Design of an Electronic System for Internets of Things (IOT) using Power Line Communication

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Abstract— This paper,' Design of an electronic system for Internets Of Things Using Power line communication' discusses the communication of electronics devices over existing power line system in a building. Power Line Communication (PLC) is a communications method where signals are carried across already existing power lines, rather than through other mediums such as optical fibers or radio waves. PLC has been a very important interdisciplinary topic for power, communications, industrial and automation engineers and researchers since 1980s. The benefits are obvious: valuable additional uses without the need for expensive infrastructure investments. PLC promises to be an enabling home network technology due to its ability to deliver data over existing power lines in homes. The paper aims to thoroughly explore the theoretical and practical aspects of power line communications (PLC) techniques to research and design a working PLC and on/off control system for IOTs.

Key words: Power Line Communication, PLC System Model, IOT, Web of Things, Industrial Automation, Home Automation, X10

I. INTRODUCTION

In recent years, considerable attentions have arisen over the Internet of Things (IoT) technology and its applications. An IoT [1,2] is a network which consists of a variety of smart devices, such as radio frequency identification (RFID), infrared sensors, Wireless Sensor Networks (WSN), global positioning system (GPS), laser scanners and the Internet to sense and identify physical world [3-4]. IoT describes a world where just about anything can be connected and communicate in an intelligent fashion. In other words, with the Internet of Things, the physical world is becoming one big information system. IoT devices can be used to monitor and control the mechanical, electrical and electronic systems used in various types of buildings (e.g., public and private, industrial, institutions, or residential).Home automation systems, like other building automation systems, are typically used to control lighting, heating, ventilation, air conditioning, appliances, communication systems, entertainment and home security devices to improve convenience, comfort, energy efficiency, and security.

Home automation, Industrial automation and home security is also a major step forward when it comes to applying IoT. All these advances add to the numerous list of IoT applications. Now with IoT, you can control the electrical devices installed in your house while you are sorting out your files in office. Your water will be warm as soon as you get up in the morning for the shower. All credit goes to smart devices which make up the smart home.

Industrial control and home automation has rapidly been gaining popularity for the past decade. Powerline Communication, a new technology that sends data through existing electric cables alongside electrical current, is set to turn the largest existing network in the world, the electricity distribution grid, into a data transmission network. PLC will make it possible to interesting solutions both industrial control and home automation requirements including phone surf the internet over power lines. Long-distance monitoring of alarms and air-conditioning systems, comfortable control of intelligent household appliances and off-site readings of electricity meters will all become feasible-simply via the power grid. The IoT technology has led to many novel and fascinating applications in the scenarios of medical care, energy grid, industry control, precision agriculture, intelligent transportation, and so on. One of the most fruitful areas of IoT research has focused on its applications in smart grid [6].

II. PROPOSED MODEL

To use the design and implement a power line communications system that connects a Master Side circuitry and the receiving circuitry (slave) and moreover one should be able to transmit command over the power line to switch on/off an electrical device (IOT). Here for line interface between AC mains power line and the embedded hardware system we use a power line modem. Power line modem is useful to send and receive serial data over existing AC mains power lines of the building. It has high immunity to electrical noise persistence in the power line and built in error checking so it never gives out corrupt data. The modem is in form of a ready to use circuit module, which is capable of providing 9600 baud rate low rate bi-directional data communication. Due to its small size it can be integrated into and become part of the user's power line data communication system.

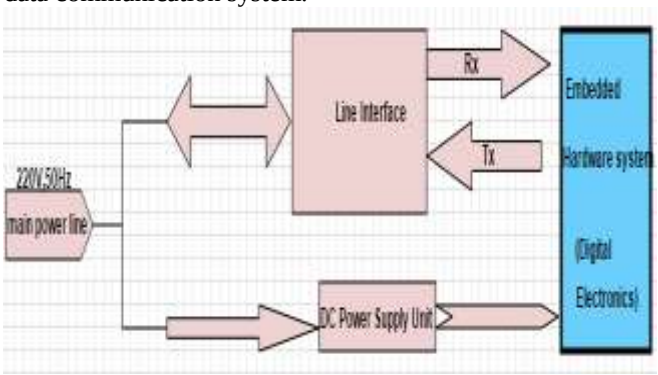

Fig. 1: Block Diagram of Transceiver for Power Line communication

III. DESCRIPTION FOR PROPOSED MODEL

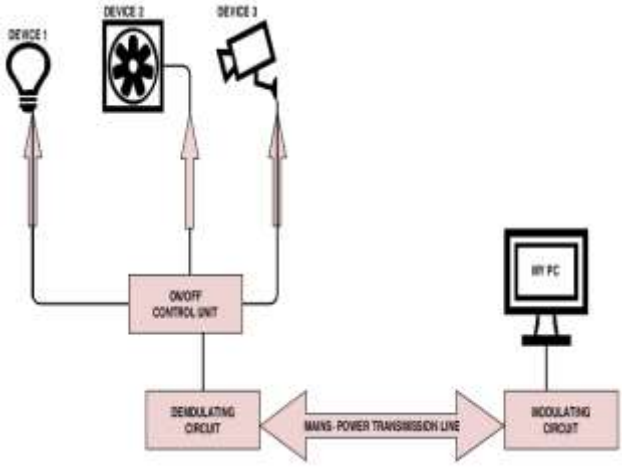

Fig. 2: Proposed Model

The block diagram shows a personal computer (pc) used for communication and device control connected through the powerline, which is the communication channel. Since the communication is simplex, one pc is connected through modulator and on other hand the Slave circuitry is connected through demodulator to the power line. The scheme of modulation and demodulation used is FSK as it is inherently immune to noise which is an important property as notoriously bad channel that has been developed without regard for any communications considerations. The pc connected through modulator to the power line transmits data and Slave circuitry with demodulator receives data. Here the devices to be controlled by the transmitter pc are connected through the I/O card of the receiver. The transmitter pc sends command to the receiver to on/off or controls any specific device.

In our system we use the X10 protocol. The advantages of using the X10 protocol is that all the components are designed to work with the existing power lines. X10 products are available from a number of manufacturers, and the range of devices that are available provide a variety of applications that can be achieved using simple plug-in or wire-in modules[5].

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. Thus in this manner we can controlled remotely various number of electrical or electronics devices (or Internets of Things) over power line with the use of this system.

IV. CONCLUSIONS

In this study, PLC system is modeled and simulated. This paper is based on power-line communication i.e. communication over the existing power-lines. The main advantage of this kind of communication system is the existing infrastructure, which simplifies the implementation. This paper definitely brings to surface the tremendous potential in using the power line as a data communication link. In this, some major applications may drive the Power Line Communication (PLC) technology. They are:

Automatic Meter Reading (AMR) – For the readings of Electricity, Water, Gas or any other meters in the customer premises to be transmitted to a central base station for further processing, billing etc. With tens of millions of meters to be read periodically and regularly, this alone represents an enormous market.

Home Bus- For making the buildings "Intelligent", where all appliances are to be monitored or controlled continuously and automatically for convenience comfort, safety and energy - saving. This makes use of the intra-building wiring.

Distribution Automation, and Supervisory Control and Distribution Automation (DA and SCADA) – This is for the utility companies themselves to monitor and control the Power Distribution Process.

Rural Communication Applications - Where user densities are low and distances are large which makes installation of fresh infrastructure expensive and also non-profitable.

Powerline Carrier Communication Systems are a preferred choice over Wireless or other Home Networking technologies due to factors including ease of installation, availability of AC outlets, higher throughput, low cost, reliability and security.

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