Low Tension Multi Feed Power Network Monitoring using IOT

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Abstract: The Low Voltage (LV) Under Ground Cable (UGC) and Over Head Line (OHL) which is often radial in nature. There are many faults occurring in the network resulted poor network reliability. The faults on LV network mainly affects the Customers connected to that particular network. The major negative impact on customers is due to the permanent faults in equipment. Continuity of supply demanded by the Customers from the distribution network is; Hence implementation of self-healing Smart Grid technologies is the only solution to meet the customer requirement. One such technique is the identification of Location where Fault occurs, removing of faulty section and Restoration of Service i.e Fault location, isolation, and service restoration (FLISR) in low tension multi-feed network. The main objective towards implementing FLISR is to improve electricity utility's network performance, increase electricity sales, improve flexibility and reduce the impact on the economy of outages therefore improving the distribution system performance. This paper discusses various ways to implement FLISR and will also focus on a case study on real distribution networks and look at the issues associated with closing a remotely controlled or automatically operated Normally Open point for back-feeding. This paper aims to show how automated service restoration can reduce switching and restoration time from hours to minutes.

Keywords: IOT,multifeed network , FLISR

1 Introduction

Many faults occurring in low voltage distribution network. The faults which occur in distribution system may be passing fault or permanent fault cause interruption on power network. The self-healing techniques recognized across the globe. This technique avoid the blackout which will be caused by outages in the power network which may lead to. Self- healing schemes may operate without or with limited Network Control Centre (manual remote control) and Work Team (manual locally control) intervention. FLISR rapidly returns power supply to customers that are quickly restorable, long before Work Teams reach the site to locate the faulted section of the network and as such, the outage time is minimized. FLISR able to restore supply to unfaulted sections of the customers there is a need for the feeder to be installed with multiple sources of supply. Automatic fault location and automatic fault isolation are rather easy to accomplish. Fault Location, Isolation, and Service Restoration Technologies Reduce Outage Impact and Duration FLISR

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systems can operate autonomously through a distributed or central control system (e.g., DMS), or can be set up to require manual validation by control room operators. Implementing autonomous, fully automated FLISR systems typically requires extensive validation and calibration processes to ensure effective and reliable operations. The response of FLISR which operates Automatically take less than one minute, while the response FLISR which operates manually can take five minutes or more. It is important to note that FLISR only minimize impacts of outages on customers but it does not avoid.

2 Schematics Illustrating FLISR Operation

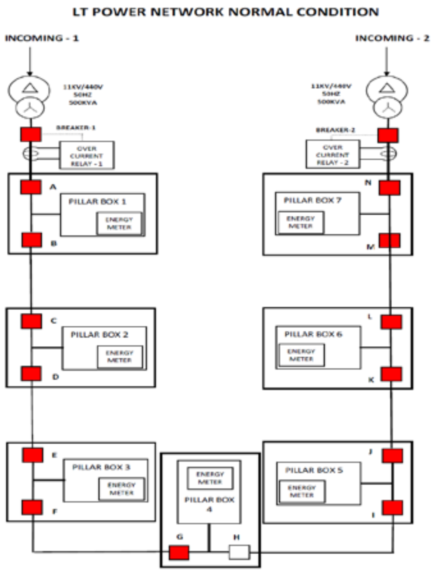

Fig. 1 *Represent the normal feeding condition of the LT power network.*

Separate Incoming 1 and 2 HT supply feed from different substation or from same substation. Two distribution transformer feeds supply to LT distribution power network. In the distribution network have seven numbers of pillar box from each pillar box feeding power to more number of customers. Let incomer 1 and 2 has individual circuit breaker 1 and 2, over current protection relay 1 and 2 and voltage sensor units. Each pillar box has two circuit breaker and voltage sensor units. Let incomer 1 feeds supply radial to pillar box 1 to 4. Incomer 2 feeds supply radial to pillar box 7,6 and 5. Let A,B,C,D,E,F,G,H,I,J,L,M and N are LT circuit breaker each two in one pillar box. Each pillar box connected through underground cable.

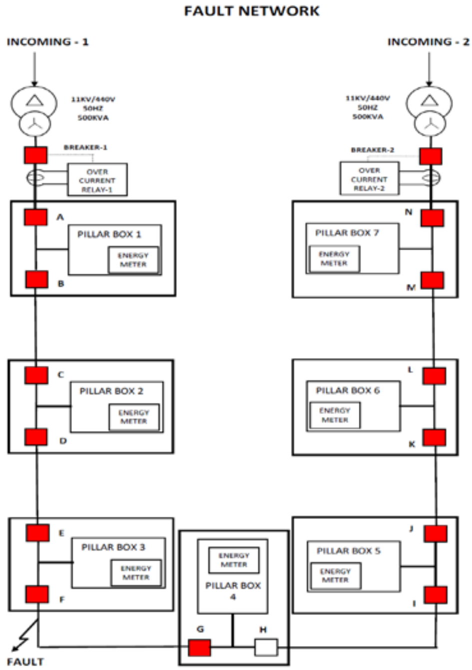

Fig. 2 *Represent the cable fault between the pillar box 3 and 4.*

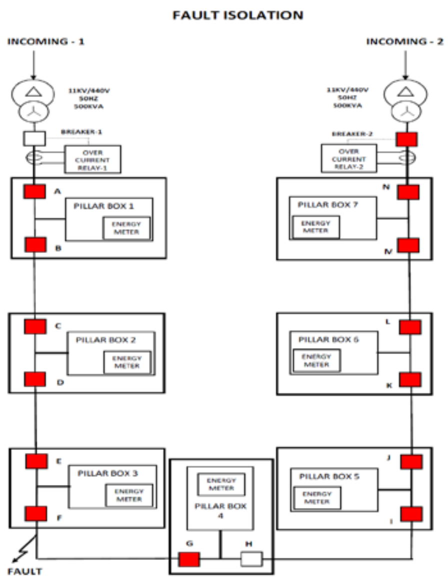

Fig. 3 *Fault Isolation*

When current reach the set current in over current protection relay. The relay initiate trip command to main breaker 1 and the breaker 1 opened. Power supply interrupted in one section pillar box 1 to 4. Power failed to the customers.

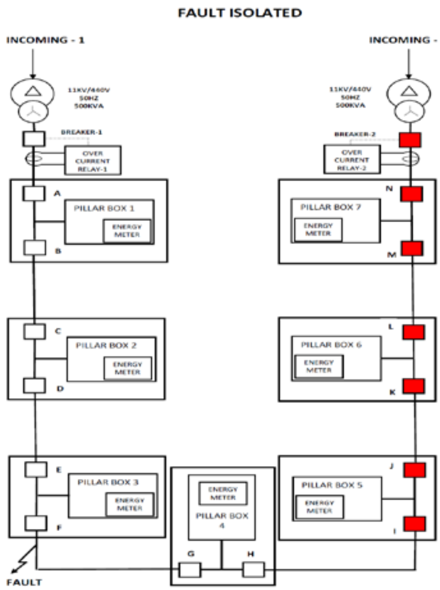

Fig. 4 *Fault isolated*

After breaker 1 open A, B, C, D, E, F and G breaker also open due to under voltage protection. Customers are affected in the 1 to 4 pillar box due to supply failure.

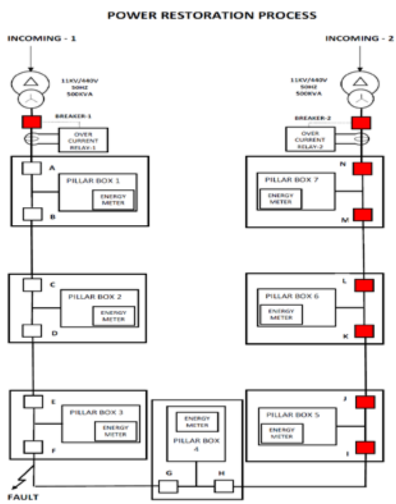

Fig. 5 *Power Restoration Process*

When the first tripping initiate microcontroller start the restoration cycle programmed in it. Delay time programmed in the controller after the time delay breaker 1 closed and controller monitor the breaker 1 closed state and voltage. Then the cable portion energized and controller monitoring weather fault in this cable portion or not.

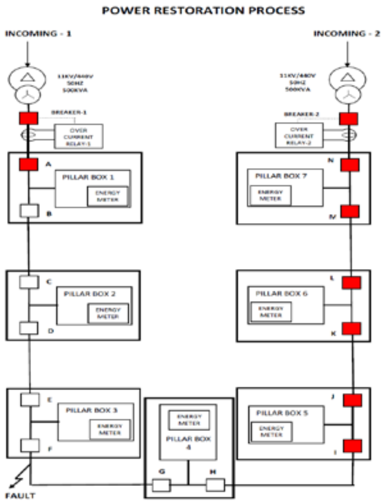

Fig. 6 *Power Restoration process*

After breaker 1 closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker A closed and controller monitor the breaker A closed state and voltage. Now Pillar box 1 energized and supply availed to the customers in the pillar box 1.

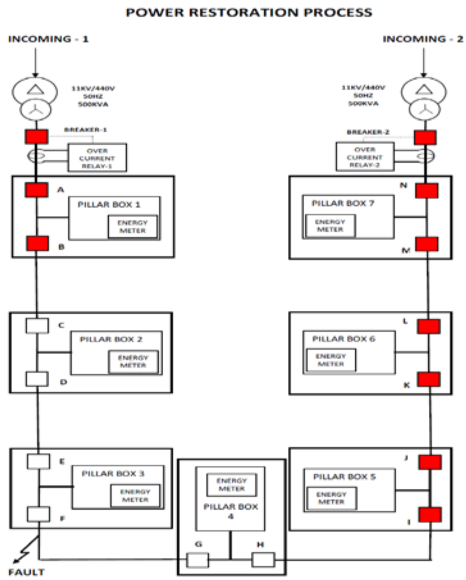

Fig. 7 *Power Restoration process*

After breaker A closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker B closed and controller monitor the breaker B closed state and voltage. Then the cable portion energized and controller monitoring weather fault in this cable portion or not.

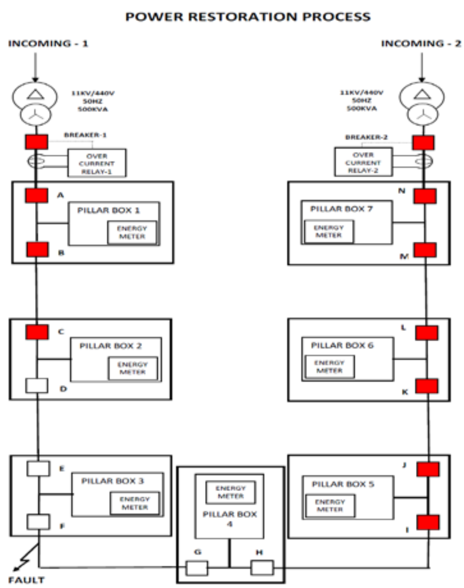

Fig. 8 *Power Restoration process*

After breaker B closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker C closed and controller monitor the breaker C closed state and voltage. Now Pillar box 2 energized and supply availed to the customers in the pillar box 2.

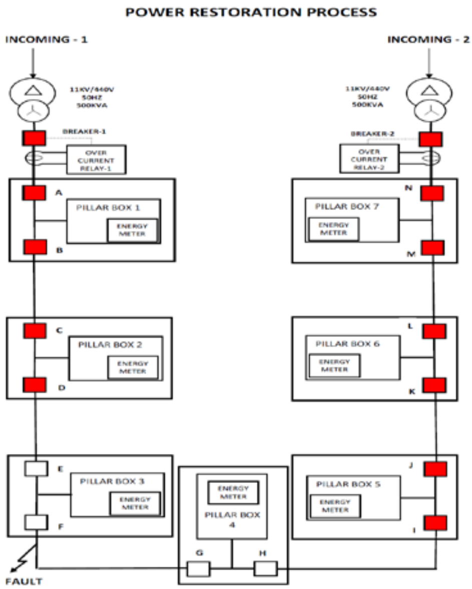

Fig. 9 Power Restoration process

After breaker C closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker D closed and controller monitor the breaker D closed state and voltage. Then the cable portion energized and controller monitoring weather fault in this cable portion or not.

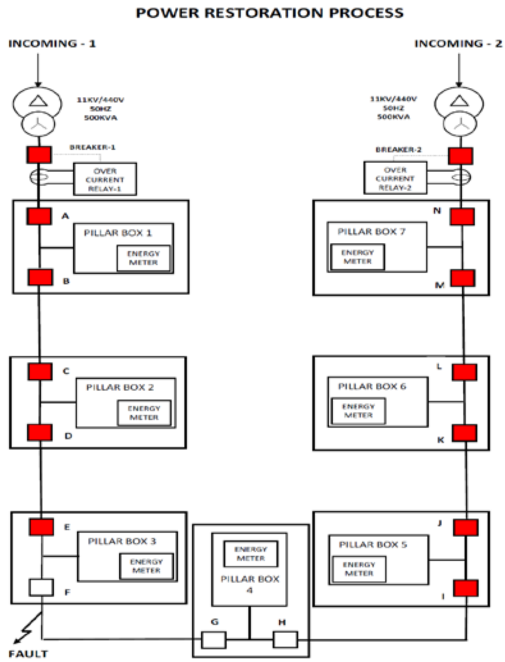

Fig. 10 *Power Restoration process*

After breaker D closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker E closed and controller monitor the breaker E closed state and voltage. Now Pillar box 3 energized and supply availed to the customers in the pillar box 3.

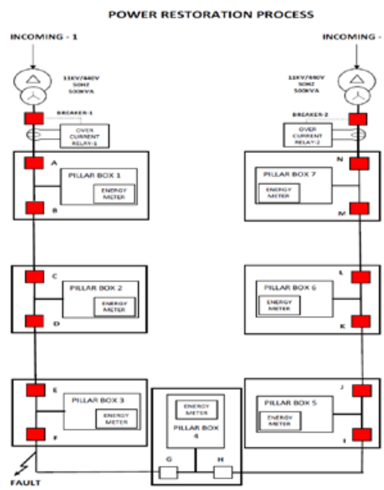

Fig. 11 *Power Restoration process*

Fig. 11 After breaker E closed state and voltage are satisfied. Delay time programmed in the controller after the time delay breaker F closed and controller monitor the breaker F closed state and voltage. Then the cable portion energized and controller monitoring weather fault in this cable portion or not. Here fault in the cable and over current relay 1 pickup and trip command initiated to main breaker 1. Now the controller determined the fault portion next to the breaker F.

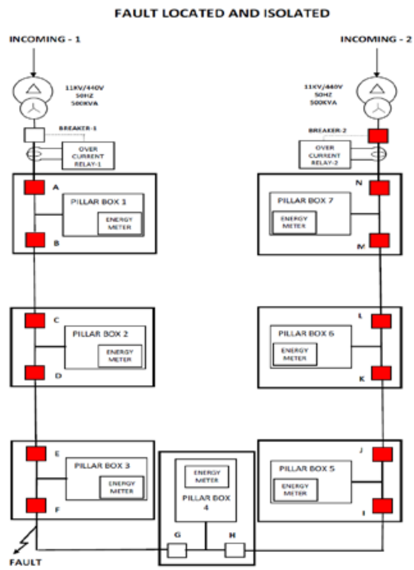

Fig. 12 *Fault located and Isolated*

Fig. 12 When current reach the set current in over current protection relay. The relay initiate trip command to main breaker 1 and the breaker 1 opened. Power supply interrupted in one section pillar box 1 to 3. Power failed to the customers.

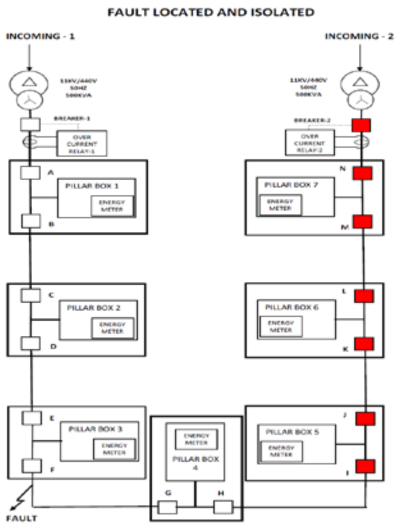

Fig. 13 *Fault Located and Isolated*

After breaker 1 open A, B, C, D, E and F breaker also open due to under voltage protection. Customers are affected in the 1 to 3 pillar box due to supply failure. Already pillar box 4 customers affected due to supply failure.

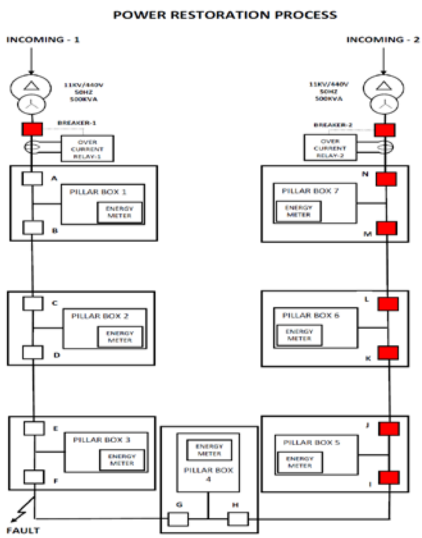

Fig. 14 *Power Restoration Process*

Fig. 14 When the second tripping initiate microcontroller located the fault portion start the restoration cycle programmed in it. Delay time programmed in the controller after the time delay breaker 1 closed and controller monitor the breaker 1 closed state and voltage. Then the cable portion energized and controller monitoring weather fault in this cable portion or not.

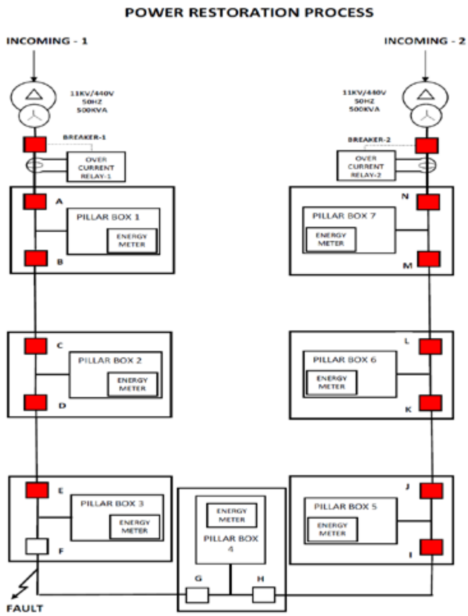

Fig. *15 Power Restoration Process*

Controller determines the fault portion after breaker F. Then controller initiate close command to other breaker A, B, C, D and E up to pillar box 4 supply availed to the customers. Now only pillar box 4 customers not availed supply.

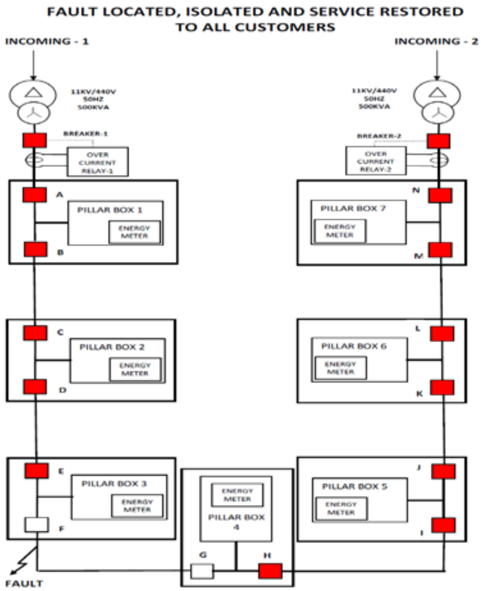

Fig. 16 *Fault Located isolated and restored to all customers*

Controller determines the fault portion between breaker F and Breaker G. Controllers initiate close command to breaker H and controller monitor the breaker H closed state and voltage. Now Pillar box 4 energized and supply availed to the customers in the pillar box 3. Now the faulty portion located between pillar box 3 and 4 alert messages send to the maintenance authority.

3 INTERNET OF THINGS (IOT)

The IOT cloud sensor is a series of sensors based on cloud platform application technology, intelligent measurement, monitoring technology, clock and environmental parameters (temperature, humidity, location, etc.). It is not only featured in wireless transmission, but also has unique remote management functions such as data measurement, threshold setting, clock synchronization, measurement time setting, acquisition cycle setting, alarm setting, interference detection, software update and so on. The product is upgraded from a single measurement to the function of measurement, monitoring, judgment and alarm. It is very suitable for measurement, monitoring and state judgment in the industrial field.

4 Conclusion

The Low voltage feeder’s performance has been analyzed when it is automatically operated or remotely controlled normal open point under different network operating conditions which are: normal, during fault and for supply restoration. From the result it was observed that auto restoration take lesser.

Reduction of time duration in which customers are affected improves reliability. This improves the performance of pilot feeders in this research and the model will be used to improve the rest of the badly performing feeders at any electricity utility. The proposed automated supply restoration algorithm will in future be of great value during FLISR operation.

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