

On Load Monitoring For Air Circuit Breaker

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Abstract— Circuit breakers are used in a system for making and breaking current flow through apparatus. Circuit breaker failures, delivery point reliability, equipment life, and maintenance effort on which an ideal monitoring of circuit breaker would be implemented; while promoting human and environmental safety and return on assets. An automated circuit breaker monitoring system gives a proposal to monitor circuit breaker's control circuit. System is designed to enable implementation of system-wide applications that applies the data recorded by the system. An implementation of system wide data analysis is demonstrated. It makes possible to trace the circuit breaker switching sequences and give result about their performance and final output. Laboratory and site checking of the designed system is performed and results are presented

Keywords—Circuit Breaker, Monitoring, Parameter extraction, Signal processing, Switching time.

I. INTRODUCTION

Circuit breakers are electromechanical devices used in power system to make or break the power flow at generator, load location and substation. Circuit breaker are capable of breaking, carrying, making current under normal condition and also making, carrying for a specific time and breaking current under specified abnormal condition such as short circuit breaker may have a lifetime of over 40 year. The majority of the time breaker remain closed and simply act as electrical conductor, but in many times they do indeed their performance protective and switching functions. breaker are operated by power system protective relays, which detect fault on the power system and identifying the appropriate circuit breaker needed to be open in order to isolate the faults and enable the rest of the of the system to function normally.

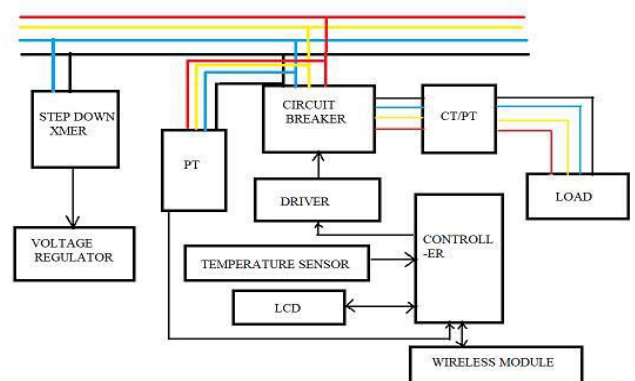
When the fault occur on such as short circuit current in an electrical system it an usually becomes necessary to operate an interrupting device. Interruption of current in a system frequently takes place during the transient condition when high current are present. The interruption produces an additional transient that is super-impose upon the instantaneous condition of the system. Thus it is recognized that interruption devices must manage with transient in the current generated in the system and the voltage transient that have been initiated by the interrupting device itself. This may creates very harsh working condition for circuit breakers. It is important that the circuit breaker are in good condition to be able to interrupt currents and prevent damage on the power system.

Circuit breaker are made in varying size, from small devices that protect low current circuit or individual switchgear design to protect high voltage circuit feeding an entire city. In addition, a circuit breaker may operated through a manual command from power system operation. Sometimes the circuit breaker may not close or open on command leading the fault to exist for longer duration leading the system goes into the abnormal state causes power losses.

To improve the system operation, the data obtained by the on-load monitoring system should not be limited to evaluating the condition of the breaker. It is used to control the sequence of breaker operation and changes in topology of the system. It may be used to enhance the accuracy of control for constant operation. More reliable assessment of the system topology can be achieved by integrating redundant data from monitoring system. It may be also possible to adjust initiating the opening or closing operation to compensate for variation in the breaking or making times that are influence by the parameters being mentioned. Additional monitoring parameter may not directly reflect as an improvement in the system operation but it may helps to increase the reliability of power system and equipment.

Data collected from breakers in the substation, the system should be combine to make deduction about topology of the system and operation that could help in increasing the system reliability. Such application required that given data should be synchronized in time.

II. HARDWARE



The circuit breaker monitoring system is design to perform following function

- Data acquisition system having input and signal must be captured and converted in to digital form when circuit breaker monitoring triggered.
- The data gathered by circuit breaker monitoring unit at breaker must be transferred to central location for further processing.

A. Microprocessor Module (16F886)

Microprocessor module performs the following functions:

- Detect event and record the data for specified duration in memory.
- Set the signal sampling frequency and the scaling factor for digital signal.
- Transmit the data to concentrator PC using communication protocol and wireless transceivers.

B. Temperature sensor :(LM35)

Temperature sensors measure the amount of heat energy generated by an object or system, allowing as to detect or sense any physical change to that temperature producing either analogue or digital output. LM35 temperature sensor provides output voltage in centigrade (Celsius). It does not required any external calibration.

The LM35 low output impedance, linear output and precise inherent calibration make interfacing to read out or control circuitry especially easy. It can be with single power supply or with plus and minus supply as it draws only 60 micro- amp from it supply, it has very low self heating, less than 0.1 degree Celsius in still air.

C. Wireless Communication Module:

The concentrator PC gathers data from all slave unit through wireless communication. The wireless transmission system unables data transfer from mutpal point to the central storage system. bluetooth is one of the most wireless communication protocol in internet of things specifications, mainly advantages of this standard is its extremelly a low power consumption, can helps making of full battery power boards with working time longer than one or two years in some of cases. The another features management protocol directly at kernel level without requesting any intervention by the user. Such type of facilities the sateup of a mess network of bluetooth device with lower latency and higher range respective standard bluetooth

D. Signal Conditioning Module:

The input signal must be scaled appropriately before converting them into digital form for processing and storage.

By using rectifier converting the input signal in DC in the +5 volt a signal conditioning circuit must be scaled the signal to be in the range required by rectifier. This signal conditioning board protect rest of the device from high voltage transient generated during closed or trip coil operation.

III. CIRCUIT BREAKER MONITORING

Need for the proper maintenance of breakers is important, as the breaker may remain idle, either close or open for long times. They are also often located in remote areas, which makes their maintenance and inspection more difficult and expensive. For reliability of operation of the power system through various system analysis it is necessary to know system topology configuration. Remote and real time monitoring seems to be perfect solution for equipment conditioning and status monitoring

Different monitoring system have been design to monitor the condition of different circuit breaker element, detect circuit breaker health and predict the time intervals for maintenance. All those devices monitor different physical values such as: the phase current, voltage, temperature, and opening or closing time. Some of the data acquisition system currently available to cater to measuring quantities from the control circuit are not suitable for on-load monitoring application of circuit breaker performance in a switching sequence that involve multiple circuit breakers because do not record enough information to make accurate observation and diagnosis of control circuit fault that may occur on multiple circuit breakers. Most of them do not have the sufficient number of channel, on-load monitoring and time synchronization capabilities to enable the artificial intelligence tools to make good decision about the status of the circuit breaker and or the system. Most of the existing monitoring system do not have any option for time synchronization of recorded data.

IV. ANALYSIS OF SEQUENCE OF OPERATION

The purpose of power system is to generate and distribute electrical energy to customers, a power system consists of diverse equipment, which is expensive. In order to build reliable protection system it is important to sense or detect fault and disconnect vulnerable element of the power system fast.

Circuit breakers have the purpose to automatically connect or disconnect different parts of the power system in order to isolate fault. When there is a fault on an element in power system, it is necessary to open all circuit supplying fault current very fast. In order to disconnect all the circuit that supply fault current, more than one breaker typically react. Bus arrangement is used to reducing the number of circuit that must be opened in case of fault. Depending upon the bus arrangement of power system network and status of circuit breaker, different circuit breakers will automatically react in case of different fault.

Power system may have to be expanded to meet growing demand for electrical energy. In order to fulfill the increased demand new substation are built and old ones are upgraded. It is common that bus arrangement vary widely from substation to substation. In practice many different solution can be found, most of the common arrangement in high voltage system are breaker-and-a-half and ring bus arrangement. In the case of any fault on line3, corresponding circuit breakers from both ends of line3 the breaker1, breaker2 and breaker3 will open and de-energized the line to get rid off temporary fault. During action to disconnect an element, various circuit breakers will react differently depending upon the bus arrangement and type of fault such as permanent or temporary. Purpose of the proposed analysis should be finding out whether the sequence of event executed correctly according to bus arrangement and cause of the action.

V. CONCLUSION

The on-load monitoring circuit breaker is described in paper and present requirement is that the system should satisfy to enable cost effective and efficient breaker monitoring function. It should be design for status monitoring purpose for the medium and high voltage breakers. By the following these requirement, it should be enable to realize low cost and efficient monitoring and provide the data that could be used to improve several power system analysis function. It gives generic system architecture that enable minimum cost realization of the system. Hardware architecture should be modular to enable effective upgrade, easy and obsolete part exchange in future.

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