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SOLAR SUN TRACKING SYSTEM USING MACHINE LEARNING

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Abstract :

An energy-efficient algorithm for a two-axis (sun) light tracker is proposed using four photoresistors and the Arduino open-source electronic prototyping platform. In addition to special tolerances for light sensors, special tolerances for two servo motors are offered. Here, if the light intensity changes in a certain range in a certain period of time, the servo motor is turned off to save energy. In this case, the load on the power supply is shown to be close to zero. Work, mechanical structure, integration of electrical framework and equipment, and the development of control frameworks that control the entire development of the module to see the maximum solar-based lighting conditions. The following is used from the LDR sensor to provide the data flag to the microcontroller. The centre of the PV board is flat to prevent solar radiation during the day and provide mechanical air conditioning during the evening. The proposed framework includes module development and the development of a 12V battery charging framework that is used as a power point for electronic devices. The results show that the cost of a single PV plant can be reduced by 8% in an inverted structure and solved with a planned DAST. In the proposed methodology, we log LDR read data and process the observed data using machine learning to realize an enhanced Search experience.

Keywords - peak power point tracking, photovoltaic system, solar panel, machine learning, supervised learning, tensor flow, zone prediction.

Introduction

Energy is the main driving factor for the development of any nation. Global society has a huge amount of energy that is produced, distributed, converted and consumed every day. The world's population is growing every day and the demand for energy is increasing accordingly. Oil and coal are the main sources of energy today, but fossil fuels are limited and polluting. Even oil prices are rising every year and medium-term regulations are not very encouraging. The exploitation of these resources increases emissions of carbon dioxide (CO), hydrogen chloride (HCL), nitrogen oxides and sulfur oxides for global warming and the greenhouse effect. This has an adverse effect on the environment.

Since the end of the 19th century, a lot of research has been done by researchers and engineers in terms of mitigating the above-mentioned problems. Renewable energy sources have been discovered as an alternative to fossil fuels. It is derived from a natural process that is constantly replenished. Renewable energy is unlimited and pure. Energy comes from natural resources such as the sun, wind, waves, tides and geothermal heat. Solar energy is simply energy produced by the sun. The history of solar energy is as old as mankinds. In general, solar energy is radiant light and heat from the sun using various technologies such as photovoltaics and concentrators. In the last two centuries, we have started to use the Sun's energy directly to produce electricity

In 1839, Alexandre Edmond Becquerel discovered that certain materials produce small amounts of electricity when exposed to light. In 1876, William Grylls Adams and his student Richard Evans Day believed that they had discovered something completely new when they discovered that electricity can be produced in cells simply by exposing them to light. [1] His contemporary Werner von Siemens, whose reputation in the field of electricity placed him alongside Thomas Edison, called this discovery "the greatest scientific importance". This pioneering work demonstrated quantum mechanics long before most chemists and physicists accepted the reality of atoms. Selenium solar cells can not convert enough sunlight

A. The system can be a good decision. Used with related works

1. Collect and classify data

First, raw data is collected. The optimal number of databases is filled by the elbow method. Cluster analysis is a method for reviewing interpretation and consistency in a database, designed to help identify relevant groups within a database. Various clustering algorithms include K-means, Fuzzy C-means, and Hierarchical Clustering. All group methods produce similar results, ensuring the consistency and validity of the method performed. A random forest is a classification algorithm that consists of several decision trees, as shown schematically. It uses a bagging method that reduces the variability of the algorithm. A decision tree is a tree-like model used for classification, and its algorithm contains conditional control statements. We use the random forest to get the best results from the above method.

Formulation of the Problem.

The main objective is to keep the solar PV panels upright during the day to maximize energy production. A dual-axis solar tracking system can be an effective way to increase the efficiency of solar cells. The problem of damage to the biotic and abiotic components of our house (ie pollution) can be reduced by using solar energy as the main source of electrical energy. Limited fuel, wood, etc. such a gift of nature can survive the crisis and extinction. Due to the more effective and less harmful side effects for people, a dual axis solar tracking on in the long run. Therefore, this project can almost show the impact of this change on people

Description of the sun-tracking machine

the primary goal of this assignment is to lay out a pretty correct solar tracker. This challenge is split into elements. hardware and software. determine 2 indicates the primary additives of the managed device. The device additives commonly include a solar panel, servo motors and a gearbox, an LDR sensor module and electronics. feedback software

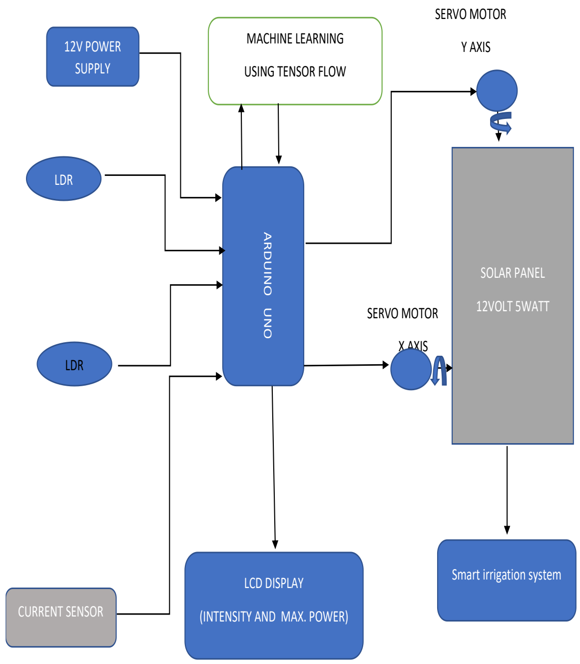
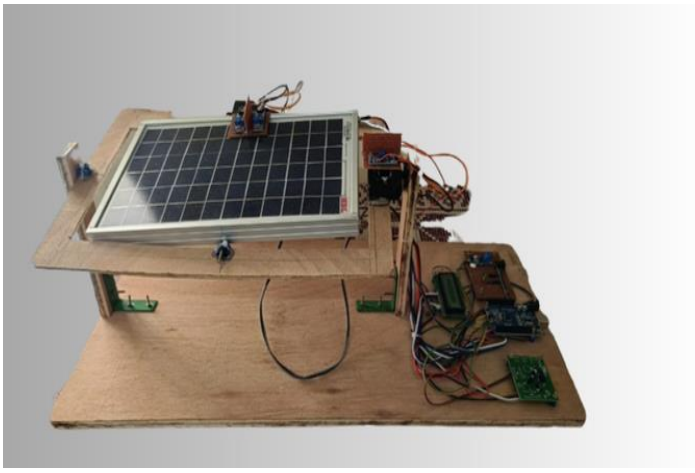


FIGURE 1:

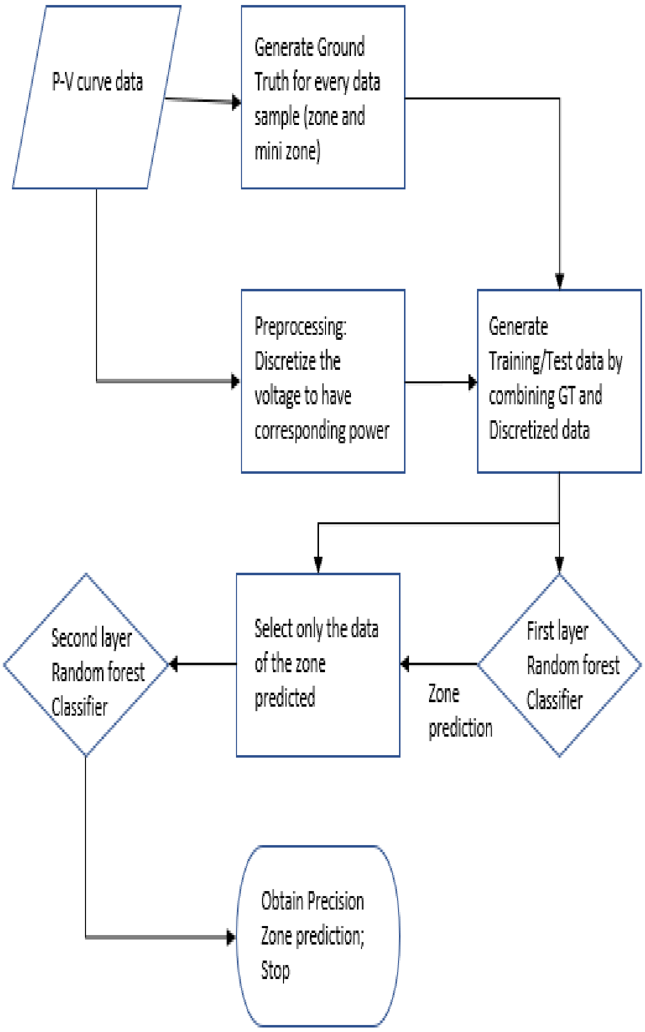
Structural arrangement :

The mechanism structure of the proposed dual-axis solar sun tracking system is shown in figure 1. LDR sensor modules are attached to the solar panel (12v 5w). And there is a servo fixed or attached to the solar panel it tilts according to the position of the sun



NESTED ZONE PREDICTION ALGORITHM

The data samples are grouped according to the zone in which their MPP lies as shown in Fig. 4. below. The voltage axis is discretized, and the corresponding power values are noted to use in the training of the random forest algorithm. In the second layer, each of the initial 16 zones is divided into 2×2 (= 4) mini zones. Based on the first layer of zone prediction, the test samples that are grouped into a zone are trained on the training samples of that



particular zone using the random forest algorithm and tagged with the new mini-zonelabels. For instance, if the test sample was predicted to be in zone 7 in the first layer, then all training samples belonging to zone 7 are considered for second layer mini zone detection. In this case, the mini zones within zone 7 are tagged as 70, 71, 72 and 73, respectively as depicted in Fig. 5. The nested zone prediction algorithm flowchart using random forest is presented in Fig2.

Experiments and results

As a result, two-axis detectors absorb more energy than fixed-angle systems. As a comparison of these two systems, one way is to calculate the efficiency of the PV cells in both systems. Efficiency is the most common parameter used to compare the performance of one solar cell with another. The efficiency of the solar panel is defined as the ratio of the output energy from a solar cell to the input energy from the sun.

Performance Analysis

We tested our model performance based on the number of data points available for the test data. The raw test data is obtained during the operation of the PSO algorithm in a real-life scenario. We reduced the number of data points in our test data to check the performance of our nested zone prediction algorithm. Table 1 shows the accuracy of the algorithm with a subsequently reduced amount of data points from the test data made available to the algorithm. There is a drop in accuracy because of the misclassification of the zone with the neighbouring zone. Our results indicate an accuracy of >90% even with only 60% of test data points made available to the algorithm – which suggests that the algorithm can help to reduce the search boundary for a

% of test data points available	**Accuracy of zone prediction without machine learning**	**Accuracy of zone prediction with machine learning**
100%	**96.26**	**100**
66%	**85.56**	**98.2**
50%	**71.9**	**95.9**
33%	**50.20**	**93.2**
% of test data points available	**Accuracy of zone prediction without machine learning**	**Accuracy of zone prediction with machine learning**
100%	**96.26**	**100**
66%	**85.56**	**98.2**
50%	**71.9**	**95.9**
33%	**50.20**	**93.2**

traditional MPPT algorithm to quickly and efficiently detect the GMPP location. It is noted that when we considered neighbourhood regions for the MPP zone prediction, our model was able to obtain a 100% accuracy

Table1.Accuracy of the data based on machine learning

Time	Solar Irradiance (W/m2)	Optimal Angle (degrees)
10:00:00	1457	33.2
11:00:00	1256	35.6
12:00:00	1559	43.9
13:00:00	1873	45.2
14:00:00	1642	50.7
15:00:00	1230	54.2

TABLE2: Sample data of the dataset validations:

When previewing Figure 5, it is obvious that the efficiency of the tracking system keeps its levels equal with a slight difference because the incident light is normal to the solar cell at all times. On the other hand with a fixed angle system as the sun passes across the sky, the incident light angle on the surface of a solar cell will decrease accordingly, which leads to reduce the resulting power as well. On September 30th 2014the behaviours of azimuth and altitude angles in degrees during whole daylight are depicted in Figures 3 and 4, according to the equations on which the solar tracker system is based.

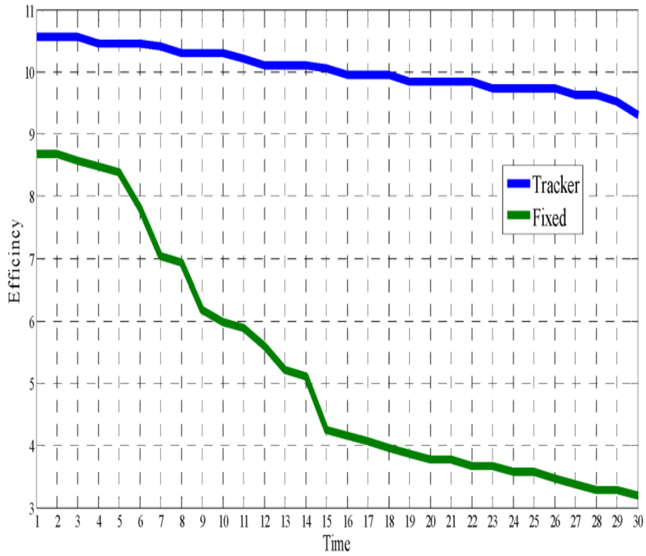


FIGURE3:Efficiency of tracking and fixed systems during 30 minutes

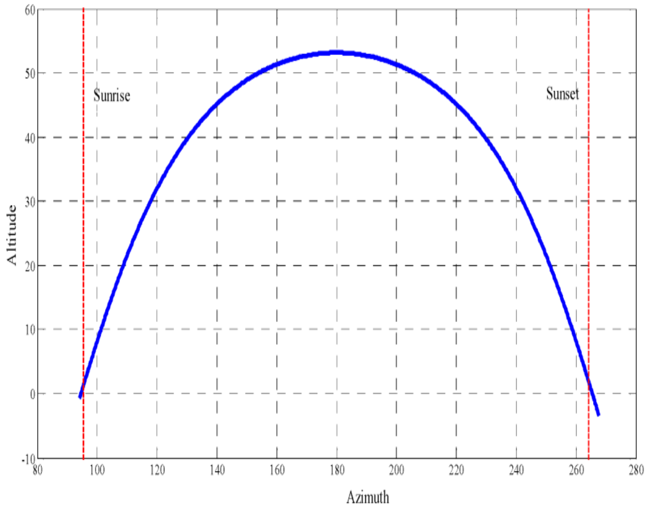


FIGURE4:Azimuth-altitude relationship for the tracking system

Conclusion

Solar tracking mechanisms improve the energy gain of solar power plants. The automatic solar tracking system is generally the one that reaches the highest energy gain in every region. It is therefore the most versatile system since it can be installed anywhere, guaranteeing a high energy gain. Solar trackers are recommended everywhere from an energetic point of view since they always increase the amount of collected energy. Two degrees of freedom orientation are feasible. Arduino Uno controller is used to control the position of DC motors which ensures point-to-point intermittent motion resulting from the DC geared motors. Standalone working and wireless communication is achieved with a computer or mobile which makes the system reliable and observable. The use of LDR sensors and high-precision voltage and current sensors guarantees a more accurate and efficient tracking system. It now displays the sensor Parameters to the User over the internet Using an effective application and also alerts the user when sensor parameters are above specific limits. This makes remote monitoring of solar plants very easy and ensures the best Power output.

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