Smart Power Management System Using PLCC

Sainath Misal[1], Jitendra Chaudhari[2], Shushant Sananse[3]
[1, 2] Dept of Electrical Engineeirng
[3]Assistant Professor, Dept of Electrical Engineeirng
[1, 2, 3] SKNSITS Lonavala, Maharashtra India

Abstract- *Load shedding is a way to shed load when the supply control is deficient to get together the buyer side power necessity and it is an extraordinary issue for some, nations like Bangladesh, Pakistan where add up to purchaser interest for which one of the vital particular of a tasteful electric power supply organization can't be kept up appropriately which titled as 'Reliability of Service'. Subsequently a dependable and effective intends to limit the heap shedding sum and lessen control creation cost is required. Power line carrier communication (PLCC) conveys information on a channel that is likewise utilized at the same time for AC electric power transmission or electric power circulation to purchasers. This task is to control the heap shedding based on current utilization of a client. A present sensor in customer end screens stack current. In substation end a point of confinement estimation of current that entered through keypad is transmitted through modem. The modem at the purchaser end demodulates the information and offers it to the Arduino. In the event that current goes above breaking point esteem then the Arduino work transfer to turn off the load.*

Keywords- Arduino, PLCC modem, keypad, transmission line.

I. INTRODUCTION

The project "Automated energy consumption reduction & power saving by using PLCC communication" provides the facility for the state electricity board to effectively manage the power distribution in the city. Each house will be having a control unit installed which will manage all the house hold appliances by using software programming and control. It will receive the commands from the state electricity board via PLCC module. And accordingly, it will take the necessary functions. This is very helpful for power distribution and reduction in power consumption which unnecessarily increases the load on state electricity board. The admin person from state board office will provide the command and power limit values via PLCC communication to all the users as per the current power usage. This is the new standard designed for automation and control network. The standard is aiming to be a low cost, low power solution for systems consisting of devices in house, factories and offices.

II. COMPONENTS

2.1 Arduino:

The Arduino Uno R3 is the latest version after the Duemilanove with an improved USB interface chip. Like the Duemilanove, it not only has an expanded shield header with a 3.3V reference and a RESET pin (which solves the problem of how to get to the RESET pin in a shield) AND a 500mA fuse to protect your computer's USB port, but ALSO an automatic circuit to select USB or DC power without a jumper! The Uno is pin and code-compatible with the Duemilanove, Diecimilla and older Arduino so all your shields, libraries, code will still work. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software running on a computer (e.g. Flash, Processing, Max/MSP).

2.2 Relay:

The electromechanical relay is an output device which comes in whole host of shapes size and design and has many uses and application in electronic circuits. In this project the relay switch has a coil which is driven by the npn transistor. The coil of the relay switch gets energized due to the collector current of the transistor according to that switch gets on and off to control the water sprinkler. We can control High Voltage electronic devices using relays. A Relay is actually a switch which is electrically operated by an electromagnet. The electromagnet is activated with a low voltage, for example 5 volts from a microcontroller and it pulls a contact to make or break a high voltage circuit.

2.3 Keypad 1x4matrix 4key Membrane switch:

A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly containing numbers are called a numeric keypad. Numeric keypads are found on alphanumeric keyboards and

on other devices which require mainly numeric input such as calculators, push-button telephones, vending machines, ATMs, Point of Sale devices, combination locks, and digital door locks. Many devices follow the E.161 standard for their arrangement.

2.4 PLCC Modem:

The communication device used for the communication over the power lines is a MODEM, commonly known as Power Line MODEM (PLM). It works as both transmitter and receiver, i.e., it transmits and receives data over the power lines. A power line modem not only modulates the data to transmit it over the power lines and but also demodulates the data it receives from the power lines. By using modulation techniques, binary data stream is keyed on to a carrier signal and then coupled on to the power lines by PLM. At the receiver end another PLM detects the signal and extracts the corresponding bit stream

III. CONSTRUCTION AND WORKING

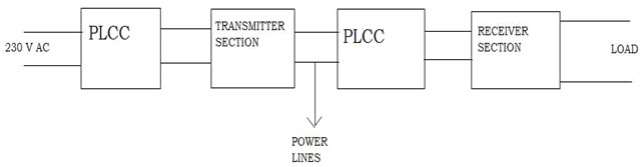

Fig1. Functional Block diagram

3.1 Transmitter Section

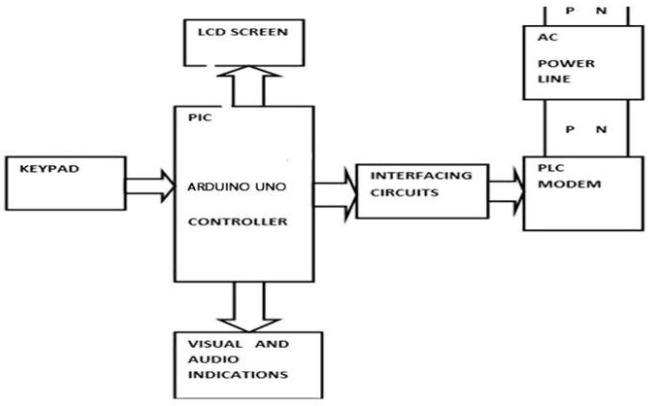

Fig2. Transmitter section Block diagram of System

3.2 Receiver Section

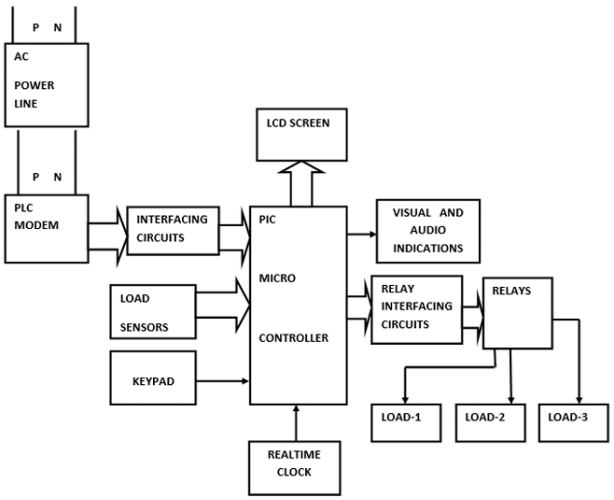

Fig3. Receiver section Block diagram of System

There are two main sections in project model one is Transmitter section and other is receiving section. Transmitter section consists of Arduino with keypad and PLCC modem. In which keypad gives the signal to the Arduino and Arduino is used to convert that signal into digital form according to given input. Arduino encodes the data and transfers digital signal to PLCC modem.PLCC modem-power line carrier communication modem is used to send and receive data through existing AC power line. It is high immunity to electrical noise persistence in the power line and builds error checking so it never gives out corrupt data. The modem is in form of ready to use circuit module which is capable of providing 9600 baud rate low rate bidirectional data communication. Due to its small size it can be integrated into and become part of the user's power line data communication. It can be directly interfaces with microcontroller UART, TXD, RXD pins receiving end section's PLCC modem collects the data from existing AC main power line and transfers digital form of data to Arduino. Arduino collects the data from PLCC modem and according to that digital signal it gives signal to two relay module, and the two relay module performs the switching operation of connected load. In this way the power management operation is carried out.

IV. ADVANTAGES & DISADVANTAGES

- In order to completely analyze the advantages and disadvantages of PLCC technology, we look into its basic application that is access to telecommunication networks. From the economic standpoint, it is very reasonable to use a pre-installed wired network instead of running new wires. It certainly reduces a lot of time & money and so is the biggest advantage of the technology.

- In many countries, PLCC is becoming a reliable high-speed source to get Internet. And in some places, especially in remote areas, PLCC technology thankfully made it possible to avail internet connections.

Power line communication is quite different in characteristics than the conventional dedicated wirings. Comparatively, it is a harsh medium.

V. APPLICATIONS OF PLCC

- PLCC technology can be deployed into different types of applications in order to provide economic networking solutions. Hence merging with other technologies, it proves useful in different areas. These are few key areas where PLC communications are utilized:
- **Transmission & Distribution Network:** PLCC was first adopted in the electrical transmission and distribution system to transmit information at a fast rate.
- **Home control and Automation:** PLCC technology is used in home control and automation. This technology can reduce the resources as well as efforts for activities like power management, energy conservation, etc.
- **Entertainment:** PLCC is used to distribute the multimedia content throughout the home.
- **Telecommunication:** Data transmission for different types of communications like telephonic communication, audio, video communication can be made with the use of PLCC technology.
- And data transfer through it can create a lot of problems. Household appliances like halogen tubes, washing machines, televisions, etc. can become prone to an unpredictable noise and interference in the transmission. Continuous plugging and unplugging of electronic devices makes power line characteristics vary constantly.

VI. FUTURE SCOPE

- PLCC modem is also used in controlling of home appliances like water pump, air conditioning, washer, cooler etc.
- It is also useful in low speed data communication networks.
- one natural application of narrow band power line communication is the control and telemetry of electrical equipment such as meters, switches, heater and domestic appliances. A no. of active development is considering such appliances from a systems point of view such as demand side management.
- Power line carrier communication is useful for various service provision such as in houses/offices, vehicles, in industry system control and advanced metering infrastructure.

VII. CONCLUSION

This project 'PLCC controlled load scheduling' is developed to control the load shedding on the basis of current consumption of each consumer. PLC modem is used for communication between substation and consumer. 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. A current sensor in consumer end monitors load current. In substation end a limit value of current that entered through keypad is transmitted through PLC modem. The modem at the consumer end demodulates the data and gives it to the MCU. If current goes above limit value then the MCU operate relay to switch the load off. By this current monitored individual load scheduling system we can efficiently reduce unnecessary load shedding for long hours in an area.

REFERENCES

[1] Aravind Chitharanjan, Sarath C M, Dheeraj E M, Ninu Joy, "POWER LINE CARRIER COMMUNICATION BASED LOAD SCHEDULING", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 04 | Apr -2017

[2] Liang Dong, Zhang BaoHui, Niu DongWen, "Virtual Carrier Based Signal-To-Noise Ratio Estimator for Medium Voltage Power Line Communication", IEEE Transactions on Power Delivery, 2011.

[3] Young-Sung Son, Topi Pulkkinen, Kyeong-Deok Moon and Chaekyu Kim, "Home Energy Management System based on Power Line Communication", IEEE Transactions on Consumer Electronics, Vol. 56, No. 3, August 2010.

[4] Pranab Biswas, Tuton Chandra Mallick, Mohammed SaifuddinMunna, Raihanul Islam, "Minimizing the Amount of Shaded Load Using Multiple Grid System during Load Shedding in Bangladesh", International Conference on Informatics, Electronics and Vision (ICIEV), 2016.

[5] S. K. Viswanath, Chau Yuen, "System Design of Internet-of-Things for Residential Smart Grid," IEEE Trans. Ind. Informat., vol. 7, no. 3, pp. 381–388, Aug. 2016.

[6] Qinran Hu and Fangxing Li, "Hardware Design of Smart Home Energy Management System with Dynamic Price Response," IEEE transactions on smart grid, vol. 4, no. 4, Dec 2013.

[7] Peter Palensky and DietmarDietrich, "Demand Side Management: Demand Response, Intelligent Energy Systems, and Smart Loads" IEEE transactions on industrial informatics, vol. 7, no. 3, page 381, august 2011.
[8] Federico Viani and FabrizioRobol, Alessandro Polo, "Wireless Architectures for Heterogeneous Sensing in Smart Home Applications: Concepts and Real Implementation", Proc. IEEE, vol. 101, no. 11, pp. 2381– 2396, Nov. 2013.
[9] A IEEE paper entitled "Design and Implementation of Control Mechanism for Standby Power Reduction" by JoonHeo