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International Journal of Engineering Researches and Management Studies

DIGITAL COMMUNICATION USING POWER LINE COMMUNICATION

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ABSTRACT

Power-line communication which is also known as power-line carrier, power-line networking carries data or signals on a conductor. It provide us help to share information or transfer data from one place to another place. Advantage of using power-line as data transfer is that every place, every building every office have power-line and connected to power-grid. Also it is easier to use AC electrical wiring than others because these AC wires are more secure, more reliable and inexpensive. First power-line have been considered electrical power. For deliver the service at less cost and better performance service provider use power-line communication now.

Keywods:- *Power-line communication, modulation, network, Baseband.*

I.   INTRODUCTION

Power-line communication is one of the major communication technique which is more reliable and available at every place and available for different application. We use Different power-lines at different frequencies. Power-line communication mainly used for telecommunication, other communication of digital media. Digital or analog signals are mean to use transmitting information from one place to another. For moving information we modulate information. We have several modulation techniques like amplitude modulation, frequency modulation. The unit performing modulation is called modem. Here power-line works as communication channel for data transfer.

II.   Data Transmission

Analog, digital formats are mean for moving the information across any medium.

A. Baseband Digital Signal

If signal has a spectral non zero magnitude for frequencies and also negligible for everywhere. Here are various methods for coding- a. Line Coding b. Multilevel Line Coding c. Clocking (Network synchronization).

a) Line Codiing-

In this we represent binary numbers in a serial-bit signaling format which we call line code. If wave from returns to '0' we called it return-to-zero (RZ) else it is non-return-to-zero (NRZ).

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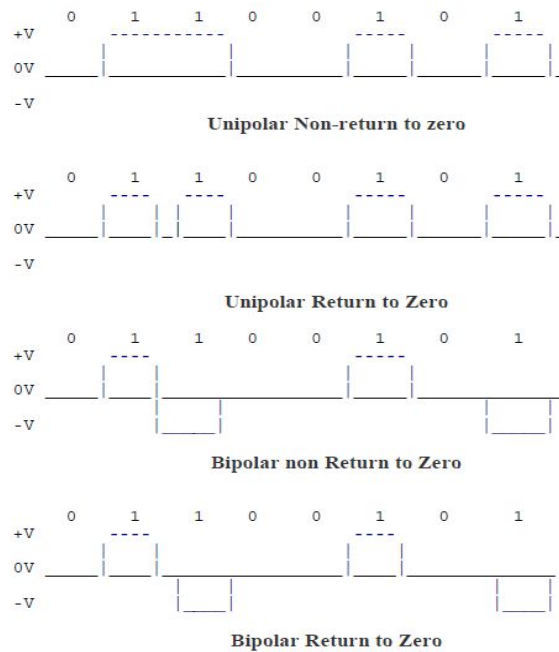# International Journal of Engineering Researches and Management Studies

Fig 1-Comperision for Digital waveform

We further classified waveform in different categories as following-

- Unipolar signaling- high voltage level represents binary number '1' and low voltage represents binary number '0'.
- Polar Signaling- we have same magnitude's signal. Positive voltage level presents by binary number '1' and negative voltage level represents by binary number '0'.
- Bipolar signaling- binary number '1' is represented by alternative positive voltage level and negative voltage level, while zero level represents binary number '0'.
- Manchester Signaling- Binary number '1' represented by positive half pulse and negative half pulse respectively. Binary number '0' for opposite of this.

b) Multilevel line coding-

Multilevel signal is a signal which has more than two values. Signals are converted to multilevel signal for reduce bandwidth so that we can modulate carriers, providing narrow bandwidth.

c) Clocking (Network Synchronization)-

These are clock types signals which is necessary for reciver to detect the data.there are many types of synchronisation for digital network. We usaully need followings-

- Bit sync
- Frame sync
- Carrier sync

B. Modulation Techniques

A carrier signal that varies with the message signal its mean this is the process of modifying our interested signal into other manner so that we can use it in easy form. There are many ways in which a radio carrier can be modulated to a carry signal, each one has advantage and disadvantage.
Modulation of two types are following-

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a) Analog Modulation

For a sine waveform we can alter three parameter – amplitude, frequency and phase. So we can further classified this analog modulation in three types-

- Amplitude Modulation (AM):   as the name says this modulation involves modulation in amplitude or intensity of the signal. Overall amplitude of the carrier is modulated. AM modulation is simple to implement, can be demodulate easily and AM receivers are very cheap. It has also some disadvantages like it is not so efficient in term of use of bandwidth.

- Frequency Modulation (FM) - this is special case of signaling. Angle signal is represented by-
$$s(t) = A_c \cos[w_c t + \theta(t)]$$
  For Frequency modulation, the phase is proportional to m(t):

$$\theta(t) = D_f \int_{-\infty}^{t} m(\sigma)d\sigma$$

  Modulator combine the carrier with baseband signal to get transmitted signal.
  Frequency is used for FM radio signal, the sound channel for Tele-communication and mobile communication.

- Phase modulation: in this type of modulation phase of the carrier signal varies in accordance to message signal. We see here that when phase changes, frequency of the signal also changes, so phase modulation comes under frequency modulation.

Types of Analog Modulation
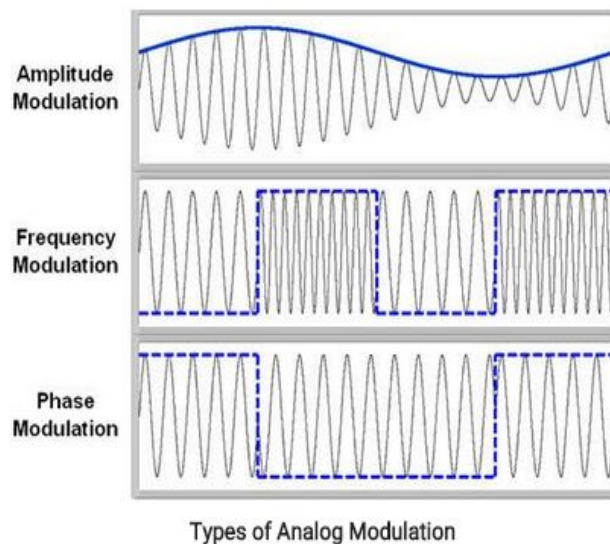
C. Digital Trnsmission of the signal

Form modulation we do digital transmission which is analog transmission of digital information. We get multilevel lines which describes modulating signal of our input signal. Basic modulation methods are: 1. amplitude-shift modulation, 2. frequency-shift modulation, 3. phase-shift modulation.
- Shift Modulation- In phase shifting modulation, phase of the signal is shifted according to their previous phase of the signal. We use amplitude shift in fiber optics technology in which light on means full amplitude and light off means zero amplitude.
- Bit rate and modulation rate- as the word Bit rate shows number of ones and zeros transferred in per second. But the number of possible stages in unit time is modulation rate.

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- Modulation Combination- many times in many devices we use combination of these above. As combination of amplitude-modulation and phase shift modulation is called quadrature amplitude modulation (QAM). Advantage of QAM in this we have more bits per Harts.

D. Uses as various types

a) Home Control (Narrow Band)
For home automation we can use power-line communication for digital communication. Home automation device operates at 20 to 200 kHz frequency. The carrier is modulated by digital signals.

b) Low speed narrow-band
System operates at high power lines with frequency 15 to 500 kHz. Baby alarm was based on low speed narrow band system. After this ripple carrier signaling came which was based on medium voltage and low voltage. An application remote meter reading was based on this. One more application is control which were mostly home appliance also meters, switches, heaters etc. there are also other applications which use main supply for telemetry. In many countries people monitoring system for monitor activities of the people on TV or other media devices, uses power line communications system as the data path between devices to see these people activates in rooms in a house while data concentrator or data checker is connected to a telephone modem.

c) Medium speed narrow band
In this distribution line carrier system uses frequency range 9 kHz to 500 kHz which include data rate 576 Kbit/s. Some project also based on this which include Real time energy management using this system project was also based on this. It was introduced in 2003 by the European Commission which ran till 2006..

d) Transmitting Radio Programs
Sometimes radio programs used power-line communication system, but it is no longer in use now.

e) High frequency (>=1MHz)
In High frequency communication system we either use large part of the radio signals or radio band or this can use narrow bandwidth.

f) Home Networking (LAN)
PLC system is also used in home networking as in interconnect home computers, entertainment devices which have Ethernet ports. Sending files between home networks is also easier than copying and running to the other computer to use the file. Basically in Ethernet cable there is connection of electric wires which have color coding. So here we see digital communication via some wires.

g) Broadband over Power-line (BPL)
This system allows us to transfer two-way (which support both ways to transmit) data with the distribution wiring in the city areas. This technology uses short wave and low-band frequencies and works at batter speed which is between 500 Kbit and 3 Mbit per second, which is similar to DSL (Digital subscriber line). In this silicon chipset are used to handle the big data and also these can handle power noise on a wide spectrum.

h) Automotive uses
- Communication of music, videos or other media in vehicles became possible because of this power-line communication. DC current of battery is used for this communication.
- Sensor supply is also based on power line communication.
- Flex ray also based on redundant transmission.
- Benefit of this, this is low cost and reliable communication system. There are many prototypes which works on this.

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III. CONCLUSION

Power-line communication helps us in communication system in many ways. This communication follows some steps as format of the system, modulation and then transfer of information. Other steps are detect data, decoding also comes in this communication system. Today digital communication based on power-line communication is used in various areas such home networking, broadband connection, LAN and other automotive devices. With the Power-line communication technology we have reliable system with less wires and less connectors.

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