Design and Implementation of Digital Notice Board Using Power Line Communication

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***ABSTRACT*:- Power line communication is one of the emergent technologies used in a cost effective and high speed communications of digital and voice data. It has been used successfully in many real time applications. The paper proposes one such application for automating an educational institution by replacing manual notice boards or circulars by digital notice boards. With a centralized database, frequent updating is easily possible. The system uses existing power lines to send the data to a specific node or to broadcast to various power line nodes. The address is assigned to each receiver and it response based on their appropriate commands. The information to be displayed is received from the main server and at reception each node checks the password and displays it. The design consists of a PC, PLC modem, controller kit and an LCD. The proposed model with a wired communication is better than the wireless communication system.**

Keywords - PLC (Power Line Communication), PLC Modem, PIC 16F877A Microcontroller, PC (Personal Computer), LCD

I. INTRODUCTION

In educational institutions, the organization uses circulars and notice boards in order to convey information to the students. This methodology will take added time for updating and many students may not be aware of the information displayed on notice boards which are not eye catching ones. Power line communications (or PLC) overcomes the above said problems. It operates by sending high frequency signals over the power cable which already carries the electricity power. These signals can be transmitted to the power nodes under a substation unit but cannot pass through a transformer.

An NS-2 network simulator was developed for home networking based on power line communication. This process is used for end to end data communication at time varying packet error rate. Based on the PLC network condition, TCP-ACK rate was controlled [1][2]. The PLC was used in solar power system with a QPSK (Quadrature Phase Shift Keying) modems. The system had three-phase inverter based IGBT to create AC line three-phase voltages and maximum power point tracking system [3]. Hakki Cavdar et al. Presented an Automatic meter reading through Power Line Communications included in a power delivery module to detect illegal electricity usage. New digitally energy meter chip is used in the detection module and the charge of energy is stored[4]. The design of automatic meter reading in broadband carrier was introduced to overcome the drawbacks of narrowband communications. The relay routing algorithm was used to measure the rate of meter reading [5]. A home server which chains the user interface web page and PPCOM (PLC Power-Controlled Outlet Module) permits the user to effortlessly control the electric home appliances by the Internet is discussed by Chia-Hung Lien et al [6]. Microcontroller based master and slave units with serial ports of communication, to couple the modem signal with a transmission port and computer at both ends cleanly explained by Sheroz Khan et al [7]. Hitoshi Kubota et al., analyzed a technique to avoid noise from home appliances and steep attenuation on frequency response of power line. Data rate transfer having selective frequency and appropriate modulation was used to realize the robust condition [8].

The noise over a power line communication was overcome by implementing a Wigner Ville distribution (WVD) with wavelet transform methods. WVD being a real energy preserving transform provides greater resolution in time and frequency. This system is a powerful investigation tool for signal readability and time frequency localization to detect if any power line signal contains noisy information [9]. To reduce the sum of ICI (Inter carrier Interference) and ISI (Inter symbol Interference) powers in Daubechies wavelet-based OFDM system, a wavelet packet structure was used over power line communication. Based on a brute-force algorithm the operation takes place [10]. In power line communication the possibility with time-domain synchronous orthogonal frequency division multiplexing (TDS-OFDM) technology was measured. In digital multimedia communications- terrestrial (DMB-T) the TDS-OFDM core technology was implemented in [11]. Rozeha A. Rashid et al. explored and developed a protocol linking the use of power line as a data transmission

medium. The designed protocol has features such as multimode simplex communication, flood transmission and even parity error detection [12]. A test bed was developed for power line communication to operate in the 230V/50Hz power line environment. The target frequency range was nearly 1MHz to 10MHz. This approach has high channel impedance controllability, through high frequency communication signal coupling [13].

II. PROPOSED SYSTEM

A new design is built by incorporating methodologies mentioned in existing systems for implementing digital notice board in educational institutions. The data is transmitted in a selective and secure manner through the power lines. The data to be displayed is entered into the host PC (Personal Computer) using VB6.0 (Visual Basic) software. The transmitter side PLC modem connected serially with the PC, processes the data by modulating with carrier signal. The modulated signal is transmitted through A.C power line and received by another PLC modem interfaced with a PIC controller. The received signal is demodulated and the controller displays the information on the LCD. Fig.1 shows the hardware configuration of the entire system.
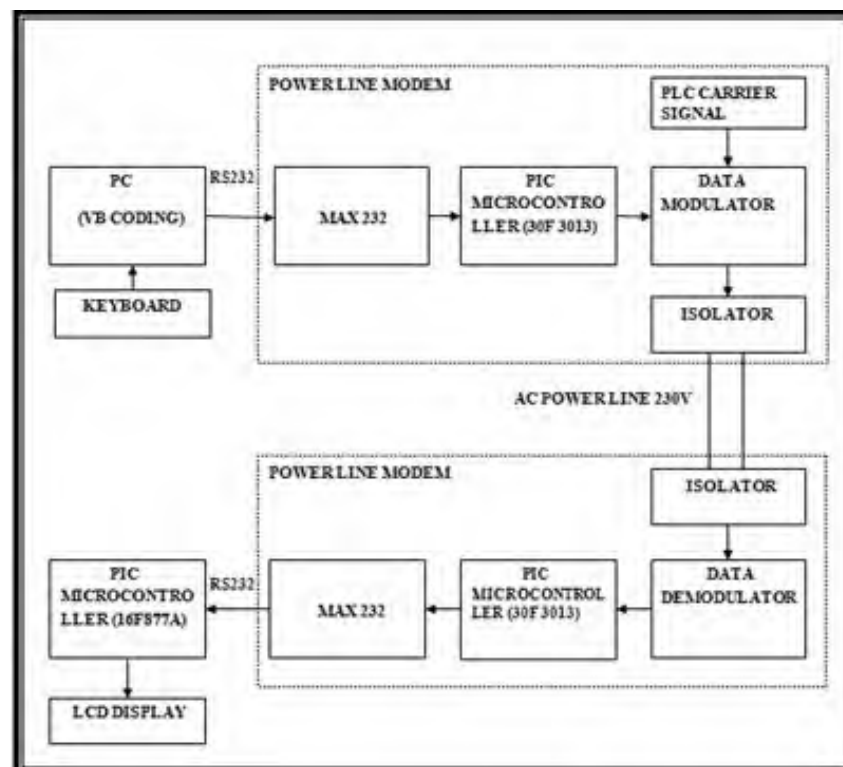

Fig.1. Entire block diagram of the proposed system

The software used for this application is installed on a PC. Input is given from it and it has the serial port connected to the transmitting PLC modem. Power line modem receives the message (character) through the serial port. Microcontroller (dsPIC30F3013) passes the message to the data modulator which uses FSK (Frequency Shift Keying) method. Signal is passed to isolator in order to protect it from over voltage and send through ac power line 230V and the receiver demodulates the carrier signal. The PIC 16F877A,which is a 8 bit, 40 pin IC having 5 ports is ideally used in low cost and low power applications [14]. This receives the decoded message and displays the character in LCD HD44780.

III. SOFTWARE DESCRIPTION

The code for PIC microcontroller is run using MPLAB IDE (Integrated Development Environment) in windows environment. To build in applications for Microchip microcontrollers and to create hex files, MPLAB IDE is used [15]. The PICKIT2 programmer is used to download a hex file in microcontroller chip [16]. Fig.2. shows the compilation screenshot.
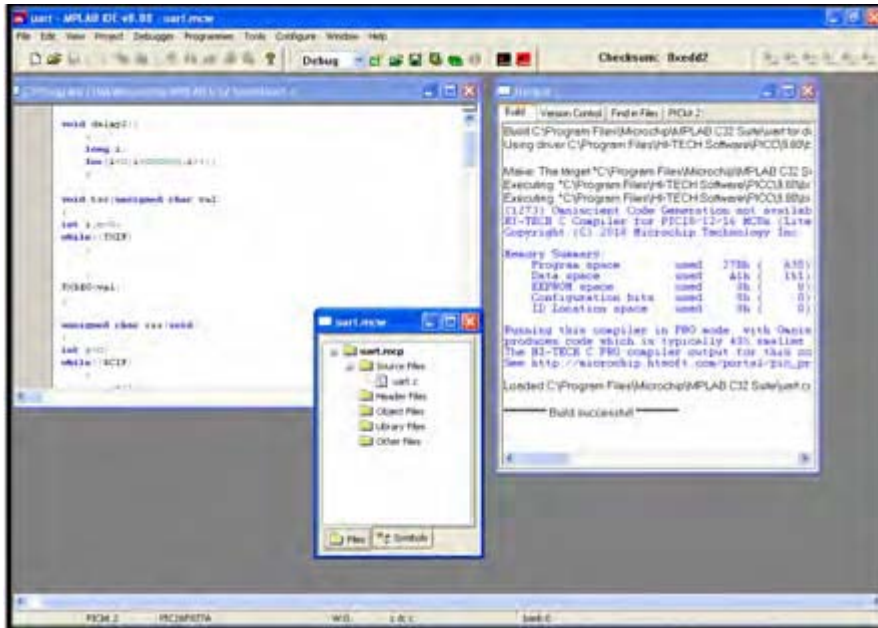
Fig.2. Compilation result in MPLAB

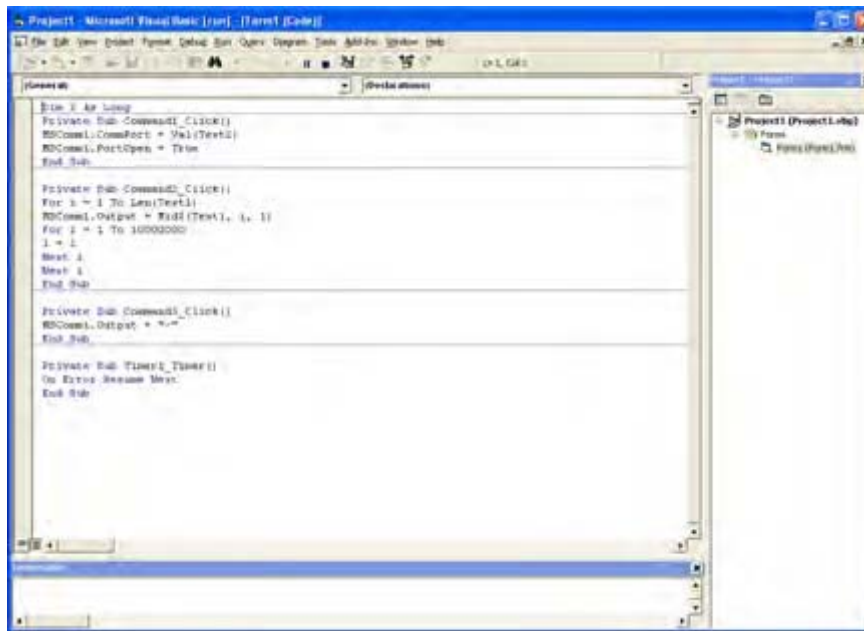The form is designed using Microsoft Visual Basic 6.0 shown in Fig.3.

Fig.3.Creating Form in Microsoft Visual Basic

IV. RESULTS

Fig.4. shows the form design in visual basic 6.0 to give input message. Fig.5. shows the entire hardware setup of the reception unit consisting of PIC microcontroller and receiver PLC modem. Fig.6. shows the transmitter and receiver of PLC modem. Fig.7. displays the entered information in LCD.

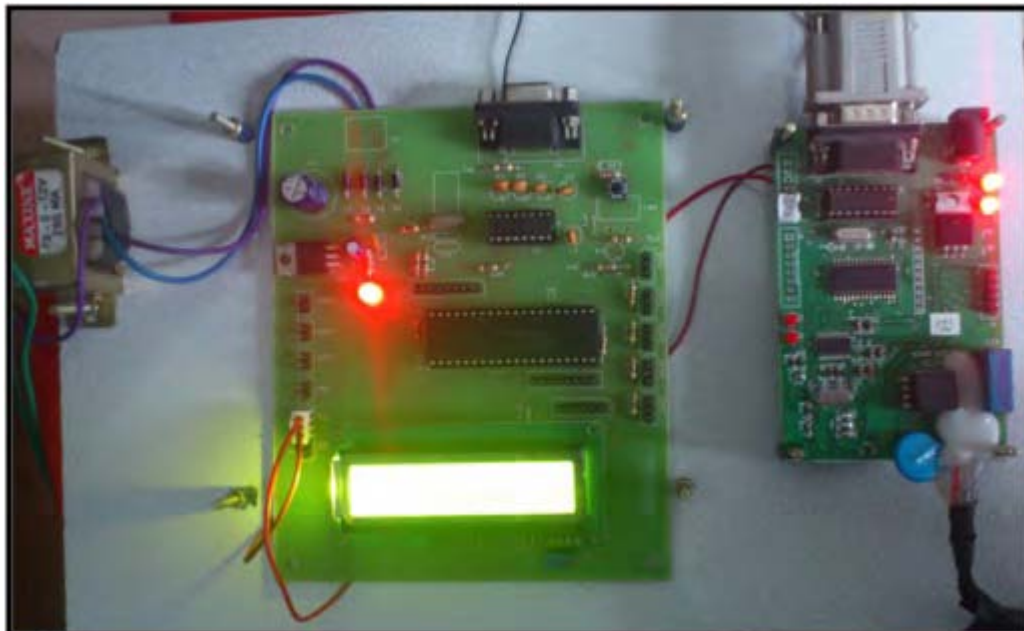Fig.4. Form design in Visual Basic
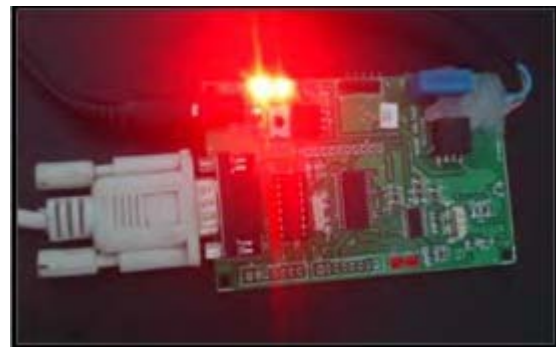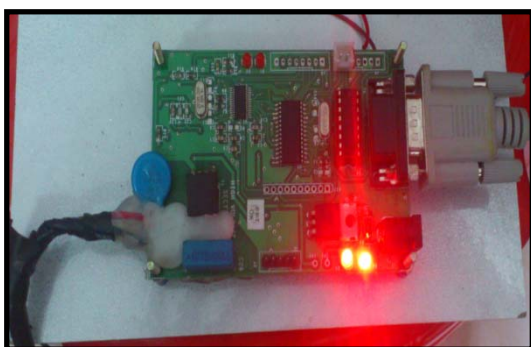

Fig.5. Hardware setup of the Receiver Unit

Fig.6. Power line transceiver modem

Fig.7. LCD Display shows the entered Information

V. CONCLUSION

The Power Line Communication (PLC) is used to deliver messages economically in educational institutions, offices, etc. The existing power line itself can be used to send/receive messages and it is highly real time oriented application. The centralized system is used to monitor the process with the help of VB software. It can be further enhanced by introducing two way communications to get acknowledgement from students.

REFERENCES

[1]   Mikio Mizutani , Yusuke Miyoshi, Kazuya Tsukamoto, Masato Tsuru, Yuji Oie, "Network-supported TCP rate control for high-speed power line communications environments", Simulation Modelling Practice and Theory ,2011, pp:69–83.
[2]   Yi-Fu Chen and Tzi-Dar Chiueh, "Baseband Transceiver Design of a 128-Kbps Power-Line Modem for Household Applications", IEEE Transactions on Power Delivery, VOL. 17, NO. 2, 2002, pp: 338-344.
[3]   Ersan Kabalci , Yasin Kabalci , Ibrahim Develi, "Modelling and analysis of a power line communication system with QPSK modem for renewable smart grids", Electrical Power and Energy Systems ,34,2012, pp:19–28.
[4]   I. Hakki Cavdar, "A Solution to Remote Detection of Illegal ElectricityUsage via Power Line Communications", IEEE Transactions On Power Delivery, VOL. 19, NO. 4, 2004, pp: 1663-1667.
[5]   Chen Ke, Qiao Chenxi, Zuo Tingtao, Hu Xiao guang , "Research of Automatic Meter Reading System Based on Broadband Carrier in the Power Line", 6th IEEE Conference on Industrial Electronics and Applications (ICIEA), 2011 pp:2763-2767.
[6]   Chia-Hung Lien, Hsien-Chung Chen, Ying-Wen Bai, and Ming-Bo Lin, Janaluddin Omar, Abubkar Hassan, Ismail Adam,"Power Monitoring and Control for Electric Home Appliances Based on Power Line Communication",IEEE International Instrumentation and Measurement Technology Conference, 2008,pp:2179-2184.
[7]   Sheroz Khan, Rafiqul Islam,Dr Othman Khalifa, "Communication System For Controlling Smart Appliances Using Power Line Communication", Information and Communication Technologies, 2006, pp: 2595-2600.
[8]   Hitoshi Kubota, Kazumasa Suzuki, Isamu Kawakami, Mamoru Sakugawa, and Hiroyuki Kondo "High Frequency Band Dispersed-Tone Power Line Communication Modem for Networked Appliances",IEEE Transactions on Consumer Electronics, Vol. 52, No. 1,2006,pp:44-50.
[9]   X. Jiang, J. Nguimbis, S. Cheng, H. He, X. Wu , "A novel scheme for low voltage powerline communication signal Processing",Electrical Power and Energy Systems, 25,2003,pp: 269–274.
[10] Volkan Kumbasar, Oğˇuz Kucur , "Better wavelet packet tree based OFDM for multipath powerline channel", Computers and Electrical Engineering, 36, 2010, pp: 397–403.
[11] Song Jian ,WU Qing, PAN Changyong , YANG Zhixing , LIU Haitao , ZHAO Bingzhen , LI Xiao "Two-Way Digital Video Transmission over Medium-Voltage Power-Lines Using Time-Domain Synchronous Orthogonal Frequency Division Multiplexing Technology", Tsinghua Science And Technology, Volume 13, Number 6, 2008, pp:784-789.
[12] Rozeha A. Rashid, Mohd Adib Sarijari, Mohd Rozaini Abd Rahim, Tan Zun YangFlood "Transmission based Protocol for Home Automation System via Power Line Communication", Proceedings of the International Conference on Computer and Communication Engineering, 2008.
[13] P. L. So, and Y. H. Ma "Development of a Test Bed for Power Line Communications", IEEE Transactions on Consumer Electronics, Vol. 50, No. 4, 2004, pp:1174-182.
[14] http://ww1.microchip.com/downloads/en/devicedoc/39582b.pdf
[15] http://ww1.microchip.com/downloads/en/devicedoc/51519a.pdf
[16] http://www.nskelectronics.in/pickit2_programmer_to_go.html