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HYBRID DUAL AXIS SOLAR TRACKING (ALL WEATHER ENERGY GENERATION) SYSTEM

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ABSTRACT

Solar energy is the viable source of renewable energy over the last two-three decades. It is now used in variety of fields such as industries, domestic purpose. Solar energy tracking system is designed to collect maximum power from sun and to convert into electrical power. Another form of energy is Vibration energy which can be converted into electric energy by piezoelectric effect. To implement the project more efficiently, the concept of piezoelectricity has been introduced. In this paper, piezoelectric-based energy-harvesting technology is applied to generate electricity from vibration along with Dual Axis Solar Tracking System Thus Making it an all-weather Energy Generation System.

Keywords: *Dual Axis, Piezoelectric, LDR & Moisture sensor, linear actuation, Arduino Uno*

I. INTRODUCTION

Solar Tracking systems is the most viable source of energy generation. These have undergone many changes in terms of its size, shape and degree of freedom and movement. Even though lots of evolution have occurred in the Solar tracking system but the limitation of using it during sunlight remains unchanged. The construction of Hybrid Dual Axis solar tracking system includes LDR sensor for generation of energy by solar radiation whereas piezoelectric sensor is used to convert the vibration and impact of rain on the solar panel into energy.

The problem in a system is that it can generate energy only by using sunrays whereas during rainy season or cloudy weather condition it cannot produced electricity. However, by combining these two intermittent sources and incorporating maximum power point tracking (MPPT) algorithm, the system's power transfer efficiency and reliability can be improved significantly. When a source is insufficient, the load demands some other energy sources to compensate for the difference. So we are presenting a Hybrid Dual axis (All weather) solar tracking system that can be used in different weather condition throughout the year.

A. Objectives

Our Hybrid Dual Axis solar tracking system is designed such that it can generate energy throughout the year i.e. summer as well as rainy season.

It uses solar energy in summer by using LDR sensor and in rainy season it uses piezoelectric sensor (impact or vibration caused by rain) for energy generation.

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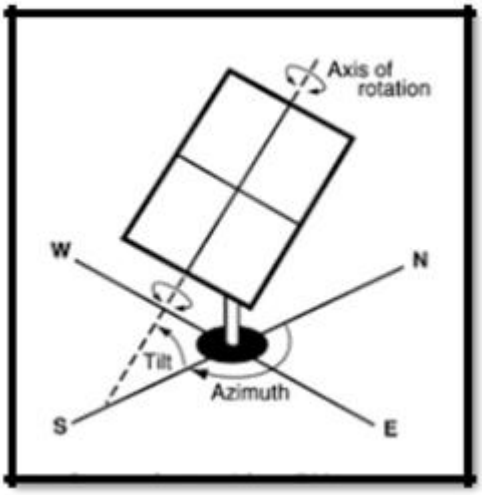

Fig . Dual axis trackers System

It can increase energy efficiency by 30% to 40% which is much more economical than conventional or other solar tracking system.

Dual axis trackers as shown in the figure 1 have two degrees of freedom that act as axes of rotation. Double-axis solar trackers, as the name suggest, can rotate simultaneously in horizontal and vertical directions, and so are able to point exactly at the sun at all times in any location.

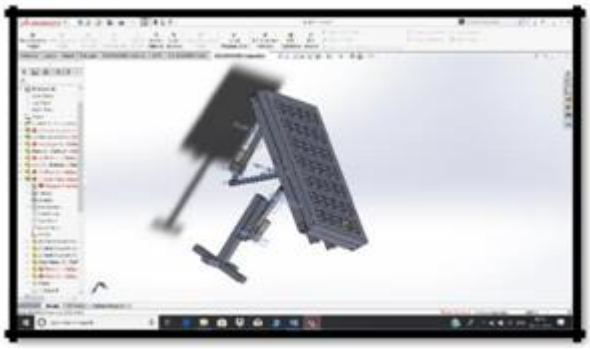

Fig. 1: Hybrid Solar Axis Tracking System

II. LITERATURE SURVEY

Here an attempt is made to review the status of literature in modification of Solar Tracking System. Modification in Dual Axis Solar Tracking System had an impressive mark in the field of Energy Generation. The propose system, is to make power generation more sustainable, economic and ecological by utilizing the advancement in the technology. The vibration energy is capable of providing large amounts of power but its presence is highly uncertain as it can be here one moment and gone in another.[1]

Similarly, solar energy is present throughout the day but the solar radiation levels vary due to sun intensity and unpredictable shadows cast by clouds, birds, trees, etc. The common inherent drawbacks of vibration and photovoltaic systems are their intermittent natures that make them unreliable. Thus, a system with hybrid combination can be utilized for energy generation throughout the year which can increase the efficiency by 30% to 40%.[2]

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III. DESIGN

A. Hybrid Dual Axis Solar Tracker
It consists of LDR for generation through solar radiation and piezoelectric sensor (vibration) during rainy season for generation of electricity.

B. linear Actuator
A linear actuator, method of actuation is used to rotate the Hybrid dual axis solar tracker (structure) through different inclination throughout the day for optimum sunlight.

C. LDR Sensors
The LDR sensor are mounted on every corner of the solar panel, i.e. for North-South and East-West direction. This sensor is used for tracking of maximum solar intensity by using dual axis linear actuation in the system.

LDR is a passive transducer hence we will use potential divider circuit to obtain corresponding voltage value from the resistance of LDR.

Fig. LDR

D. Piezoelectric sensors
The piezoelectric sensor is used to generate electricity during rainy season. This sensor is used to convert vibration energy (impact of rainfall) into electricity during weather condition, making it an all-weather energy generation system throughout the year.

Table 1: Specification of Hybrid Dual Axis Solar Tracking System

Name of Component	Dimension/No's
Monocrystalline Solar Panel	100W
Linear Actuator	2
LDR and Piezoelectric Sensor	4

IV. METHODOLOGY

As stated before, the main aim of the system is the performance of dual axis solar tracking system by motor control method.

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In this method we are using a Dual Axis Solar Tracking system to track the trajectory of sun using LDR sensors which sense the intensity of the incident light and the comparator compares the intensity among the LDR sensors and microcontroller gives the input to servo motor to rotate along the axis so as to obtain the maximum power generation.
Solar panels cannot generate electricity efficiently in case of rainy season. Piezoelectric sensors are used to sense the vibration caused in the system by impact of raindrops on the piezoelectric panel.

Hence by combining both measures of electricity generation, we increase the As stated before, the main aim of the system is the performance of dual axis solar tracking system by motor control methodIt consists of Piezoelectric sensors which are mounted on the back side of the solar PV panel for generation of electricity during rainy season by impact of rainfall for converting vibrational energy (impact of rainfall on Photo voltaic panel) for generation of electricity and LDR sensor for tracking and obtaining optimum solar intensity.

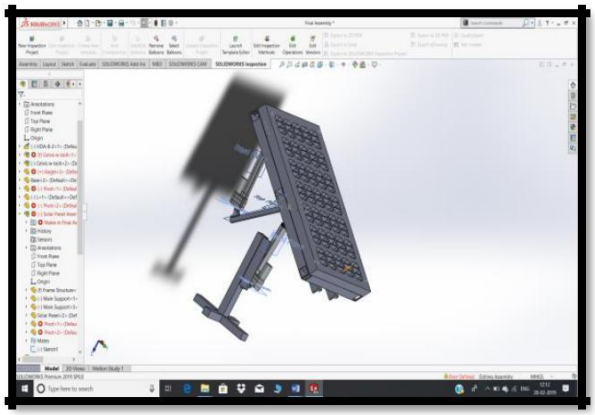

Fig. 2: Assembly of Hybrid Dual Axis Solar Tracking System

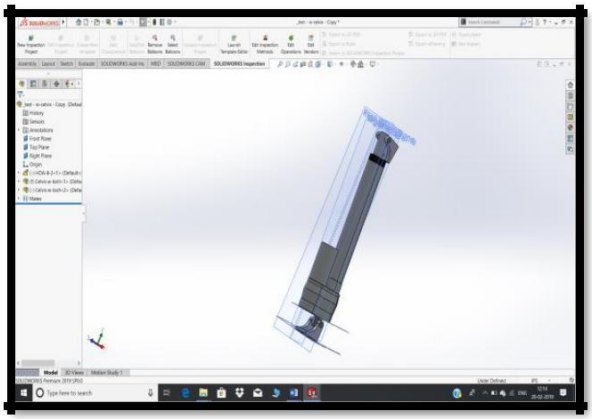

Fig. 3: Linear Actuations

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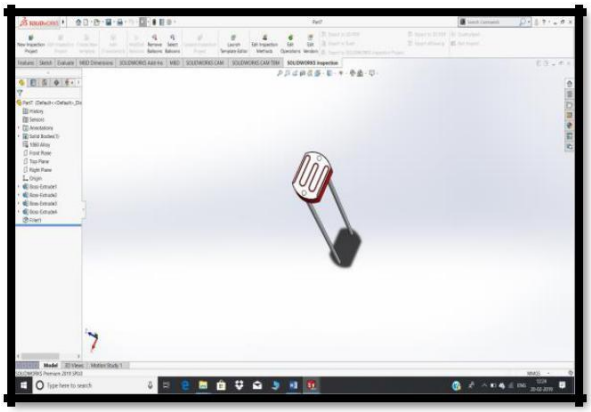

Fig. 4: LDR Sensors for Solar Tracking

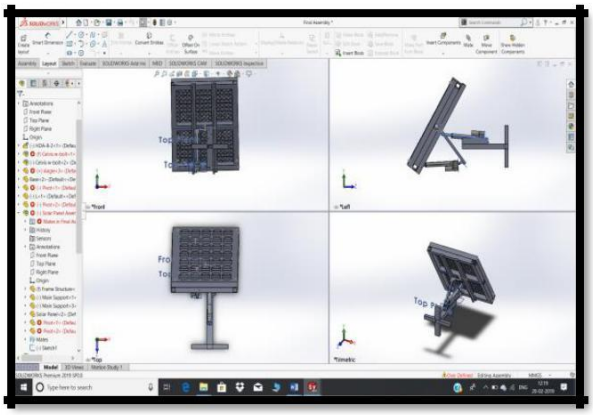

Fig. 5: Different views of Hybrid Dual Axis Solar Tracking System

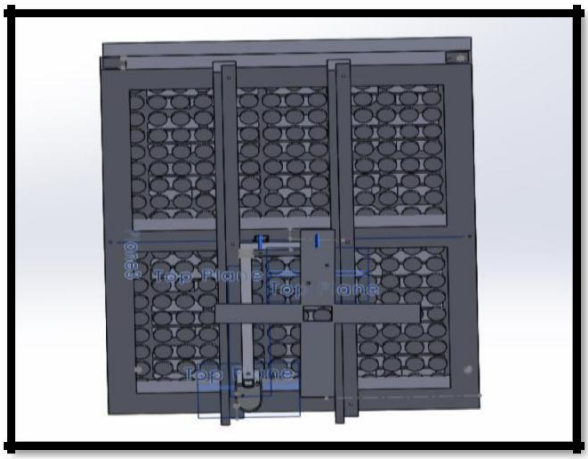

Fig. 6: Piezoelectric Sensors Mounted on Back of the Solar Panel

Piezoelectric Sensors are mounted on the back side of the Solar Panel for utilizing vibrational energy cause by solar panel during rainy season.

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V. WORKING

Sunlight sensing for maximum illumination, providing initial position and delays of photovoltaic (PV) panel, design of an adequate control unit for minimal consuming servo motors are the main challenges of solar tracking systems. That is the objective of this paper to design and implement an automatic control for directing maximum solar illumination to a PV panel. The proposed prototype Hybrid dual axis solar tracker panel is used to optimize the conversion of solar energy into electricity by orienting the panel toward the real position of the sun, at a cost of mechanical complexity and maintenance need, for the best efficiency.

In hardware development, two geared DC servo motors are pulse width modulation (PWM) controlled by a drive unit moving the panel using four light dependant resistors (LDR) to provide analogue signals processed by a simple and low energy ATMEGA168P microcontroller with Arduino. For the software part, after data processing, a C++ programming controls two DC servo motors to position light sensors in the most favourable direction, where solar panel and sensors will be perpendicular to the sunlight. Similarly, during rainy season vibration of rainfall on the solar panel can be converted by using piezoelectric sensors for generating electricity.

VI. CONCLUSION

This paper comes up with an idea of using vibration and solar energy together for generating electricity for our future needs. Hybrid vibration and solar power generation system is one of its kind which is low maintenance and also economy to use. And this system is also efficient. By using different sensor like LDR, Piezoelectric and Moisture sensor we can increase the efficiency of Hybrid Dual Axis Solar Tracking System

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