds. For our region the azimuth angle is 38°-40°.Angle of tilt is 30°- 35°. [5] By calculating the total travel we get 60^0 which is to be covered in total of 12 hours so it is required to get travel of 5^0 in 1 hour. This 5^0 travel can be achieved in 4.16 mm of stroke length of the cylinder. So from the above calculations and the observations we made a the following model in the cad software before the implementation for working model.[6]

V. MODELLING OF FRAME OF PV TRACKING SYSTEM

Fig:5 Side View

 DOI : 10.35291/2454-9150.2020.0567

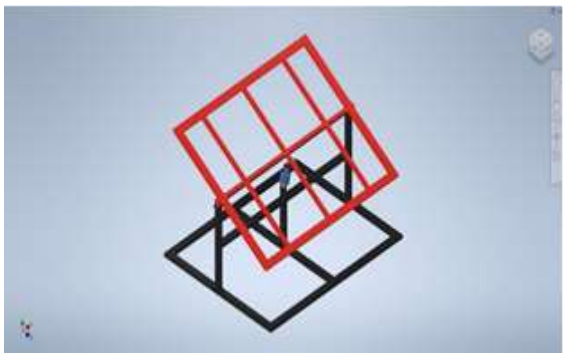

Fig:6 Prespective View

Fig:7 Rear View

VI. CONCLUSION

By implementing hydraulic system it reduces the complexity in design. Hydraulic systems can work in any environment. Dust and humidity have no ill-effects on the system. It neglects the wastage of electricity generated by the panels. As it runs on Micro Hydraulics system it requires less power which is generated by the solar panel. As the design is simple, fault in the system is easily detected during the maintenance. There is future scope of automation in hydraulically operated tracking system.

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