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Study Of Different Solar Energy Strategies And Energy Prediction Parameters

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ABSTRACT:

Solar energy is one of the world's most cost-effective and environmentally friendly alternative energy options. The flow of solar energy is extremely unpredictable due to its dependence on a variety of variables such as weather, seasons, and other environmental/ecological conditions. Estimating solar radiation is an inevitable prerequisite for optimizing solar resources and improving the efficiency of solar systems. The solar industry requires supportive policies to continue its development. Solar power systems and their related technologies have become a common green energy source around the world. Solar energy is not yet widely used in contrast to traditional forms of energy owing to the extremely high cost of building, low conversion rates, and issues with battery capacity. Considering all of this review solar system have a positive outlook future as a solar-powered global powerhouse. This paper studies a comparative analysis between grid extension and the implementation of renewable off-grid hybrid power system. Despite the challenges, numerous advanced materials and approaches to improving the efficiency of solar energy transitions raise the consumer appeal of solar power. In this paper we study the literature from the previous year research paper of promising solar power technologies. This paper also tries to discuss about which type of system used by different authors and also discussed about power generation profile used by different authors.

Index Terms: Solar energy, Photovoltaic Energy, Machine Learning.

1. INTRODUCTION

With technological advancements and an ever-increasing population, energy output must rise to meet rising demand. Our planet's energy demand is forecast to climb to an alarming 36.5 trillion kWh by 2040. Our reliance on assets such as gas, coal, and natural gas will soon come to an end as we become more aware of the dangerously unsustainable lack of these services. As a result, the emphasis is on discovering new, clean energy sources. Foreign

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

annual expenditures in green energy suppliers, for example, are rising significantly, with solar energy being one of the more prominent sources and it is one of the most renewable energy supply sources. In fact, global solar energy production increases by an average of 8.3 percent each year[12] and is expected to increase to 15.7 percent between 2012 and 2040[5].

Although solar energy is green, the sources of energy itself are dependent on a variety of ecological and environmental factors. A correlation between various historical data and the availability of solar energy is critical for organisational, policy, and planning purposes. It would also be beneficial to automatically learn these relations using machine learning algorithms in order to embed them in workflows for energy consumption optimization[10]. Climate change and the gradual decline of nonrenewable energy supplies are motivating forces behind clean energy research and growth, which impacts both countries and businesses.

Green energy, also known as renewable energy development, is a hot topic of science right now. Solar energy is one of the most common and well-known forms of renewable energy since it is simple to get and has less constraints on procurement and implementation. Solar energy is relatively expensive in comparison to fossil fuels, and energy storage options are often insufficient for night power, extended storms, and gloomy weather. The aim of this paper is to explain the development of solar power technologies. On Earth, sunlight is an inexhaustible source of free energy [11]. To produce enough electricity, a number of renewable energy sources may be used (e.g. hydraulic, biomass, geothermal and solar).

In order to generate energy i.e. it involves green resources with substantial global potential, but geothermal and hydraulic (such as dams) are geographically restricted, and biomass (such as wood and vegetables, solid waste, waste coal, biogas, ethanol, and biodiesel) needs combustion, which practically raises the intensity of carbon pollution[1]. “Technologies are being developed to generate power from harvested solar energy. Several solar power systems are economically practical and are used as renewable alternatives around the world (though not entirely eliminating conventional electricity sources) [2]”.

2. LITERATURE SURVEY

Prediction of solar energy is not a new problem. Many scientists have sought various approaches to addressing this problem.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

1) J. Jurasza, F.A. Channelsc, "A analysis of renewable energy complementarity: concept, calculations, application, and future scientific directions" The aim of this paper is to use the basic principle of hybrid energy sources (using renewable energy without dispatch) to balance their energy generation patterns. This project is solely concerned with possible temperature models. The implications of change in renewable energy have also been examined. Studies focused on the most current renewable wind, nuclear, and hybrid energy sources. In our research, we have used a narrative approach to this study article

2) David A. Wood, "Hourly averaged solar and wind power in Germany in 2016: long-term predictions, short-term forecasting, data collection, and quantitative assessments." The aim of this paper is to generate anomalous TOB MW predictions as well as to boost solar plus wind power predictions during periods of rapid weather shift. In an hourly basis, 256 recording stations are recoded all over the world. They have ten distinct data set variables. These specifics were used to examine the influence of different variables. They often address the environment and nature. The results suggest that utilising longer time period data, i.e. evidence lasting more than a year, more improvements to TOB's short-term forecast accuracy could be necessary.

3) 'A machine learning method for reviews and patent evolutionary study of solar power technologies,' Amy J.C. Trappey, Paul P.J. Chen, Charles V. Trappey, and Lin Ma The aim of this paper is to use unattended machine learning techniques together with the Latent Dirichlet Allocation (LDA) subtechnology cluster modelling algorithm to cluster patents and literature. This essay employs the text mining process. Text mining employs four machine learning methods to derive analytical results: clusters, topic emulation, doc2vec, and patent evolution graphs. The clustering method incorporates scientific literature papers which contains two different patent information in the clusters. At then, At then, To eradicate a problem with document length, the simple term frequency-inverse document frequency (NTF-IDF) is used to describe key termas. As a result, we should conclude that this research is comprehensive and original, and that it is cross-referenced using scientific literature as well as international patents.

4) "Performance evaluation of hybrid neuro-fuzzy adaptive inference system models for monthly global solar radiation estimation," Saad Mekhilef and Laith M. Halabi. The aim of this paper is to use hybrid models such as particle swarm optimization, genetic algorithms, and differential growth. In this article, a new model called Global Solar Radiation on Horizontal Surface was created (GSRHS). Using Euskalmet databases, this paper utilises

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

ANN instruments to predict solar energy in the short term, i.e. 10 minutes. As a result, the results show that using the solar radiation parameters ANN model yields a specific result. Since solar irradiation volatility is reduced, it can be used to assist micro grids with instantaneous power.

5) "Studies on data-driven prediction of building energy use," Kadir Amasyali and Nora M. El-Gohary. The aim of this paper is to review studies that developed prediction models for building-driven energy use. As illustrated in this review report, data-driven energy demand predictions pique the attention of researchers. Both models have benefits and drawbacks and perform differently in different circumstances. There is no one size norm that should be used in any situation. As a consequence, this paper presented a review of recent work on data-driven energy demand forecasts in buildings. The paper concluded with an examination of the machine learning algorithms and the models' performance criteria.

6) Puteri Fitriaty and Zhenjiang Shen, "The prediction of residential building energy output using 3D modelling analysis, attached photovoltaic cells to a tropical zone" The aim of this paper is to model the optimal PV panel installation; BIM Revit software was used to quantify solar radiation incidents. PV screens were mounted on the roof of a house by the researcher. Incident Incident Incident Solar radiation is high and consistent across the year. As a consequence, the energy generated by hypothetical PV panels was compared to actual residential energy use. This serves as the basis for evaluating the PV panel's implementation. When the photovoltaic energy generated was compared to current electricity consumption, it indicated a beneficial surplus for electricity supply. According to this report, the highest solar irradiation and the longest sunshine time occurred in October, while the lowest emission and shortest length occurred in January.

3. SOLAR TECHNOLOGY DEVELOPMENT

The sections that follow represent the detailed history of solar energy and its invention mining initiatives. The aim of this paper is to look at the past of solar science and clarify where it is going now. This framework would be used to explore additional theoretical aspects of solar physics. Solar power is attractive because it is abundant and offers a remedy to the emissions generated by fossil energy and global climate change. The Earth receives solar radiation at a rate of approximately 1,73,000 TW. This greatly exceeds the current global average energy consumption rate of about 15 TW, as well as all potential criteria.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

India is an ideal solar combination since it is both highly settled and has high solar insulation. India is now a major producer of wind energy.

Table 1. Table shows a review of literature of power generation profile, a load profile, and the methods used by various academics (In different research papers). Abbreviations: OGH(off-grid home)

Sr.no.	Authors	System	System Location	Method	Load profile	Subject	Power generation profile
1	S´anchez et al. (2014)	Photovoltaics - Wind power - Battery energy storage - Hydrogen energy storage	Spain	Heuristic equations, HOMERMatlab model and HOGA	Generalised	OGH	Measured
2	Bustamante et al. (2015)	Photovoltaics - Wind power - Battery energy storage - Hydrogen energy storage	Arizona (USA)/ Crete/ Iceland	HOMER	Constant	Off-grid telecom stations	Simulated
3	Dincer et al. (2016)	Photovoltaics - Wind power - Battery	Ontario (Canada)	HOMER	Generalised Generalised	OGH	Simulated

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

		energy storage - Hydrogen energy storage					
4	Huerta et. al. (2016)	Photovoltaics - Hydrogen energy storage	Mexico	Experimental	Emulated	OGH	Measured
5	Dorer et. al.(2017)	Photovoltaics - Battery energy storage - Hydrogen energy storage	Switzerland	MILP modelling	Measured	Grid-connected district	Measured
6	D.N. et.al. (2018)	Photovoltaics - Wind power - Hydrogen energy storage	South-Africa	HOMER	Generalised	Off-grid village	Simulated
7	Chabert et al. (2018)	Photovoltaics - Battery energy storage - Hydrogen energy storage – Biomass	Teneriffe/ Scotland	ODYSSEY software	Constant/Measured	Off-grid Telecom station/ Off-grid Home	Simulated
8	Andaluz et. al. (2019)	Photovoltaics - Battery energy	Equador	HOMER	Generalised	OGH	Simulated

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

		storage - Hydrogen energy storage					
9	Blaabjerg et. al. **(2020)**	Photovoltaics - Battery energy storage - Hydrogen energy storage	India	Experimental	Measured	OGH	Measured

4. Discussion and Implementation

Solar energy data and corresponding weather data are divided into three non-overlapping subgroups: training - the top 70% of the data, validation - the remaining 30% of the data and testing data. The training dataset is used to build the predictive model; the validation dataset is used to select parameters and the test dataset is used to evaluate the performance of the proposed method and other methods of comparison.

Table 1: Comparison Graph energy prediction parameters

Machine Learning Classification	DAT(°C)		DTSD (h)		DTGSR(kWh/m²)		DTPEG(kWh)	
	Original	Predicted	Original	Predicted	Original	Predicted	Original	Predicted
KNN+SVM	24	34	0.5	1	12.3	12	6.89	6.9

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

LSTM	24	25	0.12	0.9	12	12.08	6.9	6.85

Table 2: Comparison with classification parameter

Techniques	Machine Learning Classification	Attributes	Accuracy	Sensitivity	Specificity
Proposed Techniques	LSTM	DAT (°C)	95%	97.90%	99.99%
		DTSD (h)	96%	97%	99.97%
		DTGSR (kWh/m²)	93%	92%	91%
		DTPEG (kWh)	97%	95%	95%
	SVM+KNN	DAT(°C)	84%	86%	85%
		DTSD(h)	85%	84%	89%
		DTGSR(kWh/m²)	89.99%	89.90%	89.99%
		DTPEG (kWh)	860%	86%	83%

Table 3: Comparison with existing machine learning classifier

Techniques	Machine Learning Algorithm	Accuracy (%)	Sensitivity (%)	Specificity (%)
Proposed Techniques	LSTM	96 %	97%	99.97%
	SVM+KNN	89.99%	89.90%	89.99%
Existing Classification	Naive Byes Classifier	82.17%	98.30%	

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

Ramazan Bayindir[1]				

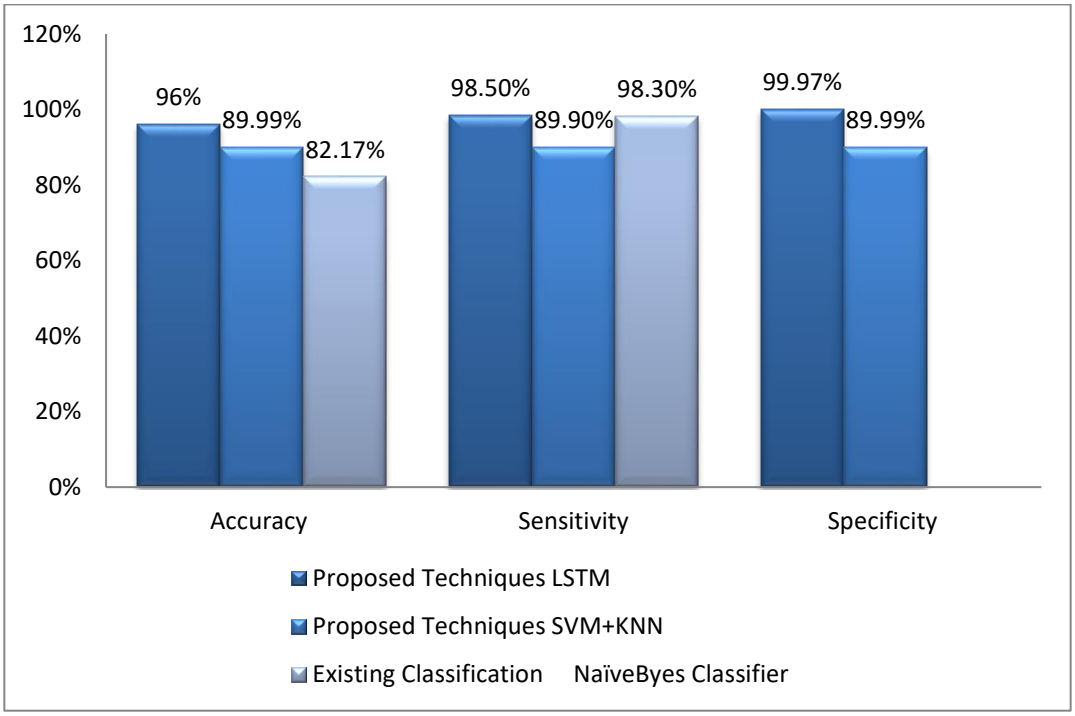
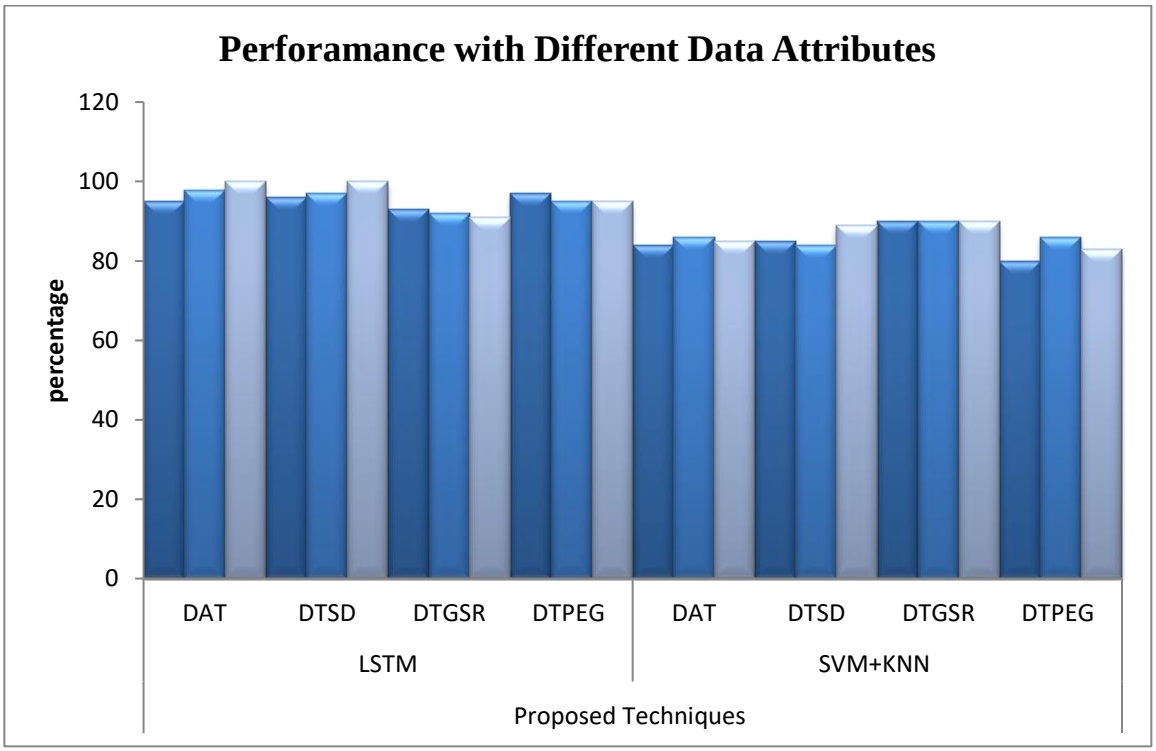


Fig1: Comparison Graph with Proposed And Existing Classification



ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11,S Iss 3, Dec 2022

Fig 2: Comparison Graph with Performance With Different Data Attributes

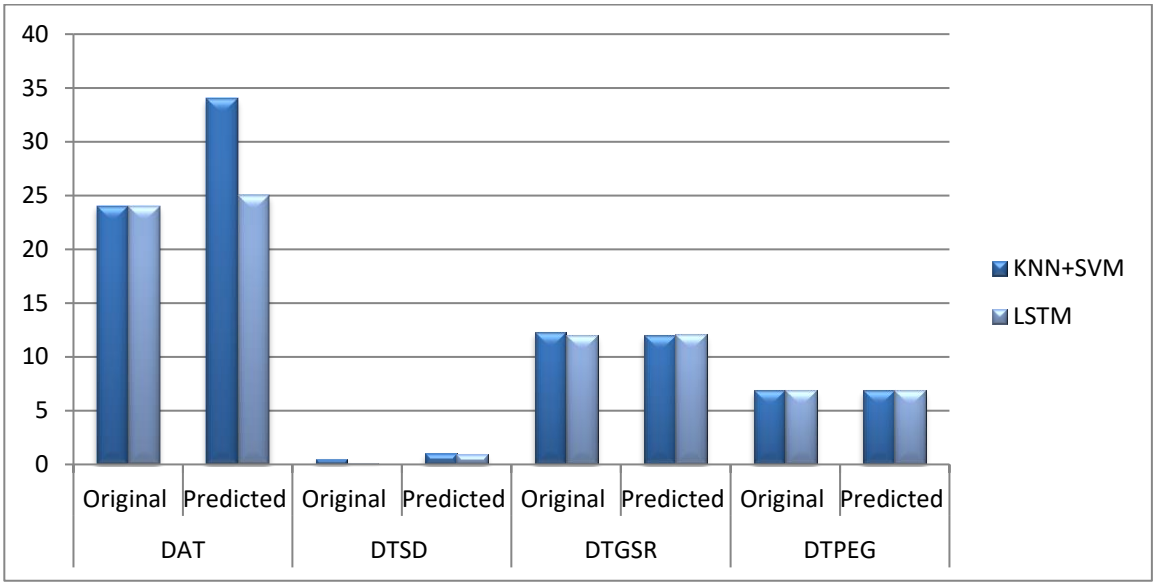


Fig 3: Comparison Graph with Performance original and predicted value

5. CONCLUSION

The study aims to assess recent developments in solar science and make predictions about the future of solar electricity. In-depth assessments of solar power technologies are provided via the study's proposed discovery process based on literature learning techniques. Policies that encourage solar energy are essential to the sector's future growth. Both grid expansion and the introduction of renewable off-grid hybrid power systems are evaluated, and an optimal design of a hybrid PV-FC-B power system is carried out. Therefore, this work presents a literature review of the sources used by a large number of researches, including the unit, power production profile, load profile, and techniques.

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