MAT JOURNALS

Scada and its Application in Power Generation and Distribution System

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Abstract

The essential common sources like Coal, gas, Diesel, nuclear and so forth. Is single time useable due to which the quantity of these sources is decreasing day by day. The emission of these fuels is also responsible for air pollution. On the other hand, if we can use renewable sources like hydro power, solar power and wind power to generate electricity such that SCADA system can incorporate to have better monitoring and reliability of the system for proper distribution of load optimise. So we have developed a system in which consumers are connected to different types of power plants via a Grid. The network load and plants are checked and controlled by the SCADA framework. This provides the uninterrupted power supply to the distributors with more reliable solution.

Keywords:SCADA, PLC, Human machine interface (HMI), Contactor, Motor, Power generator

INTRODUCTION

A properly designed SCADA system saves time and money by eliminating the need for service personnel to visit each site for inspection, data collection and analysis. To meet expanded requests of vitality and also necessities of conservation of our condition and characteristic assets future utilities need to fuse Renewable Energy Resources (RES) and Distributed Generation (DG) to an a lot more prominent degree than today.Furthermore, due to deregulations and increased dependability, the energy systems of today show an increased brittleness[2]. SCADA Representation shown in Figure 1, to adapt to the blends of required adaptability and expanding fragility new sorts of supporting data foundations and savvy parts of future vitality frameworks are by and by researched. The status of the engine is being shown on Real-time programming SCADA which gives supervisory control to the framework. SCADA (Supervisory Control and Data Acquisition) system is an automation field[12]. SCADA framework was being utilized in ventures to Control effortlessly and just. These frameworks include the exchange of information between a SCADA focal host PC and various Remote Terminal Units (RTUs) as well as Programmable Logic Controllers (PLCs), and the focal host and the administrator terminals.
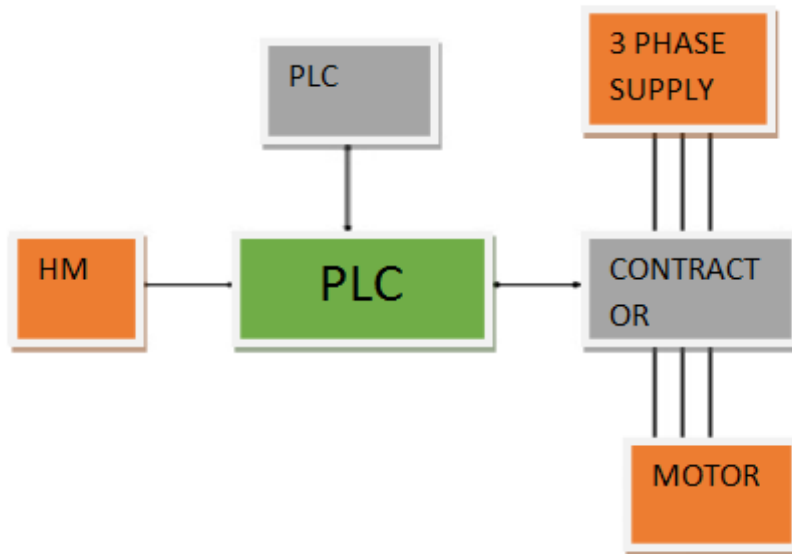
Figure 1:SCADA Representation.

Setup is done for monitoring power distribution and generation system. Also provide unit sharing operation which provide the unit maintenance without un-interruption in the power generation[3]. This paper may assist decision makers inunderstanding the demand and helpful to develop an economic power generation plant.This power generation and distribution system (PGDS) consists of three power generation .Here the generation capacities of these plants are hydro power plant, Thermal power plant and solar power plant and the maximum load on the grid is per demand available. All three power generation plants are connected to each other as well as to the consumers by a Ring Main system[6]. Ring main system is an electrical supply serving a series of consumers and returning to the original source, that each consumer has an alternative path in the event of a failure. Ring fundamental framework is a framework which gives the continuous power supply.

RING POWER MAIN SYSTEM
We connect the different plant unit to the different consumer by a ring grid as shown in Figure 2. This system is called the ring main system[5]. Through the Ring main system we can connect more than one plant to a single grid. Ring main system also provides two receiving end to the consumers that is why this system is more reliable to provide un-interrupted power supply to the consumers. When any one of the faults occurs at the grid then only that particular part may be isolated without any power interruption to the other consumers.Here we develop a hardware in which three plants are installed. Each plant is the mix of one engine and one generator.Motors are supplied by input and it works as a prime mover for respectively generator and generator supply to the bulb[8]. Also there are three blue bulbs (B1, B2, B3) connected to the generators or plant respectively. These blue bulbs show the status of the respective plant for example if the bulb B1glows it means respective Plant1 is running. A set of three red bulbs (b1, b2, and b3) are also setup and show the plants'output or total input to the ring main grid.
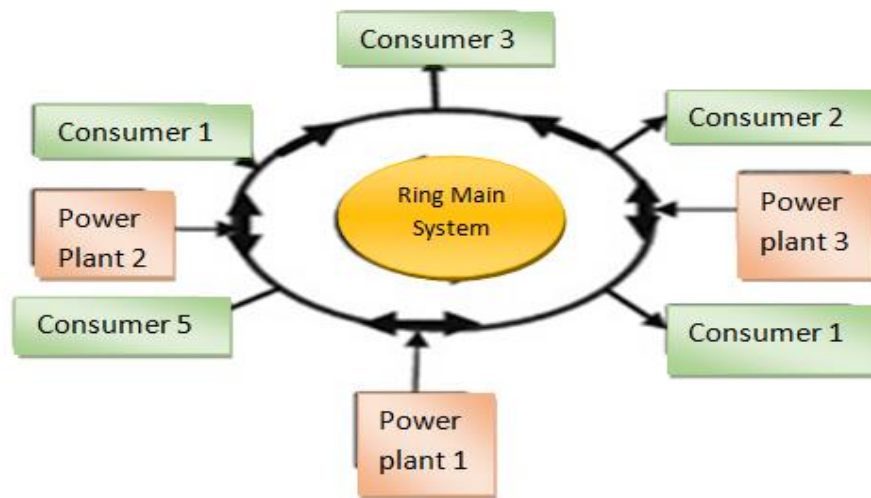
Figure 2:Ring Power Main System.

PLC (Programmable Logic Control)

A programmable logic controller (PLC) or programmable controller is a mechanical advanced PC which has been ruggedized and adjusted for the control of assembling forms, for example, sequential construction systems, or automated gadgets, or any movement that requires high dependability control and simplicity of programming and process blame conclusion. They were first developed in the automobile industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers [9]. From that point forward they have been broadly received as high unwavering quality computerization controllers appropriate for brutal situations. A PLC is a case of a "hard" constant framework since yield results must be created in light of information conditions inside a restricted time, generally unintended activity will result.

Contactor

A contactor is an electrically controlled switch (transfer) utilized for exchanging an electrical power circuit. A contactor is typically controlled by a circuit which has a much lower power level than the switched circuit, such as a 24-volt coil electromagnet controlling a 230-volt motor switch[11]. Contactors come in numerous structures with differing limits and highlights. In contrast to an electrical switch, a contactor isn't planned to intrude on a short out flow. Contactors go from those having a breaking current of a few amperes to a large number of amperes and 24 V DC to numerous kilovolts. The physical size of contactors ranges from a gadget little enough to get with one hand, to vast gadgets roughly a meter (yard) on a side. Contactors are utilized to control electric engines, lighting, warming, capacitor banks, warm evaporators, and other electrical burdens.

HMI (Human Machine Interface)

HMI (Human Machine Interface) device is connected to PLC by an Ethernet cable for manual controlling of the motor in case of emergency that can be controlled by supervisor at control room.

SCADA

Supervisory control and information (SCADA) is a control framework design that utilizes PCs, organized information correspondences and graphical UIs for abnormal state process supervisory administration, yet utilizes other fringe gadgets, for example, programmable rationale controllers and discrete PID controllers to interface to the procedure plant or apparatus. The administrator

interfaces which empower observing and the issuing of process directions, for example, controller set point changes, are taken care of through the SCADA PC framework. Be that as it may, the continuous control rationale or controller figuring's performed by organized modules which associate with the field sensors and actuators. The SCADA idea was produced as general methods for remote access to an assortment of neighbourhood control modules, which could be from various makers permitting access through standard computerization conventions. By and by, substantial SCADA frameworks have developed to end up fundamentally the same as circulated control frameworks in capacity, however utilizing various methods for interfacing with the plant. They can control substantial scale forms that can incorporate various destinations, and work over extensive separations and in addition little separation. It is one of the most commonly used types of industrial control systems; however there are concerns about SCADA systems being vulnerable to cyber warfare/ cyber terrorism attack.

RSView32
Is an integrated Human Machine Interface for monitoring and controlling automation machines and processes? Its versatility shows seamless integration with other Rockwell Software and Microsoft products as well as third-party applications. RSView32 has distinctive features as below:
- Powerful graphics editor.
- Graphic import/export wizard.
- Customize the look of graphic displays.
- Comprehensive alarms editor.
- Full-featured data log editor.
- Sophisticated logic and control editor.

RS Logix SOO was the first PLC programming software to offer unbeatable productivity with an industry leading user interface. RS Logix 500 comes in two releases: a Standard version that gives fundamental stepping stool rationale altering capacities, and a Professional version that gives extra capacities to grow your robotization arrangements and make altering step rationale straightforward.

WORKING OF SCADA SYSTEM
The system involves combined assembly of SCADA and PLC, power is generated by using induction motor, 3-phase power is given to PLC and SCADA monitors the progress and status of generated power using PLC. In case of any fault on any line of 3- phase it can be troubleshoot by using PLC. Relays can be used for electro-mechanical switching for automation purpose in order to rectify the faults. Monitoring section also equipped with HMI device that is connected to PLC by an Ethernet cable for manual controlling of the motor in case of emergency that can be controlled by supervisor at control room.We design a window for above hardware for controlling the operation and monitoring of plants' output. In control room there are controlling switches start 1, start 2 and start 3 to start the plant1, plant2, plant3 respectively. Stop' switch is to stop the complete plant. If an operator starts these units manually then we also provide facility to the Manager to stop any one or all units by STOP 1, STOP 2 and STOP 3 switches respectively. We also provide a monitoring room wherepresent water level in the reservoir and the site temperature is displayed. To show these parameters there are six box labelled WLR, SVW, ETV and TSPV. WLR shows the current water level in the reservoir, SVW sets point value of water level in the reservoir. ETV speaks to the ecological temperature, and STY (set temperature esteem) and TSPV demonstrates the temperature set-point esteem set by the overseer. There are additionally three presentations named TPl, TP2 and TP3. TPI, TP2 and TP3 demonstrate the time

length for which hydro control plant, sun based power plant and warm power plant was running individually. There are two another indicators in the monitor room labelled as OLI (Over load indicator), ULI (Under Load Indicator) and LTV (Low Temperature Value). The complete experi-mental setup has hardware PLC, and SCADA software.

SYSTEM OPERATION

The PGDS framework is the mix of equipment and the product programming. There are many sensors and relays connected to detect failure or plant, Over Load, under load, water level, solar intensity etc. If there is over load on the grid then over load relay will be activated and RTU sends the information to the master. Master performs information handling and sends the control order to the RTU to begin control age likewise and furthermore actuates the separate alert. There is an arrangement for manager of SCADA that it will utilize the extra unit with the other two fundamental units for generation. For this task there is a different programming of PLC.If the low load appears on the grid then under load relay will be activated and RTU sends the information to the master. Master performs data handling
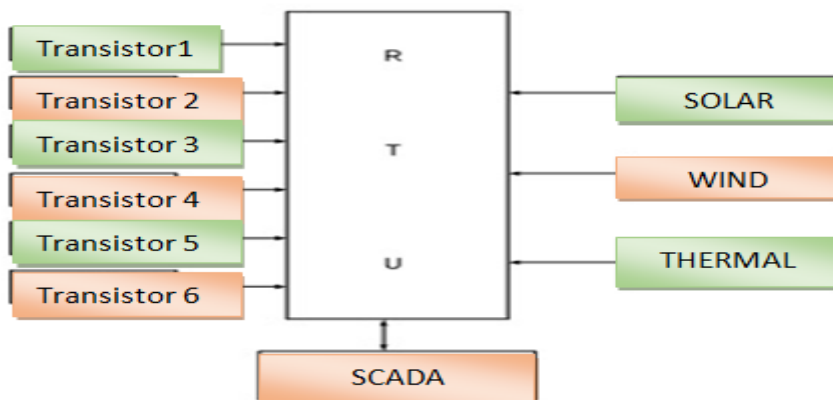
Figure 3: *SCADA Transmission System.*

And sends the control order to the RTU to close down the power generation accordingly and furthermore initiates the particular alert.There may be requirement of more generation, if such type of condition occurs then the spare unit works with all other two main units. Two main units work as it is but with the combination of an extra unit just for increasing the generation.The two operations are independent of each other. According to the requirement, operation shifts intelligently from one state to other.When due to fault or any other reason any one of the plant shuts down and interrupts the generation, SCADA will start the spare unit so that uninterrupted generation will be achieved and isolate the shutdown plant. There are six power transistors and solar plant, hydro plant, thermal plant, all the three power generation plants connected to the RTU as shown in Figure 3. Relay gives the information to the RTU that the solar plant, hydro plant, thermal plant are in shut down or start condition. Power transistors work as isolated switches in the system and are mounted on the hardware.

CONCLUSION

The paper shows the analysis of SCADA system for power generation and distribution system. All plants are connected to the consumers by a ring main system which handles the complete consumers demand automatically without

any manual operation. This paper provides a way to include supervisory control and Data Acquisition of whole power generation plants production as well as the power consumed by the consumers.The main advantage of this paper is that it provides un-interrupted power supply to the consumers and tries to use the renewable energy source for power generation in a smart way, i.e. it decreases the power generation cost. In this paper we also concentrate to the utilization of the thermal and solar energy for power generation and save the other natural sources of energy like Coal, Diesel, Gas, Nuclear fuel etc. also control the air pollution as well as the water pollution. The advantage SCADA is to have better controlling and monitoring over the complete system for the better solution.

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