

SCADA in The Chemical Industry

¹Matthew N. O. Sadiku, ¹Sarhan M. Musa and ²Osama M. Musa,

¹Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX 77446

²Ashland Inc., Bridgewater, NJ 08807

Abstract: It is hardly possible to manually control and supervise all industrial activities. Over the years, the chemical industry has been involved in the automation of many chemical processes using various industrial control systems such as Supervisory Control and Data Acquisition (SCADA), Programmable logic controllers (PLCs) or a Distributed Control System (DCS) system. SCADA system is a control system that is responsible for acquiring data and monitoring equipment. This paper presents a brief introduction of the use of SCADA systems in the chemical industry.

Keywords: chemical industry, Supervisory Control and Data Acquisition (SCADA)

I. INTRODUCTION

Supervisory Control and Data Acquisition (SCADA) is an Industrial Control System (ICS) that manages the automation of large and complex processes. It is an automation control system that is used in industries such as energy, oil and gas, water, power, and chemical. The term SCADA is used both as an umbrella for an entire control system and to the specific software that implements the supervisory control capability. The SCADA technology is mainly used for data acquisition, communications, control, and infrastructure management in an industrial environment. An example of the effectiveness of SCADA is in the industries of electric power and water. Several of these companies still use manual labor to perform measurements and check for errors. These tasks can be easily automated with SCADA systems which can help to reduce the errors caused by humans.

SCADA should not be confused with Distributed Control System (DCS). The first difference is that DCS is usually process oriented, while SCADA is data-gathering oriented. While DCSs cover the plant site, SCADA systems cover much larger geographic areas. SCADA generally supports storing of database where as DCS generally does not. DCS is focused on controlling production systems within the same geographic location. It scans and concentrates on the controlled process such as, a chemical plant and presents the information to the operators. SCADA concentrates mainly on the control center as well as the operators.

II. SCADA SYSTEM

SCADA may be regarded as a platform technology for controlling and supervising many types of industrial processes. It has both hardware and software. A typical SCADA system consists of three main elements [1]:

1. A central command center housing a computer server running SCADA software. SCADA software manages almost any form of process production.
2. Remotely controlled sensors and actuators to automate process equipment.
3. A computer communication network that connects the computers at the central command center to those at the remote locations. The computer network is the most essential component for a SCADA system to operate properly.

The SCADA software provides constant real-time production process information, collecting data from multiple sensors on the plant. Data inputs to a typical SCADA system may include measurement of environmental conditions such as temperature, humidity and air pressure a number of measured values representing environmental conditions such as temperature, humidity, and air pressure.

Accessible from any computer within the workplace, SCADA system can show real time data and management functions including true color graphic visualizations of the state of industrial machinery. The SCADA system is a client-server architecture integrating several functions. Figure 1 shows a typical SCADA architecture [2].

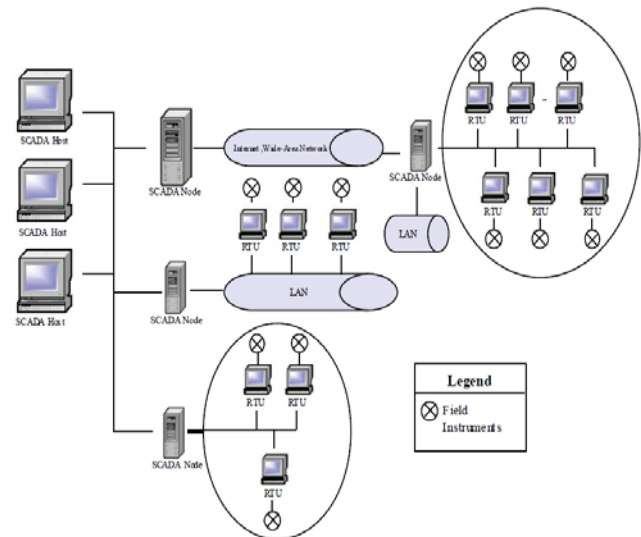


Figure 1. A typical SCADA architecture [2].

III. ADVANTAGES AND DISADVANTAGES

The advantages of the SCADA systems include [3]:

- The computer can record and store a very large amount of data
- The data can be displayed in any way the user requires
- Thousands of sensors over a wide area can be connected to the system
- The operator can incorporate real data simulations into the system
- The data can be viewed from anywhere, not just on site
- Significant reduction in net operating cost

The disadvantages of SCADA systems include [3]:

- The system is more complicated than the sensor to panel type
- Different operating skills are required, such as system analysts and programmer
- Thousands of sensors require running significant amount of wire.
- The application of SCADA for real-time control of power networks is a challenge
- Lack of compatibility with other products since SCADA uses proprietary communications and programming
- Software requires constant updates to maintain security.

IV. APPLICATIONS

SCADA system has a wide range of applications and true business processes for a variety of purposes. It is used in natural gas, petroleum, water supply systems, oil and gas industry, mining industry, electric power systems, automobile assembly line, chemical and pharmaceutical plants, petroleum industries, food processing, building management systems, transportation, heating ventilation, and air conditioning. For the chemical industry, the following are typical applications.

- *Oil and gas:* Oil and gas industry is under pressure to increase productivity through integrated automated operations. SCADA systems are used to achieve this in the industry. Its ability to collect data at remote oil and gas sites reduces personnel visits. SCADA can productively address the unique challenges of the upstream oil and gas sector. Better control and coordination of complex site operations translates to lower costs in producing oil or gas [4].
- *Pharmaceutical industry:* The pharmaceutical industry invents and manufactures medicines that make our lives healthy. Maintaining safe, flexible, and efficient manufacturing processes is crucial. The SCADA system is well suitable for all process requirements and covers all aspects of the pharmaceutical industry - from the operation of individual machines to complete plant operation. A major requirement for a SCADA solution in the pharmaceutical industry is data integrity, which affects the quality of the product.
- *Manufacturing:* This includes chemical and pharmaceutical processing, food processing, and discrete manufacturing. SCADA systems manage parts inventories for just-in-time manufacturing, regulate industrial automation and robots, and monitor process and quality control.

Most critical infrastructure, including utility and transport systems, are controlled by SCADA systems. Municipals worldwide are using SCADA systems for efficient supply, distribution, and recycling of water in urbanized areas.

Incorporating cloud computing with SCADA systems has enabled operators to control production from any location, making the operation more flexible. The two technologies will enrich each other in the modern industrial environment.

V. CHALLENGES

Although SCADA systems provide many benefits, there are still challenges that need to be addressed. SCADA systems do not always prioritize secure connections to public networks, leaving many SCADA platforms open to

attack. They are also susceptible to cyber attacks because of the advanced devices used in them are connected to outside networks such as the Internet. Their vulnerabilities encompass hardware, software, communication networks, as well as policies and procedures. There are two types of threats that SCADA systems face: direct attacks from intruder and indirect threats such as operational errors and viruses. Intruders can be hackers, terrorists or even disgruntled employees [5]. SCADA security, centered around preventing hackers, draws considerable attention due to public risk [6]. It should be regarded as a shared responsibility between government agencies and the private sector.

A SCADA system is purchased from different vendors who use proprietary communications and programming. Because of competition, vendors are becoming more transparent with their product design and the trend is away from proprietary information and more towards a less expensive standardized design.

There is a lack of training on SCADA systems. International orientation of the SCADA software solution is a major requirement. In the future, it is hoped that more open standards for SCADA systems will be adopted to replace proprietary products.

CONCLUSION

SCADA systems are crucially important because they perform numerous functions such as monitoring and controlling critical national infrastructures such as power grid, manufacturing, telecommunications, waste and water systems, and transportation networks. They are the backbone and automation heart and brains for these critical infrastructures.

Without doubt the SCADA systems have evolved rapidly over the years and are now penetrating the market of plants. SCADA systems have been an essential tool in production-critical chemical processes for several years, because such processes require data display in real-time allowing quick, strategic business decisions.

Universities should include SCADA systems in their curriculum to prepare professionals who will work to protect our critical infrastructures. The future of SCADA is bright.

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AUTHORS

Matthew N.O. Sadiku is a professor in the Department of Electrical and Computer Engineering at Prairie View A&M University, Prairie View, Texas. He is the author of several books and papers. His areas of research interest include computational electromagnetics and computer networks. He is a fellow of IEEE.

Sarhan M. Musa is a professor in the Department of Engineering Technology at Prairie View A&M University, Texas. He has been the director of Prairie View Networking Academy, Texas, since 2004. He is an LTD Sprint and Boeing Welliver Fellow.

Osama M. Musa is currently Vice President and Chief Technology Officer for Ashland Inc. Dr. Musa also serves as a member of the Advisory Board at Manhattan College's Department of Electrical and Computer Engineering as well as a member of the Board of Trustees at Chemists' Club of NYC. Additionally, he sits on the Advisory Board of the International Journal of Humanitarian Technology (IJHT).