RESEARCH ARTICLE   OPEN ACCESS

Solar Radiation Data Mining

*Sayali Satoskar, Tejas Talwadekar, **Prof. Renuka Nagpure
(Department of Information Technology, Atharva College of Engineering, Mumbai-95)
** (Assistant Professor, Department of Information Technology, Atharva College of Engineering, Mumbai-95)*
Corresponding Author ; Sayali Satoskar

ABSTRACT
Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Solar energy being a renewable source of energy is a clean and pollution free energy source available. For the effective utilization of solar energy received on earth, various research and development is carried out. Estimation of Solar Energy received during day time and Increase in the efficiency of Solar Systems is the need of hour. Data mining being a process of exploring patterns from large data sets that can be applied for the purpose of determining the solar radiation received over a particular area on earth. This system deals with capturing solar radiation in terms of watts/meter2, per second over an area continuously, and providing an effective data for the peak hours per day, peak days per week, and peak months in a year. The various patterns of Solar Radiation can be observed and studied, which can help for the development of Solar Power Generation Systems over a particular area with maximum efficiency.
Keywords - Solar, Radiation, Data Mining, Energy, Efficiency.

I.   INTRODUCTION

Generation of solar energy has tremendous scope in India. The geographical location of the country stands to its benefit for generating solar energy. The reason being India is a tropical country and it receives solar radiation almost throughout the year, which amounts to 3,000 hours of sunshine. This is equal to more than 5,000 trillion kWh. Almost, all parts of India receive 4-7 kWh of solar radiation per sq. meters. States like Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, and West Bengal have great potential for tapping solar energy due to their location. Since majority of the population live in rural areas, there is much scope for solar energy being promoted in these areas. Use of solar energy can reduce the use of firewood and dung cakes by rural household.

India has massive plan for Solar Energy generation that may not only fulfill the deficit of power generation but also contribute largely in Green Energy Production to help to reduce the Climatic Changes globally.

Due to the large scope of solar energy use in India we need Solar Radiation Data Analytics. Analysis of data need to be done in order to efficiently use the harvested solar energy. Data analytics (DA) is the process of examining data sets in order to draw conclusions about the information they contain, increasingly with the aid of specialized systems and software. Multiple sets of data will be collected from various places and this data will be analyzed in order to maximize the yield.

II.   WORKING/IMPLEMENTATION

1.1 System Block Diagram:

The block diagram of the hardware is as shown below in Fig. 2.1 which shows the working of the system.

Fig. 2.1 System Block Diagram

2.1.1 Solar Panels:

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. Two Solar panels are used in the system as shown in Fig. 2.1. Solar panel 1 absorbs solar energy and then converts it into electrical energy stores it in batteries. Solar panel 2 absorbs solar energy similar to solar panel 1.

The test load is used for testing the load conditions. The voltage and current sensors are used for sensing the voltage across the test load and current through the test load respectively.

2.1.2 ESP8266 Wi-Fi Module:
The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. ESP8266 Wi-Fi module is used in order to make the system wireless.

2.1.3 Micro SD Card Module & Micro SD Card:
This Micro SD Card module is used for transferring data to and from a standard SD card. The pin out is directly compatible with Arduino and also can be used with other microcontrollers. It allows us to add mass storage and data logging to our project.

Secure Digital (SD) is a non-volatile memory card format developed by the SD Card Association (SDA) for use in portable devices. It is used in the system to store data locally.

2.1.4 RTC Module:
The module based on DS1307, The DS1307 serial real-time clock (RTC) is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. Timekeeping operation continues while the part operates from the backup supply.

2.1.5 Lead Acid Battery:
The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the oldest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. Batteries are connected to voltage regulator and the regulated voltage is then applied to the MCU.

2.1.6 LDR:
A photo resistor is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

2.2 Software Used:
2.2.1 Arduino IDE:
The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, Mac OS, and Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board.

2.2.2 Python:
Python is an interpreted, high-level, general- purpose programming language. Python will be used to convert the collected data into graphs which can be easily understood by anyone.

2.2 Algorithm Used:
Regression is a data mining technique used to predict a range of numeric values (also called *continuous values*), given a particular dataset. For example, regression might be used to predict the cost of a product or service, given other variables. Regression is used across multiple industries for business and marketing planning, financial forecasting, environmental modelling and analysis of trends. Linear Regression Algorithm is used to find out linear relationship between two datasets.

III. RESULTS
Fig. 3.1 shows the Software Interface with output graph of Mean Solar Radiation by Hours.
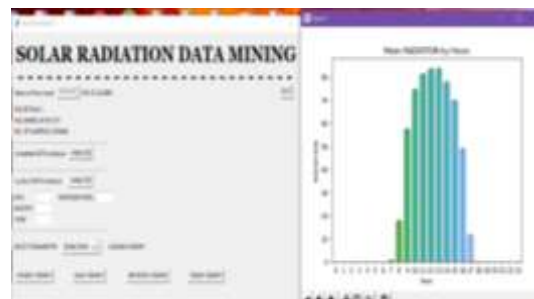

Fig. 3.1 Data Mining Output

Fig. 3.2 shows Humidity, Temperature, Intensity recorded by the model. Live data is available on website when the model is connected to WIFI.

Fig. 3.2 Live Data Output

IV. CONCLUSION

The solar Radiation over an area is obtained.Power generation from the solar radiation is observed.Humidity , Temperature , Intensity is also recorded by the model.Live data is available on website when the model is connected to WIFI.Data is constantly recorded into sd card & can be obtained from the website.

REFERENCES

[1]. "A novel data mining method for high accuracy solar radiation forecasting" by M.Ghofrani, N.Niromand; R.Azmi; M.Ghayekhloo.(2017)

[2]. "Estimating the availability of sunshine using data mining techniques" by M. Mayilvahanan; M.Sabitha. (jan 04-06-2013)

[3]. Z.Dong;D.Yang ;T.Reindll and W.M.Walsh;"A Novel hybrid approach based on self-organizing maps,support vector regression to forecast solar irradiance.(Energy vol.82,pp570-577,2015)

[4]. A hybrid approach for solar radiation and photovoltaic power short term forecast .Loredana Cristaldi, Giacomo Leone, Roberto Ottoboni .(Milano,Italy.)978-1-5090-3598-0/17/$31.00, 2017 IEEE.What are the current status and future prospects in solar irradiance and solar power forecasting? Mehmet Yesilbudak, Medine Colak, Ramazan Bayindir (faculty of engineering and architecture, department of electrical & electronics engineering.Accepted-28-02-2018