

# Making Power SCADA Ready for Smart Devices inside a Command Center

Keywords Power SCADA, Smart device

## Abstract

For traction power distribution control and monitoring system for Railway (“Power SCADA System”) requiring high reliability and real-time performance, there has been a movement toward standardizing and open architecture. However, due to the strict concern regarding reliability and long-term maintenance, the market response has been relatively cautious in adopting new technologies and devices.

Meanwhile, IT-related systems with a different quality of required performance have rapidly progressed with standardization and open architecture. Recent improvement of hardware performance and growth of mobile-IT related technologies represented by smart devices have made it possible to reduce the gaps between both systems. By applying system building techniques based on a human-centered design for pursuing ease of use, we have developed a Power SCADA System that is ready for smart devices.

## 1 Preface

The traction power distribution control and monitoring system for the Railway (“Power SCADA System”) requires high reliability and real-time performance. The Power SCADA System therefore has been built with a focus on monitoring and control functions, as customers have been cautious about the induction of new devices into this system.

Smart phones and PC tablets have acquired solid marketing positions in the general customer market and many kinds of “services” are promoted for these smart devices. Nowadays, these devices are actively adopted as IT terminals by many companies. In some fields of business, PCs are being replaced by these smart devices.

Under such a technical background, portability of smart devices and abundant user-oriented interfaces have come to be noticed in the field of Power SCADA Systems, and there are increasing market demands to actively utilize these smart devices for the Power SCADA System.

This paper introduces how our Power SCADA System has been enhanced to be smart device-friendly inside a power supply command center (“Command Center”). This development program was aimed at realizing smart visualization of the

system inside a Command Center and giving a new scalability of the system without sacrificing reliability and real-time performance.

## 2 Outline of Smart Device Friendly Function

By making the system smart-device-friendly, the Power SCADA System can provide the smart visualization function of the stored data in the Power SCADA System and distribute the data to pre-registered smart devices inside a Command Center.

### 2.1 Scope of Application

Our Power SCADA System can be used with smart devices. These smart devices are to be used inside a Command Center where security is assured. Fig. 1 shows the scope of the smart device friendly function.

### 2.2 Outline of Functions

The Smart Device Friendly Function of the Power SCADA System makes it possible for smart devices to browse system information previously monitored at a control console exclusively, and also to refer to related documents previously provided only on paper. In so doing, while utilizing the latest

user interface, it can browse the unified system-related information by substantially reducing the physical restrictions more than ever before. Fig. 2 shows the site map.

### 3 Smart Device Friendly Function Configuration

A gateway was installed for the purpose of information collection from the Power SCADA System. The gateway collects information from various components of the Power SCADA System and distributes such information to smart devices via a wireless LAN. Fig. 3 shows an example of the connection configuration.

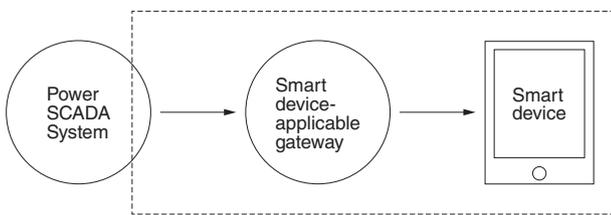


Fig. 1 Scope of the Smart Device Friendly Function

Information is extracted from the Power SCADA System and this information is then distributed from the gateway unit.

### 4 Features

The Smart Devices Friendly Function of Power SCADA System provides the following features:

#### 4.1 Reliability and Real-Time Performance

We adopted the configuration of the Power SCADA System to avoid any impact on the system's

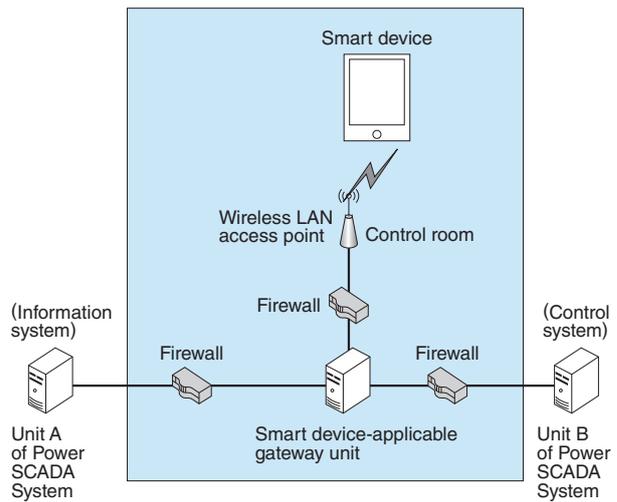


Fig. 3 Example of Connection Configuration Ready for Smart Devices

A DMZ is set up and a gateway unit is provided. Connections are made available to smart devices by a wireless LAN.

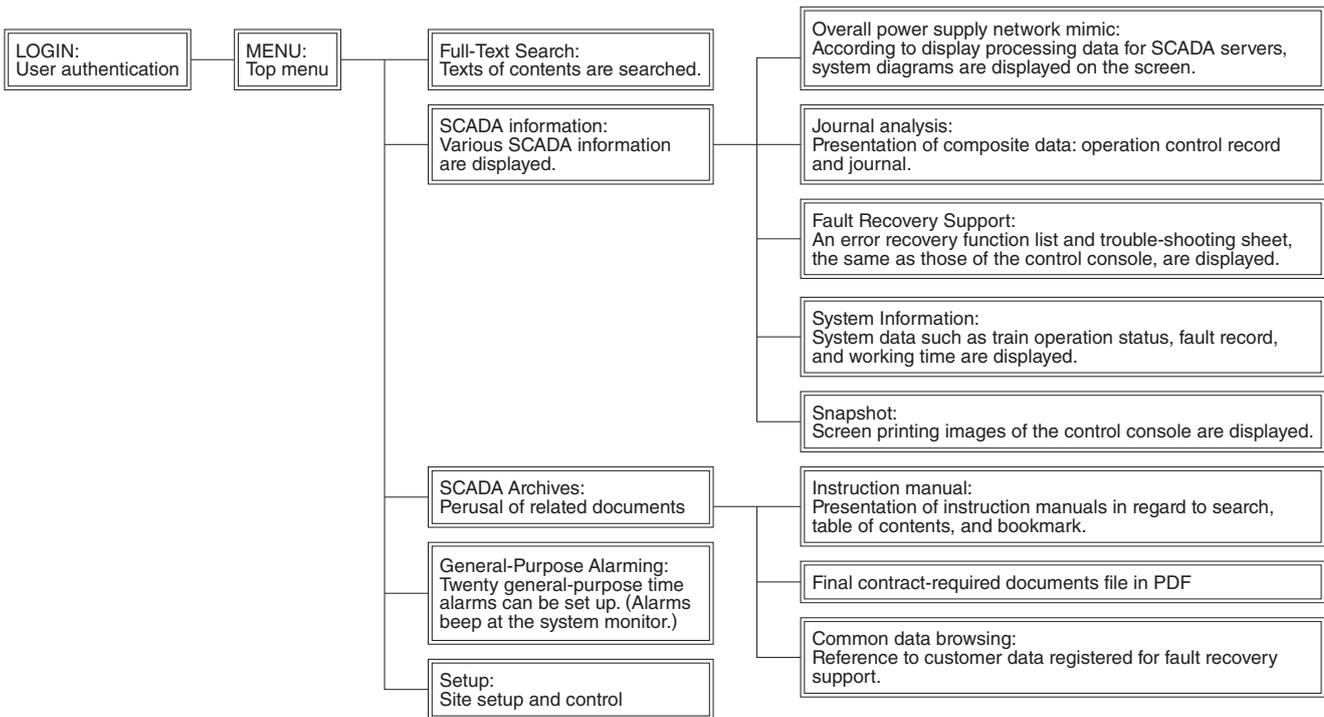
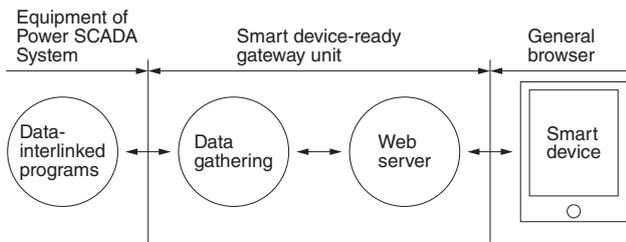


Fig. 2 Site Map

A list of functions available for smart devices is shown.



**Fig. 4** Flow of Data from Power SCADA System to Smart Device

Data are accumulated in the smart device-ready gateway unit through data-interlinked programs of various units.

reliability and real-time performance. Whenever the system is accessed from any smart device inside a Command Center, the contents are made available only by the gateway. Fig. 4 shows the data flow from the Power SCADA System to a smart device.

## 4.2 Security

Since the Power SCADA System is generally not connected to any external network, security measures were taken to avoid any new vulnerability of network security while making the system friendly to smart devices.

### (1) De-Militarized Zone (DMZ)

A DMZ is set up inside the Power SCADA System so that direct accessing is prohibited from a smart device to any area other than the gateway.

### (2) Wireless-LAN Security Measures

- (a) Access limitation by MAC address filtering function
- (b) Password setup for wireless access point
- (c) Concealment of ESSID

For an installation site of a wireless LAN access point, a frequency band is to be used and channels will be determined after the completion of a site survey via radio waves inside the Command Center. Fig. 5 shows a radio strength map (image).

### (3) Limitation of contents access

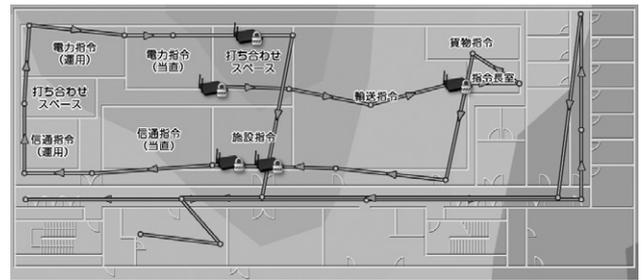
A User-ID and password is needed when gaining access to the contents. User sessions are administered by the system.

### (4) Security measures for the gateway system

We adopted security measures against unknown network security threats. For this purpose, we adopted the security software, “AhnLab WhiteShied for MEIDEN.” This software is of the white list type and it does not require updating of pattern files.

## 4.3 Reliability and Maintenance Period

In order to assure the same reliability level and



**Fig. 5** Radio Strength Map (Image)

Conditions of reception are investigated in advance in the area inside the Command Center where smart devices are to be used. This diagram shows an example of a visualized reception level from a wireless LAN access point.

maintenance period (15 years of operation under 24/7/365) for the Power SCADA System, an industrial component is used for the gateway so that information about system error can be monitored by the system.

Since smart devices are rapidly improving and changing, we adopted general-purpose products. We applied a development method in which the contents are produced based on HTML5 and can be accessed with browser software.

## 4.4 Human Centered Design (HCD)

We have been building systems aiming for “ease of use” based on the HCD method. In the development of Smart Device Friendly Function of the Power SCADA System, we applied the HCD method for user interface design aiming to total quality improvement.

## 5 Outline of Distribution Contents

In order to gain access to the contents, users need to log-in to the system. Fig. 6 shows the log-in screen and Fig. 7 shows the menu screen.

### 5.1 Full-Text Search

Full-text search can be done for the PDF documents in the gateway.

Fig. 8 shows the full-text search screen and Fig. 9 shows an example of full-text search result.

### 5.2 Overall Power Supply Network Display

This shows the display similar to the “Traction Power Supply Network mimic” available at the control console. The display status of equipment retained at the server is taken into the gateway.



**Fig. 6** Log-in Screen

User authentication is needed to gain access to the contents.



**Fig. 7** Menu Screen

A thumbnail indication of present situation is shown in part of the display on the screen.



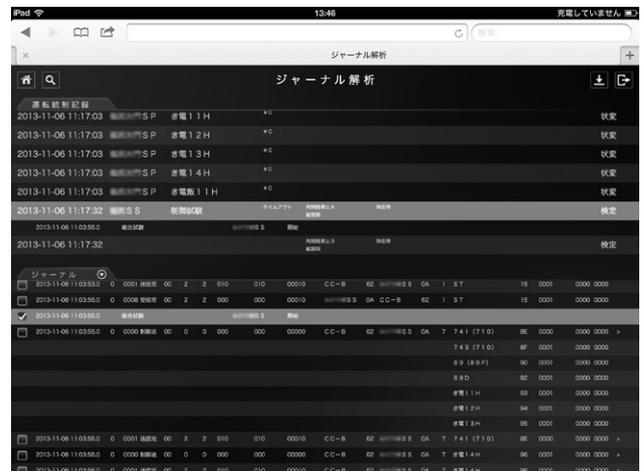
**Fig. 8** Full-Text Search Screen

A keyword is entered in the screen for the full-text search.



**Fig. 9** Example of Full-Text Search Result

The search results are highlighted.



**Fig. 10** Results of Journal Search

When search conditions are entered, both the corresponding operation control records and the journals are simultaneously retrieved.

### 5.3 Journal Analysis

This is a composite display of the operation control record and journal based on the association between them. **Fig. 10** shows the result of a journal search.

- (1) Available search conditions
  - (a) Period
  - (b) Search post
- (2) Association setup function between the operation control record and journal
- (3) Save function

### 5.4 Fault Recovery Support

This displays the same contents as a list of fault recovery support functions and a trouble-shooting sheet that can be accessed at the command console.



**Fig. 11** List of Snapshot Screens

Screen printout images can be shared with smart devices.

## 5.5 System Information

The following information is displayed as system data. The display is updated in the same manner as that for the overall power supply network mimic.

- (1) Status of power network operation
- (2) System error records
- (3) Various information about the gateway (Start time, information gathering time, and disk capacity)

## 5.6 Snapshot

An output image of “Print Screen” shown in the control console can be seen on a smart device.

**Fig. 11** shows a list of snapshot screens.

- (1) Display of thumbnail
- (2) Editing
  - (a) Addition of titles
  - (b) Creation of folders
  - (c) Transfer
  - (d) Deletion

## 5.7 General-Purpose Alarming

Twenty alarm timers can be set. Alarm sound will be generated from a speaker at the preset time.

## 5.8 Related Document Browsing

This displays instruction manuals, a set of final documents and common shared documents.

## 6 Postscript

By developing the Smart Device Friendly Function, we aimed for and realized the smart visualization of data accumulated in the Power SCADA System in the control room without sacrificing reliability and real-time performance of the system. From now on, we will proceed with specific investigation about the utilization of this system from outside of the Power SCADA control room such as a substation.

Lastly, we would like to thank all related individuals who have given us precious suggestions and cooperation during the development of this system.

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