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PERFORMANCE OF A SCADA SYSTEM FOR LARGE DISTRIBUTION NETWORK TRANSACTIONS ON POWER SYSTEMS

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ABSTRACT

SCADA refers to the centralized systems that control and monitor the entire sites, or they are the complex systems spread out over large areas. Nearly all the control actions are automatically performed by the remote terminal units (RTUs) or by the programmable logic controllers (PLCs). The restrictions to the host control functions are supervisory level intervention or basic overriding. For example, the PLC (in an industrial process) controls the flow of cooling water, the SCADA system allows any changes related to the alarm conditions and set points for the flow (such as high temperature, loss of flow, etc) to be recorded and displayed.

The aim of this thesis is, firstly to recall the basic concept of SCADA system to present the project management phase of SCADA for real time implementation and then to show the need of automation for Power Distribution Company's (PDC) on their distribution and the importance of using computer based system tower sustainable development of their services most control action are performed automatically by RTU host control functions are usually restated to basic overriding or supervisory level intervention, a computer based power distribution automation system is than discussed, finally some projects SCADA system implication in electrical companies over the world is briefly presented.

Keyword: SCADA (Supervisory Control And Data Acquisition), RTU (Remote Telemetry Unit), PLS (Programmable Logic Controllers), MTU (Master Terminal Unit), MPPKVVCL (Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited).

I. INTRODUCTION

To improve the power factor, shunt capacitor banks have been applied in many power distribution systems and industrial circuits for reactive power compensation. The power factor regulator is designed to optimize the control of reactive power compensation. Reactive power compensation is achieved by measuring continuously the reactive power of the system and then compensated by the switching of capacitor banks. At the end user connection points, the integrating breaker switched capacitor banks into a compact design with the intelligent control unit offers a reliable and affordable reactive power compensation solution for distribution systems. The benefits of doing so are:

(1) Improvement in power factor, which either eliminates or reduces the demand charges imposed by the utility.
(2) Maintaining a proper voltage level at the end user for improved productivity of industrial processes.
(3) Releasing of valuable system capacity. Increasing the useful life of pieces of distribution equipment.
(4) Reducing the energy loss in electrical conductors by reducing the required current.

II. SCADA SYSTEM

SCADA Systems as the technical capabilities of computers, operating systems, and networks improved, organizational management pushed for increased knowledge of the real time status of remote plant operations. In addition, in organizations with a number of geographically separated operations, remote data acquisition, control, and maintenance became increasingly attractive from management and cost standpoints. These capabilities are known collectively as Supervisory Control and Data Acquisition or SCADA. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules.

Fig. 1: SCADA System

SCADA systems analyze real-time data to monitor and control the proper operation of control processes. SCADA systems are vital components of most nations' critical infrastructures. They control pipelines, water and transportation systems, utilities, refineries, chemical plants, and a wide variety of manufacturing operations. SCADA provides management with real-time data on production operations; implements more efficient control paradigms; improves plant and personnel safety and reduces costs of operation. These benefits are made possible by the use of standard hardware and software in SCADA systems combined with improved communication protocols and increased connectivity to outside networks, including the Internet. SCADA is an industrial automation control system at the core of many modern industries, including: Energy, Food and beverage, Manufacturing, Oil and gas, Power, Recycling, Transportation, Water and waste water and many more.

III. PROGRAMMABLE LOGIC CONTROLLERS (PLC)

A programmable logic controller (PLC) is an industrial solid-state computer that monitors inputs and outputs, and makes logic-based decisions for automated processes or machines. PLCs were introduced in the late 1960s by inventor Richard Morley to provide the same functions as relay logic systems. Relay systems at the time tended to fail and create delays. Technicians then had to troubleshoot an entire wall of relays to fix the problem.

PLCs are robust and can survive harsh conditions including severe heat, cold, dust, and extreme moisture. Their programming language is easily understood, so they can be programmed without much difficulty. PLCs are modular so they can be plugged into various setups. Relays switching under load can cause undesired arcing between contacts. Arcing generates high temperatures that weld contacts shut and cause degradation of the contacts in the relays, resulting in device failure. Replacing relays with PLCs helps prevent overheating of contacts. In SCADA systems, PLCs are connected to the sensors for collecting the sensor output signals in order to convert the sensor signals into digital data. PLCs are used instead of RTUs because of the advantages of PLCs like flexibility, configuration, versatile and affordability compared to RTUs.

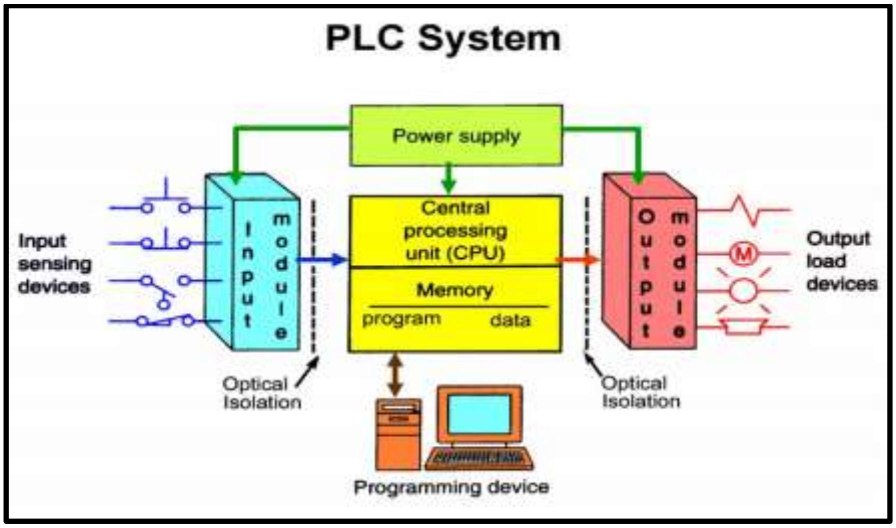

Fig. 2: (a) Block Diagram of Programmable Logic Controller

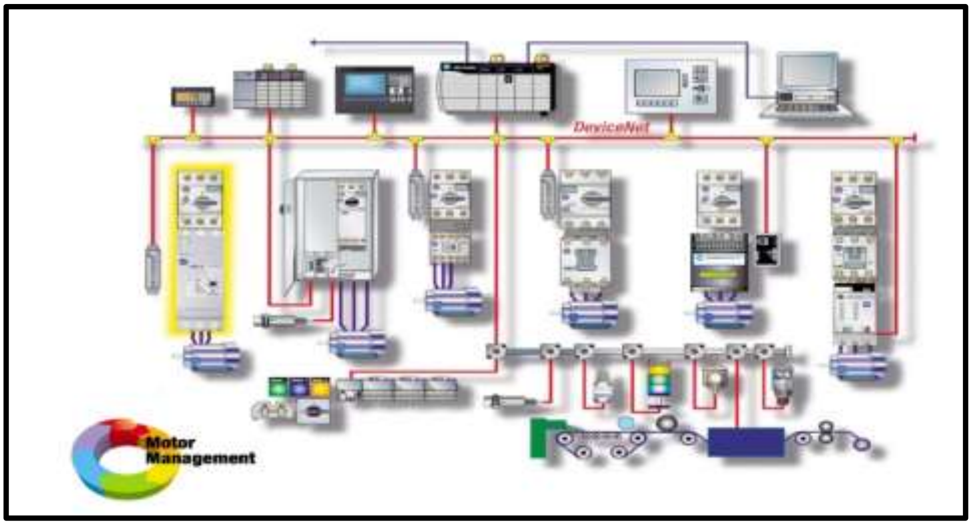

Fig. 2:(b) Internal connection of Programmable Logic Controller

IV. SIMULATION RESULTS

The control commands pertaining to different RTUs /FRTUs may be executed in parallel. If, after selecting a point, the user does not execute the control action within a programmer adjustable time-out period, or if the user performs any action other than completing the control action, the selection shall be cancelled and the user be informed. If the communication to the RTU /FRTU is not available, the control command shall be rejected and shall not remain in queue. The user shall not be prevented from requesting other displays, performing a different supervisory control action, or performing any other user interface operation while the SCADA/DMS system waits for a report-back on previously executed control actions. The system shall process supervisory control commands with a higher priority than requests for data from the RTU /FRTU /FPI data acquisition function.

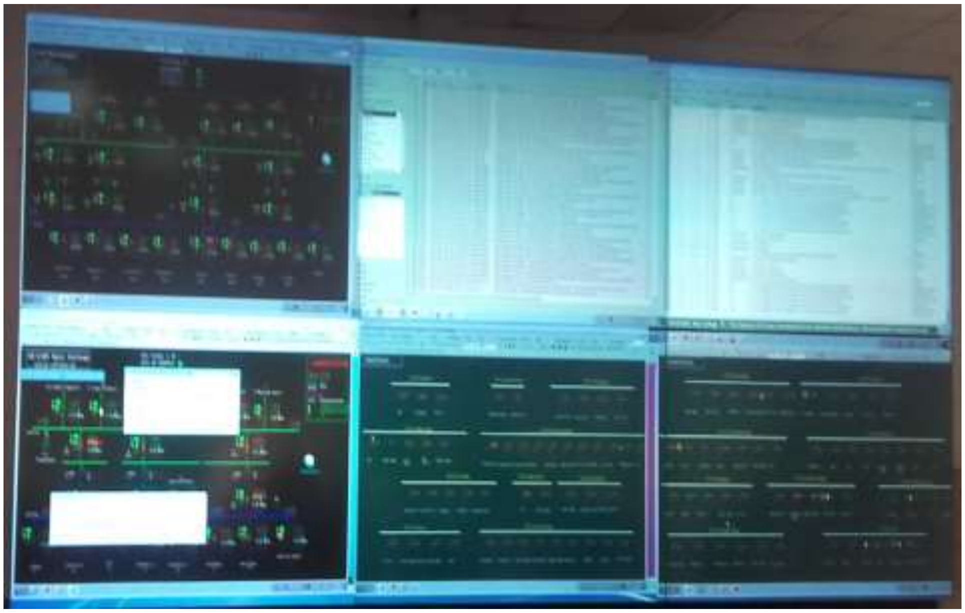

Fig. 3: GUI of SCADA showing substations control parameters in Indore Project work

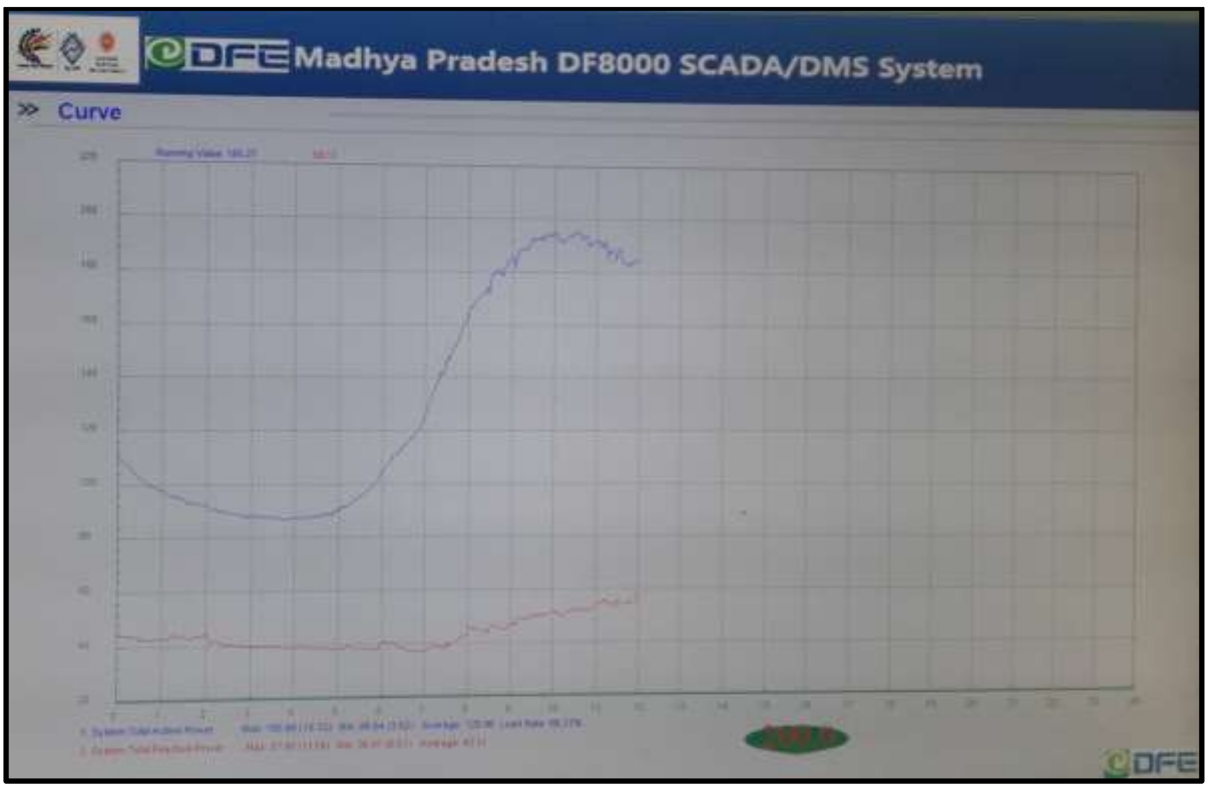

Fig. 4 SCADA Performance between (Real time) Power versus Time in 24Hours (1-Day)

Result Analysis: In the figure 4 Shows the performance between power (Y-axis) versus time (X-axis) in every hours, the system total active power Max 195.99 at 10.33 am, Min 86.64 at 3.52 am, Average power 129.96, load rate 66.31%, and the system reactive power Max 57.90 at 11.59am, Min 36.47 at 6.51, Average power 43.51.

V. CONCLUSION

The SCADA, though required capital investment, but a good SCADA/DMA system implemented in a phased manner brings returns in a shorter period , all data are available in real time and historical data in archive for planning and other applications of utility and sharing of data with all stakeholders and MIS.

Future Enhancement

1. In the future, working phases of SCADA System for Power Distribution Network (PWD) and concept of SMART Grid System.
2. Development of measurement techniques for determining the progress of control system security – There should be quantifiable processes for demonstrating the effectiveness of the efforts taken for protecting critical infrastructure SCADA systems.
3. Establishment of a publicly accessible control system vulnerability database – This is always a political undertaking, but vendors are not serving their customers if they do not keep them informed.

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