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Intelligent Access Smart Grid System,Metering and Monitoring

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I. ABSTRACT

A smart grid is an evolved grid system that manages electricity demand in a sustainable, reliable and economic manner, built on advanced infrastructure and tuned to facilitate the integration of all involved. Today existing grids are under pressure to deliver the growing demand for power, as well as electricity. These complex changes are driving the evolution of smart grid technologies. Smart grids make use of materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing asserts and make the grid more resilient in the event of disruptions. More flexible transmission and distribution systems can accommodate fluctuations in supply, increase efficiency and optimize system operations. Powerful monitoring and control system will help prevent disruptions before they occur. A smart grid combines all these features linked by communication technologies. The future electrical system must be able to meet demand for electricity in a way that also satisfies environmental concerns. The biggest changes are in the distribution network and for end users especially commercial and residential users. This report is organized as follows: section II with the prior workwhich is the base for the proposals, section III& IV with the overall work implemented section V contains the simulation result with the comparison.

Keywords: Smart grid, Powerful monitoring and control.

II. PRIOR WORK

[1] Soma Shekara Sreenadh Reddy Depuru, Lingfeng Wang, and Vijay Devabhaktuni in Enhanced Encoding Technique for Identifying Abnormal Energy Usage Pattern This paper explains the significance of the evaluation of customer energy consumption profiles for identification of illegal consumers. To reduce the complexity of the instantaneous energy consumption data for evaluation, this paper proposes and implements a coding technique , which maps instantaneous consumption data into irregularities in consumption. The obtained results demonstrate that this encoding procedure is significantly quick and robust in identifying illegal consumers.

[2] Soma Shekara Sreenadh Reddy Depuru, Lingfeng Wang, Vijay Devabhaktuni Robert C. Green in High Performance Computing for Detection of Electricity Theft describes the role of High Performance Computing (HPC) algorithms in detection of illegal consumers. This paper designs and implements an encoding procedure to simplify and modify customer energy consumption data for quicker analysis without compromising the quality or uniqueness of the data. It also parallelizes overall customer classification process.

[3] A.H. Nizar , Z.Y. Dong and Y. Wang in Power Utility Nontechnical Loss Analysis With Extreme Learning Machine Method suggest new approach to nontechnical loss analysis for utilities using the modern computational technique extreme learning machine (ELM). The result reveals whether any significant behaviour that emerges due to irregularities in consumption. In this paper , ELM and online sequential are both used to achieve an improved classification performance and to increase accuracy of results.

[4] A.Pyasi and V.Verma in Improvement in Electricity Distribution Efficiency to Mitigate Pollution explains that in developing nations the electricity distribution companies faces a major problem as power theft. In addition to causing massive financial losses, it increases the pollution level due to unrestrained usage of unauthorized power. They have also attempted to provide an economic and flexible method of detecting power theft using pole mounted FM band radio telemetry ,which will allow distribution companies to find and fix such problems with greater ease.

[5] L.J.Heranandes Jr., L.C.Duarte, F.O.Morais ,E.C.Ferreira and J.A. Siqueria Dias in Optimizing the inspection Routine for the detection of Electrical Energy

Theft describes the development of a non invasive and low-cost process that allows for the improvement of the energy theft inspection routine, increasing the field inspection team productivity and reducing the customer s embarrassment in cases where no irregularity is found. A comprehensive statistical study performed with a database of more than 80000 customers in distribution area of the utility company AES Electropaulo in Sao Paulo, Brazil concludes that the comparison between readings can clearly indicate when tempered or defective meters are found.

[6] Soma Shekara Sreenadh Reddy Depuru , Lingfeng Wang, and Vijay Devabhaktuni in Support Vector Machine Based Data Classification for Detection of Electricity Theft describes that most utility companies in developing countries are subjected to major financial losses because ofnon technical losses (NTL). It is very difficult to detect and control the NTL in developing countries due to the poor infrastructure. This paper discusses the problems underlying detection of electricity theft, previously implemented ways for reducing theft. In addition, it presents the approximate energy consumption patterns of several customers involving theft. Energy consumption patterns of customers are compared with and without the presence of theft.

[7] R. Anand, S. De, A. Naveen, in Design and Development of Vigilant Energy Metering System (VEMS) and its applications proposes metering system(VEMS). It also facilitates load forecasting and control, identifies potential areas of theft, losses and takes measures to rectify it. Advantage of VEMS is that it facilitates real monitoring of the distribution network so that in future these is the possibility of implementing 'distribution automation'. As an added advantage, we can connect the water and gas meters to this system using the meter interface units (MIUs) to develop a remote unified billing system.

[8] E.W.S. Dos Angelos, O.R. Saavedra, O.A.C. Cortes, A.N. De Souza, in Detection and Identification of Abnormalities in Customer Consumptions in Power Distribution Systems proposes a computational technique for the classification of electricity consumption profiles. The methodology is comprised of two steps . In the first one , a C-means-based fuzzy clustering is performed in order to find consumers with similar consumption profiles. Afterwards, a fuzzy classification is performed using a fuzzy membership matrix and Euclidian distance to the cluster centers. The approach was tested and validated on a real database, showing good performance in tasks of fraud and measurement defect detection.

[9] Vrushali V. Jadhav, SoniyaS.Patil, RupaliV.Rane, Swati R. Wadje in Wireless Power Theft Detection explains that power theft in non -ignorable crime that is highly prevented, illegal usage of electricity can be solved electronically without any human control , using Radio frequency technology. The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumers.

[10] S.S.S.R. Deepuru, S. Devabhaktuni A rule engine based classification algorithm for detection of illegal consumption of electricity explains that a total loss in transmission and distribution (T&D) of electricity includes nontechnical losses (NTL). Illegal consumption of electricity constitutes a major portion of NTL. From the obtained results, it is evident that the rule engine yielded appreciable classification accuracy in significantly less CPU time. Results demonstrate the robustness and accuracy of this procedure in identifying illegal consumers.

III.OVERVIEW

In existing system, the high voltage transmission grid is sophisticated, highly controlled network that supplies electricity to distribution networks, which can be viewed simplistically as wires delivering electricity to users. The transmission grid must meet whatever demand there is from the distribution systems. The electrical grids are generally used to carry power from a few central generators to a large number of users or customers and do not allow real time information to be relayed from the grid. Some of the significant issues include : the electricity delivery by means supervisory control and data acquisition (SCADA) which suffers limited bandwidths and relatively slow data transmission rates that often require several seconds or more to respond to an alarm or system change and there is no visibility in the distribution network below substation, supply has to change according to the demands continuously and the power grid will also need to maintain a buffer of excess supply, which results in lower efficiency, higher emissions, and higher costs. The major disadvantages include limited delivery system, high cost of power outage and power quality interruption, inefficiency at managing peak load, only one way communication is possible , readings should be read manually, failure can cause black out, only authorized person will be permitted to attend and rectify the fault and communication failure may lead to trouble. The existing grids has to change to meet the demand proposed by this modern society.

IV. PROPOSED WORK

The main objective of this paper is to provide quality in power supply facilitate smart monitoring and metering through smart meters and also maintain the voltage throughout the day. Readings are taken by the smart grid computer. Smart meters can transmit data through available smart communication devices such as SCADA and PLC. The fuse monitoring circuits are used to find any outage of power and restore power very fast. In addition to this to improve the voltage at the consumer end if there is a drop below the specified value, with an aid of step up transformer with dual output . The transformer which is to be included in the project is provided with two tapings (normal and boost tap) to regulate the voltage level. This information is also fed to the computer. Here the demand and the generation are kept in balance. It operates the electricity system safely and securely using sophisticated intelligent controllers.

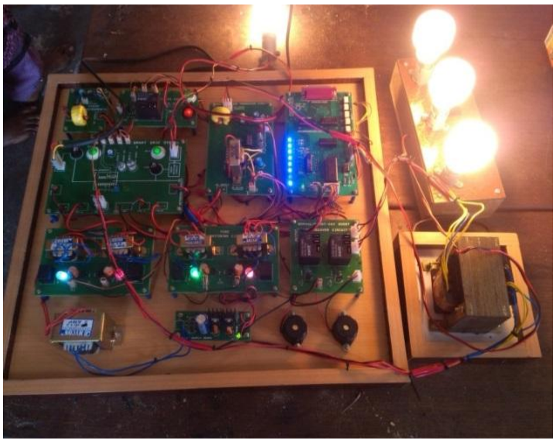

Fig.1 Hardware prototype of fuse monitoring and voltage control

V. RESULTS AND DISCUSSION

Table 1

Comparison of existing and proposal system

S.no	FEATURES	Existing System	Proposed System
1.	Monitoring	Electro-mechanical	Digital
2.	Smart transfer of information	One –way communicatio n	Two-way
3.	Quality	Manual Restoration	Self-healing
4.	Reliability	Few customer choices	Many customer choices
5.	Flexibility	Only authorised people will be permitted to attend and rectify the fault	Meter readings are read by the control station grid
6.	Capacity & Sustainability	Fuse healthiness cannot be monitored	Fuse healthiness can be monitored
7.	Energy Efficiency	Power quality interruptions and inefficiency at managing peak load	It helps to find the real loss of the power distribution
8.	Maintainence	Failure and black-out	Adaptive and islanding
9.	Demand side management	Manual monitoring	Self monitoring
10.	Outage management	Limited delivery system	It improves revenue to the power distribution authority

The comparison best outsources the improvement in power reliability and quality. With the help of temperature sensor , we can also able detect the burn-outs in the circuit. It mainly reduces the green house emission. Smart metering and fuse monitoring circuits provides trouble free smart grid to facilitate for the consumers for their availablity of power all times and the failures occurs can be automatically communicated to the smart grid computer to restore if any failure happens.

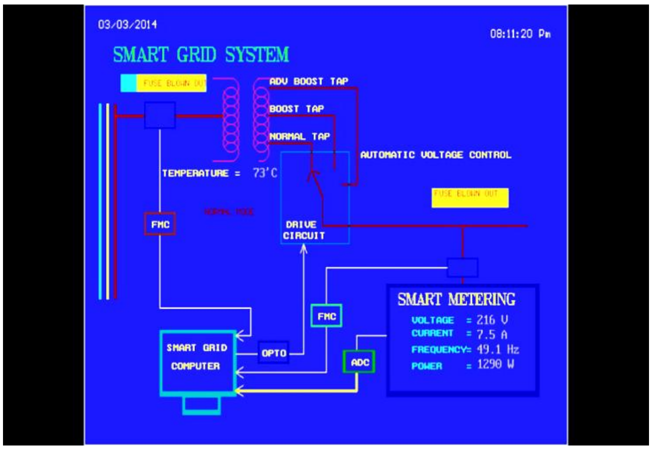

Fig 2. Automatic voltage control and fuse monitoring

[1] From the above simulation results we conclude that multi tap transformer is automatically tap changed by the smart grid computer with the aid of fast switching drive circuits, thus the distribution voltage is maintained constant at the load side. The frequency is also maintained close to rated frequency of 50Hz, which provides quality of power.[2] FMC provides trouble free transmission to facilitate for the consumers. For their availablity of power at all times and failures can be automatically communicated to smart grid comp to restore at fasterrate.
[3] It is understood from the results that , if the power is stolen on the load side ,it is automatically detected by the isolation circuits, which separates the load from the system thus provides an efficient use of power..
[4] The smart meter provides a two-way communication between the system and load ,providingself monitoring and healing.
[5] The smart meter sends the up to date price,load and cost information about electricity consumed by the load ,which reduces the time and limits confusions .
[6] Its clear that smart technology is much advanced than existing technology in few years all other present technology will get replaced by the smart grid technology.

[7] Smart grid for intelligent monitoring and outage management.Smart grid for energy savings and financial management.Smart grid is used in Commercial field, Residential field, industrial area.

V1.CONCLUSION

The smart grid project model deals with automatic voltage control to maintain the smart grid system and consumers to get the quality under all circumstances by changing the transformer tapping by measuring the grid voltage with the aid of the ADC and necessary interface circuits . The transformer provided in the smart grid project model consists of dual tapping which is automatically changed by the computer with the aid fast switching drive circuits to maintain the grid voltage close to the rated normal voltage and thereby frequency also can be maintained close to normal frequency of 50 Hz. In real time transformers with multi-tap may be used to make the smart grid system very smart to match all the situations which are all expected. Smart metering and fuse monitoring circuits provides trouble free smart grid to facilitate for the consumers for their availability of power all times and the failure occurs can be automatically communicated to the smart grid computer to restore if any failure happens. In this project all the information are passed on to the smart grid computer as hardware and digitals. The improved communication available in the present trend may transform the smart grid presented in the project into very smart one.

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