Smart Grid (WAMS) For Transmission Line Through GSM

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***Abstract*-- Modern grid is the most complex man-made monitoring system, which is a wide-area monitoring system (WAMS). Next-generation smart grid will play a crucial role which will provide time synchronization of the data, the electric power system status (WAMS), protection and control. WAMS will provide safe and efficient energy transfers well as reliable and optimize the management of the grid. Fuses are used more in power supply, transmission lines and associated equipment. As a general rule increased**

Uses of fuses can be attributed to the low-cost, simple to maintain and reliable protection. Application of fuse is one of the main areas in the entire conservation plan and other significant protection coordination unit used in smart grids. This paper attempts to review the current status of the fuse according to its rated voltage and to improve smart grid dynamic response based on real-time monitoring system for high voltage fuse blown up Indicators, second is Earthing fault indicator and the third is bus bar temperature rise indicator. Furthermore dynamic protection mode is discussed and to provide more optional applications in the smart grid to provide high-voltage fuses blown up indicators, Earthing fault indicator and bus bar temperature indicator. We use GSM technology for monitoring indication.

***Index Term*— Bus bar temperature rises sensor; Fuse blown indicator; Earthing breaks down indicator ; (WAMS) Wide Area Monitoring System; (GSM) Global System For Mobilization; (E.M.F) Electromotive Force.**

I. INTRODUCTION

Power industry developed rapidly, power grid construction lagged seriously due to the lack of transmission capacity, lead to transmission fault frequency. They are very unbalanced between power grids and power source development. To solve the problem of power supply in the first half of the 21st century, hydropower must be developed strongly. It is necessary that we construct the national energy transmission channel and the power grid development & power toward the market & smart grid startup, people pay more and more attention to power grid safe operation and the power supply reliability. It is important to realize optimization of the transmission system and to protect power normal transmission.

The modern power grid is the most complex human made system, which is currently managed by the supervisory control and data acquisition system (SCADA) and energy management systems (EMS). Typical (SCADA) and (EMS) have slow data update rate and cannot meet performance demand of a smart grid. Thanks to the rapid development of Synchronized global positioning system (GPS), synchronized-measurement technology has been developed since the 1970s for emerging wide-area monitoring system (WAMS). [1]

FUSE

"A fuse is an over current protective device with a circuit-opening fusible associate directly heated and cut off by the passage of over current through it."I this definition does not attempt to describe the generally exact standards required of a modem consistent power fuse, nor does it outline the engineering problem of applications. An endeavor has been made to have well defined standards of fuse ratings, performance, and terms established and generally accepted as a means of promoting manufacture economies and to support the user in selecting the proper fuse.[9]

OR

"A fuse is a short piece of melts when excessive current flows through it and thus breaks the circuit".

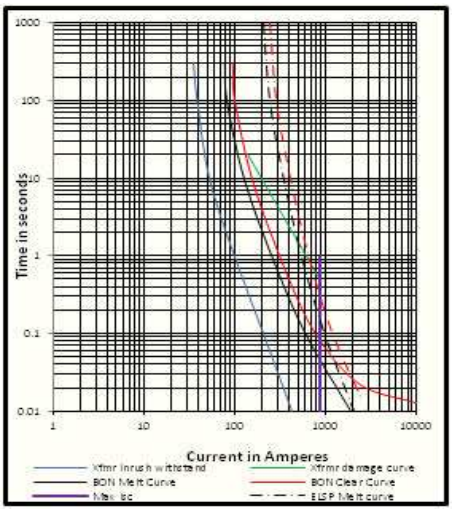
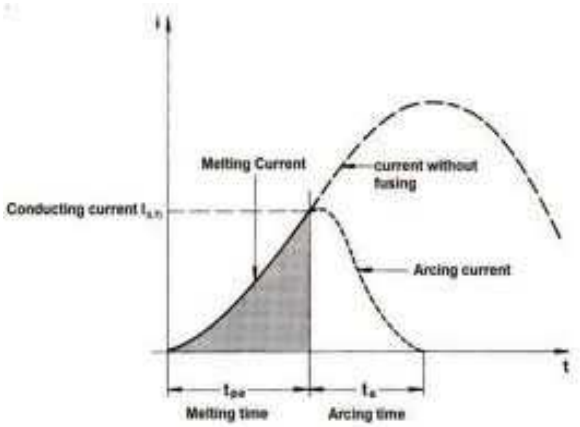


Fig. 1. Characteristic curve of fuse.



The time required to blow out the fuse depends upon the magnitude of excessive current. The greater the current, the smaller is the time taken by the fuse to blow out. In other words, a fuse has Inverse time-current characteristics as shown in Fig.1.Such a characteristic permits its use for over current protection.

Fuse importance:

The important of fuse is that the electricians want to prevent the electrical wires from becoming overheated, so they install safety devices called fuses in a centralized box. Each fuse is designed to withstand a certain amount of amperage, but the wire inside the fuse melts when it becomes overheated. When you blow a fuse, the wire usually snaps in two, and the power running through that circuit is immediately cut off. The excess heat buildup occurs whenever

Appliances draw more amperage than the circuit can handle. If the fuse is rated for 25 amps,

For example, and a user plugs in a 75 amp clothes dryer, the excessive amperage will blow the Fuse.

Bus bar Temperature Importance

Skin Effect:

The apparent resistance of a conductor has been always higher for A.C. than for D.C. The alternating

Magnetic flux created by an alternating current interacts with the conductor, generating aback E.M.F. This tends to reduce the current in the conductor. The central portions of the conductor are affected by the greatest number of lines of force, the number of line linkages Decreasing as the edges are approached. The electromotive force produced in this way by self-Inductance varies both in magnitude and phase through the cross-section of the conductor, being larger in the center and smaller towards the outside. The current therefore tends to Crowd into those parts of the conductor in which the opposing E.M.F. Is a minimum; that is, into the skin of a circular conductor or the edges of a flat strip, producing what is known as 'Skin' or ‘edge’ effect. The resulting non-uniform current density has the effect of increasing the apparent resistance of the conductor and gives rise to increased losses.

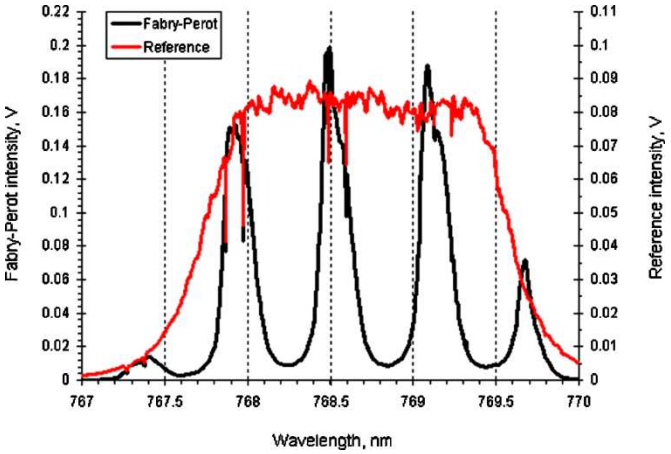


Fig. 2. Bus bar temperature sensing scale.

The ratio of the apparent D.C. and A.C. resistances is known as the skin effect ratio*:*

$$S = \frac{R_f}{R_o}$$

Where Rf = A.C. resistance of the conductor

Ro = D.C. resistance of conductor

S = skin effect ratio

The magnitude and importance of the effect increase with the frequency, and the size, shape

And the thickness of the conductor, but is independent of the magnitude of the current flowing.

It should be noted that as the conductor temperature increases the skin effect decreases giving rise to a lower than expected A.C. resistance at elevated temperatures. This effect is more marked for a copper conductor than an aluminum conductor of equal cross-sectional area because of its lower resistively. The difference is particularly noticeable in large bus bar sections. [2]

Earthing Fault Monitoring Importance:

The “Active” fault is when actual current flows from one phase conductor to another (phase to-phase) or alternatively from one phase conductor to earth (phase-to-earth). This type of Fault can also be further classified into two areas, namely the “solid” fault and the “incipient “fault. The solid fault occurs as a result of an immediate complete breakdown of insulation as would happen if, say, a pick struck an underground cable, bridging conductors etc. Or three Cable was dug up by a bulldozer. In mining, a rock fall could crush a cable as would a shuttle Car. In these circumstances the fault current would be very high, resulting in an electrical Explosion.

This type of fault must be cleared as quickly as possible, otherwise there will be:

1. Greatly increased damage at the fault location.
(Fault energy = 1^2 x Rf x t where t is time).
2. Danger to operating personnel (Flash products).
3. Danger of igniting combustible gas such as methane in hazardous areas giving rise to disaster of horrendous proportions.
4. Increased probability of earth faults spreading to other phases.
5. Higher mechanical and thermal stressing of all items of plant carrying the current fault.
(Particularly transformers whose windings suffer progressive and cumulative deterioration because of the enormous electromechanical forces caused by multi-phase faults proportional to the current squared).
6. Sustained voltage dips resulting in motor (and generator) instability leading to extensive shutdown at the plant concerned and possibly other nearby plants. [3]

In this paper we introduce the online monitoring system for transmission line protection through GSM .The parameters involve in this monitoring system is high voltage fuse blown indicated .Earthing fault indicator ad bus bar temperature rises indicator.

II. PROBLEM STATEMENT

The primary function of a fuse is to remove a faulted device from the power system (protect the system). In some cases, overload protection for the transformer is desired, and so a fuse that responds to transformer oil temperature as well as current is then preferable. As available fault currents continue to rise, it is also becoming increasingly important to remove a faulted transformer in a way that minimizes the chance of an eventful transformer failure.

In addition to performing these functions, it is also necessary that the fuses be selected such that anticipated inrush currents and cold load pick-up currents will not damage them.

III. CASE HISTORY

A client requested an insulation inspection be carried out on two high Voltage switchboards. The maintenance prior to inspection was carried out as per the manufacturer's handbook, but the client noted that the insulation values varied from year to Year.

An On-Line Partial Discharge test was carried out while this equipment was in-service, and

Revealed the following:

Partial Discharge was discovered in the voltage transformer. This VT was isolated from the circuit

And the following defects were found.

• Transformer oil tested poorly - (17kV flash over, highly acid, dark oil)
• Blue phase High Voltage fuse blown.
• Heavy Partial Discharge identified in the bushing spouts. (Refer Figure 1)
• Free roaming Iron / copper partials in bottom of tank and on ledges of VT.
• Protection scheme inoperative due to VT fuse blown (no alarm monitoring on VT supplies)

[4]

A protective earth, known as an equipment grounding conductor in the US National Electrical Code, avoids this hazard by keeping the exposed conductive surfaces of a device at earth potential. To avoid possible voltage drop no current is allowed to flow in this conductor under normal conditions, but fault currents will usually trip or blow the fuse or circuit breaker protecting the circuit. A high impedance line-to-ground fault insufficient to trip the over current protection may still trip a residual-current device (ground fault circuit interrupter or GFCI in North America) if one is present.

In compare, a functional earth connection serves a purpose other than shock protection, and may normally carry current. Examples of devices that use functional earth connections include surge suppressors and electromagnetic interference filters, certain antennas and measurement instruments. But the most important example of a functional earth is the neutral in an electrical supply system. It is a current-carrying conductor connected to earth, often but not always at only one point to avoid earth currents. The NEC (Nippon Electric Company) calls it grounded supply conductor to distinguish it from the equipment grounding conductor.

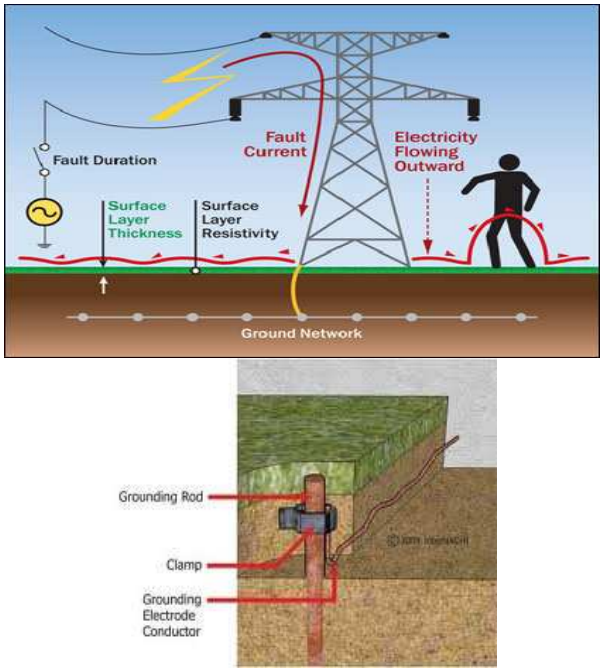


Fig. 3. Earthing ground network

In give figure.3. Show that the ground fault interrupters are a great safety system that removes electrical power if it appears any of that electricity is leaking out of the system. The leaking electricity may be due to a component failure, wet parts, or a person touched an energized part and is at risk. The system is very sensitive so that power is removed before a person can be injured or death.

IV. RELEVENT WORK

a. Power Transmission Line Online Monitoring System:

The YANG QI-PING and XU DAN-FANG LI MENG-QUN form Shanghai University of Electric Power Shanghai, China the authors' works on the Power transmission line monitoring system. The idea of online monitoring system of the proposed transmission line. It noted that the sensor technology and remote visualization techniques. In addition, they use expert systems, intelligent diagnosis.

b. Fault Locating in Ungrounded and High-Resistance Grounded systems:

THOMAS BALDWIN and FRANK RENOVATE and has other friends to design a system which located different types of faults in power system and they worked in USA. Used to track the technical time-consuming and tedious failure. Developing a ground faults location and high resistance on the ground. A description of the grounded low-voltage systems The system Operate a new type of ground Fault relays Low-cost fault permanent Confucius indicators, in the circuit Digital signal of the Earth fault relay processing techniques to detect the fault.

c. Transmission Line Temperature on-line Monitoring System Based on ZigBee:

These authors ZHOU YAO, WANG WEI, XU LIJIE, NI PINGHAO, and WANG LIN are works on ZigBee. On-line transmission line temperature monitoring system based on ZigBee. The wireless Communications technology is discussed. The temperature sensor is mounted directly on the transmission line to reflect the real-time temperature changes, so it can provide dynamic Capacity based on the analysis, the increase in operating and transmission lines.

V. OUR REELVENT WORK

These are relevant to my paper. We are working on smart grid (WAMS) for Transmission line through GSM.
There are following three parameters that we are working on that

- Bus bar Temperature Sensors.
- Fuse Fault.
- Earthing Breakdown Fault.

Fig. 4. Transmission Line One Side Fuse Blown & Other Side Fuse Is Ok

If there are any types of fault occur on transmission line like fuse fault as shown in figure.4. Bus bar temperature sensor and Earthing break down the fault. So simply SMS on mobile phone and also show on the LCD Screen that there is fault occurs.
The GSM technology is as cheap as compared to other technology and before that GSM technology is not used for (WAMS) of transmission line.

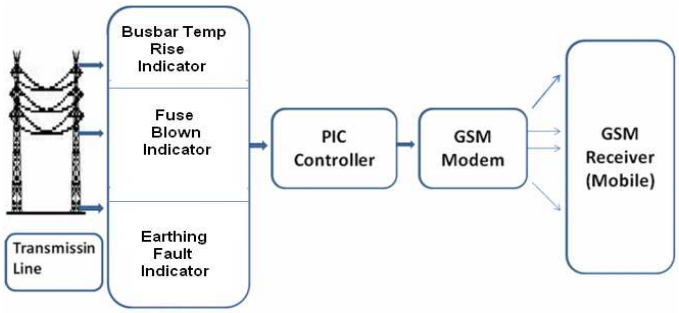


Fig. 5. Smart Grid With Three Parameters

VI. PROPOSED METHODOLOGY

Our proposed work consists of (WAMS) which is wide area monitoring system in smart grids for power transmission line. In give figure.5. Our proposed work we use fuse blown indicator, which will remotely monitor the fuse status. A Bus bar temperature rise indicator which will remotely monitor the temperature rise & fall at the last Earthing fault indicator which will remotely monitor the Earthing fault if it occurs all this monitoring will hold through GSM technology. These monitoring status first where it is transmitted and will receive at a GSM receiver which is mobile phone .We use this GSM technology for remote areas where monitoring is too much difficult. This is the first time to using GSM technology for

transmission line and we practically design a system for these three parameters and work more on this system in future .

APPENDIX

Busbar size (mm) x (mm)	Cross Sectional Area Sq mm	Weight kg/m	Approx a.c rating Still air A	A	Approx: Imperial size Free air (inches) x (inches)
20 x 10	400	1.785	480	535	3/4" x 3/8"
25 x 10	250	2.232	580	645	1" x 3/8"
30 x 10	300	2.678	700	795	1 1/4" x 3/8"
40 x 10	400	3.571	880	995	1 1/2" x 3/8"
50 x 10	500	4.464	1060	1200	2" x 3/8"
60 x 10	600	5.356	1200	1355	2 1/2" x 3/8"
80 x 10	800	7.142	1525	1735	3" x 3/8"
100 x 10	1000	8.928	1800	2065	4" x 3/8"
20 x 6	120	1.071	385	430	3/4" x 1/4"
25 x 6	150	1.339	460	515	1" x 1/4"
30 x 6	180	1.607	535	595	1 1/4" x 1/4"
40 x 6	240	2.142	675	755	1 1/2" x 1/4"
50 x 6	300	2.678	815	910	2" x 1/4"
60 x 6	360	3.214	955	1065	2 1/2" x 1/4"
80 x 6	480	4.285	1220	1355	3" x 1/4"
100 x 6	600	5.356	1480	1670	4" x 1/4"

VII. CONCLUSION

WAMS is one of the most critical parts of the smart power grid. The security of WAMS faces great challenges while satisfying energy constraints. The key point in applying to wide area monitoring system is to balance the energy consumption and the energy supply of the systems.

The Exert herm™ System provides:
> Ability to monitor cable / bus bar joints with pre-set (user definable) alarms
> The Ongoing trend analysis allows diction of problems at an early stage of development
> Increased device reliability and uptime due to avoided downtime & better maintenance
> Improved operator and facility safety (Arc Flash)
> Integrated real-time data for BMS/SCADA 24x7 365 days a year
> Definable thermal map when combined with load data

VIII. FUTURE ENHANCEMENT

In our research methodology we used three parameters in that time on transmission line. If we further work on this research in future we add more parameters for wide area monitoring system.
In future we can use GPS technology which will give real time data with an image which can help us in fault location to shows that what type of fault occurs. This will help us going forward in a modernization and one step forward to the grid modernization.

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