

Modeling a Photovoltaic Monitoring System based on Maintenance Perspective for New & Renewable Energy

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Research Summary

Research Goal

- How to develop monitoring system based on maintenance perspective for new & renewable energy

Research Objectives

1. How to integrate the various heterogeneous device such as inverters, sensors, joint boxes, and servers

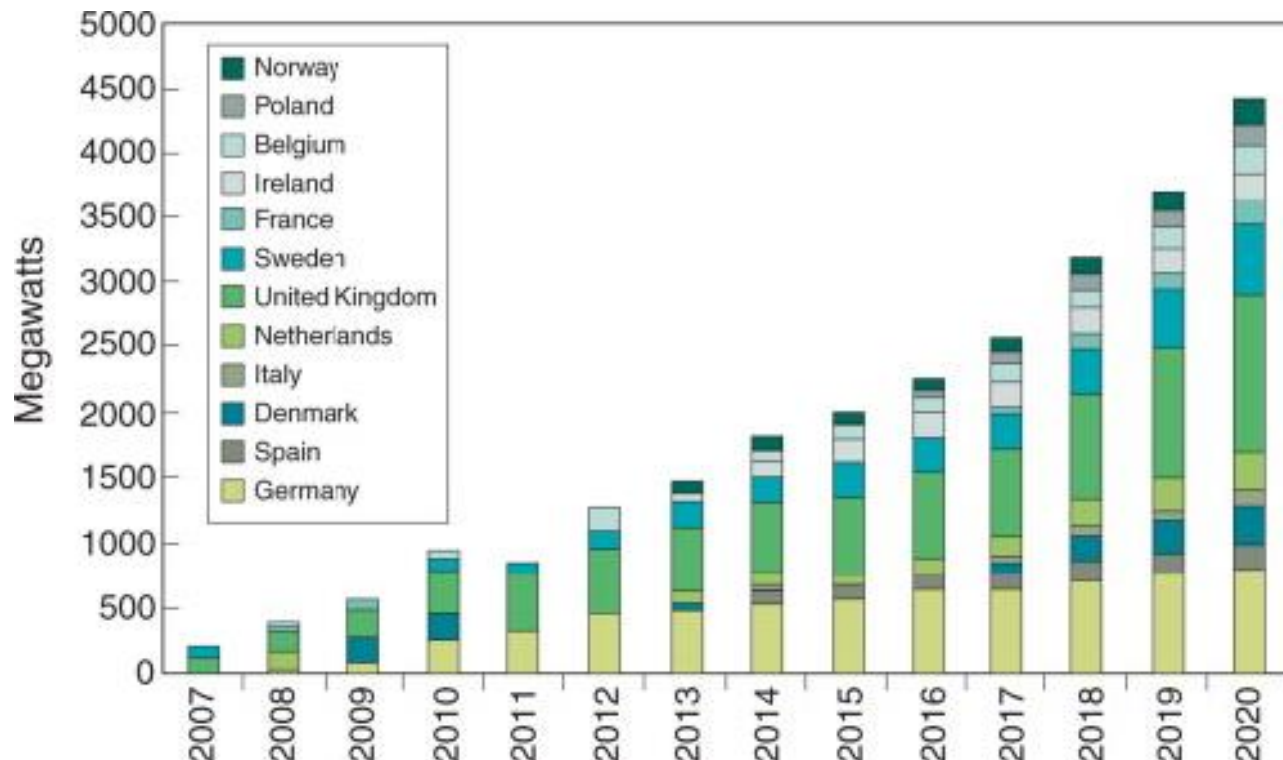
Expected Effects

1. Develop efficient integrated system of individual sub-systems based on the standard interface for data interoperability
2. Reduce cost and development period than the existing PVMS.

1. Motivation

[The world market issue of new & renewable energy]

- The international community is faced with the problem of energy depletion as a continuous increase of the world's population, the oil prices instability and the limited resources.
- The world countries have increased interest in new & renewable energy.
- The world markets of new & renewable energy are grown.



❑ The photovoltaic (PV) generation

- gaining interest among the new & renewable energy due to have the economics to fell PV module prices and to increase the efficiency with the development of technology.



❑ But it is the risk of fire

- because the energy collected from the solar cell has electrical properties and the worry about personnel injury when the structure caused by damage.
 - it requires the continuous management to maintain an efficient energy due to rapidly change the PV energy according to the sun and the climate.
- ## ❑ Accordingly, the Korea government is obliged to service the integrated monitoring to improve energy production, operating status and utilization of new & renewable energy equipment.

- ❑ But the systems of KEMC and KPE manage only the individual systems involved in their organization, the PV generation of other case (in town area) is unmanaged.
- ❑ Also, It is unmanaged or cannot perform the technical support and maintenance in this case that can't be operated after the maintenance period of systems related by new & renewable energy, but the developer and construction company and withdraw the national offices.
- ❑ We propose the design of PV Monitoring Systems (PVMS) that is possible to associate with existing legacy systems.
- ❑ We expect our proposed PVMS to be possible efficient system integration of individual systems based on the standard interface for data interoperability and to reduce cost and development period than the existing PVMS.

2. Related Works

❑ New & Renewable Energy Center (NREC) in Korea Energy Management Corporation (KEMC)

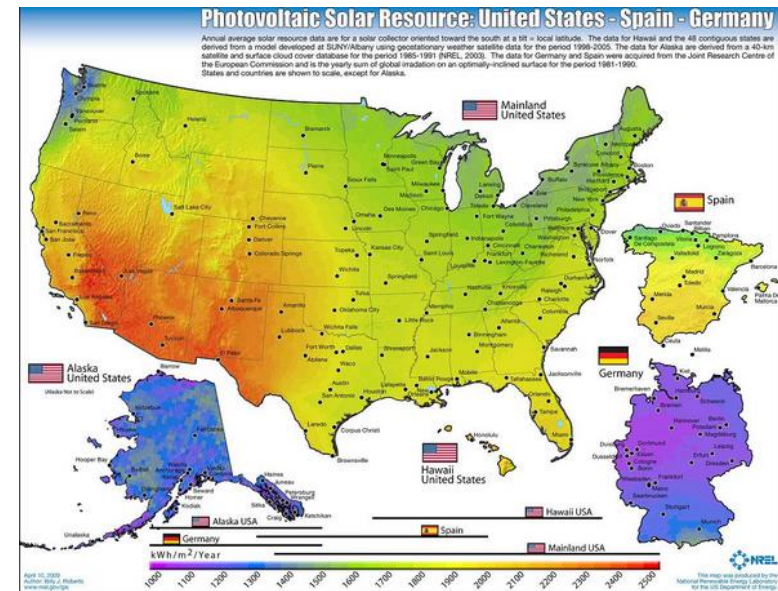
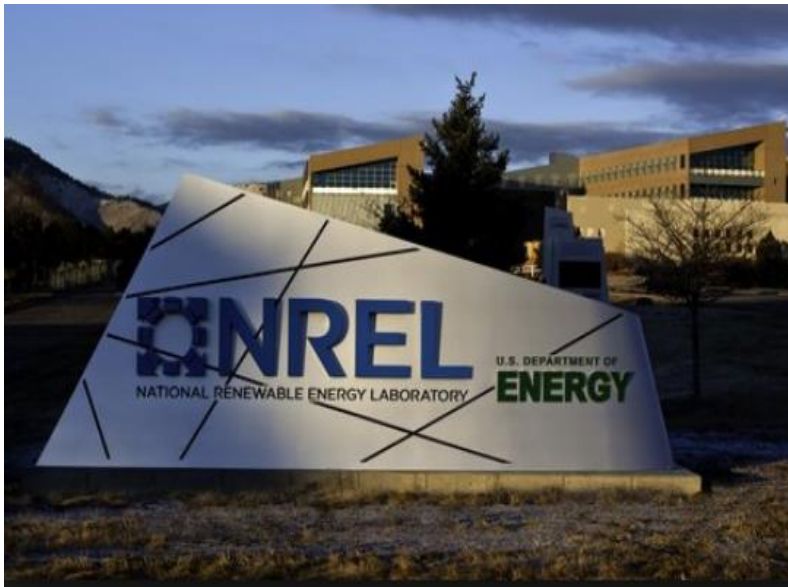
- The NREC organize the purpose to improve equipment utilization through building surveillance systems due to grow the need of grasp about operating status and utilization of new & renewable energy equipment in Korea.



- However, the system is maintained only system in their organization. It have also an existing problem that cannot be operated the end of the maintenance period.

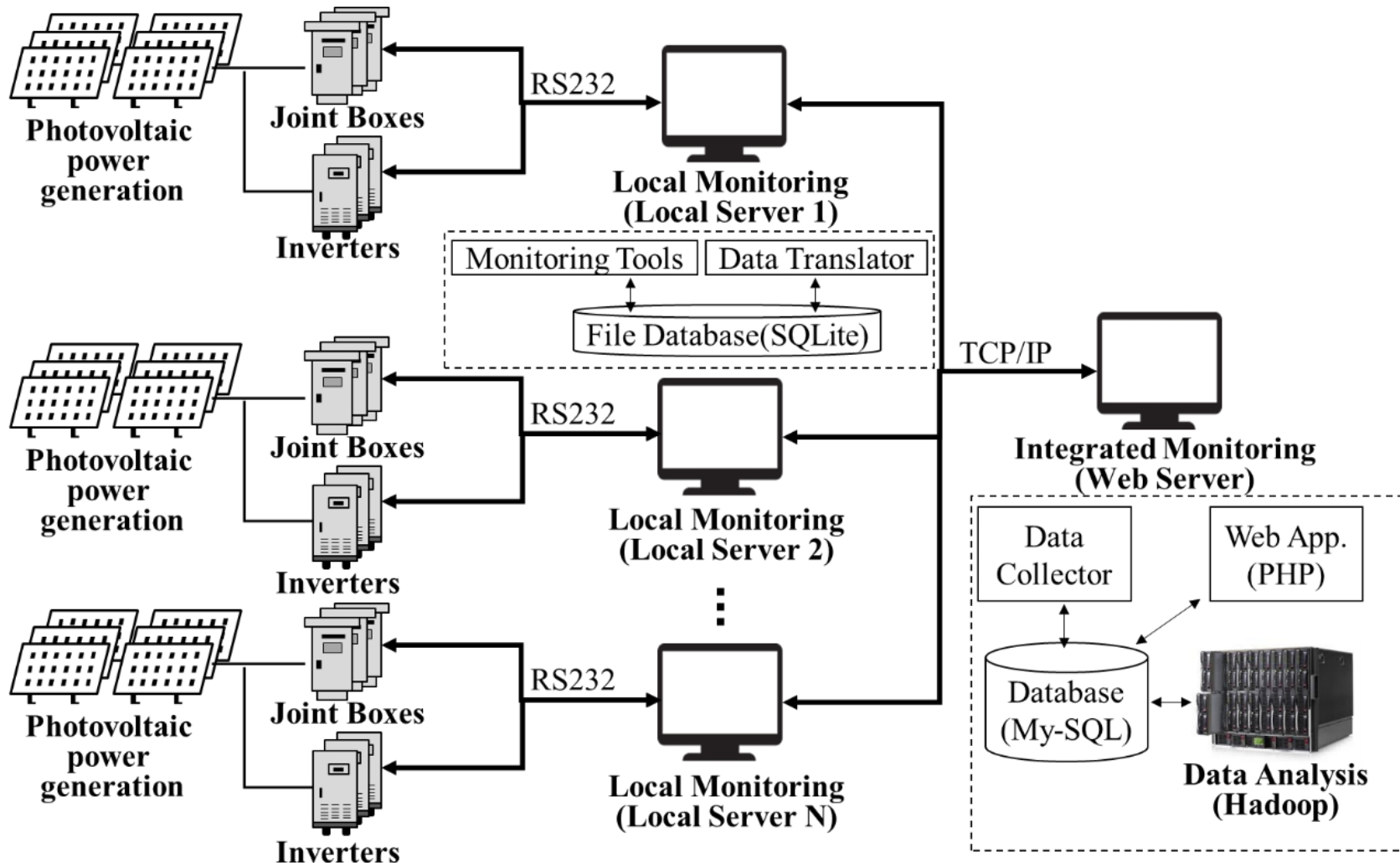
□ National Renewable Energy Laboratory (NREL) in USA

- The NREL is a national renewable energy laboratory of the United States, it researches the renewable energy and new energy technologies. NREL is consisted of six research area such as biofuels research, biomass power research, buildings research, buildings research – thermal storage wall, concentrating solar power research, photovoltaic research. After a new maintenance of radiation monitoring network by the online computer network, it was launched in precision measurement business resources and SOLMET developed a data processing system incorporating, analyzing and utilizing all the measured data in the meantime.



3. Our design of Monitoring System

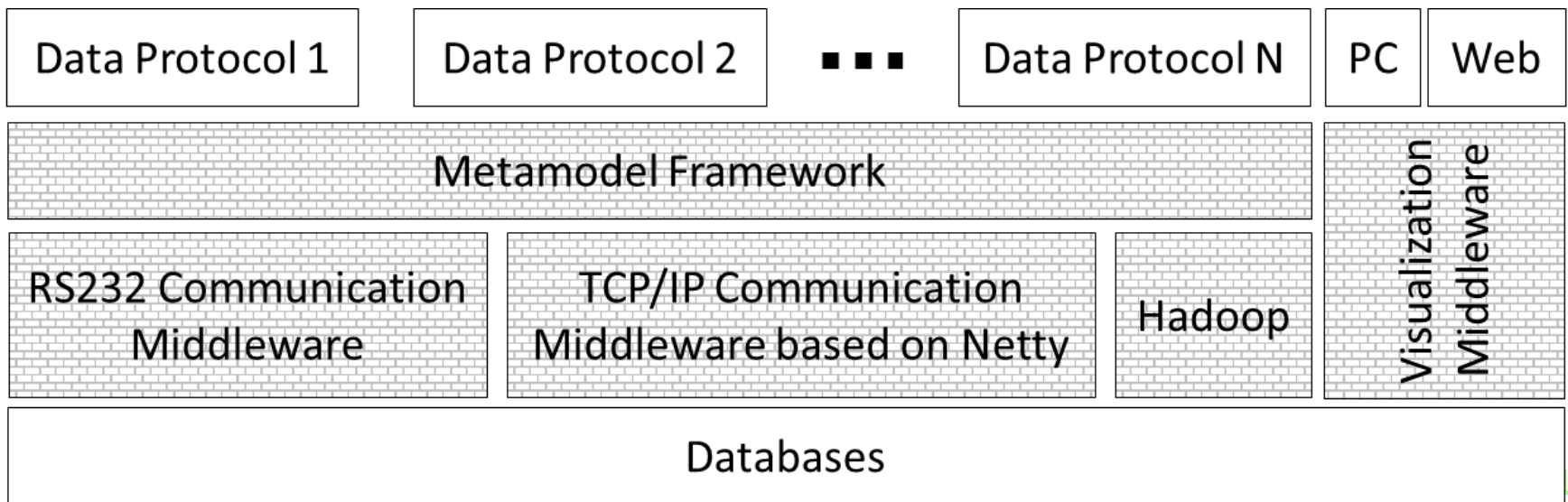
- ❑ The PVMS is consisted of local and integrated server.



3. Our design of Monitoring System

cont.

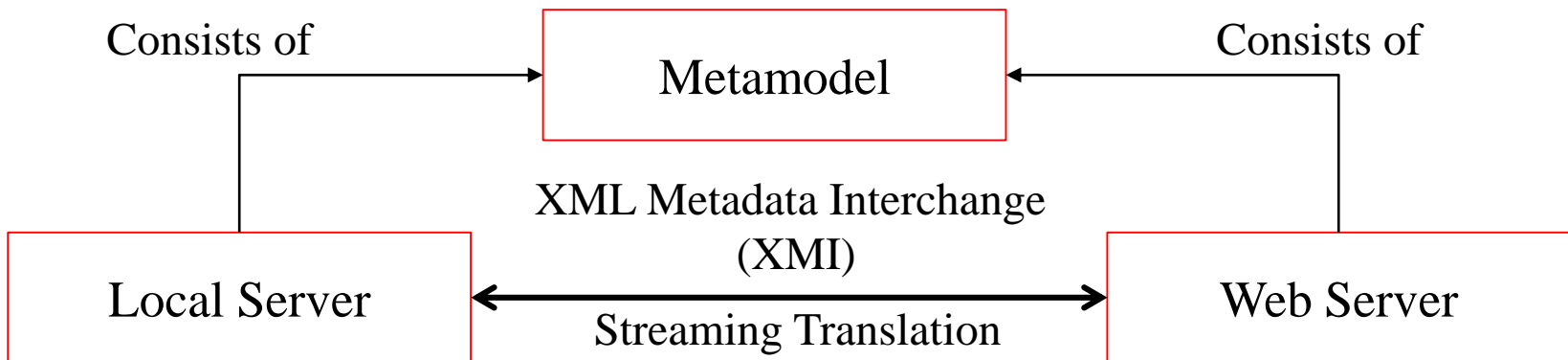
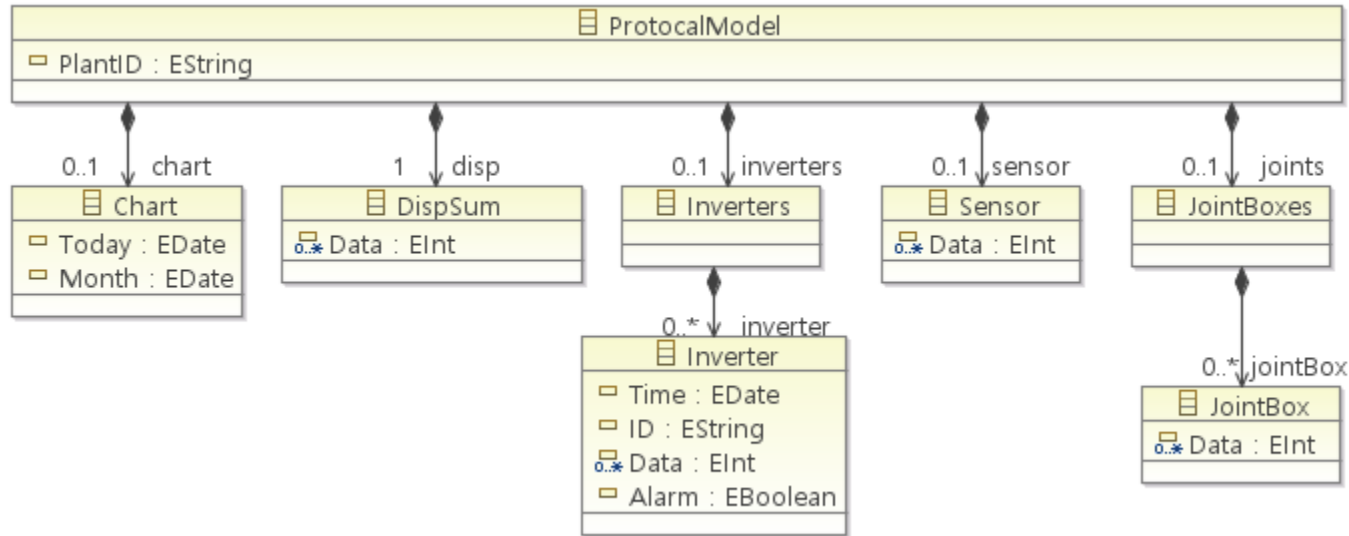
- ❑ This software platform is consists of metamodel framework, RS232 communication middleware, TCP/IP communication middleware based on Netty, Hadoop and visualization middleware.
- ❑ The metamodel framework integrates heterogeneous data protocol based on metamodel. The metamodel based protocol is able to interchange RS232 and TCP/IP communication middleware.
- ❑ The visualization middleware shows all data using graph to end-user and manager.



3. Our design of Monitoring System


cont.

□ The standard Protocol based on metamodel




4. Case Study

We are developing the PVMS as follow.



종합모니터링
접속반
발전량트렌드
데이터
보고서
알람
관리도구

▲ 현장 발전소와 중앙 서버의 통신 상태를 확인합니다. (HS-BOX로부터 실시간데이터를 수신하였습니다. [22:50:08])




현재 사용자

마지막 통신시간
2016-01-06 19:45:31



중앙서버

마지막 통신시간
2016-01-06 19:45:31

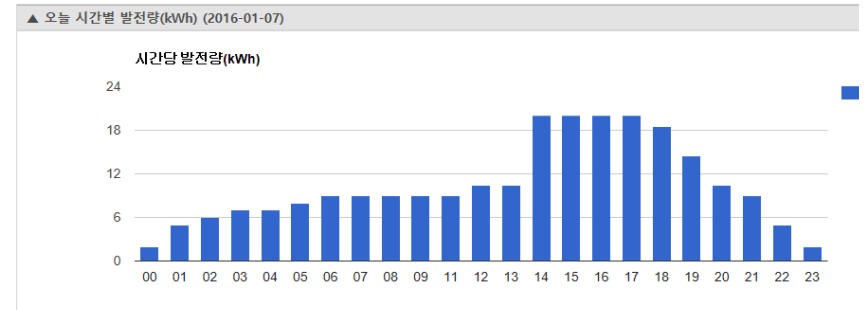


발전소 현장

현재출력(kW)	오늘발전량(kWh)	이번달발전량(kWh)	총누적발전량(MWh)	전일발전량(kWh)	전월발전량(kWh)
0.0	138.0	1060	50.9	203.0	534

▲ 최근 발생 알람

발생시간	장비	알람태그	값
발생한 알람이 없습니다.			



▲ 환경센서 (마지막 통신 시간 : 2016.01.01 21:41:26)

모듈온도(°C)	주변온도(°C)	수평일사량(W/m)	경사일사량(W/m)	풍속(m/s)	Co2	구조물진단
1.2	1.9	191.0	857.0	0.0	True	False

▲ 인버터 발전 현황

No.	현재출력(kW)	오늘발전량(kWh)	총누적발전량(kWh)	상세 계측값 보기																																
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2	0.0	138.0	36512.0	<table border="1" style="width: 100%;"> <tr> <th>현재출력(kW)</th> <th>오늘발전량(kWh)</th> <th>전일발전량(kWh)</th> <th>총누적발전량(kWh)</th> </tr> <tr> <td>1</td> <td>0.0</td> <td>138.0</td> <td>36512.0</td> </tr> <tr> <td>출력전류(A)</td> <td>0.0</td> <td>출력전압(V)</td> <td>376.0</td> </tr> <tr> <td>직류출력(kW)</td> <td>0.0</td> <td>압력전류(A)</td> <td>0.0</td> </tr> <tr> <td>입력전압(V)</td> <td>135</td> <td>주파수(Hz)</td> <td>60.0</td> </tr> <tr> <td>상태/모드</td> <td colspan="3"></td> </tr> <tr> <td>플트/알람</td> <td colspan="3">-</td> </tr> <tr> <td>마지막 통신 시간</td> <td colspan="3">2016.01.01 22:17:56</td> </tr> </table>	현재출력(kW)	오늘발전량(kWh)	전일발전량(kWh)	총누적발전량(kWh)	1	0.0	138.0	36512.0	출력전류(A)	0.0	출력전압(V)	376.0	직류출력(kW)	0.0	압력전류(A)	0.0	입력전압(V)	135	주파수(Hz)	60.0	상태/모드				플트/알람	-			마지막 통신 시간	2016.01.01 22:17:56		
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Integrated Monitoring (Web Server)

5. Conclusions

❑ The problem of Photovoltaic (PV) generation

- the risk of fire
 - the energy collected from the solar cell has electrical properties.
 - the worry about personal injury when the structure caused by damage.
- Therefore, it requires the continuous management to maintain
- But the old system is still unmanaged or cannot perform the technical support and maintenance

❑ Our idea

- We proposed the design of PV Monitoring Systems (PVMS) that is possible to associate with existing legacy systems.
- The proposed PVMS integrate the data through standard interface based on metamodel.

❑ Our PVMS provide

- the target load forecasting services, real-time energy forecasting services and mobile user notification service based on big data system.

❑ In future works, we implement and improve the proposed PVMS can be integrated monitoring operation of new & renewable energy

Thank you