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IoT Based Solar Tracking System for Power Output Maximization

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Abstract:- In this research paper we are focusing on power output maximization by using IOT based dual axis solar tracker. The system is divided into two parts, hardware system and software system. Hardware system includes light dependent resistor (LDR) which is used for detecting the sun light, two servo motor which are used to move the solar panel and software system consist of coding by using HTML programming language and send to Arduino NANO controller using Proteus software. Dual axis solar tracker captures maximum sun radiation.

Keyword:- *Servomotors, Arduino Nano, LDR, IOT, Dual Axis Solar Panel.*

I. INTRODUCTION

India has an increasing energy demand day by day so there is need of green energy. According to WORLD Energy council prediction, electricity demand will increase in 2030. Costly fossil fuels are imported by India, as India is the largest coal consumer in World. There is need to find alternative source for generating electricity to fulfil the demand. A scheme for "Development of Solar parks and Ultra Mega Solar Power Projects" is targeting the 40 GW capacity at end of year 2022.Dual axis solar system project is very important nowadays. The main aim of this project is to track the intensity of sunlight and follow the path of sun for maximum power output. For getting the maximum power output from the system, it should capture the maximum intensity from sun by tracing its path.

II. RESEARCH METHODLOGY

➢ *Hardware System*

- *Dual Axis Solar Tracker*

Dual axis has two degrees of freedom for axis rotation. It can rotate in horizontal as well as vertical direction so it can track the sun. The system realizes moment along and azimuthally axis. Static version is 40% less efficient than dual axis solar tracking system. Dual axis solar tracker is device that oriented toward sun to maximize the amount of energy harvested from sun rays it increases the efficiency of solar panel. The microcontroller used is Arduino which has many advantages. It is relatively inexpensive, easy to use, and open source, meaning that users can modify and adapt the code to suit their specific needs. building a dual axis solar tracker using arduino.

Table 1 COAL IMPORTED

YEAR	COAL IMPORTED (million tonnes)
2015-2016	207
2016-2017	195
2015-2018	293
2015-2019	235.35
2015-2020	248.54
2015-2021	215.25
2015-2022	209

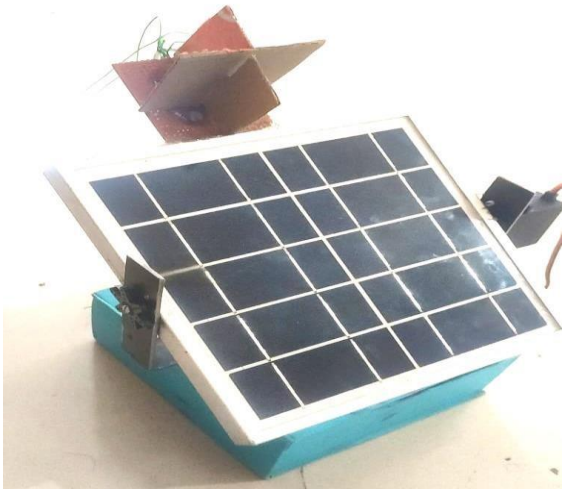

Fig -1: dual axis solar tracking system

Design considerations for a dual Axis Solar Tracker System include the type of solar panel, the location and climate, and the desired level of accuracy and precision. Control algorithms play an essential role in the performance of the dual-axis solar tracker system. Regular maintenance and troubleshooting are essential for a dual-axis solar tracker system to ensure optimal performance and longevity.

- *Sensors*

Sensors are sensitive to intensity of light which can be used as solar tracking sensors. when the sun is on left, the sensor on left receives more light than other sensor it will direct the panel to rotate in the direction of sun light.

- *LDR*

They detect the region of sun light with a higher density. Through servo motors, the solar panel is moved to the location having high light density. Every LDR forms a

potential divider when linked to the power source, so every change in light density corresponds to a change in voltage across the LDRs.

- *Arduino*

It is an open-source prototype platform built on simple hardware and software. It is made consisting of a circuit board with a microcontroller that can be programmed and readymade software called Arduino IDE (Integrated Development Environment), which is used to develop and upload computer code to the actual board.

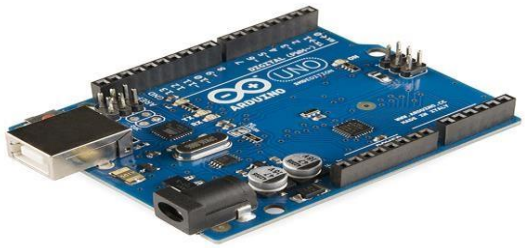

Fig -2: Arduino nano

➢ *Software System*

Proteus software is used for testing and simulation of dual axis solar tracker system. To build a simulation circuit to test the kinematics of this project proteus software is used. The motion and rotation of the solar tracker will be tested to determine the correct sequence for the system. Start with four sensors that locate the sun. The data received from the sensors is converted from analog to digital and read in Arduino UNO for getting the position of the sun and the solar panel. The system will analyse the data to determine sun position and move the servomotor horizontally and vertically according to command specified in Arduino IDE. In circuit when power is given Arduino nano turns the servomotor. Arduino is main processor and servomotor rotate the solar panel. For this project, two servo motors with 180 degrees angle, horizontal and vertical, were used.

➢ *Process Of Dual Axis Solar Tracker*

The project is about tracking the sun radiation and monitor the output with the help of IoT. First step is to detect light with the help of sensor and send the output signal to arduino for next process. Second step is arduino will process the information which is came from sensor and direct servomotor to turn the panel at angle where intensity of light is maximum. The energy from sun is collected by photovoltaic cell and send to arduino. In last step all collected data is sent to IoT through Wi-Fi module. the data collected will be seen on mobile screen in fraction of second.

➢ *Sun Position*

AZIMUTH ANGLE: The azimuth angle refers to the angular distance of a point from true north (geographic north), rather than magnetic north. By determining the azimuth angle, one can determine the position of the sun on a map. When using a compass, it is necessary to account for the magnetic declination specific to your location.

- *Elevation Angle*

The elevation angle is the angle formed between a horizontal line and the line of sight to a particular point. It is measured positively when facing the zenith, which is the point directly above the observer.

- *Zenith Angle*

The zenith angle is the angle between a line perpendicular to the plane of the horizon and the line passing through the observer, extending upward towards the point directly above the observer's head.

- *Sunrise And Sunset*

Sunrise and sunset refer to the moments when the upper limb of the sun just touches the horizon, marking the beginning and end of daylight.

- *Noon*

Noon is the time when the sun reaches its highest position in the sky in terms of solar time.

III. SIMULATION OUTPUT

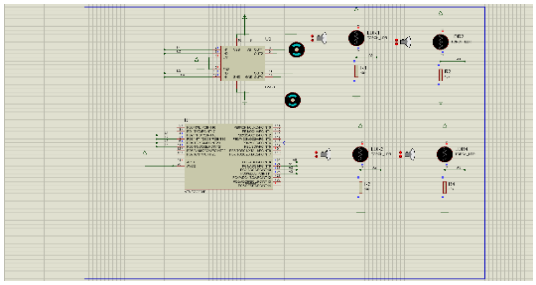

Fig -3: Simulation of Circuit

IV. TRACKER SYSTEM

Fig -4: Prototye Model

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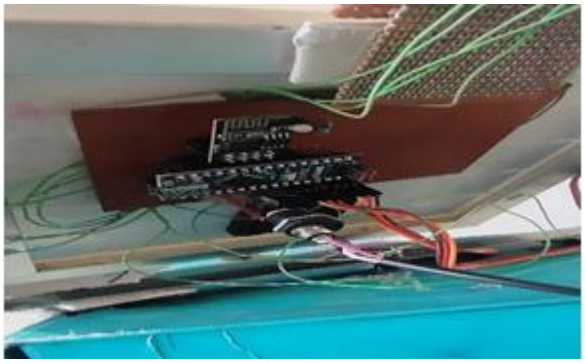

Fig -5: Model connections

V. RESULT

Table 2 OUTPUT

Sr no.	Time	Output voltage(V)	Output Current (mA)	Power Output (mW)
1	7 am	2	200	400
2	9 am	3	300	900
3	11am	4	400	1600
4	12pm	5	500	2500
5	1 pm	5	500	2500
6	3 pm	4	400	1600
7	5pm	4	400	1600
8	7pm	3	300	900

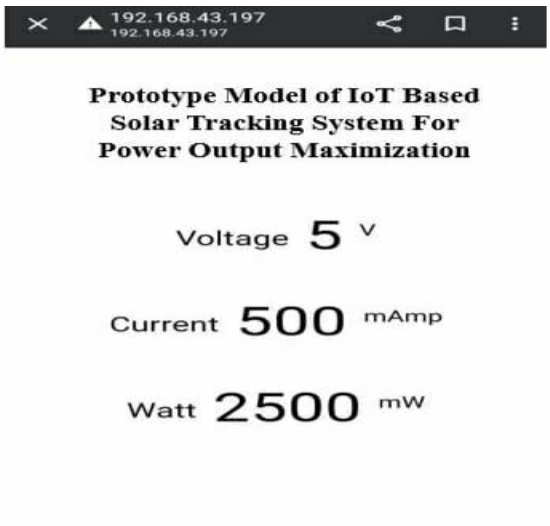

Fig -6: Web page output

VI. CONCLUSION

A dual-axis solar tracking system is an effective solution for maximizing power output in solar energy systems. By incorporating both horizontal and vertical tracking mechanisms, this system can optimize the positioning of solar panels throughout the day and across seasons, ensuring that they capture the maximum amount of sunlight available.

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