PLC BASED INTELLIGENT CONTROL OF SUBSTATION

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Abstract - A leap in the development of the substation has risen by development of intelligent electronic device. Power system load increase day by day to the point where the system has to operate at its full limits. So to protect the equipment and for good supervision we carry out some new monitoring and signal processing solution for the substation based on synchronized sampling technology and multifunctional intelligent electronic device. In the project, much better monitoring are done to make sure that substation operation does not bring undesirable consequence. This automated monitoring and signal processing in substation will become a powerful feature to assure system reliability and protection.The activity plan basically works with the advice of PLC which will account the value of voltage and current through the arrangement of programming set in PLC and if the value increases than rated value, it will command to the contactor and will trip circuit breaker.

Key Words: plc ,programming, substation, fast operation, human safety, equipment safety.

1. Introduction

The high voltage substation includes the primary equipment such as circuit breaker, transformer, instrument transformer, etc. and the secondary equipment such as monitoring, control and protection device. Which are installed in the control house. In the legacy substation solution, all the interface between primary and secondary equipment are connected by hard wired cabling. Different length and type cables are bundled, which makes the installation, as well as future maintenance and modification labor intensive. In addition due to the large number of wires in highly electromagnetically polluted substation switchyard environment, the wiring may experience significant electromagnetic interference both conducted and radiated. The sensing and signal processing in existing substation designs is centered on a number of individual sensors being placed in the switchyard and hard wired directly to the control house.

The individual monitoring, control and protection devices that are using those signals for their decision-making are located in the control house. This concept is very inefficient in allowing integration of data and signal processing across the substation . Besides, exchanging information among IEDs in the control house is realized by a combination of rigid wiring between devices and low speed serial communications. If a sophisticated inter- IED control scheme is to be realized, a large number of wiring interconnections between multiple IEDs is required. Such wiring approach is complicated to deploy and difficult to check errors. The low speed serial communications is often limited to master/ slave communication mode, so the true peer-to-peer communication between IEDs is not feasible.

The new monitoring and signal processing solution in substation based on synchronized technology and multifunctional IEDs.

1.1 Function principle

This project summarizes requirements for automated fault analysis functions that may be performed in substations in the future. Particular focus is on requirements for implementing a new concept of merging operational and non-operational data with a goal of improving fault analysis. The requirements are aimed at expanding the substation automation role in automated fault analysis towards better serving many utility groups: operations, protection and asset management.

1.2 Objectives

The main object for our project is to protect from fault (over current, under current, under voltage).A solution for automated merging of data captured by digital fault recorders (DFRs), digital protective relays (DPRs), and circuit breaker monitors (CBMs) is developed. An optimal fault location algorithm that uses data from substation IEDs, as well as data from SCADA PI Historian and simulation data from short circuit program is implemented. A risk-based asset management methodology for maintenance scheduling taking into account condition-based data captured by substation IEDs is being developed.

1.3 Problem specification

Our project aim is to save equipment from the various type of fault such as over current, under voltage, over voltage and this will done by PLC based system.

2. Block diagram

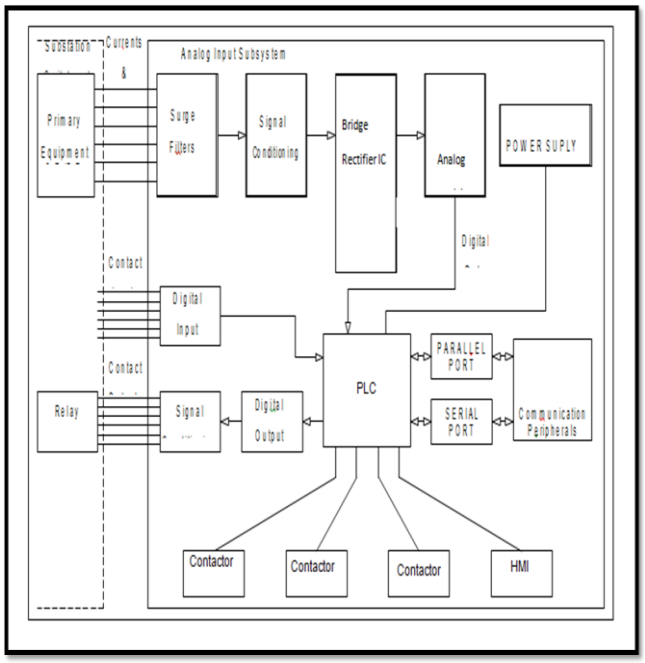

Figure 1

One of the issues with electromechanical or static relays is that the relays are not in operated condition during normal behavior of the power system. They operate only under abnormal or faulty condition of the power system. This may not happen very frequently and in certain cases it may happen very rarely. Hence the integrity of relay operation can be confirmed only by frequent relay testing exercises. There is no continuous check on their operational integrity. The use of digital computer for power system protection and plc. based digital protection solve this very tricky problem. One very important advantage of plc. Based digital protection is that they can perform the functions of protection, measurement and control simultaneously. With the national and international grids having long ultra high voltage tie lines transferring bulk of power, the use of plc based digital protection is not only proving to be effective but also more or less essential.

PLC (siemens S7 200 smart)

The S7-200 SMART series is a line of micro-programmable logic controllers (Micro PLCs) that can control a variety of automation applications. Compact design, low cost, and a powerful instruction set make the S7-200 SMART a perfect solution for controlling small applications. The wide variety of S7-200 SMART models and the Windows-based programming tool give you the flexibility you need to solve your automation problems.

Current transformer

A current transformer (CT) is a type of transformer that is used to measure AC current. It produces an alternating current (AC) in its secondary which is proportional to the AC current in its primary. Current transformers, along with voltage or potential transformers, are Instrument transformer.

Potential transformer

Potential transformer or **voltage transformer** gets used in electrical power system for stepping down the system voltage to a safe value which can be fed to low ratings meters and relays. Commercially available relay and meters used for protection and metering, are designed for low voltage.

Rectifier circuit

Now we come to the most popular application of the diode: *rectification*. Simply defined, rectification is the conversion of alternating current (AC) to direct current (DC). This involves a device that only allows one-way flow of electrons. As we have seen, this is exactly what a semiconductor diode does. The simplest kind of rectifier circuit is the half-wave rectifier. It only allows one half of an AC waveform to pass through to the load.

Control circuit:

An electronic circuit is composed of individual electronic components,suchas resistors, transistors, capacitors, inductors and diodes, conductive wires or traces through which electric current can flow. The combination of components and wires allows various simple and complex operations to be performed: signals can be amplified, computations can be performed, and data can be moved from one place to another.

Contactor:

A contactor is an electrically controlled switch used for switching an electrical power circuit, similar to a relay except with higher current ratings and a few other differences. 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 220-volt motor switch.

3. FLOW CHART

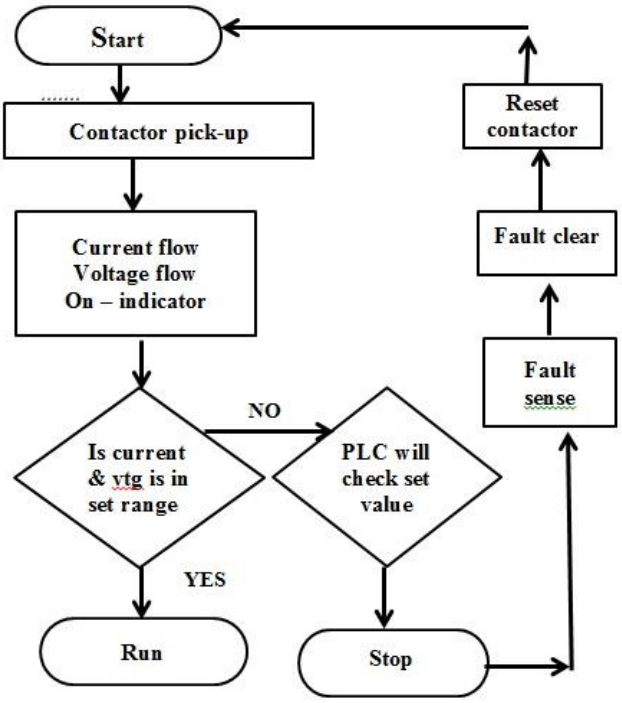

Figure 2

Start: In the process when the main supply is started the current and voltage flow.

Contactor pickup: The voltage and current start to flow when the contactor will pickup

Current and voltage flow: When the contactor is pick up the definite value of voltage and current will flow.

If the value is in set range: If the value of voltage and current are in rated value then the system work in proper manner. And if not than contactor will reset.

Stop: If the value change then the rated set value the system will stop.

Fault sense: When the value of the voltage and current changes then the set value the PLC will sense the change in value.

Fault clear: After sensing the fault the PLC will command the contactor which will trip the circuit breaker and stop the system

4. RESULTS

The fig show the implementation of substation with the circuit and interfacing it with the plc.so the project works as when the main supply is turn on the current and voltage circuit continuous sense the value of voltage and current on the line. When any unbalanced is there in any of two quantities the change is sense by the circuits.

There are the current transformer and step-down transformer connected to the circuit so any change in quantity will give the change in secondary of transformer. This values are then convert in low voltage supply (0 -9 v) by circuit which is given to the plc which will scale the set value and change value and give the signal to the control circuit which will control signal to the actuator and relay which will trip the circuit.

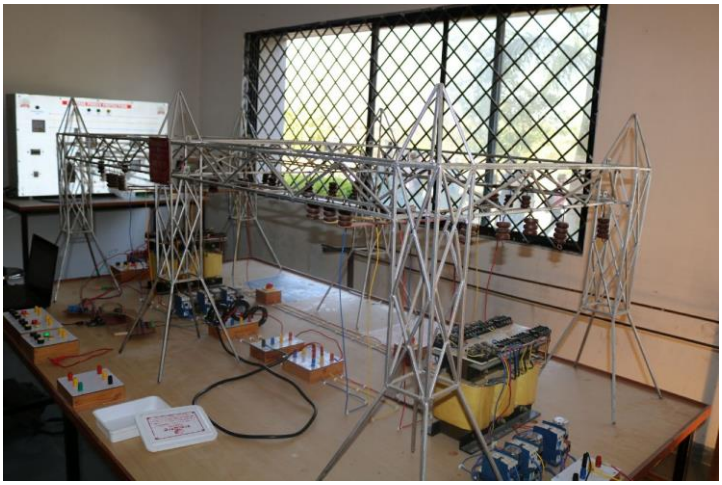

Figure 3

5. CONCLUSIONS

On this project we conclude that in normal operating condition the value of voltage and current passing through every phase of the line, if not exceed than the rated value then the system work at appropriated condition. But when any fault or unbalanced is occurs there will be change occurs in set value that will be automatically sensed by the PLC and trip circuit will operate and it will give signal to the contactor. So the supervision control will be obtained which will reduce the time.

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