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Intelligent Energy Billing and Security System

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Abstract- Power utility companies are suffering from revenue losses due to uncollected bills and energy tampering since long time. The problem of revenue losses due to tampering the energy meters at domestic and industry level are severe. The proposed intelligent energy billing and control system with two-way communication is capable of detecting tampering and fault.

I. INTRODUCTION

The Automation of Public Service Sectors is the current trend, which transforms the manpower oriented services to semi-automatic or full automatic sectors. As the country is opened to globalization, people's income is rising and the Busy word is now become essential part of everybody's life. So, governments prefer not only to give quality service but also the error free services to their citizens. As a result, this project proposed here is an advanced system, which helps Electricity Boards or Electricity Corporations to handle the Billing system smoothly. This project helps them to give quality service to their customers without any kind of problems.

Traditionally, energy monitoring has been done through electromechanical or electronics energy meters installed on various loads. This present system is not giving the expected satisfaction of the energy supplying authorities.

It has many drawbacks:

a) We get only the raw data.
b) With available man power, as per the records, it is not possible to prepare error free bills.
c) In the existing system, the billing for amount of energy consumed in different areas of city is difficult.

Modern technologies can offer much more elegant and cost effective solution to this need. Recording of energy consumption data through current pulses is simplest and cheapest arrangement.

This project is aimed at developing system for accurate reading and billing from a consumer side to central office through RF communication.

The main objective of this system is

1. To collect, process and record power consumption data of customer & Monitor electrical load.
2. Identifying customers with faulty meters.
3. On non_ payment of bill power line of that customer will be cut.

Monitoring the energy consumed /supplied and energy accounts over a particular duration on each meter.

II. BENIFITS OF SMART METERING

In recent years, power quality is concerned with level and study of problems in electrical energy. New electronic devices are more susceptible for low power quality events, like sags, swells, transients, flickers and harmonics distortion. These problems can impact in operation costs by downtimes and lost productions [2].

The challenge of any industry that depends on electrical energy for production is the low consumption with high power quality and low costs. Electrical energy managers were created with purpose of maximizes the electrical energy utilization and help fault detection. According to the higher competition, more and more industrial consumers are adopting monitoring systems that helps to obtain information to minimize costs, maximize power quality and insure that the manufacturing process proceeds with correct operation. Researches show that power quality is serious and relevant subject in respect of operational costs, having losses about million dollars every year [2].

To overcome all these problems there is need to develop respective system. Some of advantage of ACEM system is given below

Energy Savings:

Better use of electricity. When consumers get an incentive to use less energy during peak time use, less electricity needs to be produced.

Reducing theft:

In some areas, theft detection and prevention is one of the single biggest aspects driving the move toward auto billing system are seen every year due to increasing theft, and an ACEM solution inclusive of distribution asset management and threshold monitoring for usage provides the utilities with a valuable tool in eliminating, or at a minimum greatly reducing these losses.

Reducing late payments:

In other areas, where late payment or nonpayment is a significant problem, some utilities are including in ACEM systems the ability to directly control consumption on a premise-by-premise basis by setting thresholds that cannot be exceeded without tripping a breaker at the premise. This approach will allow utilities to avoid the huge revenue losses incurred in the past.

Increased Data Security:

Automatic meter reading provides increased performance in the data collection. You avoid reading errors and missing meter readings. Reading data automatically also provides increased security of data flow between the ACEM system and other applications. Avoiding manual data entry or manual data transfer a potential source of error is eliminated.

Improved cash flow budgeting and management:

With automatic meter reading utility bills are based on actual consumption. This generates a steady cash flow. Billing is based on real-time data and estimated bills are no longer necessary.

Reduced operation costs:

With automatic meter reading you have constant access to real-time data and have meter readings available on request. This helps you handling customer complaints. Readings in connections with med move-in/move-out are done easier and faster and even retroactive, should a costumer forget to notify change of address in due time. Costs for meter reading will be reduced and thereby total costs of operation.

Reduced cost over the life time of the ACEM system:

The financial benefits of automatic meter reading last over the lifetime of the ACEM system.

Improved customer service:

With accurate utility invoices there is no need for estimates or adjusted billing. Demand reads can be done as part of the customer service. You can react quicker in abnormal situations and monitor demand and consumption closely. And you strengthen your image with the consumer as a reliable partner within energy supply and energy services.

III. PRESENT THEORIES AND PRACTICES

In past there were electromechanically meters which included manual meter reading. But this system had problems such as low accuracy, poor theft detection, communication is expensive & control over the meter is nil.

Again delay in billing, wrong estimates, meter tampering, huge cost of disconnection and re-connection for non-paying customers, difficult in accessing meters due to scattered customers and power tampering which are the sources of revenue loses.

Now a day's energy meters are in use, but they also have some disadvantages like

1. Highly Person dependant.
2. Human errors cannot be avoided.
3. Accessibility of meters in rural/ Agricultural zones is difficult.
4. Energy Audits performed based on bill collection which is highly inaccurate.
5. Billing done mainly on estimated/ monthly average basis. Billing cycle requires excessive time.
6. Meter data used only for billing, cannot help in analysis like demand analysis, energy audit etc.
7.

Auto billing and control system for energy meter is a step to provide the mechanism to get the billing in energy meter automatically and also without human interaction.

IV. STEPS FOR IMPLEMENTATION

Transmitter module

It consists of

a. Energy Meter
b. Microcontroller
c. RF module

Energy meter keep record of collected power consumptions of data then after receiving command from microcontroller pass that data to RF module. It Transmitter that data toward receiver side.

Receiver module

It consists of

a. RF module
b. Microcontroller
c. Central office unit

At receiver module RF module receives data & transmitter it to microcontroller & then to central office.

Every consumer has a power line coming from the electricity board which is connected to the energy meter. This energy meter keeps a record of power consumed by the consumer.

An electric meter or energy meter is a device that measures the amount of electrical energy supplied to a residence or business. These are customers of an electric company.

The most common type is more properly known as a (kilo)watt-hour meter or a joule meter. Utilities record the values measured by these meters to generate an invoice for the electricity. They may also record other variables including the time when the electricity was used [3].

The electrical energy meter manufactures have focused their research effort towards the development of modem and more precise energy meters for large customer, where the added precision justifies the necessary investment. As a result, electromechanical energy meters remain pervasive for residential application [7, 8, 9]. However, the advent of low cost microcontrollers enables the development of a cost effective electronic electrical energy meter for residential use as well.

As the electronic version does not possess rotating parts, it helps in avoiding tampering by unscrupulous persons. Furthermore, for large scale manufacturing, the costs can become lower than those of the electromechanical meters currently in production.

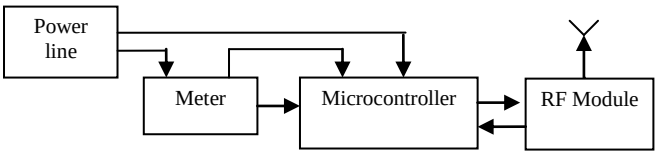

Fig. 1. Transmitter Module

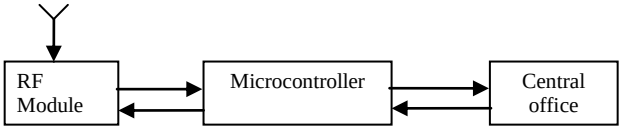

Fig. 2. Receiver Module

When a switch is pressed, the probe sends an interrogate signal to the touch module to collect the meter reading. The software in the device matches the serial number to one in the route database, and saves the meter reading for later download to a billing or data collection computer.

A microcontroller is a computer-on-a-chip. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). In addition to all arithmetic and logic elements of a general purpose microprocessor, the microcontroller usually also integrates additional elements such as read-only and read-write memory, and input/output interfaces. Microcontrollers are frequently used in automatically controlled products and devices, such as automobile engine control systems, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes [4].

A remote automatic utility reading system includes a reading control center for transmitting commands to and receiving measurement data from remote terminal units via a command responsive control unit. The control unit is characterized by a computer having a stored program of subroutines, one of which is an interrupt subroutine. The interrupt subroutine is periodically entered as commands are received by the control unit from the reading control center

and directs entry into other ones of the subroutines for execution thereof to effect the simultaneous interlacing of the commands and measurement data being transferred between the reading control center and the remote terminal units prior to transmission[5]. An automated meter reading server having an open, distributed architecture that collects, loads, and manages system-wide data collected from energy meters and routes the data automatically to upstream business systems. The ACEM server includes a repository of metering data, and additionally provides timely access to information by including collection, storage, validation, estimation, editing, publishing and securing of meter consumption and interval data.

The ACEM server obtains data from meters equipped with modems via standard telephone lines or public RF networks. The data is converted from the format of the meter/communications infrastructure to a format usable by the ACEM server and the repository. The data is converted from the ACEM-compatible form to a format of a specific upstream business system. Wireless Communication using RF Signal Communication is established for the transmission of data and control signals between the meter interface units and the central office through RF signal [6].

VI. CONCLUSION

This paper presents a model developed in order to measure the electricity consumption of the domestic electricity users and utility industries. The model has capability of transmitting the measured values of energy meter from customer side to a central database via a wire-less channel. Each energy meter has unique identification number by which the central data acquisition server identified each of it. A microcontroller functions as the main processing element of this product. It is programmed in such a way that it would measure energy and transmit the measured values through a specified channel. The designed meter is not only capable of measuring electricity, but also capable of detecting faulty meter. As a final product a comprehensive system is billing of energy meter store the values in a database.

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