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Ethernet based Smart Grid to for monitoring and controlling Energy sources

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ABSTRACT:

Smart meters are the key component of the smart grid which helps both the user and supplier to control consumption of energy according to availability of resources .Electricity market is facing great losses due to an increase in cost for generation of resources .The wastage of electric energy again results in economical problem, thus smart metering system has been considered as a good method to make use of energy effectively. The proposed energy metering system consists of energy meter, communication using Ethernet and web server. A single phase energy meter has been implemented using ARM microcontroller and communication part has been implemented using Ethernet communication. Server and consumer end are implemented web server. This meter is able to measure energy and will communicate the data to the electricity board.

I.INTRODUCTION

Smart grid is an electric power system which does the operations like generation,transmission and distribution of electricity.Smart grid provides a solution for electricity wastage.Smart meters are the key components of smart grid.The two way communication facility of smart meter gives real time consumption information to the users.This helps the consumers to reduce their overall electricity consumption.Smart meters provides remarkable benifits if implemented in smart grids as its two way communication acts as a gateway between the consumers and suppliers to manage their electricity consumption. For conventional meter reading system, meter reader has to go to each and every home and get the reading and record it in reading books. Also the customers have to get bill from the authority. This approach in conventional meter reading system requires more human intervention and will be time consuming one. So implementation of an automatic meter reading system is essential in commercial as well as in industrial field by enhancing both networking system and information system[1].

II. LITERATURE SURVEY

AMR is the system which collects data using one way communication. The system which has the ability to control and monitor the energy meter is AMI.The combination of both AMI and AMR will make the system smart.AMR reduces the meter cost to suppliers and bills the customer with actual meter reading. Also it allows frequent reading[2].AMR requires special infrastructers which makes the system to communicate to the server and back to customers. The communication can be wired like Ethernet or PLC or wireless like GSM or Wimax.Automatic meter reading networks are also introduced in [3],[4].Bluetooth based energy meter has been implemented to retrieve the meter reading with less human intervention[5].but it has only short range of communication.GSM and zigbee communication can also be used to

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communicate to the remote server[6]. This also have some practical difficulty while sending message from home to the central server each user has to pay cost of message and if data services fails then it will be difficult to send meter reading when it is requested by the electricity board. Ethernet communication can be used to avoid the network failure problems. Only initial installation cost is required for Ethernet communication. Also communication can be achieved by allocating a small band width along with the home telephone network. The electricity board can be able to get the status of real time energy consumption of each home with less cost. Smart meter is one of the major component of smart grid. The grid can be effectively managed by the distributers with the detailed load flow provided by smart meter. Smart meters will act as an intelligent system which maintains electricity services efficiently. Smart meters reduces cost, saves energy and increases reliability of system[7-9].Smart meters are essential for the success of smart grid.

III.SYSTEM OVERVIEW

The proposed energy metering system consists of an energy meter,ethernet communication and webserver.A single phase energy meter has been implemented by using ARM microcontroller and communication part has been implemented using Ethernet communication, server and consumer end are implemented using webserver.The communication between the server and consumer end can be carried out using many different technologies such as Bluetooth technology,Wi Fi,Ethernet,GSM etc.Of which this paper adopted ethernet communication to transmit data from the energy meter to the server.

a)Energy meter

The energy meter part consists of voltage and current controlling unit, level shifter and ARM .For experimental purpose an incandescent lamp of 60 Watt is used .Current and voltage transducers are used to step down current and voltage to safer values. Voltage and current signals are level shifted and fed to the ARM board. The function of this circuit is used to clamp the ac signal with respect to a preset reference DC voltage. The output from the voltage level shifter is given to the analog input of ARM board at pins A0 and ground .Similarly the output from current level shifter is given to the analog input of ARM board at pins A1 and ground. When the inputs are given to the ARM board, the controller on the board will calculate the energy.

b)Communication part

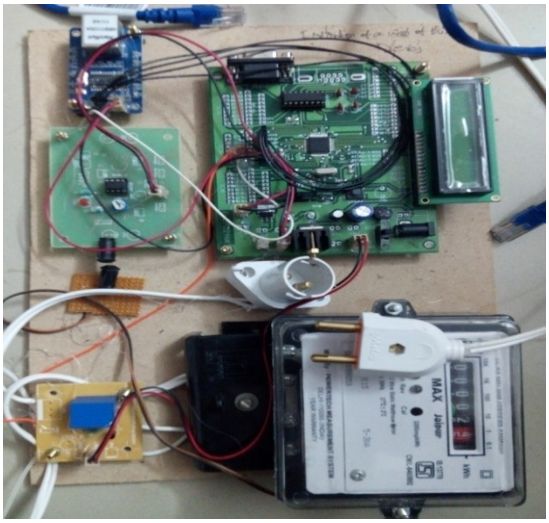
The communication part has been implemented by using Ethernet communication so that the storeded data can be transmitted to the web page with less cost.

c) Server and management part

The collected energy consumption is send to the remote server and it is stored in a database. The server managerial system will take care of controlling and managing the consumption of electricity usage of the consumers.

IV. SYSTEM HARDWARE:

LIQUID CRYSTAL DISPLAY:



Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it. But due to lack of proper approach to LCD interfacing many of them fail. Many people consider LCD interfacing a

complex job but according to me LCD interfacing is very easy task, you just need to have a logical approach. This page is to help the enthusiast who wants to interface LCD with through understanding. Copy and Paste technique may not work when an embedded system engineer wants to apply LCD interfacing in real world projects. You will be knowing about the booster rockets on space shuttle. Without these booster rockets the space shuttle would not launch in geosynchronous orbit. Similarly to understand LCD interfacing you need to have booster rockets attached! To get it done right you must have general idea how to approach any given LCD.

INTRODUCTION TO ARM7

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications.

The ARM7EJ-S processor is a synthesizable core that provides all the benefits of the ARM7TDMI low power consumption, small size, and the thumb instruction set while also incorporating ARM's latest DSP extensions and enabling acceleration of java-based applications. Compatible with the ARM9™, ARM9E™, and ARM10™ families, and Strong-Arm® architecture software written for the ARM7TDMI processor is 100% binary-compatible with other members of the ARM7 family and forwards-compatible with the ARM9, ARM9E, and ARM10 families, as well as products in Intel's Strong ARM and x scale architectures. This gives designers a choice of software-compatible processors with strong price-performance points. Support for the ARM architecture today includes:

- Operating systems such as Windows CE, Linux, palm and SYMBIAN OS.
- More than 40 real-time operating systems, including qnx, Wind River's vxworks and mentor graphics' vrtx.
- Co simulation tools from leading eda vendors
- A variety of software development tools.

ETHERNET:

Ethernet is a family of computer networking technologies for local area networks (LANs) and metropolitan area networks (MANs). It was commercially introduced in 1980 and first standardized in 1983 as IEEE 802.3,[1] and has since been refined to support higher bit rates and longer link distances. Over time, Ethernet has largely replaced competing wired LAN technologies such as token ring, FDDI, and ARCNET. The primary alternative for contemporary LANs is not a wired standard, but instead a wireless LAN standardized as IEEE 802.11 and also known as Wi-Fi.

CONCLUSION

The aim of this project work was to design a device which monitors the energy consumed in a home and to send the consumed energy to the remote server as per request from the electricity board.The data is collected and it will be cheked whether the consumption of electricity usage is more or not.An Ethernet communication is used in this paper since the data will be available without any delay.Ethernet features will be further exploited in future.Other future work will includes building new prototypes of the device in real scenerios such as installing it in houses.

This system allows the consumers to monitor and track their energy usages.Now a days if consumers want to know their energy usages to limit their use they should wait until the electricity bill comes.By using this device the consumer will be able to get alert messages when their electricity usage exceeds certain limit.The information about the energy consumption helps the users to reduce energy

usage and therefore save both energy and money.

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