

Integrated SCADA System: An Integrated Transportation System Control Platform



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In recent years, control facilities for rail systems that integrate operation and maintenance information have become increasingly required. A conventional control system is composed of multiple independent subsystems, with a decentralized configuration that requires a special operation terminal which has a different screen design and different operating instructions for each subsystem. When used for a transportation system that handles a wide range of information, this conventional decentralized configuration has disadvantages, such as a high probability of losing time or making operational mistakes in an emergency response. Additionally, it takes time to master the operations and maintenance of each subsystem.

The Integrated Supervisory Control and Data Acquisition (SCADA) system consolidates the monitoring and control functions of these subsystems in one operation terminal, providing a user platform which can be operated through an integrated human-machine interface (HMI).

1. System configuration

System configuration is shown in **Figure 1**. The Integrated SCADA system mainly consolidates communication systems, including the following subsystems:

- Closed-circuit Television (CCTV) System
- Public Address System
- Passenger Information System
- Telephone System
- Time Distribution System
- Network System
- Mimic Display System
- Access Control System
- Platform Screen Door System
- Signaling System (train location)
- Power System (traction power)

2. System functions

Functions of the integrated SCADA system are mainly divided into two types: functions common to all parts of the system, and subsystem functions for the monitoring and controlling of individual subsystems. These functions are described below.

(1) Common Functions

Common functions include user management, alarm and event management, and historical data management. The user management function enables user registration and assigns user rights for the monitoring and control of individual facilities by subsystems or by stations, according to the jurisdiction of the controller. The alarm management function collects alarms from all of the connected subsystems and provides an integrated alarm list. Filtering can also be applied depending on various conditions, such as the location of the alarm, level of severity, and type of subsystem. The historical data management function displays the alarm and event history, various stored data logs, and trend charts.

(2) Subsystem Functions

Subsystem functions monitor equipment status for the entire subsystem, as well as display detailed information on individual equipment and their control. For example, subsystem functions include selecting cameras for the CCTV System, image display, and pan/tilt/zoom (PTZ) operation of the cameras. The Passenger Information System, such as the selection of the display zones and message display, are integrated with SCADA.

The Public Address System and Telephone System are also integrated to include announcement functions, the selection of announcement zones, and the receiving and making of calls, which can all be handled on one operation terminal.

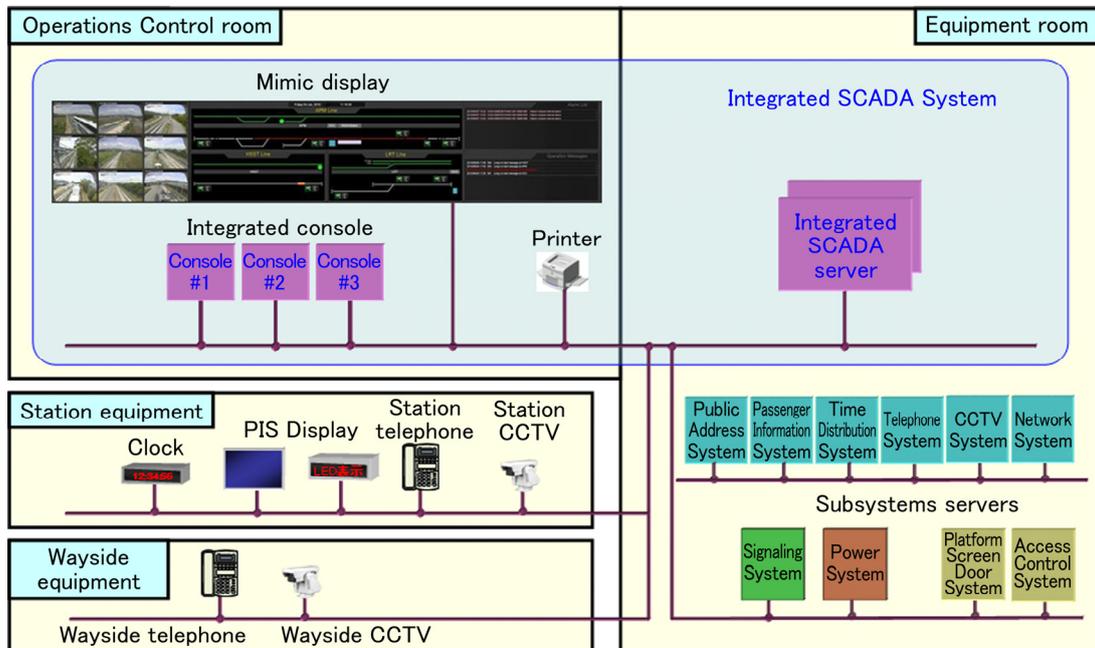


Figure 1 System configuration

3. Human–Machine Interface (HMI)

The system was designed in consideration of the entire operations of the transportation system in order to develop a user-friendly system from the viewpoint of the controller.

There are two types of consoles: large touch-screen consoles (**Figure 2**) and conventional keyboard and mouse (**Figure 3**) consoles. The touch-screen console consists of three screens, including one operations screen and two monitoring screens, that together form a T on the console. This is a unique approach by Mitsubishi Heavy Industries (MHI). A controller can open various application windows on the operations screen, depending on the station or individual subsystems under monitoring, and can customize the screen layout by arranging the applications on the monitoring screens.



Figure 2 Touch-screen type console



Figure 3 Keyboard and mouse console

Four types of windows are available: the layout window, which displays the layout of a station facility; the subsystem operations window, on which different subsystems are operated individually; the schematic window, which displays system equipment diagrams; and the alarm window.

From these four different types of windows, the user can access each individual subsystem for a wide range of applications. The layout window displays the layout and status of the subsystem equipment, using icons to represent individual subsystem equipment. When an icon is selected, detailed information on the equipment and its control panel appear on the screen allowing intuitive and simple operations, even for first-time users.

The types of subsystems displayed on the layout and schematic windows and the arrangement of the equipment vary depending on individual projects. Therefore, those windows should be designed individually for every project. Accordingly, MHI has developed a screen-design support tool that reads the list of equipment, and allows the user to select the appropriate equipment from the list displayed on the screen, and then arrange the icons by drag and drop.

4. Conclusion

Introduction of the Integrated SCADA system should simplify complex central control facilities and their operations, thereby reducing the operations load by controllers, as well as improving the emergency response capabilities and shortening the operations training period.