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ARTIFICIAL INTELLIGENCE IN POWERSTATION

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Abstract : *Recently, there are concerns about the liberalization of electric power supply, deregulation, and the impact on the global environment, and ensuring a highly reliable electric power supply has become a major social need worldwide. To meet this need, we are conducting detailed research and development on power distribution systems and equipment monitoring. These are related to (1) "digital technology" based on the application of high-speed semiconductor devices, (2) intelligent substations applying IT (information technology), and (3) system configurations aimed at high-speed communication. It includes future intelligent control, protection, monitoring, and communication system requirements for substations, with advantages in terms of high performance, feature distribution, information exchange, and integrated distribution management. Today's traditional devices also require streamlined functionality, improved sensor technology, and a standardized interface. By facilitating these developments, the following savings can be expected across the system:*
(1) Reducing the cost of remote monitoring in the areas of device monitoring, operation, and maintenance.
(2) Integrated device management.
(3) Cost reduction by space saving by downsizing of equipment.

***IndexTerms - Artificial intelligence, Digital technology,Powerstation*.**

I. INTRODUCTION

Upgrading of our 500-kV trunk transmission system is nearing completion, and the power system has been significantly improved. However, cost reductions are needed to address the influx of IPP (Independent Power Producer) and the introduction of power distributors caused by the withdrawal of control over power supply. To achieve this, each electricity supplier reduces costs by efficient use of resources, improving efficiency, and effectively managing plant and equipment investments. Additionally, power systems will be extremely complex, requiring operation in an uncertain and unstable environment. Therefore, the safe and economical operation of energy systems requires advanced and innovative control methods. The energy distribution system also requires initial investment reductions, such as unit price and downtime, as well as reduced costs for the entire life cycle, including the cost of operating / maintaining a sub-station system. The development of a new energy distribution system is considered to meet these needs. It will embrace "digital technology" and "IT-related technologies," which have made rapid progress in recent years. The plan aims to reduce total costs, not only to reduce the cost of the unit but also the costs of installation, construction, operation, and maintenance. This article discusses building smart sub-channels in the power distribution system, as well as protection / control-integrated assets as examples of new technologies.

I. CONCEPT OF INTELLIGENT SUBSTATION

In conventional substations, substation apparatus, such as switchgear and transformer, control, protection and monitoring equipment is independent of every other device, and connection is based on the signals coming through the cable. On the other hand, an intelligent substation shares all information on apparatus, control, protection, measurement and apparatus monitoring equipment through one bus by applying both “digital technology” and “IT-related technology.” Moreover, high efficiency and miniaturization can be achieved because the local cubicle contains unified control/protection and measurement equipment that is one integrated system (see Fig. 1). Since an optical bus shares the information between the apparatus and equipment, the amount of cable is sharply reduced. Moreover, as international standards (IEC 61850 and 61375 etc.) are adopted and the system conforms to the telecommunications standard, equipment specifications can be standardized for different vendors.

I. APPARATUS MONITORING SYSTEM

All data from individual monitoring and measurement devices is transmitted over the optical bus and used for higher level monitoring systems. Utilities and manufacturers' maintenance sites can retrieve the data they need via an intranet or the Internet and monitor their devices remotely. Database structure, analysis, and diagnosis such as trend management and history management are also possible. This means that you can check for signs of anomalies at the right time and respond quickly in an emergency.

3. Intelligent substation

Care plans can also be written to ensure reliability, by examining the definition of review and component management, effective maintenance planning and maintenance of integrity also takes place simultaneously

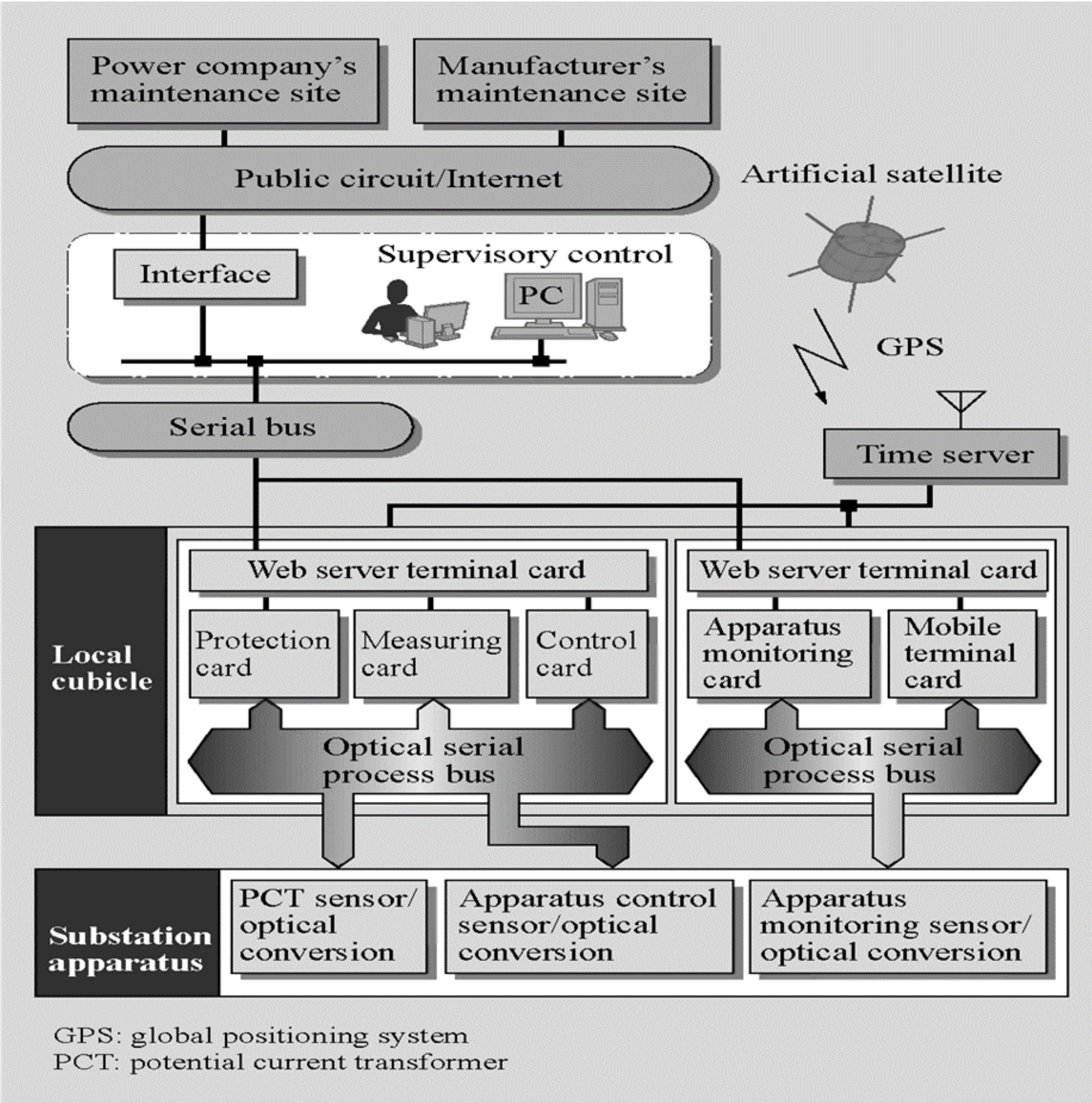

Fig. 1—Intelligent Substation System Configuration (Image). The whole substationsystem is combined by optical LAN, and apparatus composition is simplified.

3.1 Power System Controls

Power system controls can be broadly divided into two categories: area and area (region / system-width). The boundary between the two categories is inaccurate as location controls are often used to fine-tune local control parameters and set points. Location controls are a key factor in the need to process the information collected in various network locations and to model the behavior of large components of the power system. This type of control is usually not limited to the type of automatic response but usually includes strategies based on false information and human intervention. Local control, on the other hand, is often implemented using standard automatic control rules, such as PID controls, which are believed to provide adequate functionality in many systems. However, this is not to diminish the usefulness of clever new methods, such as abstract thinking controls, of local control.

For convenience, power system higher level controls are classified here as:

- Generation planning and automation control: includes unit commitment, economic exports, and automated production control; in the past, well-established control systems were used but this situation has been changing to address the new situation created by the restructuring of the energy industry;

- Electricity control: usually localized but some systems have already moved to second integrated control at the top to allow for efficient use of active energy sources and to increase the margins of stability;
- Protective defense management: aims to identify unsafe workplaces and promote remedial measures; major challenges in this area are online Dynamic and Voltage Security Assessment (DSA and VSA);
- Emergency management: manages the system control problem after a major disruption; is a form of event-driven control and includes special protection schemes;
- Restorative control: its main function is to reboot the system after a major disruption followed by a small or complete shutdown.

3.2 Theoretical framework

Smart system strategies can be very helpful in using local power system controls. Many of these applications require large amounts of system information, which can be provided by modern telecommunications and computer technology, but require new processing techniques that can extract valuable information from these large green data collections. Importantly, such large data sets are always accurate and often contain a variety of uncertainties. Finally, control actions may be based on stated quality assumptions, which need to be translated into quantitative decisions.

An important factor to consider in the use of energy systems management is that, in the redesigned area of the energy system, a number of these functions will fall under the category of related services. Therefore, in addition to technical problems, economic and financial infrastructure should be considered in the development and implementation of control systems.

4. Devices that can contribute to an intelligent substation

4.1 Switchgear and Transformer

The load can be significantly reduced because the PCT sensor signal is digitized on the outlet edge and the load on the PCT only reaches that of the A-D (analog-to-digital) switch. Rogowski coils are used as current sensors and capacitors that can have capacitive power are used as electrical sensors. These sensors significantly reduce the size of the switchgear (see Fig. 2).

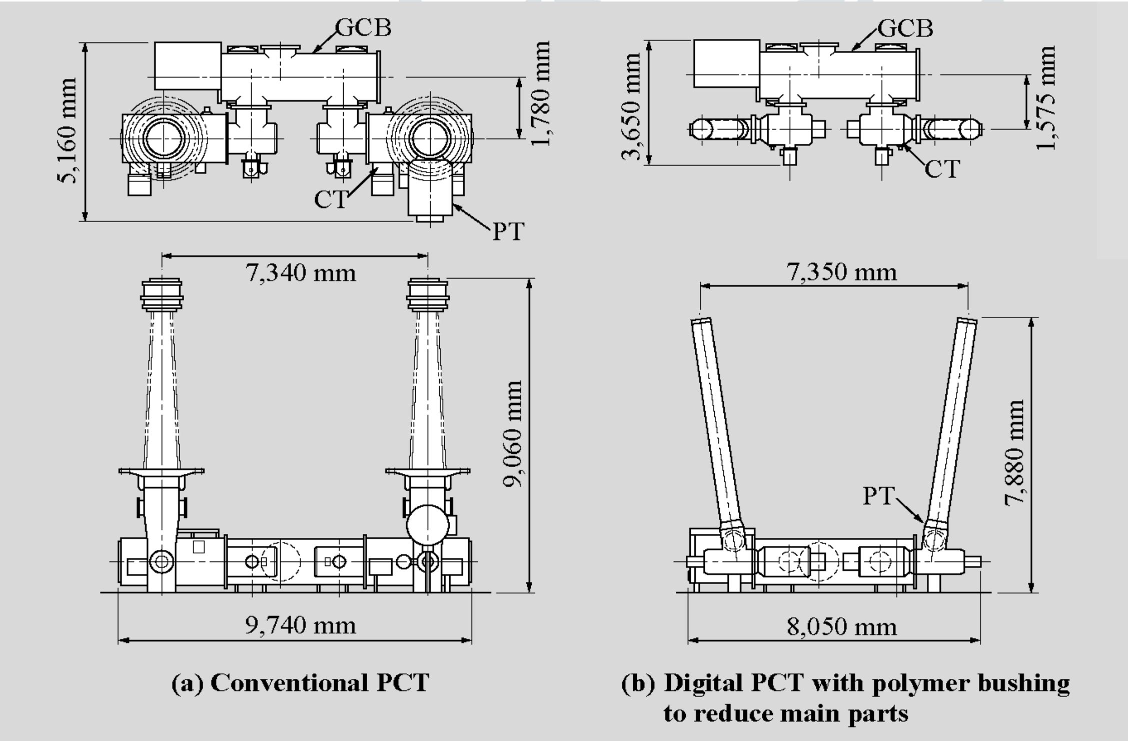

Fig. 2—Gas Combined Switchgear Miniaturization by Digital Correspondence Sensor. 550-kV GCS (gas combined switchgear) is shown as an example

GCB: gas circuit breaker

CT: current transformer

PT: potential transformer

Present studies on miniaturizing conventional equipment have so far been aimed at standardizing series. Advanced miniaturization will be attempted by digitizing this system, corresponding to its need.

4.2 Protection And Control

Smart sub-channels need protection and control of the equipment to be installed outside and this requires coherence for the local cubicle to accommodate you. Exterior installation requires the development of inputs against heat and air intrusion without the reliability of the components. Sturdy protection and control equipment will create the need for integrated protection / control and overcrowded parts. The current protection / control system using integrated equipment is described below.

4.3 Remote Control Functions By Web Correspondence

The cost of operation and maintenance should be reduced and detailed real-time information is required on the digital protection and control unit, during a breakdown, or when the operational manager is notified of changes in local equipment to ensure system stability. Also, there have been demands for the use of the remote, as well as for the operation of the human control station on unmanned remote stations. A standard digital panel stores and analyzes system information (current / voltage data) in the event of errors, and the CPU has highly automated viewing functions.

However, our system collects voltage and current data stored within the panel, in the remote control phase, and the automatic viewing results are analyzed and applied immediately. The system has a connection, which directly receives the network data from the security and control units on the channel.

4.4. The interface characteristics are as follows:

(1) Widely used TCP / IP as standard interface is adopted, improving performance that allows easy access to used networks only. Using a standard browser, most computers can easily access the network.

(2) The server is on the panel, and individual details and details are displayed to the operator as a database information. Also, the information is accessible to The many client at

(3) With the use of a standard browser, communication using the general public circuit is possible without limiting the communication method or the use of a special network.

The cost of network equipment is reduced, and as the system operates more efficiently, it also reduces costs.

5. Applications

Few problems in energy systems cannot be solved by conventional methods based on a few needs that may not always be possible. In these cases, the strategies of artificial intelligence are the most obvious and the only option. Areas of AI use in energy systems are:

(i) Performance of energy system such as unit commitment, hydro-thermal integration, economic deployment, traffic management, maintenance planning, state measurement, loading and flow of energy.

(ii) Electrical planning planning such as generator expansion planning, power system reliability, power transmission expansion configuration, efficient power planning.

(iii) Power system controls such as power control, stability control, power flow control, loading frequency control.

(iv) Power station management such as petrol power management, thermal power management.

(v) Network control as location, measurement and control of FACTS devices.

(vi) Electric markets as bidding strategies, analyzing electricity markets.

(vii) Power system automation such as recovery, management, error detection, network security.

(viii) Utilization of the distribution system such as planning and implementation of the distribution system, side response demand and demand side control, operation and intelligent grid control, network restructuring.

(ix) Distributed production applications such as distributed production planning, photovoltaic solar power station control, wind turbine domain control and renewable energy resources.

(x) Predictability application such as short-term and long-term volume forecasting, electric market forecast, solar power forecast, wind power forecast.

6 Advantages

- Protection from accidents caused by unforeseen events.
- Reduce the risk of accidents.
- Minimal manual operation.
- Accurate and real-time feedback.
- Quick response time.
- Real-time error detection and recording.

6.1 Disadvantages

- Decrease in job opportunities.
- Inability to consider necessary tolerance as the system aims for precision.
- Unable to monitor yard equipment meters
- Even though the proposed system is intelligent ,continues supervision is required.
- Adjustments cannot be made.

7. Conclusion

We have described new emerging technologies in the power supply system. With the advancement of communications technology and the proliferation of IT-related technologies, research and development has also been advancing based on intelligent system thinking, not only in units or equipment, but also in the system's constitution itself. It can be believed that the needs of future customers will vary greatly in this field. We will need to accelerate the development and release of compatible and low-cost products, in line with the needs of these future clients.

8. Future enhancement

Artificial Intelligence (AI) has the potential to reduce energy losses, reduce costs, and accelerate the use of clean renewable energy sources across the global grid, as well as improve the performance, maintenance, control, planning and planning of energy systems. AI is therefore very close to the renewable, clean and affordable energy needed for development. The energy sector has a bright future with the advent of smart grid-enabled grids if used properly. In addition, AI brings the customer back to focus by connecting power generators, belt managers and eliminating customers so that they can connect and be delivered more efficiently and effectively. It should also be noted that AI is also recognized for minimizing environmental impacts from thermal power plants, improving their efficiency and thus contributing more efficiently to grid power

AI enables power grids that allow dual communication between resources and consumers. Smart grids embedded in a knowledge base that allows for interaction between their various components to better respond to rapid changes in power demands or emergencies. This layer of information, created by the extensive installation of intelligent metals and sensors, allows for data collection, storage, and analysis. Considering the large volume and the unique structure of such data sets, techniques such as machine learning, Internet of Things, etc. are best suited for analysis and application. These analyzes can be used for a variety of purposes, including metallic error detection, predictive care requirements, sustainable energy quality monitoring, and renewable energy forecasting, and the latest innovation of Information and Communication Technology (ICT). The energy sector in the developed world has begun to use AI, Data Analytics, Internet of Things (IoT), and related technologies that allow communication between intelligent grids, smart meters, and computer devices..

8.1 Scope Of Applications

• Limit on performance of power system
• Extensive power system configuration

8.2 Scope Considered For Intelligent System Methods

• Legislative / strategic approaches
• Model-based thinking
• Synthetic sensory networks
• Evolutionary system
• Limited assumptions (incomprehensible sets, certainty features, etc.)

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