Power Line Carrier Communication (PLCC) Systems: A Review

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Abstract:- 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. 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.

Keywords- Power line, Carrier, Communication, PLCC

Literature Survey:

A. M. Musfira Samreen et al. (2017) proposed that in every aspect of life automation is required to reduce the work. So we have designed automated Meter Reading for Electricity using power line carrier communication. This AMR will overcome the current old method of electricity billing process. This project eliminates the need for employing Electricity Board meter readers and this set of employees can be used elsewhere. The drawback is reduced by using a prepaid energy meter which is based on the concept "Pay first and then use it". The prepaid energy meter uses a recharge card which is available in various ranges (i.e. Rs. 300, Rs. 200, Rs. 150, Rs.50, etc.). PLCC, Power Line Carrier Communication, is an approach to utilize the existing power lines for the transmission of information. In today's world every house and building has properly installed electricity lines. By using the existing AC power lines as a medium to transfer the information, it becomes easy to connect the houses with a high speed network access point without installing new wiring.

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. The PLC channel is discussed to such an extent.

ANJU K N et al. (2016) Visible light communication based on LEDs is an eco-friendly IT green technology. Light-emitting diode (LED) is the main part of visible light communication. The optical wireless communication provides many advantages, such as being license-free, high directional channel, and electromagnetic interference (EMI) free. Meanwhile, in power line communication we are using the power lines as a medium for communications, that is here power lines are carrying the data. PLC technology could provide the consumer with a spectrum of services such as Internet, home entertainment and home automation. Dealing with very high voltages and its isolation is a problem of PLC. Also power line communication is affected by a number of noises, it make the communication system a worst one A solution to this problem is proposed by combining Power Line Communication and Visible Light Communication.

B. A. Mork et al. (2014) proposed the results of the development and application of a power line communication components library, including single and double-frequency line traps, line tuning units, CCVTs, transmitters, receivers, balanced and skewed hybrids, and signal level probes. The library is developed for ATP-EMTP using ATPDraw. Benchmarking of laboratory measured characteristic versus model behavior has been carried out for the particular components. System level simulation of a power line carrier system is performed to demonstrate the modeling capabilities. This approach is a marked advancement over traditional steady-state model analysis methods.

M. Gowsalya et al. (2015) proposed Energy measurement and billing system is not a convenient one in the traditional metering system. To calculate the bill amount in Electricity Board (EB) for the energy consumed by the consumer and to feed the value in the database is a difficult task. The aim of this idea is to use power line carrier communication for data transmission and security. The consumer can access their data about the status of the load, which is connected with the central board using PLCC. The PIC based system is used to monitor continuously and to display the status of the load connected. The PIC based smart meter sense and monitors the load connected to it. It monitors the energy consumed by each load and displays the data using LCD. This system has the advantages of doing Energy auditing in an area and to find the losses in the distribution system. BY using the LABVIEW, ECLIPSE and MPLAB software's are used to view the output of the load.

M.Prabhu et al. (2017) proposed a smart power metering system or issue is captivated by countless profits. The distribution of overheads and gross settlement of smart metering between markets parties involved. Energy savings and an improved security of supply are the major drivers and deems in smart metering as huge targets of a nation. The Smart metering system will monitor the consumed power in particular home and transmitted via PLCC . In EB Server Section, Easily we will monitor the home section data and control the load via PLCC then we can easily to controlling via PLCC modem using Smart Metering system we can avoid Wrong Power Usages

Nitesh Kumar Jangir (2012) gave 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.

Prasad P. Telharkar et al. (2015) describes that home power consumption tends to grow in proportion to the increase in the number of large-sized electric home appliances. An embedded system without any new additional wiring has been developed for home power management. By using Power Line Communication (PLC) technology, electric home appliances can be controlled and monitored through domestic power lines. We describe a PPCOM (PLC Power-Controlled Outlet Module) which integrates the multiple AC power sockets, the power measuring module, the PLC module and a microcontroller into a power outlet to switch the power of the sockets on/off and to measure the power consumption of plugged-in electric home appliances. We are also designing an embedded home server which supports the Web page user interface, thus allowing the user to easily control and monitor the electric home appliances by means of the Internet. In addition, the field experiments reported have demonstrated that our design can be practically implemented and provides adequate results.

Purnendu Shekhar Pandey et al. (2012) proposed a general and technical orientation on the one of application of "Power line Carrier (PLC) Communication Systems" with scrolling message on LED/LCD with keyboard facility in real time with the presentation of a widespread and detailed analysis on the standards, characteristics, technologies, products and development associated and currently being deployed in the PLC communication systems. Since the developments and research on the subject had been relatively new in India and information scattered, the lack of collective information had been the primary Initiative behind this research. Power Line Carrier (PLC) is still widely used to provide real-time communications for protection of high voltage transmission lines. This PLCC module provides bi-directional halfduplex communication over the mains of any voltage up to (220-250)V AC and for frequency 50 Hz or 60 Hz. Usually modules is in receiving mode all the time attending to incoming communication on the power line. This application gives serial data to transmit on its RX-IN pin, it switches over to transmit and transmits the data through power line. Once transmit process is complete it switches back to receive mode. During transmission of data by Red LED indicates user that data is transmitting. At the receiving end receipt data indicated by Green LED which is on TX out pin itself. Data communication of the modules is clear to user's data terminals and protocol self-determining; as a result, multiple units can be connected to the mains without affecting the operation of the others. In this we can connect the PLC modem to the Atmega 16 controller and then program it and simulated with ISP connector and then at last connect PLC system to the AC power plug.

S.Venkatesulu et al. (2014) presented in this paper a digital data transmission/reception via power lines. The Power line communications uses the existing power line infrastructure for communication purposes. This technology is preferred over other communication technologies like Satellite, Wireless and Optical fiber communications due to wide availabilities of power lines as Power lines are one of the most widely available communication medium for PLC technology and also it is already existing infrastructure. Finally we describe a communication strategy that eventually could be used for information transfer over the power-line communication channel. The advance power line communication system is to establish communication in remote area with High data rate and less cost.

Sanjay Belgaonkar et al. (2012) describes smart Lighting is a lighting technology designed for energy efficiency. It includes high efficiency fixtures, day lighting and automatic controls that make adjustments based on conditions such as occupancy. This smart lighting system is connected through power line which is also used for communication. Power Line Communication (PLC) is a technology which uses power lines as physical media for data transmission. PLC can offer a "no new wires" solution because the infrastructure has already been established. PLCs are used for transmitting data at rapid speed through a power line in a house, an office, a building and a factory etc. Here, the existing alternating current (AC) power wires serve as a transmission medium by which information is relayed from an AC source. Present paper deals with design and development of a smart lighting system which is controlled by MSP430 microcontroller and power line communication.

Vivek Akarte et al. (2014) constituted 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 power line carrier are very significant in signal propagation. The power line modem uses the power line cable as communication medium. It is convenient as it eliminates the need to lay additional cables. The modem at the transmission end modulates the signal from data terminal through RS-232 interface onto the carrier signal in the power line. At the receiving end, the modem recovers the data from the power line carrier signal by demodulation and sends the data to data terminals through RS-232 interface.

Conclusion: 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.

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