WIRELESS THREE PHASE LINE FAULT MONITORING

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ABSTRACT

One of the earliest and continuing problems with electricity distribution systems is AC power line disturbances on customer premises due to various known and unknown reasons. Lack of information at the base station (33kV sub-station) on the loading and health status of the 11kV/415V transformer and associated feeders is one primary cause of inefficient power distribution. Due to absence of monitoring, overloading occurs, which results in low voltage at the customer end and increases the risk of frequent breakdowns of transformers and feeders. In fact, the transformer breakdown rate in India is as high as around 20%, in contrast to less than 2% in some advanced countries.
In the event of a fault on any feeder section downstream, the circuit breaker at the 33kV substation trips (opens). As a result, there is a blackout over a large section of the distribution network. If the faulty feeder segment could be precisely identified, it would be possible to substantially reduce the blackout area, by re-routing the power to the healthy feeder segments through the operation of switches (of the same type as those for load management) placed at strategic locations in various feeder segments.

I INTRODUCTION

The power lines disturbances are mainly caused by heavy loads like compressors, welding machines etc. and short circuits due to mishaps. This imbalances the three phase power transmission line due to overloading of any particular phase, which has great impact on highly sensitive loads. This imbalance sometimes causes the failure of fuse in the main distribution box (the station where 11 KV 3 Wire AC Supply is converted to 4 wire 415V Supply)

The fault in power transmission line network are hard to diagnose specially when the distribution is through underground cables, with this case the technician has to check entire nodes preceding on that node, this process takes hours for fault diagnosis and corrective action, so it is necessary to implement fault detection system in transmission line network.

The fault detection system can be implemented for three phase electrical distribution system. A practical prototype system can be implemented for fault detection in power system and also the system can be successfully designed using 8-bit Microcontrollers, which allows the detection of faults. Continuous monitoring of the three phase parameters such as voltage, current and energy consumed can be done using data logging system on the PC screen

through hyper terminal. There will be communication between the host stations (Main Substation) and Distribution boxes under using standard wireless protocol. Communication can be done via RS 232 UART Port.

This Project introduces the intelligent system which continuously monitors the 3 phase supply 415V with rigidly equipped Voltage and current transducers and a wireless transmitter. The device will only record the data when interruption occurred and signals the nearest substation that exception has occurred inclusion of real time system records all the data of incident like date, time, type of fault, line imbalance, single phasing, overloading etc.
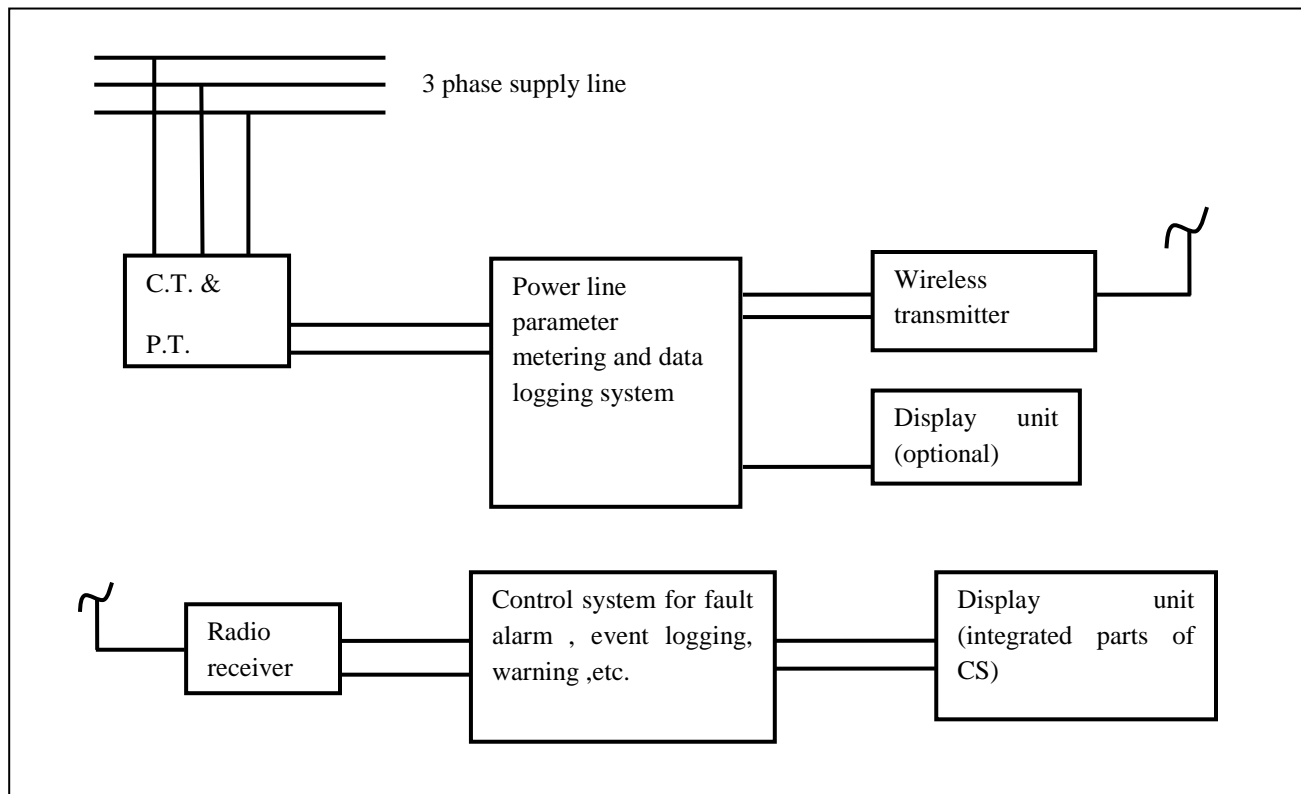
II BLOCK DIAGRAM

Fig.: Generalized Block Diagram of System

III CONSTRUCTION

Sr.No.	Device	Function
1	Microcontroller 18F4520	To send the command to transmitter and receiver and display the message on LCD screen.
2	865MHz Transmitter and Receiver Module	The modules receive data from the Microcontroller, transmitter transmits the message and receiver receives it.

3	Opto-Coupler/ Opto-Isolator MCT2E	To reduce the voltage level up to 12V.
4	LCD Display	To display the message.
5	Voltage Regulator	To regulate the voltage in each section.
6	Level Float	To indicate oil level in the transformer.
7	Temperature Sensor LM35	To check the temperature of winding.
8	PCB- Motherboard PIC Application board	To mount the components.
9	Regulator 7809	To regulate the voltage in each component.
10	Various cables	To connect circuit and transmit message.

IV WORKING

Initially at power ON, the microcontroller 18F4520 will get initialized. The LCD initialization will take place. The welcome message may occur on LCD. The initialization data will be sent to PC through serial communication. The parameters data will be with reference to date time. After every 5 second the data will be logged. The transmitter system will be installed at 11KV/415V feeder where the total distribution is done. Also, separate microcontrollers are used for every individual feeder. This microcontroller will separately monitor available at the individual area. The feeder health status will be available on the local display. These units will be sent to the sub-station with wireless communication.

The 865MHz transmitter and receiver modules are used for master (Substation) & slave (11KV/415V Feeder) communication. The master slave communication is for detection of location of feeder for diagnosis purpose to locate feeder with fault. The power line parameters will be sensed. It will be sent to the substation. If the fault occurs then the failure of the feeder can be exactly located. Thus, we can find theft of electricity. This clear information will be available on PC of substation.

V COST OF PROJECT WITH EQUIPMENTS

Sr.No.	Equipment	Quantity	Cost (₹)
1	Level float-20mm	1	250
2	IC PIC18F4520	1	450
3	IC Max 232	1	40
4	Opt coupler	3	75
5	LM35 sensor	1	60

6	865MHz wireless module (Transmitter & Receiver)	2	1200
7	Capacitor	25	50
8	Diode	25	40
9	Resistor	45	45
10	Opt-Coupler MCT2E	3	75
11	Toggle switch and push button switch	2	20
12	Wooden board	1	60
13	Flat board cable with connector for display	1	40
14	Regulator 7805	1	30
15	Motherboard PCB designing and development	1	1250
16	Current and voltage sensing PCB designing and development	1	1000
17	LCD display 20x4	1	500
18	RS 232 Cable	1	250
19	RS 232 to Microcontroller cable	1	200
	Total		5635/-

VI CONCLUSION

From our project so far we have studied lots of things from literature survey to design on paper. Our work towards completion of this project will result in build of a well equipped system for future power grids. This project will not only focus on monitoring & maintenance of HV line but also will be capable of taking intelligent decision at worst case situations. We will be hoping for the best result from our engineering prototype of this project.

6.1 **Advantages:**

▪ Ease of maintenance: Maintenance work will get reduced significantly, as fault gets diagnosed in less time, data about exact time and location of fault will assist the electricians take necessary actions immediately without wasting time thus to restore power as early as possible.

▪ Real time monitoring of faults: Inherent ability of monitoring can prove as significant advantage for monitoring of parameters like voltage, current etc. to detect disturbances in real time, the fault will be logged as it occurs.

▪ Intelligent decision system can be deployed: Using this system the smart decision system can be implemented to auto isolate the line from the main substation when situation is out of control and risk of damage to the Distribution link or node.

- Protection against natural lightening can be done: Real time monitoring of voltage parameter can detect the lightening during rainy seasons thus disconnecting the supply temporarily will definitely help in protecting customer appliances from over voltage.

- Compatible with existing system and software: The backward compatibility to the existing system makes it absolutely feasible to implement on current distribution line without any major modifications.

6.2 Applications

- 3-phase line fault detection: Faults in a particular line can be detected and the necessary information is sent to the main station.

- Power grid system monitoring: Recently, developments in solar and wind energy harvesting technology have led to the need for efficient monitoring of power grids.

- Power quality improvement program: As heavy loads (inductive) creates switching transients affecting the overall power quality, thus the system will monitor power line parameters and will isolate particular node from the line.

- In industries for monitoring the health status of motors and transformer.

6.3 Future scope & Developments

In this era of 21st century the demand of the automation is significantly increased due to advancements in the IC technology, it is now possible to control several things using single chip application specific IC's. Our project is expected to have much development in coming future. Thus during the initial work of our project we found some margins of improvements. Those are:

- Use of centralized monitoring system can reduce overhead of monitoring at each station.

- Use of GSM technology can reduce effect of Electromagnetic interference, thus by relaxing stringent requirements of shielding.

- Adaptation of latest mobile technology for software interface can make use of Smartphone as a monitoring device.

- Integration to Google's android can make the system user friendly among the wide platform.

VII ACKNOWLEDGMENT

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