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The Development of the Connection Board Monitoring System Using Radio Communication at a Photovoltaic Power Plant

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Abstract

In this paper we have studied on collecting information about all its state through the monitor able connection board using radio communication without additional wiring, saving efforts and time in checking and repairing the failure part in case of problematic occurrence, and maximizing the generating efficiency by solving the degradation of generating efficiency.

Keywords: Components, Connection Board, Photovoltaic Power Plant, Radio Communication

1. Introduction

The Photovoltaic Power System Manager can't identify whether the normal power is supplied from each solar cell array or not since the existing connection boards has performed just the function to supply electricity from solar cell arrays to an inverter. To solve this problem, the maximizing method of generating efficiency through the monitor able connection board should be searched. Monitoring the connection board after the power station construction requires the wide additional wiring in the premises to use RS-232, 422 and 485 communications. And the degradation of generating efficiency may occur since it may take much time and considerable efforts to detect and repair the failure part when failures occur in the system[1]. To solve this problem, we have built the monitoring system so that the manger can collect information about the situation of all connection boards using radio communication module without additional wiring.

2. Relevant Study

2.1 Local Relevant Technology State

The demand for new renewable energy including photovoltaic power is expected to increase continually, and the necessity for the management technology of solar photovoltaic energy as to the technological development of photovoltaic modules and cells is also being increased. However few companies which have string-unit monitoring technology of connection boards and the connection board structure are not standardized[2].

Yet and is determined as to plant equipment and types of photovoltaic inverters. There are a variety of types such as channel display type, detachable type, fuse openable type, PCB module type, and high-voltage type, and at present mainly the building and operation by using wire communication like RS-485 are performed[3].

2.2 Overseas Relevant Technology State

Global photovoltaic power market is led by Germany, Europe, U.S. and China. And it appears that they record good profits in each value chain as a result of stabilization of photovoltaic power business. Global photovoltaic power market is expected to grow by 30% average per year over 2010-2014. Given the securing of economic feasibility as to the reduction of photovoltaic power cost and the explosive demand increase by Asian countries besides U.S and China, the growth of 30% average per year is expected continually and thus installation capacities of the global

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photovoltaic power are expected to extend from 16.6GW in 2010 to around 37.3 GW[4].

3. The Development of the Monitoring System of Connection Boards using Radio Communication at a Photovoltaic Plant

3.1 Fabrication of an Embeded Device for the Connection Board Monitoring

The Figure 1 indicates the schematic diagram of current and voltage state monitoring of a connection board. RF communication module (424MHz UHF) enables the operation of a data collection device and radio communication. And we have fabricated a closure to facilitate the installation within the connection board and the management. Our system is designed to help fabricate a tentative connection board and to mount a current and voltage sensor.

3.2 Fabrication of RTU for Data Collection

The Figure 2 shows the schematic diagram performing radio communication with the connection board through RF communication module (424MHz UHF). A closure performing Ethernet communication with the server through TCP/IP module can be installed on an external wall of the building.

The test of server-client RF radio communication was performed at the Photovoltaic Power Plant in Buan, Jeonbuk. The result showed a good reception of string-data through maximizing of data reception rate by performing repeated transmitting-receiving over three-times on the feature of RF radio communication

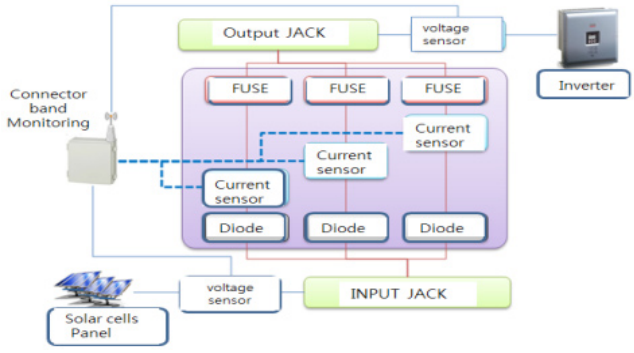

Figure 1. Schematic diagram of the Connector Band Monitoring.

3.3 The Building of Web-based Monitoring System

The Figure 4 and 5 show on the APM-based test web-page how to inform the registered manager of SMS by using

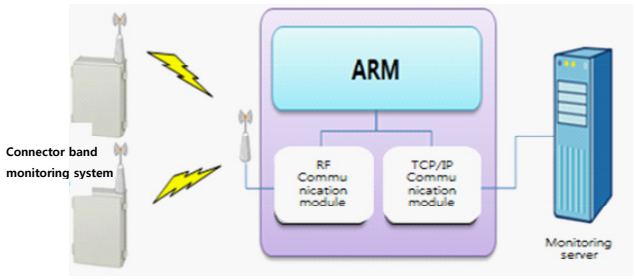

Figure 2. Schematic diagram of the RTU.

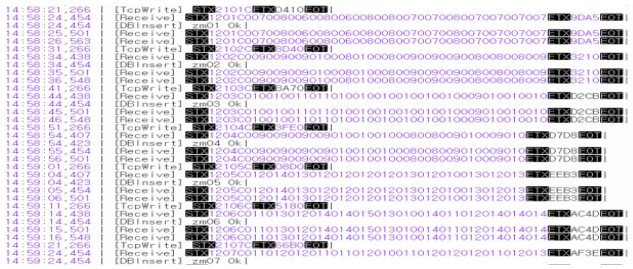

Figure 3. Data transmitting-receiving log.

스트링 정보

번호	상태	평균	최고	최저	String1	String2	String3	String4	String5	String6	String7	String8
1	정상	0.7	0.9	0.6	0.7	0.9	0.6	0.7	0.7	0.7	0.7	0.7
2	정상	0.9	1.4	0.7	0.8	0.8	0.7	1.4	0.7	1	0.7	0.7
3	정상	0.8	1	0.6	1	0.7	0.6	0.8	0.9	0.6	0.7	1
4	정상	0.8	1.1	0.7	0.7	1.1	0.7	0.7	0.7	0.7	0.7	0.8
5	정상	0.8	1.3	0.7	0.8	0.7	1.1	0.7	1.3	0.7	0.9	0.7
6	정상	0.8	1.1	0.6	0.6	1.1	0.7	1.1	0.6	0.9	0.6	0.8
7	정상	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7
8	정상	0.8	0.9	0.7	0.9	0.8	0.9	0.7	0.7	0.8	0.7	0.8
9	정상	0.8	1.1	0.6	1.1	0.7	0.7	1.1	0.7	1	0.6	0.8
10	정상	0.9	1.3	0.7	1.3	0.8	1.1	0.7	1.3	0.7	0.8	0.7
11	정상	0.9	1.3	0.7	1.2	0.7	0.7	1.3	1.1	0.7	1	0.7
12	정상	1.1	1.9	0.7	0.9	1.1	0.7	0.7	1.2	1.9	0.7	1.3
13	정상	1	1.4	0.7	0.7	1.3	0.7	1.1	1.1	0.7	1	1.4
14	정상	0.9	1.6	0.7	0.9	0.8	0.7	0.7	0.9	1	0.7	1.6

Figure 4. String data reception.

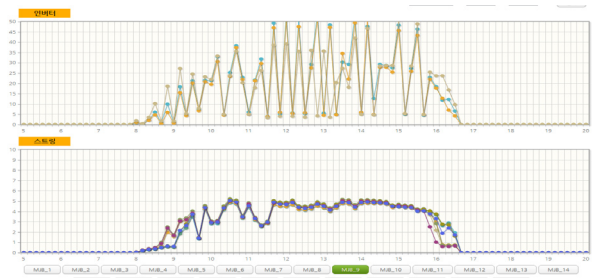

Figure 5. Tracking the graph displays the day of receipt.

CDMA modules as a result of checking statistical and real-time indices through analyzing the collected data after storing collected string data from each connection board into the server DB. In addition, it is designed to perform the regular transmission of signals and the transmission on detecting a failure. The Figure 6 and 7 show on String data collection devices and Half-channel data acquisition board connected by string.

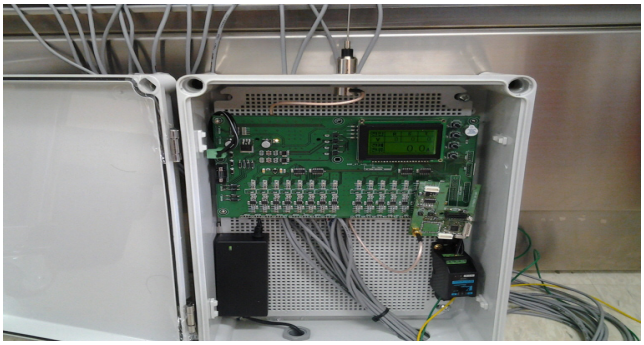

Figure 6. String data collection devices.

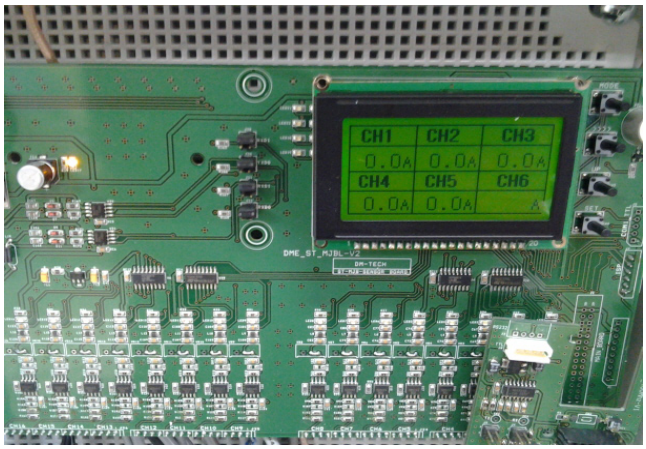

Figure 7. Half-channel data acquisition board connected by string.

4. Conclusion

The manager of photovoltaic power system can't identify whether the normal power is supplied from each solar cell array or not and from solar cell arrays to an inverter. And to solve this problem, the maximizing method of generating efficiency through the monitor able connection board should be tried. Monitoring the connection board after the power station construction requires the wide additional wiring in the premises to use RS-232, 422 and 485 communications. And the degradation of generating efficiency may occur since it may take much time and considerable efforts to detect and repair the failure part when failures occur in the system. To solve this problem, we have built the monitoring system so that the manger can collect information on the situation of all connection boards using radio communication module without additional wiring.

5. Acknowledgment

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