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ijrset@gmail.com

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Solar Energy Prediction System Using Machine Learning

Setu Shekhar Singh, Aryan Jaiswal, Shukla Vikas Rajesh, Ritik Mehta,

Prof. Abhilasha Narote (Guide)

Dept. of Information Technology, Smt. Kashibai Navale College of Engineering, Pune, India

ABSTRACT: Technology advances will make solar electricity increasingly more accessible in the upcoming years. By 2030, it's feasible that solar energy will make up the majority of the energy used to generate power in a sizable area of the planet. The environment and the fight against climate change will both gain from this.

Different from most existing research works on solar radiation prediction, which mainly focus on the offline solar radiation prediction, in this paper, we implement SVM algorithm to realize the fast and accurate real-time prediction of solar radiation can be.

KEYWORDS: SVM Algorithm, Machine Learning, Python, Spyder, CSV Dataset

I. INTRODUCTION

The increasing demand for renewable energy and the dramatic cost reduction in photovoltaic modules (PV) have been promoting the expansions of solar power world-wide, which is expected to grow by The uncertainty in PV power outputs due to the intermittency of solar radiation in changing weather conditions can affect the operation and economies of PV systems, and therefore hinder their expected growth The ability to predict solar radiation reliably provides a solution to this problem by enabling the optimization of solar energy integration, ensuring grid stability and regulating energy markets.

Quite possibly of the most serious issue that sun-oriented energy innovation presents is that energy is just created while the sun is sparkling. That implies evening and cloudy days can intrude on the inventory. The lack made by this interference wouldn't be an issue in the event that there were minimal expense approaches to putting away energy as very radiant periods can really produce overabundance limit. Countries like Japan and other global leaders in solar energy technology are focusing on creating sufficient energy storage to deal with the rising global capacity for solar power.

Solar power will turn out to be much more reasonable before long on account of progressions in innovation. It's conceivable that sun powered energy will be the main wellspring of energy for the creation of power in a huge piece of the world continuously 2030. Climate change and the environment will also benefit from this.

II. RELATED WORK

The updated methods utilising different techniques are gathered to analyse the Solar Energy. The following study on various models made by different authors using various technologies and a thorough assessment of various researchers' efforts are mentioned;

1. “Real-Time Prediction of Solar Radiation based on Online Sequential Extreme Learning Machine” made by authors Jie Zhang, Yuefan Xu, demonstrated Solar energy, which is one of the greatest potential renewable energies, has widely attracted attention in current years. Accurate prediction of solar radiation is the premise of exploiting and utilization of solar energy. However, most of the research works on solar radiation prediction focus on the offline prediction, which is not practical and suitable in real world applications.

2. B. M. Alluhaidah, Hamed H. H. Aly, made “Performance Testing of Different Configurations of Hybrid Proposed Models for Solar Radiation Prediction Using WNN and ANN”, and their model stated that the solar energy resource is important because it offers a response to polluted energy challenges. Solar radiation forecasting is important to deal with as the overall all power generated depends on the forecasted model. In this paper Saudi Arabia is used as a



case study. Several meteorological variables will be used to find better result of hourly Global Solar Radiation (hGSR) prediction in terms of error.

3. Giovanni Scabbia, Antonio Sanfilippo worked on “Exogenous Parameters in Solar Forecasting” that provided the ability to predict solar radiation reliably is crucial in optimizing solar energy integration, ensuring grid stability and regulating energy markets. One way to improve accuracy in forecasting solar radiation with time series modeling is to use exogenous variables (e.g. temperature, humidity, pressure, wind speed, and direction) in addition to solar radiation measurements.

4. Muhammad Hassan, Amine Bermak proposed “Solar Harvested Energy Prediction Algorithm for Wireless Sensors”, in order to efficiently utilize solar harvested energy in design, precise solar harvested energy prediction is a challenging task due to irregularity in solar energy patterns because of continually changing weather conditions. In this paper, we are presenting efficient algorithm for solar energy prediction based on additive decomposition (SEPAD) model.

III. METHODOLOGY

Mathematical Model

Let S is the Whole System Consist of

S= I, P, O

Where;

I= SELOC, LOG, RE, PRO

LOG=user login into system

SELOC= Select CSV file

PRO= Upload the dataset

R= SVM Classification

P = Process

Step1: User will login

Step2: User will select Company

Step3: User will Analyse Data

Step3: User will Apply Mathematical Algorithmic Method

Step4: System will give Prediction about solar energy

OUTPUT: Display result on system

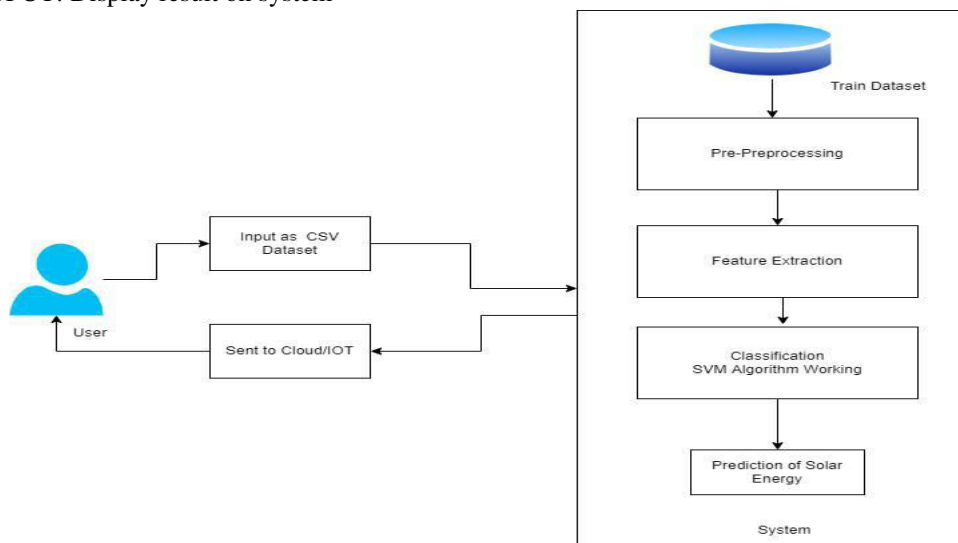


Fig-1: System Architecture

IV. APPLIED TOOLS AND TECHNOLOGIES

Python: Python is a high-level, interpreted, and versatile programming language. Python's design philosophy, developed by Guido van Rossum and first released in 1991, places a significant emphasis on code readability through its extensive use of whitespace. Programmers can use its object-oriented approach and language constructs to write clear, logical code for both small and large projects.

Garbage collection and dynamic typing are features of Python. It works with object-oriented, functional, structured (especially procedural), and other programming paradigms. Python is frequently portrayed as a "batteries included" language because of its thorough standard library.

Anaconda: For scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), Anaconda is a free and open-source distribution of Python and R. that expects to improve on bundle the board and sending. The dissemination incorporates information science bundles appropriate for Windows, Linux, and macOS. Boa constrictor, Inc., which was founded in 2012 by Peter Wang and Travis Oliphant, is responsible for its creation and upkeep. Because it is a product of Anaconda, Inc., it is also known as Anaconda Distribution or Anaconda Individual Edition. Other products from the company include Anaconda Team Edition and Anaconda Enterprise Edition, neither of which are free.

Databases

- The database is used for most part to store client data, for example, usernames and passwords and other information that is required for registration.

Database SQLite was used to perform database functions.

Support Vector Machine (SVM) Algorithm

Support Vector Machine, sometimes known as SVM, is a linear model used to solve classification and regression issues. It can resolve both linear and nonlinear issues and is effective for a variety of real-world issues. The fundamental idea behind SVM is that information is separated into classes by a calculation that creates a line or hyperplane.

The capacity to create non-linear dependencies between the input and output data sets gives Artificial Neural Networks (ANN) one edge over natural neural networks.

SVM can be used to provide predictions of the high quality. A study on datasets downloaded from Kagle is conducted to quantify their felicity as input features in order to investigate further potential improvements in vaticination quality. The SVM model outperformed the ANN model, according to the results.

V. RESULTS

The project successfully delivers a comprehensive interface with interactive features, including a dashboard displaying a keyuser-friendly registration and login system, a contact form for user communication.

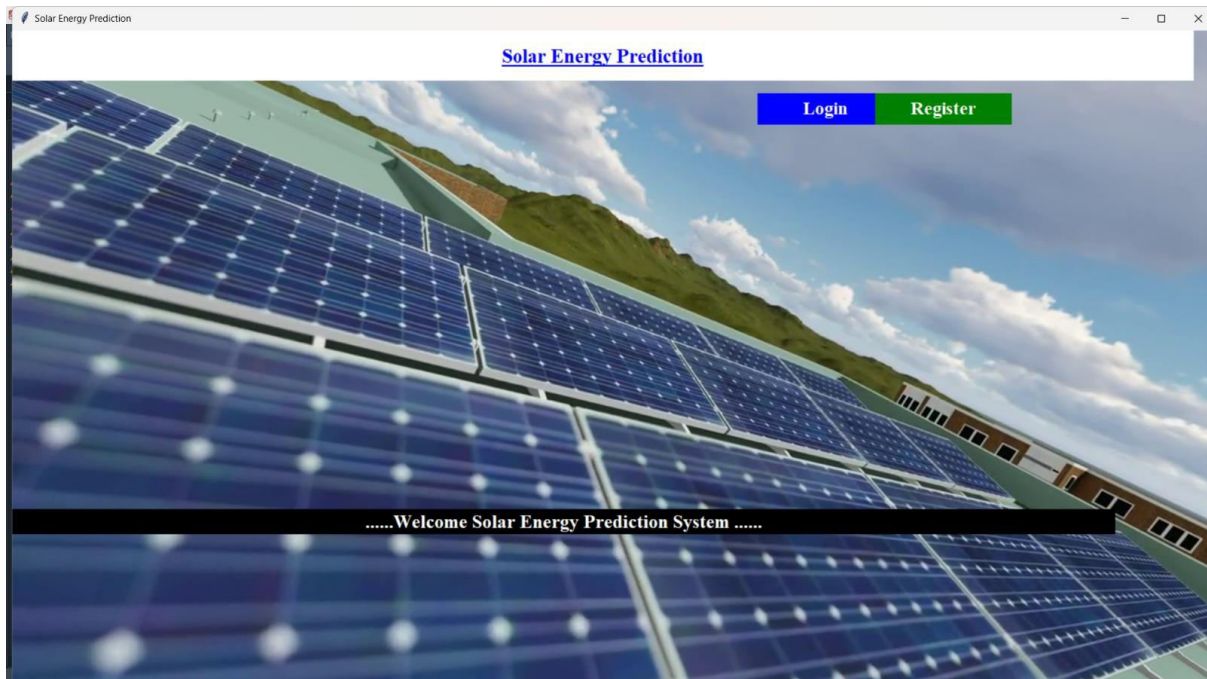


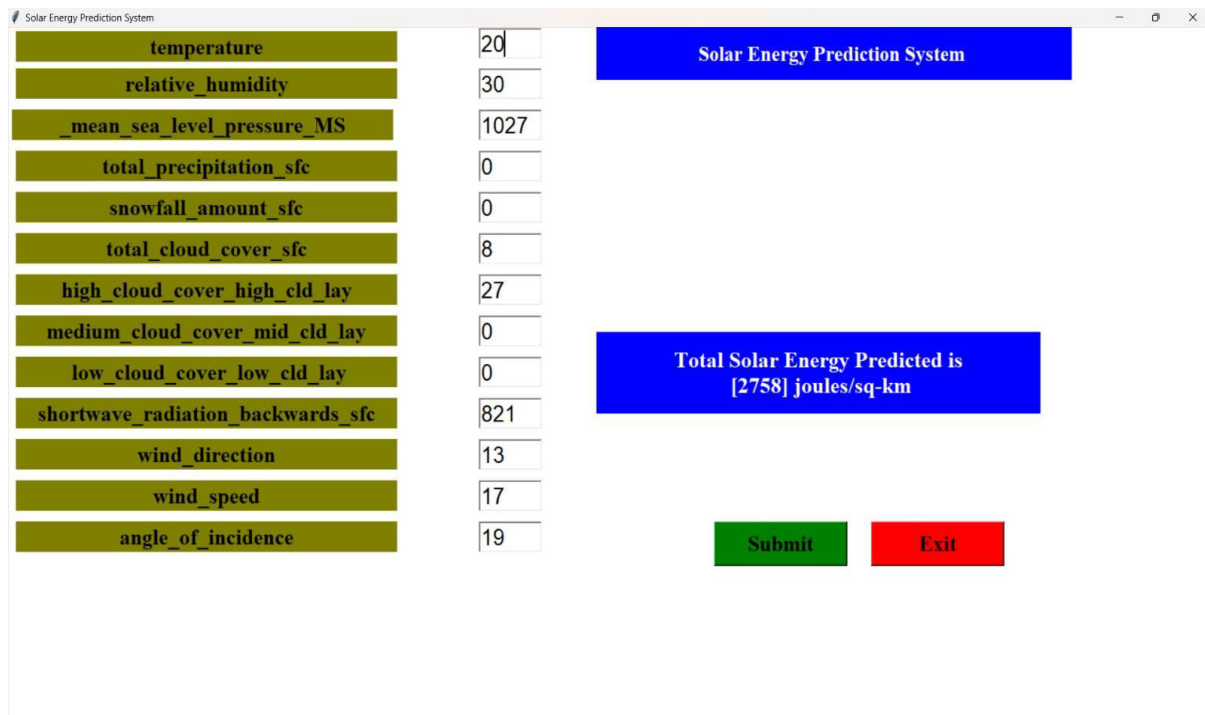
Fig-2: Home Page

The Home page encompasses various sections, including the home page, contact form, registration page, and dashboard, providing an interactive platform for users to navigate, communicate, and access different features.



Fig-3: User Interface

This interface provides a dashboard displaying key information such as the login and registration form through which user can access the system.



temperature	20
relative_humidity	30
mean_sea_level_pressure_MS	1027
total_precipitation_sfc	0
snowfall_amount_sfc	0
total_cloud_cover_sfc	8
high_cloud_cover_high_cld_layer	27
medium_cloud_cover_mid_cld_layer	0
low_cloud_cover_low_cld_layer	0
shortwave_radiation_backwards_sfc	821
wind_direction	13
wind_speed	17
angle_of_incidence	19

Total Solar Energy Predicted is [2758] joules/sq-km

Fig-4: Solar Energy Prediction Result

The solar energy predictor is a vital functionality within the project, where users can input various parameters such as temperature, relative humidity, angle of incidence, wind speed, etc. to predict the solar energy.

VI. CONCLUSION

It is evident from results that our algorithm performs better as compared to other algorithms in unpredictable weather conditions. In order to further improve performance of our algorithm, we are considering dynamic tuning of scaling parameters used in our algorithm so that it could dynamically tune its performance in run time. Using SVM algorithm we can predict the solar energy. More accuracy can be detected.

REFERENCES

1. S. Sobri, S. Koohi-Kamali, and N. A. Rahim, "Solar photovoltaic generation forecasting methods: A review," *Energy Convers. Manag.*, vol. 156, pp. 459–497, Jan. 2018.
2. O. Ayvazoglu and U. B. Filik, "Estimation methods of global solar radiation, cell temperature and solar power forecasting: A review and case study in Eskişehir," *Renew. Sustain. Energy Rev.*, vol. 91, pp. 639–653, Aug. 2018.
3. S. Sperati, S. Alessandrini, and L. Delle Monache, "An application of the ECMWF Ensemble Prediction System for short-term solar power forecasting," *Sol. Energy*, vol. 133, pp. 437–450, Aug. 2016.
4. A. T. Eseye, J. Zhang, and D. Zheng, "Short-term photovoltaic solar power forecasting using a hybrid Wavelet-PSO-SVM model based on SCADA and Meteorological information," *Renew. Energy*, vol. 118, pp. 357–367, Apr. 2018.
5. S. E. Haupt and B. Kosovic, "Big Data and Machine Learning for Applied Weather Forecasts: Forecasting Solar Power for Utility Operations," in *2015 IEEE Symposium Series on Computational Intelligence*, 2015, pp. 496–501.
6. M. Abuella and B. Chowdhury, "Random Forest ensemble of support vector regression models for solar power forecasting," in *2017 IEEE Power Energy Society Innovative Smart Grid Technologies Conference (ISGT)*, 2017, pp. 1–5.
7. M. K. Behera, I. Majumder, and N. Nayak, "Solar photovoltaic power forecasting using optimized modified extreme learning machine technique," *Eng. Sci. Technol. an Int. J.*, vol. 21, no. 3, pp. 428–438, Jun. 2018.
8. A. Gensler, J. Henze, B. Sick, and N. Raabe, "Deep Learning for solar power forecasting - An approach using



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| DOI:10.15680/IJIRSET.2023.1205378 |

AutoEncoder and LSTM Neural Networks,” in 2016 IEEE International Conference on Systems, Man, and Cybernetics, SMC 2016 - Conference Proceedings, 2017, pp. 2858–2865.

9. T. Verma, A. P. S. Tiwana, C. C. Reddy, V. Arora, and P. Devanand, “Data Analysis to Generate Models Based on Neural Network and Regression for Solar Power Generation Forecasting,” in 2016 7th International Conference on Intelligent Systems, Modelling and Simulation (ISMS), 2016, pp. 97–100.

10. L. Cavalcante and R. J. Bessa, “Solar power forecasting with sparse vector autoregression structures,” in 2017 IEEE Manchester PowerTech, Powertech 2017, 2017, pp. 1–6.



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