Arduino Based Autorecloser for Three Phase AC System

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***Abstract*--- The paper aims to develop micro-controller based auto-recloser for the three phase supply system. The project circuit breaker closes automatically after a brief interruption in the event temporary fault while it remains in tripped condition in case of permanent fault. The electrical substation which supply the power to the consumers i.e. industries or domestic can have failures due to some faults which can be temporary or permanent. These faults lead to substantial damage to the power system equipment if faults are permanent and not cleared immediately. If faults are temporary then faults adversely affect reliability, stability etc. Most of these faults are temporary, therefore to improve reliability, stability of supply auto-reclosers are installed. We are proposing micro-controller based auto-recloser. This system will be built using arduino and a data acquisition system to detect type of fault and the microcontroller will record the severity of fault. After occurrence of the fault CB will trip. After that Arduino micro-controller will check the system voltage and decide if fault is temporary. It will close the CB and if fault is really temporary then system will continue to run normally. However, if fault persists, Microcontroller will trip Circuit Breaker again. The micro-controller will repeat the process for predetermined period. This mechanism will possibly replace the mechanical relays in the system and combine it with data acquisition system which will increase system efficiency and reduce the cost of line equipments.**

Keywords— Arduino, relays, data acquisition system

I. INTRODUCTION

The electric energy produced at generating stations is transported through high voltage transmission lines to utility. Transmission lines should transmit power over the required distance economically and satisfy the electrical and mechanical requirements prescribed in particular cases. Generally the 70 to 90 % of faults on overhead lines are transient. A transient fault, such as an insulator flashover, bird or kite fault, is a fault which is cleared by the immediate tripping of one or more circuit breakers to isolate the fault, and which does not recur when the line is re-energized. Faults tend to be lesstransient (near the 80% range) at lower, distribution voltages and more transient (near the90% range) at higher, sub transmission and transmission voltages. The remaining 10 - 30% of faults are semi permanent or permanent in nature. It is clear that the majority of faults can be successfully cleared by the proper use of tripping and auto resetting. This de-energizes the line long enough for the fault source to pass and the fault arc to de-energize, then automatically recloses theline to restore service. Thus, auto resetting can significantly reduce the outage time due to faults and provide a higher level of service continuity to the customer. Furthermore, implementing the arduino based protection with successful high-speed auto resetting on transmission lines can save the line from major faults and it will be a major factor when attempting to maintain system stability.

II. PROBLEM STATEMENT

In the current scenario, if fault occurs in the transmission system then whether the fault is temporary or permanent,the line trips.Hence the supply will not resume unless the supply is resume by external closing.Thus, by use of auto-reclosure scheme the system will reclose if the fault is temporary and trip if the faut is permanent.Thus by use of auto-reclosing scheme,the transmission line integrity is maintained.

III SYSTEM DESCRIPTION

Under normal working conditions the load will receive the supply from the main three phase supply system. The Arduino and Data Acquisition System will be connected just prior to the load. The main components of this system are Arduino and Data Acquisition System. Arduino will continuously sense the value of voltage and current and when fault occurs in three phase system the arduino will measure the value of voltage and current and when fault occurs in three phase system the arduino will measure this value of voltage and current and send it to Data Acquisition System where this value is stored. This value is compared with the reference value of voltage and current .If the measured value is greater than reference value then arduino will trip the circuit breaker .Hence the load will get isolated from faulty system and the transmission system integrity will be maintained.

IV. BLOCK DIAGRAM

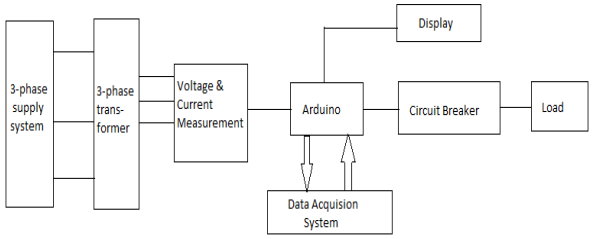
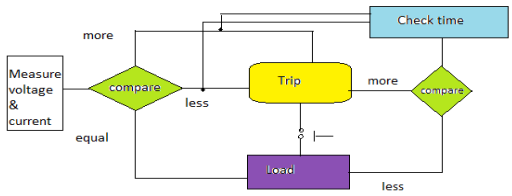


fig.1. Block Diagram



V. ARDUINO AND DATA ACQUUISITION SYSTEM

For controlling operation of the autoreclosing system a comparatively cheaper arduino can be easily interfaced with the transmission line. Interfacing arduino on transmission line makes the protection system comparitively cheaper and easier to maintain and repair. A data acquisition system with Arduino also provides fascility of data storage i.e. it stores the value of corresponding fault voltage and current with the time for which the fault remains in the line. Interfacing Arduino and DataAcquisition System removes hard wired relays from the protection system. Different type of arrangements can provide both primary and backup protection .

Arduino having high performance, low power, and 8 bit microcontrollers can be used. Arduino Mega is sufficient for interfacing the transmission line with the Data Acquisition System having many input terminals makes it easily to various input output terminals.

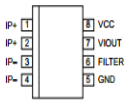
Data Acquisition System with the Arduino makes the protection system compact and makes it more reliable since electronics operaation is always more faster than the conventional mechanical operation.

Conventional current and voltage sensors can be used with Arduino to measure the current and voltage readings of individual phases. The sensors are:

A. Current Sensing Unit

Current sensing unit is connected to the each individual phase through a step down transformer. A conventional current sensor like ACS712 can be easily interfaced with the arduino to measure each individual phase current

Pin-out Diagram



Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sampled; fused internally
3 and 4	IP–	Terminals for current being sampled; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

B .Voltage Sensing Unit

A voltage sensing unit senses the individual phase voltages. The conventional AtoD pins of the Arduino can be used to connect the different phases for measurement of the phase voltages. Various volatges like Line to Line voltages and Line to Ground voltages can be checked with these pins.

C. Current & Voltage Comparison

This measured individual values of current and voltages can be compared with the preset values in the Arduino. This values once measured get immediately stored in the Data Acquisition System. After comparing these values, Arduino checks the time for which these values remains deviated from its original preset values. If the time for which the input remains deviated is more than the preset time then the Arduino disconnects the load from the faulty system i.e. the it Permantly trips the load. If the input gets stabilized (in case of transients) then after tripping the load the Arduino tries to close back the contactsof the Circuit Breaker, this can be termaed as Autoreclosing.

D.Data Acquisition System

The Data Acquisition System stores the values of the current and voltages at each phase after a particular time interval. Hence the system also acts as a supervisory scheme for the transmission line.

VI. CONCLUSION

The paper aims to design an Autorecloser for three phase system with Data Acquisition System. This system will reduce the human efforts of closing the Circuit Breaker and also reduce the cost of the protection system. Autoreclosing will improve the transmission system stability and integrity. Also use of comparativly cheap Arduino and Data Acquisition System will make it more easy and simple to understand.

VII. FUTURE SCOPE

The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a protection scheme to be implemented in other transmission lines of higher level.

Also the current system can be made to work with conventional SCADA or other Communication Services like GSM to operate remotely.

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