

Solar Radiation Data Mining

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Abstract : Solar energy is radiant light and heat from the Sun that is harnessed for solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. It is an important source of renewable energy. It is 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 determining the solar radiation received over a 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 area with maximum efficiency.

Keywords: Solar, Radiation, Data Mining, Energy, Efficiency.

I. Introduction

Generation of solar energy has tremendous scope in India. India being a tropical country receives solar radiation almost throughout the year, which amounts to 3,000 hours of sunshine which is equal to more than 5,000 trillion kWh. Almost, all parts of India receive 4-7 kWh of solar radiation per sq. meters. This is equivalent to 2,300–3,200 sunshine hours per year. 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. Proposed System

2.1 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. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in

commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W).

2.1.2 ESP8266 Wi-Fi Module

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer Espressif Systems. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

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.

2.1.4 RTC Modules

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. Address and data are transferred serially through an I²C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power-sense circuit that detects power failures and automatically switches to the backup supply. 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. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors.

2.1.6 LDR

A photoresistor is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor 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, MacOS, 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.

III. 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 Micro SD card & can be obtained from the website.

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