

# Automatic Load Control using PLCC Technology

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**Abstract** – Single-phase induction motors are mostly used in home appliances and Industrial control because of their low cost and reedy construction. Many industrial processes need variable speed drives for lots of applications. This paper investigates the speed control performance of single-phase induction motor using microcontroller18F2520. SPWM technique has been employed in this H-BRIDGE inverter to provide the motor with ac voltage. The PLC modem which generates the analogue output signal for corresponding button pressed using key pad and then this analogue output is fed to PLC modem (transmitter) and sent through the power line. At another end, plc receiver picks up the signal and send it to the signal decoder, there the decoding takes place and data is given to the Micro controller.

**Key Words:** ATMEL microcontroller, PLCC Technology, PWM pulse, receiver, transmitter.

## 1. INTRODUCTION

Automation essentially involves leveraging the power of technology to reduce the dependency on human presence and decision making for any process. It leverages different electronic equipment to control different parameters of any process. It is prudent to save energy in every way possible. It is paramount to make such systems as easy to use as possible so that people can use their appliances in a smarter way to save energy. It also enables people to be more energy conscious by enabling them to have a real time status of electric appliances. Power Line Carrier Communication, is an approach to utilize the existing power lines in the house or office for the transmission of information. 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.

Most of them require rewiring or connecting every appliance to a central unit, for example the systems which use Ethernet. This escalates the cost and deters users from using such systems. RF, Bluetooth based automation systems have limitations in being employed in areas which have concrete walls and surroundings. The purpose of the system is to provide convenience to the user and also to reduce power consumption and save energy. 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.

Power lines were originally devised to transmit electric power from small sources to large sinks in the frequency range of 50-60 Hz. Initially, the first data transmissions over power lines were primarily done only to protect sections of the power distribution system in case of faults. In such an event, the fast exchange of information is necessary between power plants, substations.

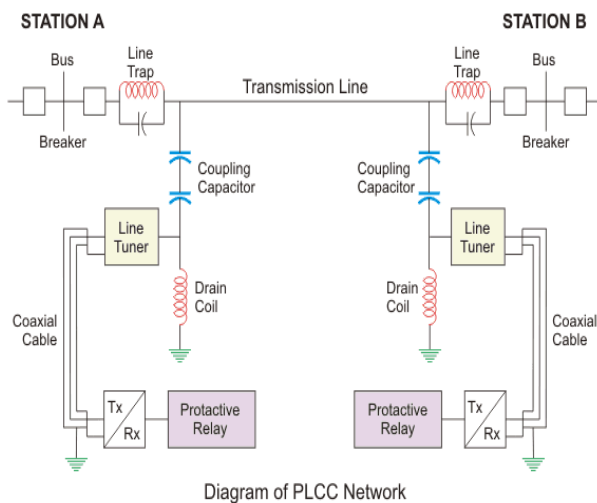
Some islanding prevention methods lose effectiveness in the multi-inverter case in which a large number of DERs are connected to the PCC. For example, impedance detection techniques use an output perturbation to test the impedance of the network connected to their terminals. If many DERs are connected but their perturbations are not synchronized, these perturbations can “average out” and their effect is lost. Anti-islanding can become extremely difficult if DERs using rotating generators, such as wind turbines or cogeneration facilities, are present in the island. The most effective types of anti-islanding protection, classified as “active” methods, utilize positive feedback to make the inverter unstable when the connection to the utility is lost. Most of these methods can be made to work quite well in both the single- and multi-inverter cases.

Active anti-islanding methods can also cause problems under abnormal or transient grid conditions. There are many conditions other than islanding that can cause abnormal voltages. For example, consider the switching “on” of a large load. This will cause a momentary drop in voltage amplitude. The amplitude drop could be large enough and last long enough to fall below one of the inverter’s undervoltage trip settings. If the inverter deactivates, this “false trip” is exactly the opposite of the action that would benefit the power system at that time. The importance of this problem is limited at present due to the low penetration level of DERs into grids, but at higher levels, this issue could become significant. One area of high interest

for DER deployment is in microgrids. A microgrid should be able to operate either autonomously or in a grid-parallel mode as circumstances dictate. In other words, in a microgrid, islanding is actually a design requirement when the grid is not connected.

## 2. BLOCK DIAGRAM

In the present age of Information Technology, the present focus is both on creation as well as dispersion of information. In order to be able to reach the end users for the provision of information, the popular technologies currently being used include telephone wires, Ethernet cabling, fibre optic, wireless and satellite technologies. However each has its limitations of cost and availability to reach the maximum number of users. The advantage of using electric powerlines as the data transmission medium is that every building and home is already equipped with the powerline and connected to the power grid. The power line carrier (PLC) communication systems use the existing AC electrical wiring as the network medium to provide high speed network access points almost anywhere there is an AC outlet. In most cases, building a home network using the existing AC electrical wiring is easier than trying to run wires, more secure and more reliable than radio wireless systems like 802.11b, and relatively inexpensive as well.



For most small office home office (SOHO) applications, this is an excellent solution to the networking problems. For many years, systems have been built to communicate low bandwidth analog and digital information over residential, commercial and high voltage power lines. Power line have been considered for the transmission of electricity in the past. However, with the emergence of modern networking technologies including broadband, there is a more-than-ever need for the utility and service providers to discover solutions that are able to deliver the services to the consumers at minimum cost and maximum performance. Only recently have companies turned serious attention to communicating over power lines for the purpose of data networking. The potential of power line as a powerful

medium to be able to deliver not only electricity or control signals, but even full duplex high-speed data and multimedia content, is being explored now. Since the developments in the field of power line networking is fairly new, the information is mostly dispersed and there is a lack of collective reference material that summarizes the existing technologies, available solutions and technology trends in the power line carrier communications.

Before going into the depth of technicalities, a brief introduction of the electric power distribution follows. For the discussion of this thesis, the terms power line carrier (PLC) communication systems or residential powerline circuit (RPC) or distribution line communication (DLC) systems refers to the low voltage part of the electrical power distribution network. Basically, this comprises everything attached to the secondary side of the distribution transformer i.e. the medium voltage (MV) to low voltage (LV) transformer, including the low voltage network within the consumer's/customer's premises and all the loads attached to it.

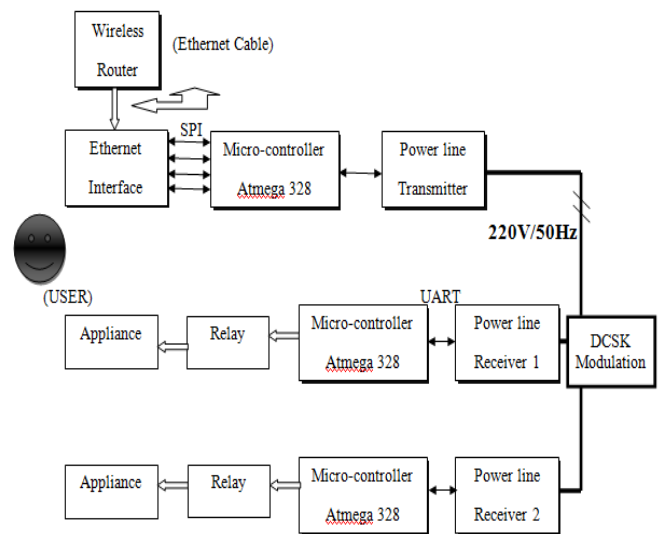


Fig. 2.1: Block Diagram of Automatic Load Control Using PLCC

## 3. METHODOLOGY

A Wi-Fi enabled device is used as means of input. An iPod Touch is used for this purpose, which provides the user with a touch screen interface facilitating ease of use. A Wi-Fi network is first setup using a wireless router. The micro-controller connects to the wireless router through an Ethernet interface card. The Ethernet interface card and the micro-controller communicate over a SPI bus. An application on the device consists of 3 buttons and 1 slider and enables us to send messages. When a user presses a particular button, specific messages are sent over the Wi-Fi network to the micro-controller which decodes the messages. The microcontroller converts these messages into simple control

signals. The commands sent by the micro-controller to switch ON/OFF an appliance are not sent directly to the appliance, but rather these commands are broadcasted over the power lines using a PLCC transmitter.

The IT800D is a system on chip solution optimally designed to provide the best performance over the Power Line medium. PLCC capabilities are added to the modem by integrating the IT800D into the modem circuitry. The IT800D handles the channel access on behalf of the modem, in addition to handling the entire communication over the power line. The PLCC modem can be configured with various communication parameters through interface.

Differential Code Shift Keying modulation technique is known for its extreme robustness and belongs to the family of spread spectrum modulation technologies. Spread spectrum modulation is a technique in which a signal is transmitted on a bandwidth considerably larger than the frequency content of the original information. Spread spectrum modulations provide many advantages they are less susceptible to narrowband and burst noises, able to work when the signal level is lower than the noise level.

### 3.1 Components used in Circuit

Arduino ATMEGA-328 microcontroller has been programmed for various applications. By using the power jack cable, arduino microcontroller has been programmed so that the execution of the program may takes place. Various kinds of arduino board are present in the market. In this paper, Arduino UNO ATMEGA-328 microcontroller is described in a detailed manner. Arduino software is installed in the computer and so that we can edit and upload the program according to the applications. Mainly these arduino software supports c and c++ programming languages. Various inputs and outputs are present in the arduino board and therefore simultaneously 8 input and output ports can be used for various applications. Some of the applications used by using arduino boards are rotating general motor, stepper motor, control valve open, etc.,

### 3.2 Power Line Carrier Communications (PLCC)

One candidate technology that seems to possess all of the desired properties is power line carrier communications (PLCC). The transmitter T, is installed on the system. This transmitter sends a signal that propagates to all lower levels of the power system. At each GPS location, a receiver marked R, detects this signal and uses it as a continuity test of the line. Since the PLCC signal provides a direct continuity test of the connection, no positive feedback or monitoring of terminal voltage conditions is required to make PLCC reliable in islanding detection. Thus, it is not necessary to use under/overvoltage or under/over frequency relaying specifically for islanding prevention. At the least, the voltage/frequency set points could be made much wider than is necessary now, so that the GPS could stay on-line and support the grid during transients. However, with a high-performance PLCC system, the GPSs

could do much more, using active controls to assist the power system in maintaining voltage and frequency regulation.

## 4. CONCLUSION

The system was tested using a Power Line transmitter and two receivers connected to appliances kept at different locations but within the same electric network. The appliances were controlled by sending specific commands to trigger the relays which were the switch link in the circuit. The signals do not get transmitted through the MCB so the signals sent from one house don't interfere with that of the neighbor's. The response to commands sent by the iPod interface had a lag of 0.6 to 1 second. Some of the challenges faced during the course of implementation of the system. Reliability of PLCC system to improve the reliability of data reaching the end receiver redundancy was introduced by sending the data twice from the Power Line transmitter.

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