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Case Study: Implementation of 132kv Malegaon Sub-Station Using SCADA

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Abstract: *This paper purposes a '**Case Study: Implementation of 132 KV Malegaon Sub-station Using SCADA**' an innovative design to develop a system based on SCADA. Now Malegaon 132KV sub-station is not based on SCADA. It is used for monitoring the voltage, current, fault current in a substation and to protect the system from the rise in mentioned parameters on real time basis. In order to enhance the controlling during fault conditions, efficiency of sub-station, all equipments are converted into modern technology i.e SCADA technology. All old equipments are controlled and monitored by using SCADA. The system is accomplished by using PLC ladder diagram and SCADA software. This automated distribution system is analyzed to develop a secure, reliabe and convenient management tool which can use Remote Terminal Unit (RTU). This sub-station is efficient and reliable for conventional electrical distribution system in Malegaon by using SCADA based technology.*

Keywords: *SCADA, PLC, RTU, MTU, Sub-station, Communication means.*

I. Introduction

Malegaon 132 KV sub-station established in 1978 with old technology, having a capacity of 200 MVA. It consist of heavy distribution load because this substation consist of several feeders and mostly feeders are connected with power loom areas that means having a very heavy load. During fault condition and due to overloading sub-statioon takes a fault clearing time more due to lack of SCADA technology. Due to overloading conductors are brake at any time in the substation which is very harmful for sub-staion and their worker's security The equipments are automated on the old technology basis. It consist of huge loads than its capacity among other substations in Maharashtra.

To overcome the problems of overloading during faulty condition or transient condition , it is very necessary to interface sub-station with new technology and new technology is SCADA. SCADA (supervisory control and data acquisition system) refers to the combination of telemetry and data acquisition. SCADA encompasses the collecting of the information via a RTU (remote terminal unit), transferring it back to the central site, carrying out any necessary analysis and control and then displaying that information on a number of operator screens or displays [1].

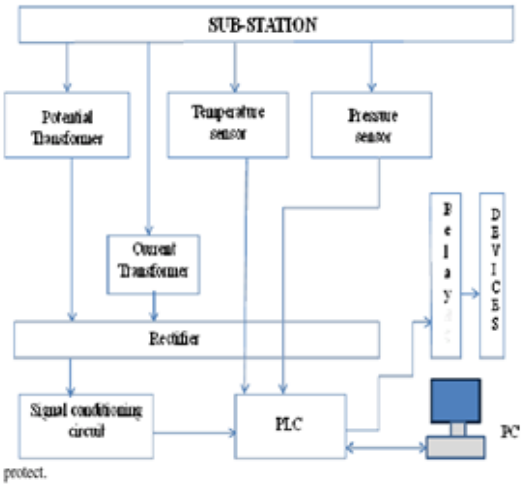

Fig. Simplified Block diagram of Proposed System

So we can enhance the operation of sub-station's equipments and real time operation easily performed during fault condition. Implementation of 132 KV Malegaon sub-station using SCADA system as an integrated system for the digital and analog automation of distribution sub-station [2]. A SCADA system gathers data from sensors and instruments located to remote sides.Then, it transmits data at a central s
ite for controller monitoring process. SCADA system consists of one or more field data interface devices (RTUs or PLCs).A communication system such as radio, telephone, cable, satellite, etc.A central host computer sever or severs (also called a SCADA center, or Master Terminal Unit (MTU)). A collection of standard and/or custom software (Human Machine Interface(HMI)).

As the use of PLCs in substation automation applications increases, and the demand for substation and distribution automation increases, utility engineers are seeking ways to implement applications. With deregulation, utilities are decreasing engineering staff levels.

II. Proposed Design

SCADA (Supervisory Control and Data Acquisition System) forms the front end for Energy Management Systems (EMS). A simple SCADA provides the raw data of the operating condition of the system to the control centre operators. State Estimation forms the backbone for Energy Management System. Although reliability remains a central issue, the need for the real time network models becomes more important than before due to new energy market related functions are to be added to the existing EMS.

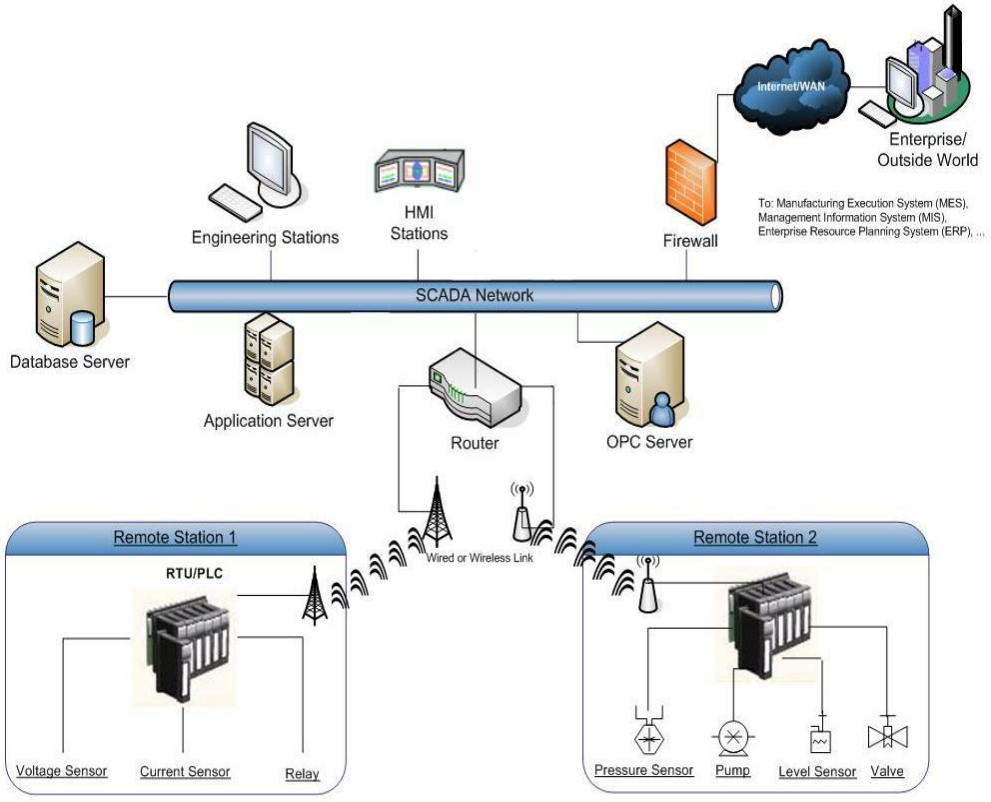

Fig. Flow of SCADA System

The role of SCADA and Automation systems is to optimise power system performance and minimize operating costs. Consequently, SCADA and Automations directly relevant in the delivery of operational excellence as part of the Business Performance operational strategy and achieving a network delivering customer value and choice as part of the Transformation Performance. The SCADA and Automation activities necessary to ensure these outcomes are achieved are summarized.

A SCADA system usually consists of the following subsystems:

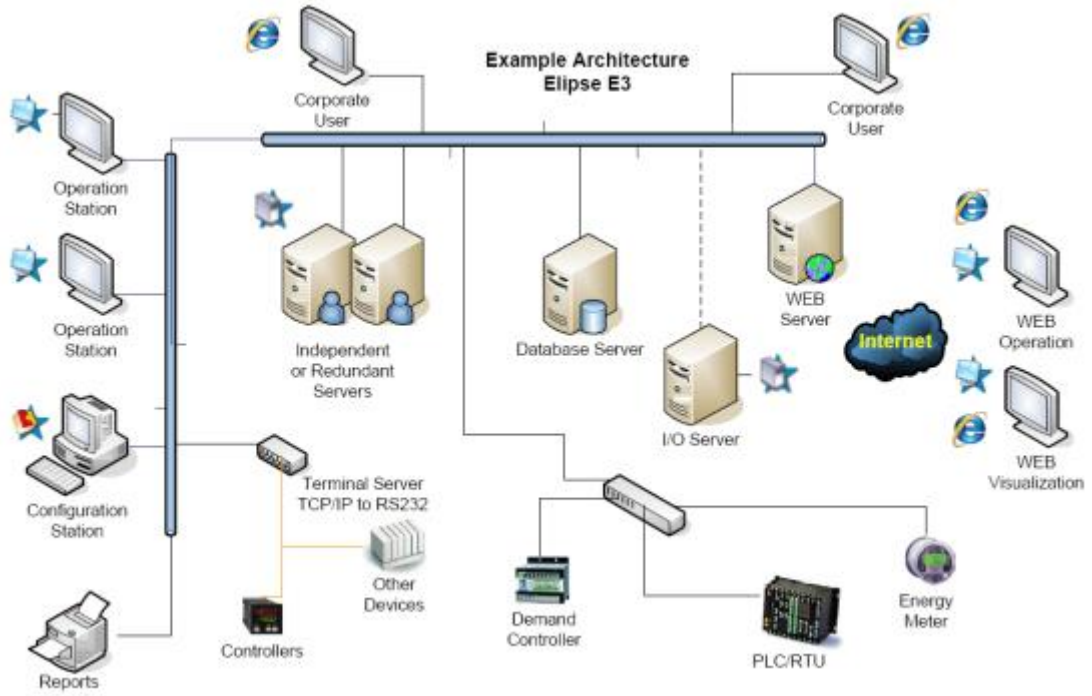

Fig. SCADA Architecture

a) *Remote terminal units(RTUs)* - connect to sensors in the process and convert sensor signals to digital data. They have telemetry hardware capable of sending digital data to the supervisory system, as well as receiving digital commands from the supervisory system. RTUs often have embedded control capabilities such as ladder logic in order to accomplish Boolean logic operations.

b) *Programmable logic controller* (PLCs) - connect to sensors in the process and convert sensor signals to digital data. PLCs have more sophisticated embedded control capabilities (typically one or more programming languages) than RTUs. PLCs do not have telemetry hardware, although this functionality is typically installed alongside them. PLCs are sometimes used in place of RTUs as field devices because they are more economical, versatile, flexible, and configurable.

A data acquisition server is a software service which uses industrial protocols to connect software services, via telemetry, with field devices such as RTUs and PLCs. It allows clients to access data from these field devices using standard protocols[3].

c) *A human machine interface* - or HMI is the apparatus or device which presents processed data to a human operator, and through this, the human operator monitors and interacts with the process. The HMI is a client that requests data from a data acquisition server. A supervisory (computer) system, gathering (acquiring) data on the process and sending commands (control) to the SCADA sy

III. Operation Principle

PLCs in substations increases, the criteria for selection of control system integrators, engineering firms and consultants will become an extremely important factor in the success of PLC substation automation and SCADA projects. One of the most important criteria is that the control system integrator, the engineering firm or the consultant has sound business practices in place. They should also have a project management methodology in place to assure the success of these projects. The changing requirements due to privatization and deregulations have created needs for analyzing information from different sources within DW. These needs require new high performance solutions represented by the new data warehouse of SCADA system.

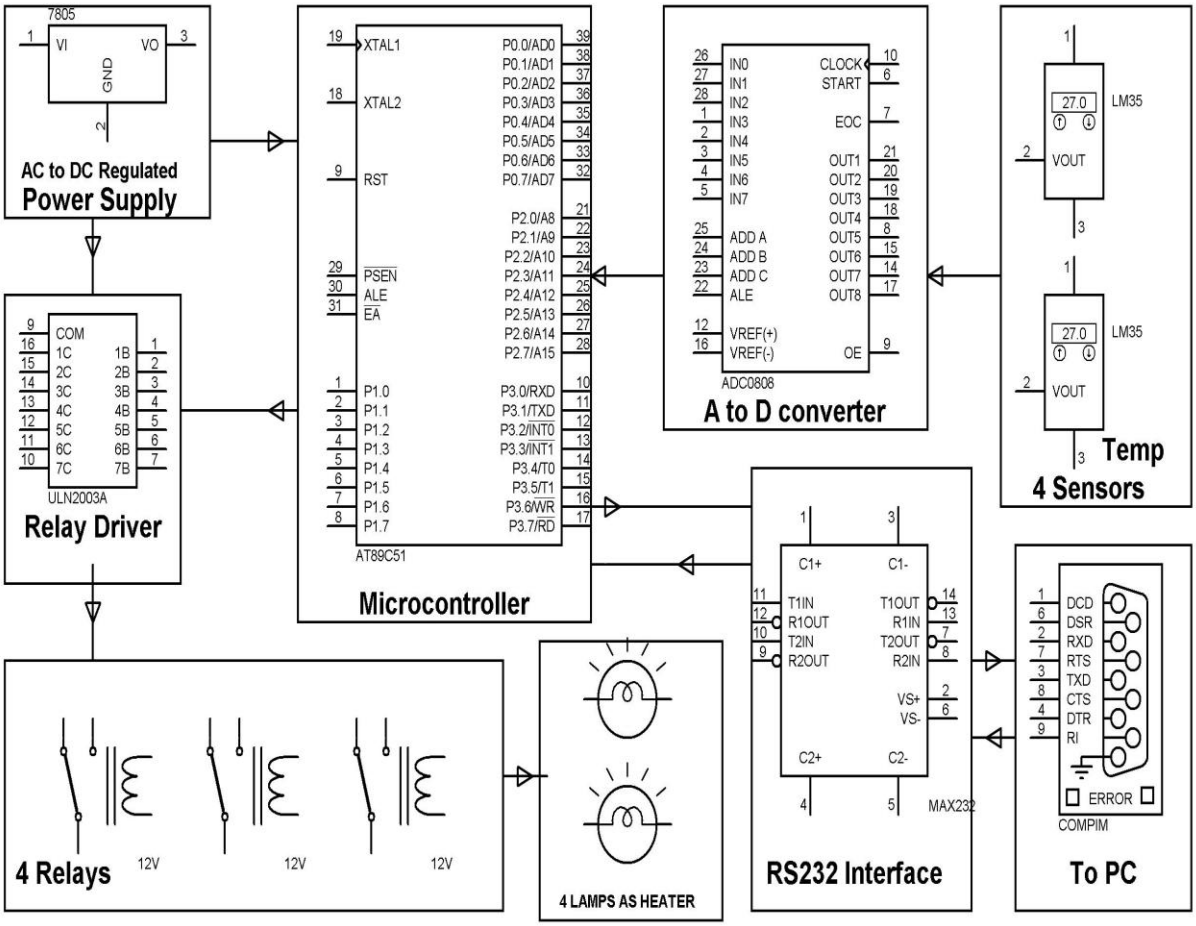

Fig. Circuit diagram of SCADA based substation

The use of PLCs (Programmable Logic Controllers) in substation and distribution automation applications has grown in recent years. The economics of PLC based solutions mean that substation automation and SCADA solutions can be applied even more widely. The RS232 used to interface the PLC kit and the PLC soft wares. This will help the utilities respond to the challenges presented by deregulation. As the use of PLCs in substations increases, the criteria for selection of control system integrators, engineering firms and consultants will become an extremely important factor in the success of PLC substation automation and SCADA projects. One of the most important criteria is that the control system integrator, the engineering firm or the consultant has sound business practices in place.

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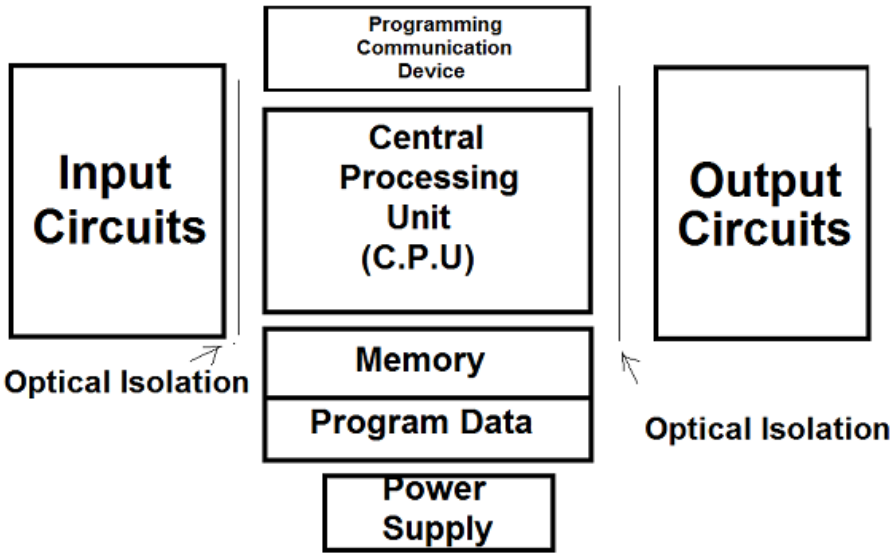

Fig. PLC Working block diagram

PLC or Programmable Logic Controller is a user friendly microprocessor specialized computer that carries out control functions of many types and levels of complexity. Its purpose is to monitor crucial process parameters and adjust process operations accordingly. It can be programmed, controlled and operated by a person unskilled in operating computers. Essentially, a PLC's operator draws the lines and devices of ladder diagrams with a keyboard onto a display screen. The resulting drawing is converted into computer machine language and run as a user began in the 1970s, and has become the most common choice for manufacturing controls. Programmable Logic program. PLC will operate any system that has output devices that go on and off (Discrete, or Digital, outputs). It can also operate any system with variable (analog) outputs. The Control engineering has evolved over time. In the past humans A was the main method for controlling a system.

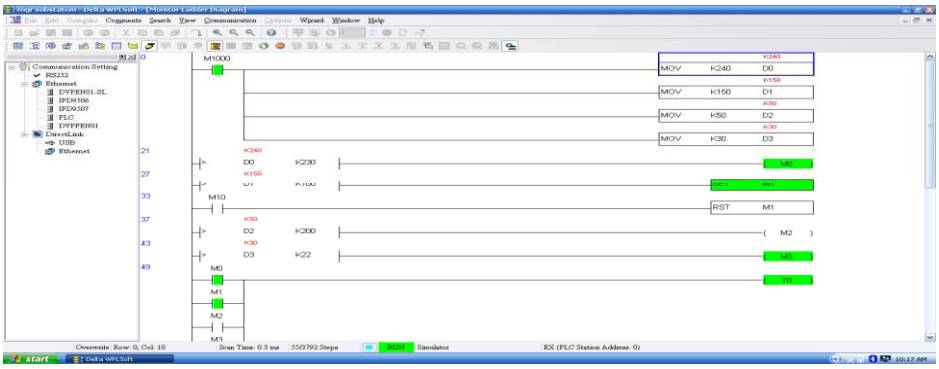

Fig. PLC ladder diagram for Sub-station automation

PLC programs are typically written in a special application on a personal computer, then downloaded by a direct-connection cable or over a network to the PLC. The program is stored in the PLC either in battery backed-up RAM or some other non-volatile flash memory. Often, a single PLC can be programmed to replace thousands of relays.

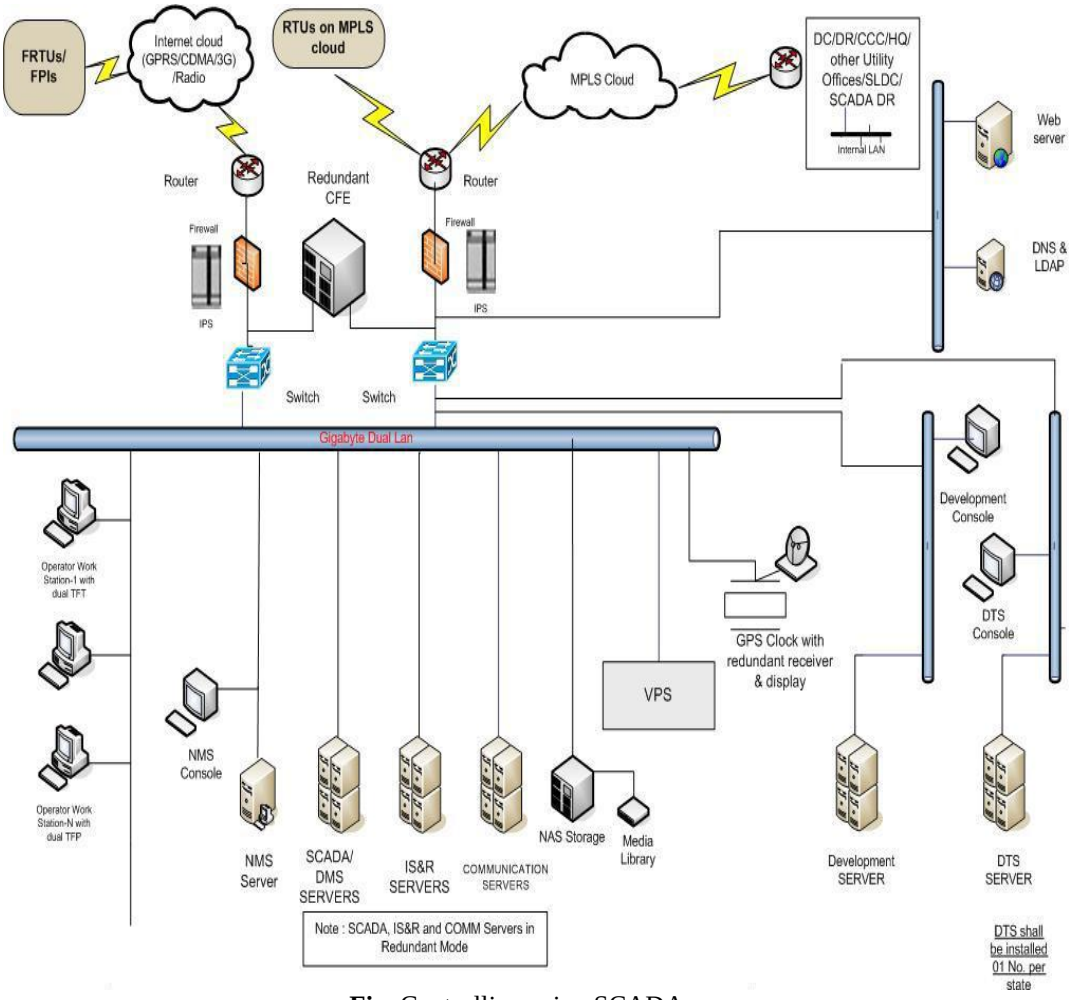

Fig. Controlling using SCADA

All civil & architectural works, internal and external electrification, special electronic earthling for Server system, Air conditioning and ventilation, firefighting system and Access control system required for SCADA/DMS system are outside the scope of the SIA, however contractor has to indicate the space requirement for SCADA/DMS control center , DR center, RTU / FRTU/Auxiliary power supply & communication equipment any other specific requirement, power supply requirement including standby supply requirement, so that the utility can provide the same as per bidder's requirement.

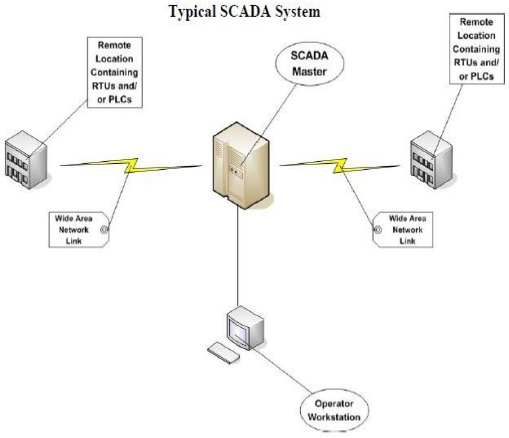

Fig. SCADA System components

Jian Wu [4] et al describes the Supervision Control and Data Acquisition (SCADA) system is a communication and control system used for monitoring, operation and maintenance of energy infrastructure grids.Compared with traditional applications.

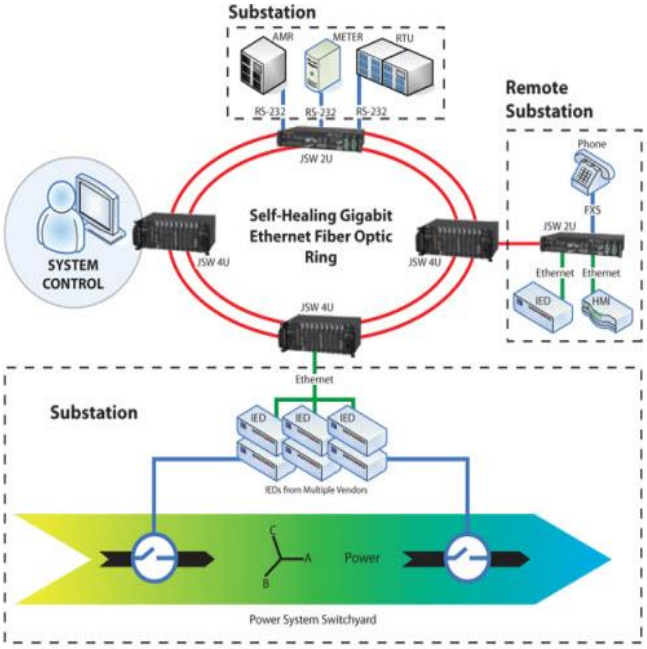

Fig. SCADA Based Substation

IV. Experimental Result

The other system that can be used is PLC, SCADA very useful for data acquisition and for controlling functions. It may reduce human efforts with the automation of the substation which increase transformer life, reduce faults and increase stability. It increases the efficiency of the system. This leads to accurate and reliable operations. It will provide fast and easy monitoring with more efficient way as compared to existing manual monitoring of the sub-station.

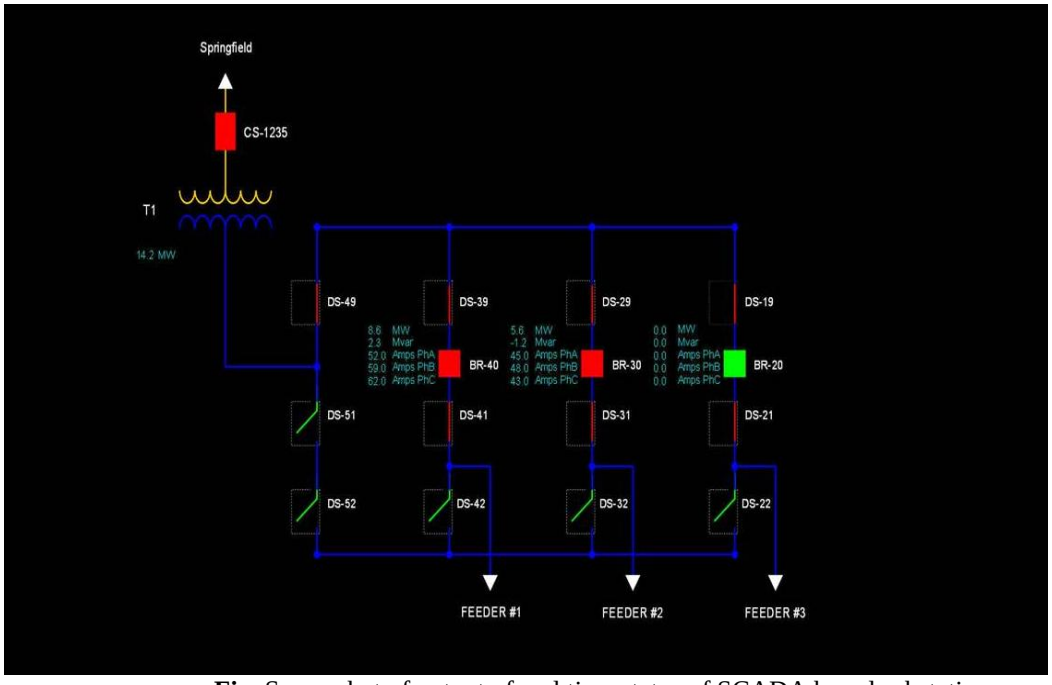

Fig. Screenshot of output of real time status of SCADA based substation

A) ***Advantages***

- Paper provides a better interaction among the equipments.
- Equipments may become very sensitive in the sense of faults.
- Stability, capacity and the monitoring problems of the sub-station reduces.
- Real time data acquired by the RTU.
- Real time operation performed by MTU.
- Visual appearance of monitoring function is easily understand by the new operator.
- Enhance system capabilities in power system.
- Security is high as compare to other system.

B) ***Limitations –***

- Things in the paper, more difficult in practice.
- Data requirement of this topic is complex.
- Better communication medium required.

C) Applications –

- It is helpful for use of real time status of the power system.
- Also used in Dynamic protective relay setting for dynamic station topology.
- It is possible to use it in the automatic switching.
- Protective relay interface/ interaction easily used in the system.

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