Development of a Photovoltaic Power Generation System Condition Monitoring Service "SANUPS NET"

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1. Introduction

In recent years, rising concerns for planet environment protection and the nuclear accident in the wake of the Great East Japan Earthquake has resulted in much focus on renewable energies. In particular, the popularization of photovoltaic power generation is expanding the most, backed by enhanced governmental support measures.

Amidst this situation, the feed-in tariff system for renewable energy implemented in July 2012 has led to an increased number of electric utilities operators installing photovoltaic power generation systems, and greater requirements for maintenance and monitoring of such systems.

This paper provides an overview of "SANUPS NET", a photovoltaic power generation system condition monitoring service developed in response to these requirements.

2. Background of the Development

Sanyo Denki developed "SANUPS PV Monitor" in 2009 as a device capable of monitoring photovoltaic power generation systems via on-site LAN lines. However, there were limitations due to the collection and tallying of power generation and other measurement data only being possible on the computer using the same on-site LAN line.

Since implementation of the feed-in tariff system for renewable energy, the environments in which photovoltaic power generation systems are installed have diversified, and an increasing number of installations are in places difficult for a dedicated line to reach, such as outdoors and rooftops.

Moreover, power generation operators who install photovoltaic power generation systems as operators of electric utilities require the ability to remotely monitor the operational status of systems and centrally control the data of multiple systems.

Sanyo Denki developed "SANUPS NET", a photovoltaic power generation system condition monitoring service in response to such requirements.

3. Product Overview

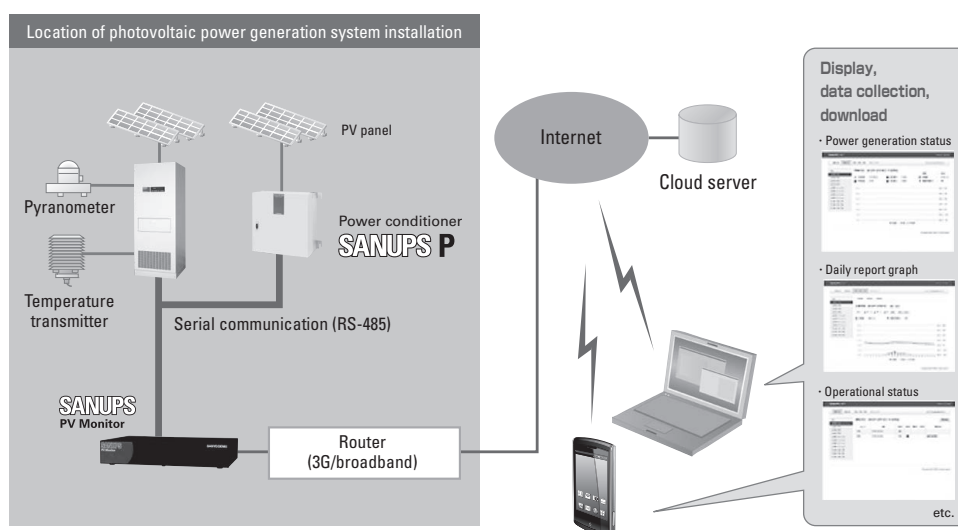Fig. 1 shows the system configuration of this product.

Fig.1: System configuration

In this system, the "SANUPS PV Monitor" communicates with our photovoltaic power conditioner through RS-485 to receive information necessary for maintaining and monitoring the photovoltaic system and collect data. Moreover, by connecting the "SANUPS PV Monitor" to an internet line using a router, data can be stored on the "SANUPS NET" cloud server.

Customers can monitor the power generation and operational status of their photovoltaic power generation systems remotely by accessing the cloud server via the internet.

4. Features

4.1 Using the cloud service (Note 1)

By storing the data collected on the cloud server, it is possible to use the "SANUPS NET" from a computer or smartphone in any environment with an internet connection. No special software needs to be installed to use the cloud service. It can be used from a normal Web browser.

(Note 1) A service whereby data is stored on the internet.

4.2 Monitoring functions

This product has three monitoring functions, and by using these, it is possible to centrally monitor multiple photovoltaic power generation systems. Please note that on the "SANUPS NET" display screen, photovoltaic power generation systems are referred to as "plants".

(1) Power generation status display unit

Able to display the plant's power generation for that day, cumulative power generation, etc. There are two types of screens. One where the power generation statuses of multiple plants are displayed in a list and another where the power generation details are displayed in a graph by plant.

Fig. 2 shows the screen displaying power generation status of all plants.

Fig. 3 shows the screen displaying power generation status by plant.

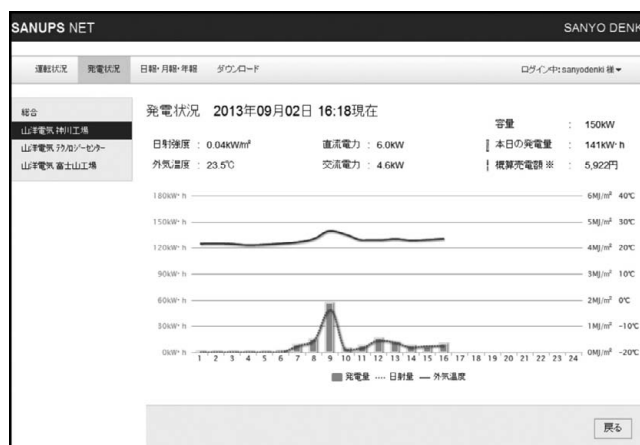Fig. 2: Screen displaying power generation status of all plants

Fig. 3: Screen displaying power generation status by plant

(2) Operational status display function

Able to display operation statuses of plants, existence of alarms, alarm history and so on. There are two types of screens. One where the operational statuses of multiple plants are displayed and another where the details of operational statuses and alarm history are displayed in a graph by plant.

Fig. 4 shows the screen displaying operational status of all plants.

Fig.5 shows the screen displaying operational status by plant.

Fig. 4: Screen displaying operational status of all plants

Fig. 5: Screen displaying operational status by plant

(3) Alarm notification function

Alarms can be emailed to a preregistered email address in the event that problems arise with plants.

Up to five addresses can be specified for sending notifications to.

4.3 Data collection function

This product can tally and store the data collected from plants. It also allows the stored data to be displayed by day, month and year, in graphs and be downloaded.

(1) Daily report/monthly report/yearly report display function

Able to display the plant's power generation, cumulative power generation, etc., either in days, months or years. There are two types of screens: one where the power generation statuses of multiple plants are displayed in a list and another where the details of power generation are displayed in a graph by plant.

Data can be stored for twenty years.

Fig. 6 shows the screen displaying monthly report of all plants.

Fig. 7 shows the screen displaying monthly report by plant.

Fig. 6: Screen displaying monthly report of all plants

Fig. 7: Screen displaying monthly report by plant

(2) Measurement data download function

Able to download measurements for each plant by day, month or year in CSV file format.

Also possible to download measurements for each power conditioner in the same way.

(3) Alarm history download function

Able to download alarm history for each plant for a specified timeframe in CSV file format.

5. Options

To enable systems to be built in places where the plants cannot be reached with a hardwired internet line, Sanyo Denki has developed a "Mobile Communication Pack" which features the "SANUPS PV Monitor" and mobile router inside a waterproof box. The "Mobile Communication Pack" can be used in any area with FOMA 3G communication.

Fig. 8 shows the mobile communication pack.

Fig. 9 shows inside the mobile communication pack.

Fig. 8: Mobile communication pack

Fig. 9: Inside the mobile communication pack

6. Advantages for Customers

Customers are able to maintain photovoltaic power generation systems with high operational rates through remotely monitoring the operational statuses of their systems and detecting failures and trouble faster.

Because the collected information is stored on a cloud server, customers do not need to prepare the special computer for this service and can reduce maintenance costs.

7. Specifications

Table 1 shows the specifications of the photovoltaic power generation system condition monitoring service "SANUPS NET", while Table 2 shows specifications of the "Mobile Communication Pack".

The "SANUPS NET" includes two types of services. One is a system information control service in which all functions can be used, and the other is a "visualization of power" service, where functions are limited to power generation status display, daily/monthly/yearly report display and download.

Table 1: "SANUPS NET" specifications

Item		Specifications	
Service types		System information control service - 10 year batch	"Visualization of power" service - 10 year batch
Supporting Web browser		Microsoft Internet Explorer 8.x 9.x 10.x Mozilla Firefox 10 or later Google Chrome Mobile Safari Android Browser	
Functions Supported: ○ Not supported: —	· Power generation status display (Overall, by plant)	○	○
	· Operational status display (Overall, by plant)	○	—
	· Alarm notification function (5 emails)	○	—
	· Device information display	○	—
	· Daily/monthly/yearly report display	○	○
	· Measurement download	○	○
	· Alarm history download	○	—

Table 2 "Mobile Communication Pack" specifications

Item	Specifications
Model No.	PV-MBLPK01
Input voltage	100-240 V AC
Power consumption	Maximum: 20 W
Operation environment	Temperature: 0℃ to 40℃ Humidity: 20 to 90％RH (with no condensation)
Communication method	3G wireless communication W-CDMA
Dimensions (W x D x H)	400 × 165 × 300 mm
Weight	Approx. 6 kg

8. Conclusion

This paper has provided an overview of the "SANUPS NET" , a photovoltaic power generation system condition monitoring service. The development of this product has made it possible to support photovoltaic power generation system condition monitoring using cloud and we believe this will contribute to sales expansion.

It is predicted that more requirements will emerge relating to the maintenance and monitoring of photovoltaic power generation systems. Sanyo Denki intends to develop more sophisticated products to meet these requirements and continue to provide products which earn customer satisfaction.

We sincerely thank the many people involved in the development and realization of this product for their advice and support.
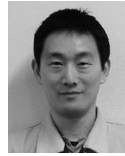
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