In this project, we introduce a new concept of awangi (M - Finally the wireless method sending data is feasible - Radiation). Due to its directional data communication, Communication networks in the field of electricity can prove -eghe), [n] - Selection of -eghe), [n] - Automation of Energy Meter, Power -Line Communication Based on Energy Meter Automation -Namita N. Jinde -D.M.I.E.T.R. Sawangi (Meghe), Wardha(M.S.) namita.j2692@gmail.com -Rashmi K. Bhojane -D.M.I.E.T.R. Sawangi (Meghe), Wardha(M.S.) rashmibhojane2692@gmail.com -Reetesh V. Golhar -Assistant Professor -D.M.I.E.T.R. Sawangi (Meghe), Wardha(M.S.) reetesh.golhar@gmail.com

Abstract — In this project, we introduce a new concept of Power line Communication. Here, we multiplex data into 240v power lines which provide electricity to our various devices. This method of communication opens up a broad spectrum of applications where this technology can prove useful. In this project, we try to demonstrate one application of this technology. Here we Automate the process of connection / disconnection of power supplies of various consumers, by developing intelligent power meters that are able to decode this data, which carries information about the supply status of the various consumers, based on which the intelligent power meter automatically connects, or disconnects the power supplies of these customers.

I. INTRODUCTION

Automating kilowatt-hour (kWh) meter reading has become a necessity for most energy suppliers as deregulation, freer customer choice and open market competition occur in the energy supply sector. Visual inspection of meters is time-consuming and labour intensive. A study, conducted by Eyre [1], had shown that a human meter reader could only achieve an equivalent average information rate of about 1bit/s, which is very slow. Moreover, some meters are located in places of poor accessibility that greatly increase the difficulty of reading such meters.

The scope of this project is to make use of new modern technologies and implement them into more practical fields. Our project deals with the implementation of Power Line Communication networks in the field of electricity billing. We can make use of this technology to such an extent such that even complex problems can be handled in an easier way. This type of networks can also be used for creating emergency response network. Our project eliminates the need for employing EB meter readers and this set of employers can be used elsewhere.

The amount of time spent in doing all these works manually can be reduced because of this kind of network implementation. Each household is allocated a particular id so that they can be uniquely identified. There is no chance of manipulation in our proposed system. The long queues in the billing counter can be avoided by implementing our model. This model is also cost effective, practical and efficient. The data sent by the home unit then and there is automatically stored in the back end database at the office module. So, all the data and statistics are stored in the central archives automatically just in case for future references in case of any discrepancies. This saves hours and hours of manual data entry needed for entering the data into the central system. So our module is useful in that aspect also.

Though many technological innovations are taking place in this world, existing electricity consumption billing process seems in India to be very obsolete and does not meet the latest technology available. In this project, the above said process is totally automated and the communication is made possible entirely through the power line. This communication is bi-directional at a faster data rate through long distances. By digitizing, the currently used analogue energy meter has been completely transformed to a digital one. Hence it is beneficial to the customers as the system is made very user friendly. The automated EB billing procedure has the ability of fulfilling a set of needs for the user and the EB workers:

1. The automated EB billing system eliminates the need to pay the bills at the EB office
2. This system allows the user to get updated details of the power used in his house
3. The user can also verify if the bill received is the right one or not
4. Finally the wireless method sending data is feasible even when more buildings are being built into the Network.

Identification and Selection of Hardware Components.

1) The core module: PLC 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. Features

- Transmit and Receive
- serial data at 9600 bps
- Data Tx/Rx LEDs
- Powered from 5V

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2) The Relay Module, for Switching Circuit.

We are using relay because they act as Electronically Controllable Switches. An electromagnetic coil, when energized, attracts a conductor plate, thus closing the circuit.

Note that when power is applied to the coil, it energizes and attracts the metallic plate, which is itself acting as one terminal of the switch.

Our microcontroller will give signal to switch the relay based on command sent by server pc.

3) Microcontroller board

The P89V51RD2 is an 80C51 microcontroller with 64 kB Flash and 1024 bytes of data RAM. A key feature of the P89V51RD2 is its X2 mode option. The design engineer can choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle) or select the X2 mode (6 clocks per machine cycle) to achieve twice the throughput at the same clock frequency. Another way to benefit from this feature is to keep the same performance by reducing the clock frequency by half, thus dramatically reducing the EMI. The Flash program memory supports both parallel programming and in serial In-System Programming (ISP). Parallel programming mode offers gang-programming at high speed, reducing programming costs and time to market. ISP allows a device to be reprogrammed in the end product under software control. The capability to field/update the application firmware makes a wide range of applications possible. The P89V51RD2 is also In-Application Programmable (IAP), allowing the Flash program memory to be reconfigured even while the application is running.

Features:

- 80C51 Central Processing Unit
- 5 V Operating voltage from 0 to 40 MHz
- 64 kB of on-chip Flash program memory with ISP (In-System Programming) and IAP (In-Application Programming)
- Supports 12-clock (default) or 6-clock mode selection via software or ISP
- SPI (Serial Peripheral Interface) and enhanced UART
- PCA (Programmable Counter Array) with PWM and Capture/Compare functions
- Four 8-bit I/O ports with three high-current Port 1 pins (16 mA each)
- Three 16-bit timers/counters
- Programmable Watchdog timer (WDT)
- Eight interrupt sources with four priority levels
- Brown-out detection
- Low power modes

II. BLOCK DIAGRAM

III. CIRCUIT DIAGRAM
IV. CIRCUIT DIAGRAM DESCRIPTION

Power Supply

The Power Supply part of the circuit consists of a switch, a power indicator LED and regulation components. The input supply is first rectified using a bridge rectifier, as can be seen in the circuit. The rectified output is then filtered using a R-C filter. We usually provide a 12v DC input supply. The pure DC supply is then given to the voltage regulator IC, LM7805 which regulates it and provides us with a stable 5v output voltage. We then use this regulated supply to power up our microcontroller, LCD and other ICs on the board.

Microcontroller

- All ports of the microcontroller are open, and as such we can use any port for any purpose.
- Port 0 is provided with external pull-up resistors as we are going to use this port for i/o operation on data, and not for memory addressing (port 0 is address/data multiplexed).
- An external crystal oscillator of 11.0592 MHz is connected to the clock input of the microcontroller. As such our controller will work on this clock freq.
- Port 2 of the microcontroller is also parallel hard wired to the LCD module, by default. As such, if the LCD module is used, port 2 will be used for its operation.

LCD Module

- The LCD module consists of 16 pins, most of which are hard wire shorted or grounded or given a constant 5v input.
- Only 6 pins are actively used to control the LCD, i.e. print data on the LCD. Of these 4 pins are data pins. 1 pin is a edge level triggered enable pin. Another pin is the command/data select pin.
- These 6 pins are connected to port 2 by default.

Serial Communication unit (and MAX 232 IC)

- Our microcontroller has a built in USART (Universal Serial Asynchronous Receiver Transmitter). Pins 3.0 and 3.1 of port 3 are also Rx and Tx pins of the uC.
- These pins are used to communicate with any serial device. We shall use it to communicate with the PC via the RS232 port of the PC.
- The MAX 232 IC is used as an intermediate link between the PC and the uC, during serial communication. This is required as the PC RS232 port and the uC serial pins communicate using different logic systems.
- The uC is a TTL device, and hence works on TTL logic system where 5v is digital 1 while 0v is digital 0. On the other hand the PC works on RS 232 logic system where 12v is digital 1 and 0v is digital 0. As such communication between these devices is not possible.
- The MAX 232 IC works as a Logic converter during serial communication. It converts all signals originating from the uC to the RS232 logic system and transmits them to the PC. Also, it converts all 12v RS232 logic system voltages to TTL voltages before transmitting them to the uC. As such the MAX232 IC converts the voltages bi directionally.

V. PROPOSED WORK

We propose to create such energy meters, which will have the de multiplexer or decoder circuits to decode this information. This data will then be read by an AVR microcontroller circuit also built in the energy meter. Based on the information, which is nothing but the billing status of the consumer, indicating whether he has paid his bill or not, the microcontroller circuit will trigger a relay based switching circuit, which controls the power supply to the customer.

The information will be encoded into the power stream at the source, or at the distributing local substation, by the electric company officials, by an encoding/multiplexing circuit. It will contain the information of all consumers, being retransmitted periodically. We will demonstrate this system with a single energy meter, due to budget constraints. We propose to create such energy meters, which will have the demultiplexer or decoder circuits to decode this information. This data will then be read by an AVR microcontroller circuit also built in the energy meter. Based on the information, which is nothing but the billing status of the consumer, indicating whether he has paid his bill or not, the microcontroller circuit will trigger a relay based switching circuit, which controls the power supply to the customer.

The information will be encoded into the power stream at the source, or at the distributing local substation, by the electric company officials, by an encoding/multiplexing circuit. It will contain the information of all consumers, being retransmitted periodically. We will demonstrate this system with a single energy meter, due to budget constraints.

VI. ADVANTAGES

- Remotely Connect / Disconnection of Power supply through PLCC Meter
- Ability to detect tamper events and outage occurrences
- Monitor electrical load in real time.
- System has no running cost for data acquisition.
- Reduction in manual meter reading costs.
- Reduction in late and estimated billing costs.
- Improved meter accuracy & Reduced meter maintenance expenses.
- Reduction in Revenue Protection losses
- Pre-Paid Metering can be done remotely, without requiring local smart card / Swipe Card.
VII. CONCLUSION

This proposed Automated EB model includes an office module which has a PC with its back end connected to a database. The other module is the customer home module which is present at the home this module is used to make note of the amount of power consumed by the customer and after a period of 2 months it sends the PC in the EB office. This EB office module calculates the data and sends it to the customer along with the due date. The customer also gets details of the bill on his mobile phone through which he can pay the bill. The advantages of this model are,

- Automation of all features including communication from the EB office to the customer.
- Saves data using automatic control and storage systems.
- It involves less cost to communicate.
- This system increases productivity.
- To increase n number of customers to communicate and automate.

REFERENCES


