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WORKING PHASES OF SCADA SYSTEM FOR POWER DISTRIBUTION NETWORK

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ABSTRACT

In today's competitive electric market, utilities are expected to provide highly reliable power supplies at the lowest possible cost. Distribution automation and remote control are recognized as ways for intelligently using appropriate technology to increase the reliability at reduced system operation cost, automated operations and service restoration can eliminate the need to send out the personnel to switching points so that switching can occur effect on the system reliability SCADA "Supervisory Control And Data Acquisition" Computer Science Essay SCADA (Supervisory Control and Data Acquisition) SCADA is a collection of equipment that provides monitoring and control of process and parameters of a central site.

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

Data acquisition starts at the PLC or RTU level, which includes the equipment status reports, and meter readings. Data is then formatted in such way that the operator of the control room can make the supervisory decisions to override or adjust normal PLC (RTU) controls, by using the HMI.

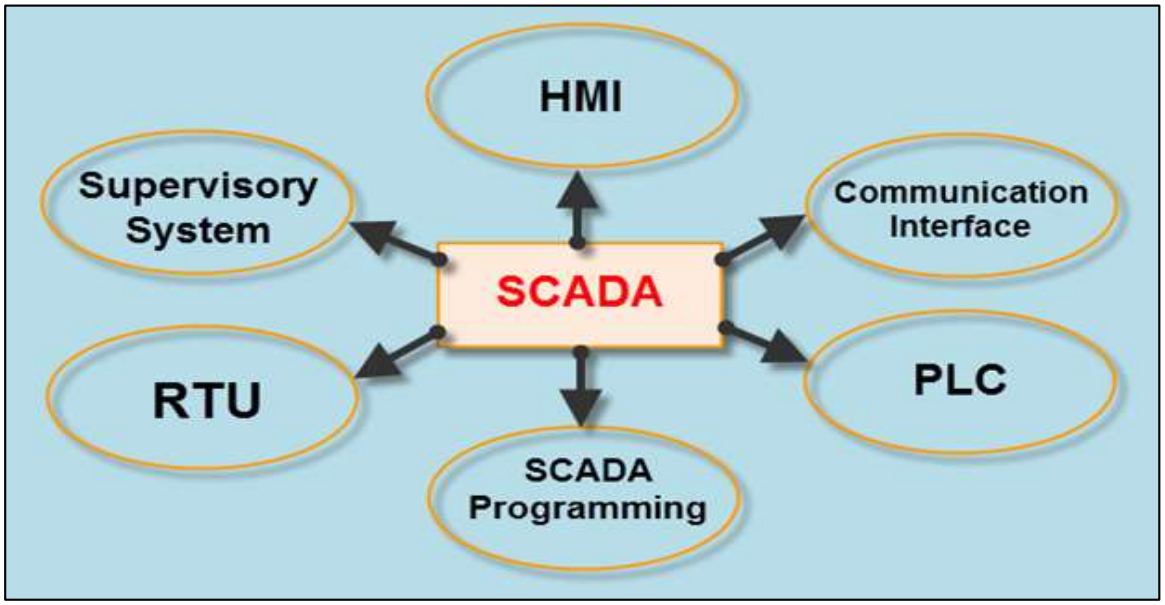

Fig. 1: Basic Block Diagram of SCADA

SCADA systems mostly implement the distributed databases known as tag databases, containing data elements called points or tags. A point is a single output or input value controlled or monitored by the system. Points are either 'soft' or 'hard'.

The actual output or input of a system is represented by a hard point, whereas the soft point is a result of different math and logic operations applied to other points. These points are usually stored as timestamp-value pairs. Series of the timestamp-value pairs gives history of the particular point. Storing additional metadata with the tags is common (these additional data can include comments on the design time, alarm information, path to the field device or the PLC register). The different types of SCADA systems, primarily we must know a few SCADA basics. Consider the block diagram of SCADA system shown in the figure which consists of different blocks, namely Human-machine Interface (HMI), Supervisory system, Remote terminal units, PLCs, Communication infrastructure and SCADA Programming.

A. Areas of SCADA systems control

(A) **Power Systems:** SCADA is used in Electric power generation, transmission and distribution to analyses load flow analysis, to predict the control operation within the statutory limits as prescribed.

(B) **Functionality** - alarm detecting and event monitoring, data acquisition, network operator interface, non-real time control, Data bases and data logging, use of MMI, logging/archiving, report generation, automation.

(C) **Water and sewage:** SCADA is used to monitor and regulate water flow, Water Leak detection and location, Treatment plants integrated local / remote control, Pumping station automatic management.

II. REMOTE TERMINAL UNIT (RTU)

Remote Terminal Unit is a microprocessor based equipment or intelligent device (RTU) designed and developed specifically for use in electrical utilities and is geared towards monitoring distributed control system or SCADA by transmitting telemetry data to the system and/or altering the state of connected objects based on control messages received from the system. RTU collects data from the field either digital or analog parameters or both and transmits all the data to the Master Control Centre (MCC). RTU can be interfaced with the MCC with different communication media (usually serial (RS232, RS485, RS422 or Ethernet). RTUs can support standard protocols (Modbus, IEC 60870-5-101/103/104, DNP3, ICCP, etc.) to interface any third party software. The RTUs drives also high current capacity relays to a digital output board to switch power on and off to devices in the field. RTUs also monitors analog inputs of different types including 4-20 mA, 0 to 10 V, -2.5V to 2.5V, 1 to 5V etc.

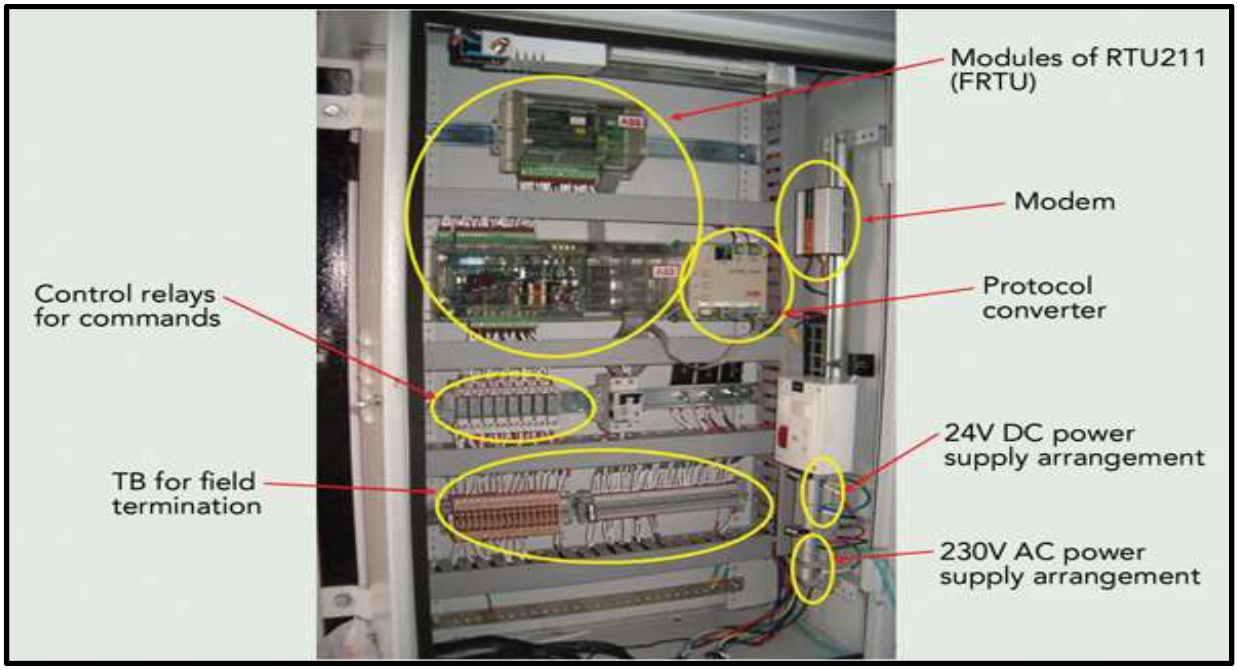

Fig. 2: Internal Structure of RTU

The RTU firmware runs on a real time operating system running various tasks to achieve the end functions and is in modular structure. The functions like online reconfiguration, down line loading are included in the RTU firmware. Any new applications specific tasks can be built into system. The microprocessors regularly scans all process values and are stored in the memory for onward transmission to Master either at a regular scan time initiated by SCADA System or on any limit violations /status change noticed on a field value. The RTU is provided with a real time clock and is synchronized with SCADA system clock on regular basis. All the events and alarms at the RTU are time stamped. RTU also maintains list of Sequence of Events (SOE) up to a resolution of 1 ms and are reported to SCADA System. The Synchronization of real time between the SCADA System and RTU are obtained with periodic time synchronization routines. An optional facility is provided to accept real time from the master control communication server where accurate system wide real time. It is consist of different part like Modules RTU211 (FRTU), Modem, Protocol Converter, Control panel for commands, TB for filed termination, and DC/AC power supply management etc. the figure 2 show RTU.

III. SIMULATION RESULTS

Supervisory control shall allow the SCADA system to remotely control switching devices. A control action shall require a confirmation-of-selection-prior-to-execution response. Initiation of the control execute step shall occur after the dispatcher confirms that the correct point and control action have been selected. After the dispatcher/DMS function initiates control execution, the RTU/FRTU shall be addressed for verification that the correct point has been selected at the RTU/FRTU and then the control action shall be executed. It shall also be possible to reset the flag in FPI through a command. It shall be possible to issue control commands as a group control from SCADA where switching devices pertaining to different RTUs/FRTU or a RTU/FRTU may be controlled as a group. The SCADA system shall send the control commands sequentially (without dispatcher intervention), if the commands pertain to switching devices in the same RTU/FRTU, using the Selection Check before operate (SCBO) of prior–to-execution.

A. Full Graphics User Interface (GUI)

The current trend in the user interface (UI) is toward a full graphics (FG) user interface. While character graphics consoles are still in use by many utilities today, SCADA vendors are aggressively moving their platforms to a full graphics UI. Quite often the SCADA vendors have implemented their new full graphics user interface on low-cost NT workstations using third-party applications to emulate the X11 window system. Full graphic displays provide the ability to display power system data along with the electric distribution facilities in a geographical (or semi geographical) perspective. The figure 3 shows the Visual Projection system 33/11KV, M.P.S.R.T.C., in different area connectivity through SCADA system.

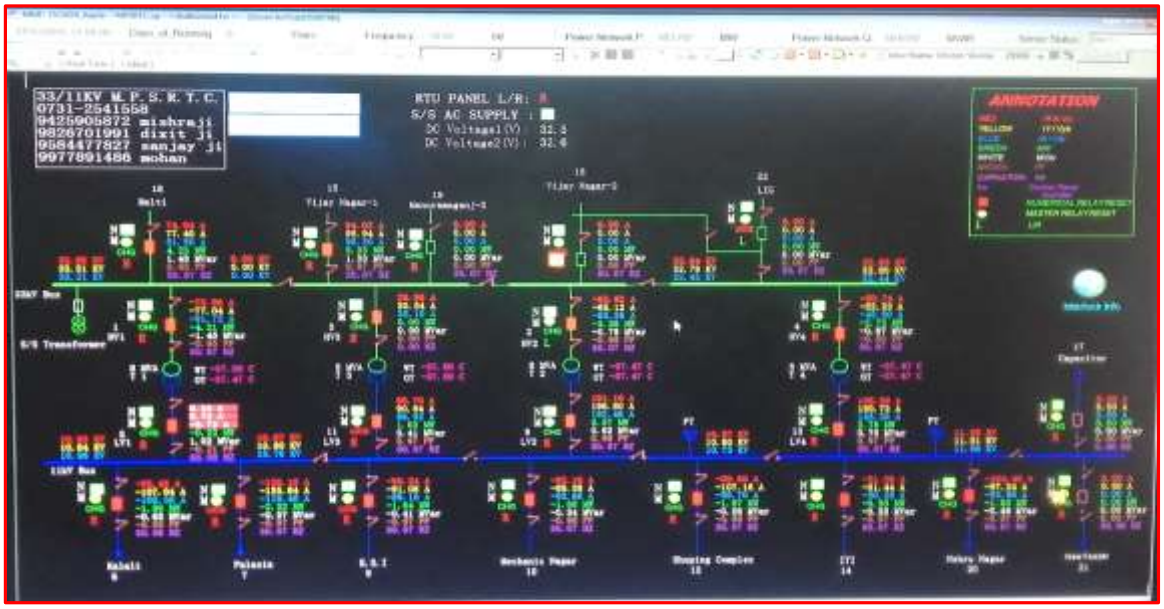

Fig. 3 Visual Projection system/GUI 33/11KV, M.P.S.R.T.C real time line parameters

The advantage of using a full graphics interface becomes evident (particularly for distribution utilities) as SCADA is deployed beyond the substation fence where feeder diagrams become critical to distribution operations.
In the Visual Projection system/Graphics User Interface was shown in different colors annotation with symbols, the RTU panel was two condition R/L (R instants to Real and L instants to Local) over project is work in real time (R-RTU panel). Where three colors red, yellow and blue show three phases, red square indicates numerical relay reset and yellow cercal Master relay reset, also shown in transformer oil and air indication. The figure5.2 show the different annotation chart, in figure 5.3 Visual Projection system of SCADA showing all substations in Indore City, in the Indore city power system distribution in different five zone (East, West, North, South and Central zone) in the city more than 250 station is connected in SCADA power system.

B. Performance Analysis

The performance analysis of SCADA in which 33/11vKV substations are supervised and operated by remote SCADA Control Center in this analysis we considered different area in Indore.

Fig. 4: SCADA Performance between Current versus Time in 24 Hours

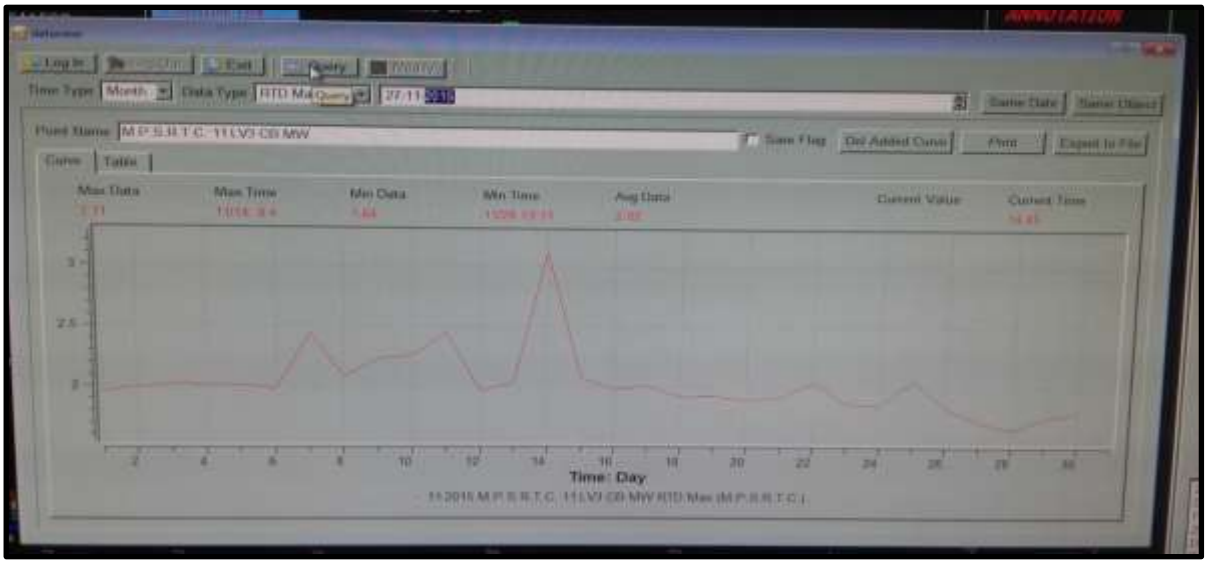

Fig. 4: SCADA Performance between Current versus Time in 30days (1-Months)

We study in different parameter like frequency, power, current, main power etc. so we analyzed SCADA System is best monitoring in power system, it's inform every second reading in power lost or consume power as well as frequency, current, water information, air direction, humanity in atmosphere, temperature etc. the X-axis show the (time/Month/year) and Y-axis is shows the Current in MW. The SCADA system is also capable for more and more pervious recorded saved in memory with graphically as well as minimum and maximum value. In the figure 5.9 shows (M.P.S.R.T.C. 11V3 CB MW RTD Max) the relation between current versus time (in every Hour). It is show Max Data 1.68, Max Time 19.15, Min Data 0.00, Min Time 15.0, Arg. Data 1.27, Load Rate 75.77%, Current Value 0.98, Current time 14.45.

Result Analysis: In the figure 5.10 shows (M.P.S.R.T.C. 11V3 CB MW RTD Max) the relation between current versus time 30 days (1-Months). It is show Max Data 3.11, Max Time 11/14 (Where 11-November Month, 14-Date), Min Data 1.64, Min Time 11/28 (Where 11-November Month, 28-Date), Arg. Data 2.02, Current time 14.45.

IV. CONCLUSION

By using SCADA system, large network having several generating stations and substations and large load centres is controlled from centralized load dispatch. Scada system emphasis on electricity utility remotely-monitor co-ordinate, control transmission and distribution components and devices in real time from a remote area with acquisition of data for analysis and planning from one control area. Most SCADA systems run either on a UNIX variant or on VMS.

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