

POWER LINE COMMUNICATION SYSTEM

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Abstract –

Power Line Communication System (PLCS) is an emerging technology that utilizes existing electrical power infrastructure for data transmission. Devices can exchange data and access communication via the power grid thanks to its ability to provide communication across power lines. This approach has many benefits, including as cost-effectiveness, quick implementation, and broad availability without out the need for additional cabling. Smart grid management, home automation, industrial control systems, and Internet of Things connectivity are just a few of the fields in which PLC has found use. This abstract provides an overview of PLCS, highlighting its benefits, challenges, and key technologies. It also discusses the potential of PLCS in transforming power distribution net-works into intelligent and interconnected systems. Additionally, emerging trends and future directions for PLCS research and development are explored, emphasizing the potential for enhanced reliability, speed, and efficiency in data transmission over power lines. This paper proposed a two-way communication from source to load sides using BPSK (Binary phase-shift keying) and QPSK (Quadrature phase-shift keying) modulation techniques. Monte Carlo simulation is used to predict the transformer theoretical channel AWGN (Additive White Gaussian Noise) and compare the efficiency of the proposed methods. To compare the performance curve, randomly chosen data with sizes ranging from 10 k to 50 k are employed.

Key Words: Transformer, Transmission line, Arduino nano, ATmega328p

1. INTRODUCTION

To send electric power from a little to endless sources and sinks on the repeat extent of 50-60 Hz electrical links were plan. Electrical links are ordinarily requested into high, medium, and low voltage organizations. Electrical link media interchanges, or electrical link frameworks organization (PLN) uses the flow electrical association for correspondence from the structure. So, the cost of foundation is lower lesser than other correspondence systems and the openness of correspondence organization can be any place outlets exist. Electrical link correspondence is an emerging home association advancement that grants purchasers to use their by and large existing wiring system to relate home devices and to the Internet. For correspondence purposes there are electrical power supply network is used in power line correspondence. PLC is also used in inside electrical foundation inside constructions and homes knows as in-home PLC for various

correspondence applications. PLCS modems are used to make correspondence in power supply networks supply. The data signal from standard specific contraptions, (PC, telephone) is changed over a PLC modem in a design that is fitting for transmission over electrical links. Nevertheless, to give higher data rates PLC network needs to work in a repeat scope of up to 30 MHz power line progressed ally line (PDSL), mains correspondence. PLCS are network produces electromagnetic radiation and upset various organizations uses working in a comparative repeat range.

2. Work Methodology

A PLC transmitter ought to be planned appropriately to upgrade the sign against an antagonistic climate. The transmission line medium is viewed as a hurtful climate against advanced information. This is on the grounds that electrical cable transmission climate may contain stray signs as heartbeats that could be uproarious at the collector side. These heartbeats may meddle with the sent signals and make an undesirable mutilation that upsets the activity of the framework. In this way, baseband transmission of information is in effective and henceforth one of the advanced tweak methods should be utilized to acquire resistant information structure and to ensure safe transmission measure. A basic square outline of a PLC transmitter is appeared in Figure 1. A fundamental PLC transmitter comprises of five principle sub-organizes: an information source, channel encoding, UC, an advanced modulator, and an interfacing circuit. The transmitter work is to regulate the information signal utilizing one of the computerized tweak procedures and afterward to stack it to the electrical cable organization. Tweak is generally utilized on the grounds that it gives a solid but straightforward framework. Regulation is an extraordinary instance of ASK (Amplitude Shift Keying) adjustment, where no transporter is available during the transmission of a zero. An interfacing circuit is utilized to confine the 220V/50 Hz from the low voltage climate. A PLC beneficiary is associated with the electrical cable organization through an interfacing circuit

3. Block Diagram

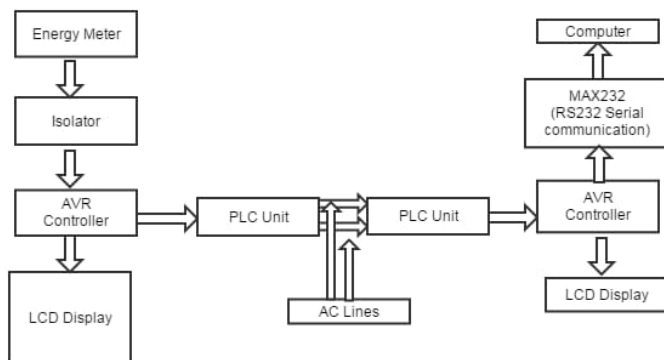


Figure 1 Block Diagram

4. PLC transmitter

The proposed PLC transmitter is shown in Figure 4 and consists of the PIC 16F876 which is used as a data source and data synchronizer, an OOK modulator, a power amplifier and an interfacing circuit. Data levels between the PLC and the PLC modulator are converted using a level converter, an operational amplifier that functions as a basic comparator.. a schematic of the proposed transmitter circuit. The inter-facing circuit used in both the transmitter and the receiver.

Critical parameter selections have been made based on best output results and working experience in order to reduce the impact of the distortion problem. The chosen carrier frequency (f_c) must be much greater than the data baud rate and stable. Therefore, an oscillator was built using LM566CN voltage-controlled oscillator to produce a rectangular waveform with frequency of 140 KHz which is much greater than the used data baud rate (500 bit/s). Since a rectangular waveform produces better distortion performance, it was chosen. An interfacing circuit that includes an LC resonant circuit after power amplification supplies the current level required to load the modulated signal to the power line. Drive the interfacing circuit. The power amplifier was designed using the C3039 power transistor. The C3039 power transistor is usually used for high voltage, high speed applications, especially in inductive circuits. The 220 V/50 Hz is isolated from the PLC transmitter's low voltage environment by the interface circuit. Additionally, the high voltage spike caused by switching is suppressed by the interacting circuit..

5. PLC receiver

In the suggested PLC receiver, a preamplifier is used to first amplify the received signal.. Then the amplified signal is entered to the plc module, which recovers the original data. The microcontroller receives the received data and transforms it from serial to parallel. The receiver is isolated from the 220 V/50 Hz environment using an interface circuit that is comparable to the interface circuit used by the transmitter. Figure 7 shows a block diagram

of the suggested PLC receiver, and a schematic diagram of the receiver circuit is displayed. The Plc module/demodulator

circuits were designed using a basic logical AND gates proceeded by level converters used to interface TTL to CMOS of the PIC and the OOK modulator. An operational amplified that operates as a comparator was used as a level converter. When logic HIGH is higher than 8 V and logic LOW is lower than 2 V, the comparator changes the data levels to different levels. The carrier signal used in modulation was obtained using an voltage controlled oscillator.

3. System testing and results

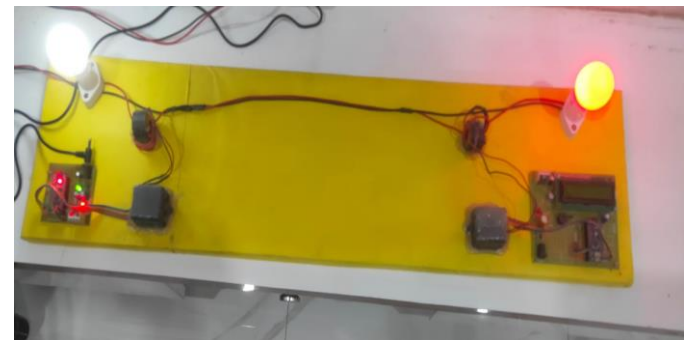


Figure 2: Modal Prototype

6. Result

PLC is a technique that allows exchange of data by means of electric power supply network that are presented in every dwelling, office and in every building. This gave us an understanding of the standards, noise, and channel as well as the use, benefits, and drawbacks of PLC technology. This document aims to provide an overall understanding of the topic in concise and quick way to the reader and researcher in the power line communication. In this we find PLC is attractive research area many studies are still necessary to be better understand and improve the performance of power line for high bit rate transmission .

7. Conclusions

The strength to enable the message signal to travel farther, its strength should be raised. Modulation is crucial in this situation. The primary purpose of modulation is to increase the signal's strength without changing the carrier signal's properties. PLC is a strategy that permits trade of information through electric force supply network that are introduced in each abode, office and in each building. In this we came to think about the application, benefits and detriments of PLC innovation and acquired some thought of the guidelines, commotion and channel. We trust this paper gives a general comprehension of the point in brief and speedy manner to the pursuer and specialist in the electrical cable communication. In this we discover PLC is appealing exploration region numerous examinations are as yet important to be better comprehend and improve the exhibition of electrical cable for high digit rate transmission We have planned a straightforward and dependable PLC framework. The framework accomplishes the necessary requests of steadiness, dependability, and exactness. The framework was tried during numerous long periods of constant activity, and it was tracked down that the communicated signal experienced low degrees of commotion and twisting. The framework can be carried out utilizing off the rack segments and can be utilized for low

information rate applications, for example, meter perusing and controller applications.

8. Future Scope

The proposed future work can be expanded in a variety of ways.. Gyroscope and Accelerometer can also be used together for human activity recognition using machine learning. Blood pressure to determine if a soldier is in distress or not, a sensor and an electrodermal activity sensor can be used in tandem. A suitable and better routing algorithm can be used to make this system more reliable and energy efficient. Every aspect of the soldier's environment will be surrounded by ubiquitous computing, which combines computational and physical infrastructures to create a whole new integration. Hundreds or perhaps thousands of sensors and computing devices will proliferate.

9. References

- [1] Xavier Carcelle, Power line communication in practice.
- [2]ETSI, www.etsi.org/WebSite/Technologies/Powerline.aspx
- [3] Galli, S., the Inter Inter-Co-PHY Protocol (IPP): A Simple Co Existence Protocol. IEEE International Symposium on Power Line Communications, Dresden, Germany, 31 March 2009.
- [4] Galli, S. & Oleg, L., Recent developments in the standardization of power line communications in the IEEE. IEEE Communications Magazine, pp. 64–71, July 2008..
- [5] Mains Network, http://en.wikipedia.org/wiki/Mains_network.
- [6] Galli, S., the Inter Inter-Co-PHY Protocol (IPP): A Simple Co Existence Protocol. IEEE International Symposium on Power Line Communications, Dresden, Germany, 31 March 2009.
- [7] Galli, S. & Oleg, L., Recent developments in the standardization of power line communications in the IEEE. IEEE Communications Magazine, pp. 64–71, July 2008.
- [8] Mains Network, http://en.wikipedia.org/wiki/Mains_network
- [9] IEEE P1901, Draft Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications, PUA and UPA contribution to IEEE 1901 call for submission on BPL access requirements Functional and Technical Requirements, pp. 1–41, February 2006. Online www.upaplc.org

- [10] Sathya, R., Broadband over powerlines: a rapid way to join the knowledge society. Africa/Middle East Next Generation Network Summit, Johannesburg, South Africa, 17–19 February 2008. Online www.ist-powernet.org