International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 4 April 2023, pp: 795-798 www.ijaem.net ISSN: 2395-5252

AI based 2-way renewable harvesting system real-time monitoring with IoT

A.Prabaharan*, Abdul Kalam E#, Dhanasekaran M#
,Saravanan S# , Paramesh kumar S#

*****Assistant Professor, Department of Electrical and Electronics Engineering, VSB Engineering College, Karudayampalayam, Karur-639111.

#Final year student, Department of Electrical and Electronics Engineering, VSB Engineering College, Karudayampalayam, Karur-639111.

Date of Submission: 05-04-2023 Date of Acceptance: 15-04-2023

ABSTRACT:
The move to a more adaptable, intelligent, and interactive grid system, known as the Smart Grid (SG), has already been made in the electric grid for load management, energy forecasting, greater penetration of renewable energy generation, future planning, and operations. However, as more products and vehicles become electric, there is a big imbalance between supply and demand for energy. When energy is produced from diverse renewable energy sources including solar photovoltaic (SPV) and wind energy, it is known as renewable energy harvesting (REH), which is crucial in regulating this demand response gap. The AI-RSREH strategy, or the AI-powered Recommender System for REH in residential homes, was therefore proposed in this research .The primary objective of the proposed AI-RSREH technique is to reliably anticipate energy generation based on SPV and wind energy, and this study intends to reduce the discrepancy between real and expected energy output while also providing a recommender system for SPV installation. For the demand response gap, an exploratory residential house-wise data analytics is carried out. With a recommender system depending on the outcome of the energy generation forecast, AI-RSREH predicts energy generation using a stacked Artificial Neural Network (ANN) model . The results demonstrate the effectiveness of the suggested strategy in comparison to the existing approaches with regard to variables like SPV installation in residential homes and prediction accuracy.

Key Words: PI controller, Transmission lines, Energy, Power loss, GPS, IoT.

I. INTRODUCTION

The main purpose of this paper is to develop a prototype of the AI Based 2 way renewable energy harvester, With the rise in power demand, Smart Grid (SG) technology has emerged as a crucial tool for integrating renewable energy more easily and widely in order to close the demand response gap. It is an improved version of the conventional grid infrastructure that enables two-way transmission of energy and data (gathered from end users, or consumers/proconsumers), in order to close the demand response gap.

In Smart Grid, the Demand Response Management (DRM) system is crucial for maintaining a balance between supply and demand for electricity. DRM keeps an eye on clients' energy usage to maximise energy efficiency and cut costs [1]. In order to close the demand response gap in the residential sector, the DRM has considerably advanced renewable energy harvesting (REH), utilising a variety of renewable energy sources (RES) like solar and wind energy.

According to a research by the International Renewable Energy Agency (IRENA), India's residential sector uses 24% of the country's yearly energy consumption and is expected to increase by an additional eight times by 2050. In the residential sector, solar photovoltaic (SPV) electricity systems are frequently used. A PhotoVoltaic (PV) system with energy-generating solar panels installed on the roof of a house, building, or other structure is known as an SPV power station.

Numerous electrical accessories and parts, including modules, cables, and mounting systems, are included in this REH system. Depending on the needs of the customer and the size of the rooftop, REH systems on residential buildings typically

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have capacities ranging from 5 to 20 kilowatts. In India, rooftop solar energy amounts to 2.1 Gigawatts (GW), with 30% of that electricity coming from residential buildings.

The suggested plan enables a number of non-essential energy loads that must be reduced during peak hours in order to lower customers' energy bills. Prior to SPV installation, accurate estimates of energy generation must be made in order to maximise its potential. Numerous scientists worldwide are attempting to forecast the development of trustworthy SPVs. Numerous elements are influencing the SPV energy generation. For instance, Al-Dahidi et al. have found that on hot days, the cell module temperature can easily approach 70 °C, resulting in a sharp decline in energy production below nominal levels, which is one of the biggest issues in REH.

II. SYSTEM MODEL

A system Model figure 1 depicts the AI-RSREH's system model for the prediction of energy generation and recommender system to improve energy generation. AI-RSREH comprehend of four layers: (i) Energy Generation Layer, (ii) Data Collection and Preprocessing Layer, (iii) Prediction Layer, and (iv) Analysis Layer. Following is the description of each layer

Fig.1 system Model .

III. WORKFLOW OF THE PROPOSED APPROACH

In Fig.2 depicts the workflow of the proposed AI-RSREH approach, which encompasses AI model, i.e., specific LSTM model for energy generation prediction

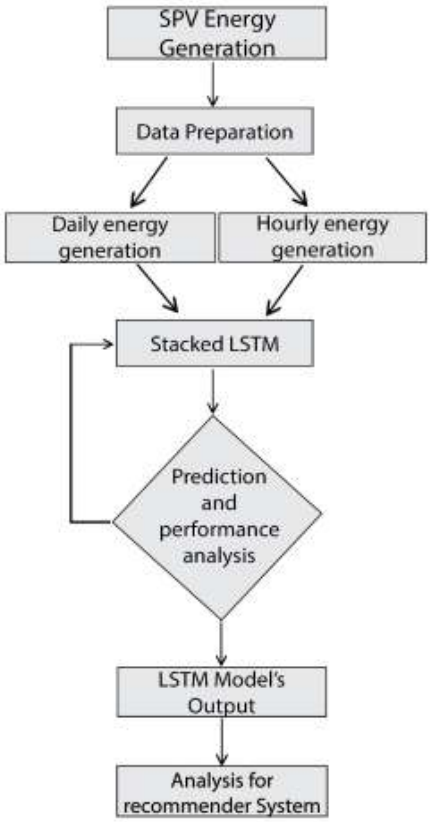

Fig.2 Workflow of the proposed AI-RSREH approach.

IV.RESULTS AND DISCUSSION

By using the "Ai Based 2 Way Renewable Energy Harvesting System And Realtime Monitoring With Iot", we will able to get the real-time data from the SPV and Windmill like, how much energy is generated, and how much energy is fed into the battery for the usage in grid. Also, we will able to get the knowledge about SoC and Battery voltage through IoT. And also, the real-time data about grid voltage, by this real-time information this system recommends which is best suitable energy at the time. From the graph we will able to make a dataset, hence the future prediction is also possible.

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This is the voltage that is coming to the grid in real-time. Once we switch on the circuit the voltage is stepped up using transformer and the result is monitored lively via IoT.

This is the live output of the photo voltaic array or solar panel.When the solar panel is subjected to light or solar rays the voltage is generated and the generated voltage diagram is shown above.

Similarly, this is the voltage graph generated by the windmill. While rotatory motion of blades causes a spike in voltage , this maybe change very quickly due to the non-uniformly wind.

This is the voltage level in the battery, basically in this project we are used a 12v battery and the voltage capacity is monitored real-time, by using the photo voltaic cells and windmill it gets charged.

Soc is nothing but state of charging. It is understandable easily by percentage of charge in a battery and the charging state. If the voltage is generated from the renewable resources, the state of charging is get a little spike and vice versa.

V.CONCLUSION

REH has become a critical component of the SG system for DRM. Furthermore, estimating energy generation using SPV can help customers (i.e., consumer/prosumers) manage their energy demands and close the demand-supply gap. Therefore, this paper proposes AI-RSREH, i.e., an AI-empowered approach for REH prediction along with a recommender system. The proposed AI-RSREH approach is divided into two-stage to benefit all the stakeholders; the first stage is all

about SPV energy generation prediction using the LSTM model in residential houses. Then, the second stage encompasses a recommender system to enhance energy generation in the residential area where the demand response gap is high. Here, the resulting outcome from stage one, i.e., the LSTM model, became essential for the second stage of analytics. Further, using the energy generation prediction findings, an analysis of the SPV generation for a particular residential area can be performed, and various outputs can be shared among stakeholders like utility companies, end customer, etc., to benefit them. As a result, the proposed AI-RSREH approach strives to close the gap between energy demand and response. In the future, we will extend this research work for sustainable solutions for REH from agricultural residue and management of RES.

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