A Review on Power Line Carrier Communication (PLCC) Systems

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Abstract - Data Transmission in the twentieth century mainly meant the transmission of telephonic data over the wires. This had many disadvantages. Telephonic Equipment is comparatively costlier. Telephone Circuits were often unreliable. Telephone Lines were found to be unable to sustain the harsh weather conditions in the mountainous terrain and the extreme weather. In addition the electrical interference between the parallel power lines and the telephone lines was a case of concern. On the flip side the power Lines were much more robust and reliable. Since power Lines were already available it made much more sense to use them rather than investing in the making of new lines. Power Lines Communication gained a lot of ground in the early twentieth century. The advantages that were offered by the implementations of this technology and its social and economic impacts led to many companies investing in this technology and using it in their own grid. The basic idea of power line carrier communication system (PLCC) is to use the existing power cable infrastructure for communication purpose. Our system will mostly be implemented in small areas such as residences, offices, etc. and with the use of this system; various kind of devices can be controlled remotely. The main benefit of this system stands to the residential users of making their dream of automation of their house. With just a simple set up of a transmitter and receiver, and ensuring equal phase supply, one can control a host of devices and enjoy the leisure of living in a fully automated house. Another major factor is the ubiquity of the medium - power outlets are commonly found and available throughout the house or the office and may very well serve as communication nodes. The external electrical grid can also be used for many applications whose solutions provide many opportunities for equipment vendors and utilities to offer new services, features and products, cut costs of current services, fully automate manual processes and procedures. It can also be used to improve current products, monitor and collect valuable data, offer remote service options and and create new business and revenue streams utilizing the existing infrastructure.

Keywords- Power line, Carrier, Communication, PLCC

Literature Survey

M. Gowsalya et al. (2015) Traditional metering method is not a convenient for energy measurement and billing. It is more difficult to calculate the bill amount to be paid by a particular user based on the energy consumed and to feed the value to the Electricity Board. This paper aims a new approach for data security and transmission of data using Power Line Carrier Communication (PLCC). This system has an immediate access to the consumer residence in an area with the central board using PLCC. The ARM based system continuously monitors and records the Energy consumption. The smart meter in each residence is connected by central board through the power line. The smart meter calculates the amount to be paid according to the units consumed and also it notify the status of the load connected with it. With help of PLCC the data can transceived from the individual appliances. The data are energy consumption, cost and usage time. The data were transferred from smart meter to knowledge base. This system has the advantages of doing Energy auditing in an area and to find out the losses in the distribution system. LabVIEW software is used to view the output of the individual appliances.

Jovita Serrao et al. (2012) This paper serves as a general and technical reference to transmission of data using a power line carrier communication system which is a preferred choice over Wireless or other Home Networking technologies due to the ease of installation, availability of AC outlets, higher throughput, low cost, reliability and security. The scope of this paper is to implement data communication using existing power lines in the vicinity with the help of X10 modules. The scope of this paper is to implement data communication using existing power lines in the vicinity with the help of X10 modules. The system basically consists of two modules, a transmitter and a receiver that can communicate with each other using the existing power cables in residential and commercial areas. This paper elaborates on only the transmitter end of the PLCC system.

Nitesh Kumar Jangir (2012) This paper gives information of power handling by means of communication system and using their net for auto and manual power management at very cheap cost. In this project we use existing network of power line for the data communication by using a network of microcontrollers. The microcontroller uses sensors for intake values from atmosphere than control electric and electronics equipments according to instructions. Project proposes to use Power lines as a medium to carry control data to control a load.

Siddhartha Sarma and Ayush Bansal (2014) As in everywhere automation is required to reduce the work and curbing electricity theft in India, which accounts for 80% of the power losses. While the nation strives to mark a new golden era, the power sector suffers contributing to blackouts and costs $17 billion in lost revenue annually, according to calculations by Bloomberg. With the nation-wide production at over 250GW, as on August 20141, weak infrastructure accounts for various losses – transmission, distribution, aggregate technical and commercial losses. Considering that the loss at 25%, the amount accounts that 63.34GW i.e. nearly the load the grid carried during the July, 2012 blackout. If mitigation strategies were considered to half the slippage, New Delhi had enough power to lighten up for a week. In this write-up, proposed is a power line communication (PLC) based automated meter reading (AMR) that is used to monitor electricity demand and decide on the required supply by the power station control room (PCR). Along with this primary feature, the proposed system can be trigger SMS to the nearest authority about the location of theft, tracing with the help of consumer database detail..

Y.Gobikannan et al. (2014) There are various ways through which we can pay the electricity bill. Though there are various ways, a person from electricity board has to visit each one's house and note down the reading. In order to reduce the man power and to reduce the errors created by man power, we are introducing a new idea of billing. Power line carrier communication presents new area for automatic meter reading, by equipped energy meter with power system. In this power line carrier communication based energy meter, we are implementing a new idea of sending the electricity bill to the electricity board through the power line itself. The power line is used as a bidirectional medium. We are feeding all the information regarding the tariff amount fixed by the government in the microcontroller. The micro controller calculates and gives us the accurate amount. At the end of the day, the amount of power consumed and cost of it will be announced by a voice circuit. In month end, the total amount will be send to the electricity board through the power line. This is very efficient and cost effective. This also reduces the man power and the errors caused due to manual calculations.

Sharmila Durai and Rangarajan Parthasarathy (2014) The egression of new technologies has led to the development of new security concerns. The current technology is inadequate to handle new security challenges in fields of networking, banking and health care. Security concerns arise in both wired and wireless communication medium. The wireless communication covers small area, lacks in security and data loss. In wired communication, the layout of wires and amplifiers increases the infrastructure cost. To overcome the above problem, we propose Power line carrier communication with (Physically Unclonable Function) PUF to secure the data. The proposed model Power line carrier communication with PUF is termed as PPUF. To improve data security in wired communication without new infrastructure for establishing the communication network in the hospital, we apply Quantum Fourier PUF to access individual modules and enable data encryption over the transmission line of Power Line Communication. The Quantum Fourier PUF performs better than existing PUF models in terms of lower order of magnitude delays, energy consumption, and resilience to various attacks.

Subhra J. Sarkar and Palash K. Kundu (2015) With the various advances in load forecasting techniques, now a day it is possible to perform load scheduling effectively. Modern day wireless communication techniques are replacing the older wire based systems. In this paper it is proposed to implement an automated system employing GSM & PLCC for the smooth operation of power generation & control. Load dispatch centre (LDC) will communicate with the individual power generation units & send scheduling based information through GSM techniques. The generation plants, in turn will actuate the scheduled data for their generation control using power line communication based SCADA system.

R. Reedy (2015) Conventional anti-islanding techniques used in gridtied photovoltaic (PV) systems pose many disadvantages at high levels of PV deployment. One such issue is the inability of these systems to ride-through grid disturbances. In this paper, the use of a Power Line Carrier Communications (PLCC) Permissive anti-islanding scheme is investigated as a means of safely enabling ride-through operation of grid-tied photovoltaic systems. Here potential fault scenarios are considered, along with performance, cost, and design considerations for the PLCC Permissive components, as well as potential system configurations and methods of implementation. While PV systems are the largest (and growing) form of distributed generation (DG) generating in parallel with utility feeders, it is important to note that this technique is effective for any DG technology, whether inverter-based or rotating, including wind, hydro and fossil fueled bio-gas machines.

Vivek Akarte This article constitutes an overview of the research, application, and regulatory activities on power line communications. Transmission issues on the power line are investigated and modeling approaches illustrated. Contemporary communication techniques and reliability issues are treated. Power lines constitute a rather hostile medium for data transmission. Varying impedance, considerable noise, and high attenuation are the main issues. The power line communication (PLC) is a new technology open to improvements in some key aspects. Some companies in the world provide broad band PLC devices and an increasing number of utility companies have already gone through field trials and commercial

deployment of PLC services. Power-line communications over the low-voltage networks is gaining the attention of researchers in both broadband and narrowband application areas. The transmission characteristics of the powerline carrier are very significant in signal propagation.

M. Ahmed et al. (2008) This paper presents the development of a power line carrier in low distribution automation system (DAS) for operating and controlling low voltage (LV) downstream of 415/240V. Supervisory Control and Data Acquisition (SCADA) based Remote Terminal Unit (RTU) along power line communication (PLC) system are used for DAS development that practically simulates the downstream distribution system functions in an automated manner. It is the first DAS research work done on customer side substation for operating and controlling between the consumer side system and the substation using PLC. Most of the work in this paper is focused on PLC that provides an effective communication system for both RTU and SCADA systems. The Human Machine Interface for SCADA system is developed using customized software and an RTU microprocessor and its software implements.

Abdul Mannan et al. (2014) In this paper, we give an overview of the power line communication (PLC) technology. This paper presents an overview of the research, applications, standards and importance of the power line communication. Power line communication is an emerging home network technology that allows consumers to use their already existing wiring system to connect home appliances to each other and to the Internet. Noise in power line communication and impulsive noise are presented in this paper.

Vivek Akarte et al. (2014) This article constitutes an overview of the research, application, and regulatory activities on power line communications. Transmission issues on the power line are investigated and modeling approaches illustrated. Contemporary communication techniques and reliability issues are treated. Power lines constitute a rather hostile medium for data transmission. Varying impedance, considerable noise, and high attenuation are the main issues. The power line communication (PLC) is a new technology open to improvements in some key aspects. Some companies in the world provide broad band PLC devices and an increasing number of utility companies have already gone through field trials and commercial deployment of PLC services. Power-line communications over the low-voltage networks is gaining the attention of researchers in both broadband and narrowband application areas. The transmission characteristics of the powerline carrier are very significant in signal propagation.

Conclusions

PLCC technologies are proposed for safe, simple and effective solution of one of the most vexing problems presented to utility operators by high penetrations of DG: how to keep the ever-growing generation resource online during system disturbances, with concurrent absolute certainty that a dangerous unintentional island does not present a backfeed hazard, and do so for any penetration level or combination of DG.

No separate wires are needed for communication purposes, as the power lines themselves carry power as well as communication signals. Hence the cost of constructing separate telephone lines is saved.When compared with ordinary lines the power lines have appreciably higher mechanical strength. They would normally remain unaffected under the conditions, which might seriously damage telephone lines. Power lines usually provide the shortest route between the power stations. Power lines have large cross-sectional areas resulting in very low resistance per unit length. Consequently the carrier signals suffer much less attenuation than when they travel on usual telephone lines of equal lengths.Power lines are well insulated to provide only negligible leakage between conductors and ground even in adverse weather conditions. Largest spacing between conductors reduces capacitance, which results in smaller attenuation at high frequencies. The large spacing also reduces the cross talk to a considerable extent.

Future work

will include a validation of the design concepts on the distribution system of Lakeland (Florida, USA) Electric, using off-the-shelf components from a supplier of PLCC metering and control equipment. Results from the validation should lead to improved design, in terms of cost, performance, and energy requirements for the PLCC receiver and continuous carrier transmitter, as well as detailed simulation of carrier propagation in a number of different environments and scenarios.

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