Hitech Energy Meter With Automation Load Control Using Arm 7 TDMI LPC 2148

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ABSTRACT

Energy meter reading tedious process. Now a day energy meter reader goes to every premise and takes the reading manually then issues the bill. In manually reading human error possible and not provide reliable meter reading. To avoid this difficult task Automatic Energy Meter Reading (AMR) system is introduced. AMR is the technology that automatically collecting consumption and status of data from energy metering device and transferring the data to Electricity Board (EB) office by using Wireless Sensor Networks (WSN). After verifying customer"0s serial number bill will be issued then data has been stored into database. The proposed system automatically disconnect meter either load crosses concern limit or payment periods exists. It also does not provide electricity tampering and provide accurate meter reading.Traditional metering method for retrieving the energy data is not convenient and the cost of the data logging systems is high. So this paper presents of design and development of Automatic meter reading (AMR) system. AMR system is a boom for remote monitoring and control domestic energy meter. AMR system give the information of meter reading, power cut, total load used, power disconnect and tempering on request or regularly in particular interval through SMS. This information is being sent and received by concerned energy Provider Company with the help of Global system for mobile communication (GSM) network. This system not only reduces the labor cost but also increase meter reading accuracy and save hugs amount of time.

Keywords- *ARM7 (LPC2148) Microcontroller, Short message service (SMS), Automatic meter reading (AMR), GSM, Zig-bee, Tamper detection.*

1. INTRODUCTION

Now a day energy meter reader goes to every premise and takes thereading manually then issues the bill. In manually reading human error possible and not provide reliable meter reading. An energy meter is a device which is used to measures the consumption of energy of any residence or other industrial establishment. In Conventional metering system to measure electricity consumption the energy provider company hire persons who visit each house and record the meter reading manually. This is only a sluggish and laborious. In Conventionally metering system people try to manipulate meter reading by adopting various corrupt practices such as current reversal or partial earth fault condition, bypass meter, magnetic interference etc. If any consumer did not pay the bill, the electricity worker needs to go to their houses to disconnect the power supply.

The ZigBee devices are extremely limited in resources including processing, memory and power, short operating range .GSM based automatic meter reading system is a succor. In this system each and every meter is provided a particular ID number. This ID number is provided according to SIM card unique service number. This system continuously monitors every meter reading daily, weekly, monthly or on request and sends to central server of energy Provider Company. The meter reading is stored in database server through SMS gateway. After billing calculation a bill is issued by energy Provider Company which can be sent through SMS. AMR also sends the information of power cut and power consumption through SMS. This SIM card service number is used to identify and retrieve customers detail for billing and identification purpose.In traditional meter reading system, meter reader people who visit every home and take the reading. In manual meter reading system, error reading and error calculation is possible. Especially, during rainy days difficult go every house and take reading. If payment period exists, electricity board mans need to go to their houses and discontinue the energy meter supply. Traditional meter reading system mostly defends on field officers only.

Some of the customers tampering the electricity, it provides significant amount revenue loss for ourgovernment. Old meter reading system security is biggest issue because easy to tampering the electricity andwrongly takes the reading. Automatic Energy Meter Reading includes various technology for data collection such as PLC (power line communication) method, RF (Radio Frequency) Method, GSM based technology and Zigbee based technology but zigbee based AMR technology is better than other technologies. Earlier power line communication used for energy meter reading [1]. Power line communications are easily disturbed by noise. GSM based automatic meter reading provides meter reading with improved billing andreduce tampering [2]. In rural areas coverage of GSM network is biggest issues. Automatic meter reading system is convenient way to collects data and frequently reading meter and also gave power cut information [3]. Automatic Energy Meter Reading system provide remote monitoring that is control the domestic energy meter from anywhere in the world and does not allow tampering of electricity. Relaxation time is given to customers. Once payment period exceeds, automatically disconnect energy meter and information is given to customers. Similarly customers consume extra load than normal, automatically discontinue the meter. This proposed system provides accurate meter reading and flexible billing.

2. LITERATURE SURVEY

Traditional metering method for retrieving the energy data is not convenient and the cost of the data logging systems is high. So this paper presents of design and development of Automatic meter reading (AMR) system. AMR system is a boom for remote monitoring and control domestic energy meter.
AMR system give the information of meter reading, power cut, total load used, power disconnect and tempering on request or regularly in particular interval through SMS. This information is being sent and received by concerned energy Provider Company with the help of Global system for mobile communication (GSM) network. This system not only reduces the labor cost but also increase meter reading accuracy and save hugs amount of time.In AMR system no need meter reader people for accessing the meter it automatically read and transferring to electricity board offices. AMR systems avoid error meter reading and error reading. It s also provides increasing security of data.

3. PROPOSED SYSTEM

Now a day's automation is in every field, although there are many places automation has been emerged andsuccessfully implemented but still the service provider for energy still uses conventional methods for getting the energyconsumed by individual customer. This method is very time consuming and un- economical and may lead to human error.
Our proposed system (AMR) will automatically send the data of the digital energy meter to the service provider with thehelp the help of the GSM modem once in a day and hence the system will report the service provider once in a through SMS.
The same system can be used to check the last reading consumed by the consumer, when demanded by user through the same GSM modem .The device can also be used to control the load from both the ends that is (user –service provider) with the help of relay circuit and system will also be provided with an LCD display which will update the consumers with different information's regarding tariff change or sudden power cut. The main aim of this project is to design a hi-tech energy meter with automatic load control.

4. FUNCTIONAL DESCRIPTION

The high level block diagram of the wireless meter reading system is shown in the Figure.1.The Power Supply section supplies all other components with required Power. The ARM7 LPC2148 microcontroller module takes the data from the energy meter and performs the necessary control operations like breaking the circuit through Relay control unit and the required information to the mobile phone via the communication module GSM. The MAX-232 which was inbuilt in the ARM7 is used as a serial communication interface for the GSM modem for transmitting the data from the controller to the mobile phone. In the Load bank section a 60W incandescent bulb is used as a load for the purpose of energy consumption of the user.
The user can obtain the status of the energy consumption and the billed amount by sending the corresponding commands [10] from the mobile phone to the GSM modem. Then it sends the commands to the microcontroller section and the required information is sent to the user mobile through the GSM modem. If the consumer fails to pay the billed amount in time, the disconnection and reconnection can be done by sending their corresponding

commands to the controller. Whenever a request is obtained by the user to the controller and the data has been sent the DC buzzer gives a beep sound as an indication that a request has obtained and sends the data to the user.
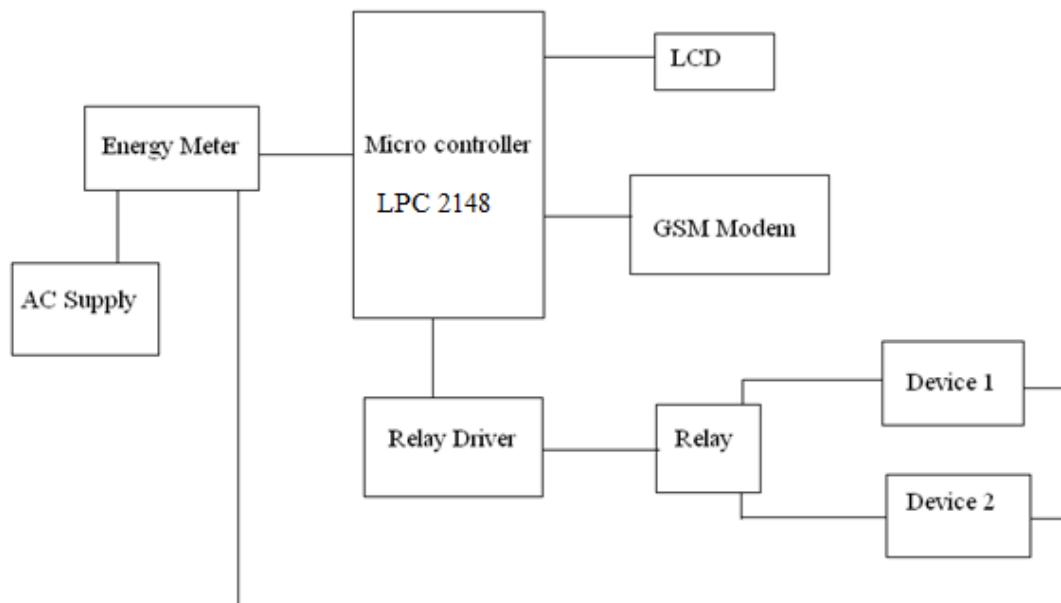

Fig. Block diagram.

5. HARDWARE REQUIRED

Hardware module required for this are
       ARM 7
       ZIGBEE Module
       Touchscreen
       LCD
       Microcontroller
Energy measuring unit (EMU)
       GSM Module

5.1 ZigBeeModule:

The ZigBee network is defined by the ZigBee Alliance and based on the IEEE 802.15.4 standard, which is target data RF embedded applications that require a low data rate, long battery life and secure networking. It is intended to operate in the 2.4GHz unlicensed ISM band [1-2]. There is no large numbers of data which need to convey between the wireless ordering terminal build-in ZigBee module and the center node, and because of having no high requirement of data rate, so ZigBee is well suited for wireless ordering system. Each ZigBee modules includes an IEEE 802.15.4-compliant radio, an 8051 microcontroller, programmable I/O, flexible antenna and range solutions, Transmit range is up to 300m, which can meet the demand of wireless ordering system completely.

ZigBee module can be configured in star, mesh, and cluster tree network topologies. IP-Net includes support for our innovative 'serial mesh mode', allowing RS232/RS485 data streams to be transmitted over multiple hops to improve data reliability and increase transmission range. ZigBee Wireless network of restaurant which is configured in star topology. In this routing topology, data traffic and network commands are routed through a central node. Peripheral nodes require direct radio contact with the central node. An ordering end device acted as a peripheral node in the network is an RFD, it have stringent requirements for low power and memory space. An IEEE 802.15.4 network requires at least one FFD usually line powered to act as a network coordinator. The

coordinator sets up a network, initializes a network, manages network nodes, stores network nodes information, and transmits to control center server via RS232.

GLCD and Touch Screen:

The handheld ordering terminal implements human computer interaction by 128x64 GLCD and touch screen. There is a high performance GLCD Controller integrated on chip. CPU transfers pixel data to GLCD screen. The terminal uses 4-wire resistive touch screen. S3C44B0X need sampling to judge whether a touch screen has been touched. FM7843 is a 4-wire resistive touch screen input controller integrated circuit which is widely applied to small portable devices battery powered. The device is a 12-bit analog-to-digital converter with a synchronous serial interface and touch screen driving circuit.

Energy measuring unit (EMU)

The energy measuring unit consists of a standard calibrated energy meter along with the tampering detection circuit. If any variations other than the rated voltage or specified values are obtained, the ARM -based embedded system (AES) generates the necessary signals required for further operations.

In many countries, it is seen that the consumers attempt to obtain electrical energy illegally. These incoming losses ofstolen power for utility companies are very high. It's necessary for utility meter to have the capability of tamperdetection. The following events are considered for tamper detection. The following events are considered for tamper detection by the method.

- Missing potential event
- Current unbalance event
- Current reversal event

If any above event occurs, the AES will record the meter status in database and inform UCC about tamperwarning on the instant.

6.FLOWCHART
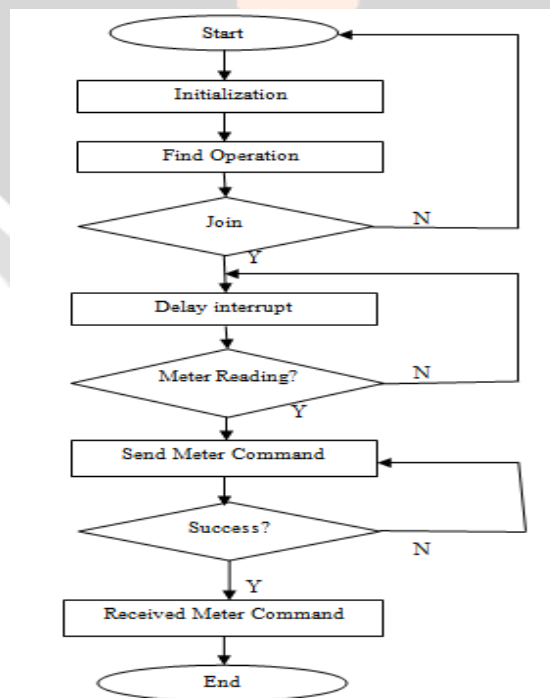
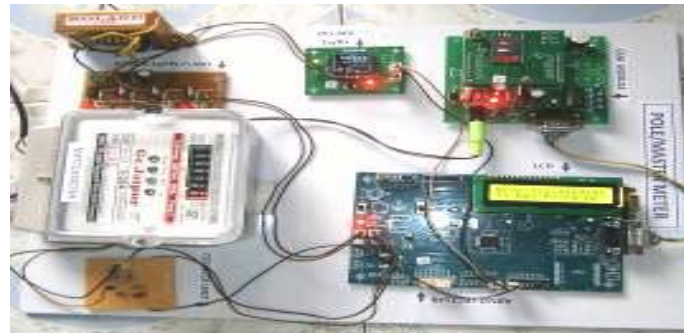Fig, Flowchart of the system

7. TESTING AND DEPLOYMENT

Fig. Working Module of Project

Basic design of the system is designed for measuring electrical bill wirelessly &sends the information regarding bill to consumer &gives the status of the energy meter. The message sends data regarding the amount paid for the consumption& deadline for the paying bill, depends of the payments the electrical bill, the system checks whether pay the bill or not, when the consumer failed to pay the within time, then the system disconnect the power supply wirelessly to energy meter by selecting proper switch located at control unit. Basically system has 3 sections, Meter section, control unit section& mobile unit. Control unit is a consisting of ARM 7 processor LPC2148, zigbee module, GSM module and 3 switches (STATUS switch, ON switch, OFF switch) Meter unit is a consisting of ARM 7 processor LPC2148, zigbee module, energy meter, relay.

The entire operation of the system will do from control unit by proper selection of the switches. When switch 1 is selected then the system reads the energy meter reading in terms of number of units wirelessly through zigbee modules & then electrical bill is measured for corresponding number of units consumed by the energy meter & sends the information regarding the electrical bill will be sent to consumer mobile through GSM module message consisting of information regarding electrical bill & the deadline for the payment of the bill. When the consumer fails to pay the electrical bill in time then the power supply to energy meter will disconnect wirelessly by proper selection of switch& then the status of the energy meter sent to the consumer.

8. CONCLUSION &FUTURE ENHANCEMENTS

GSM based energy meter is easy to installation and beneficial for both energy provider and consumer. AMR is not only solve the problem of manual meter reading but also provide additional feature such as power disconnect due to outstanding dues, power reconnect after pay dues, power cut alert, tempering alert. AMR also gives the information of total load used in a house on request at any time. It sends a SMS alert to energy provider company whether a person using more than specify limit of load. The statistical load used and profile can help customer manage their energy consumption. This system is secure and reliable because it can be accessed only by an authorized person. If anyunauthorized person tries to access the system this system send an alert to energy provider and also give warning of that unauthorized person. Further we can concentrate on the bill payment through online automatically using E-Billing. But the proposed system has a drawback that embedded system is purely dependent on the GSM module.

In the present work wireless meter reading system is designed to continuously monitor the meter reading and to shut down the power supply remotely whenever the consumer fails to pay the bill.

It avoids the human intervention, provides efficient meter reading, avoid the billing error and reduce the maintenance cost. It displays the corresponding information on LCD for user notification.

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