

Live Energy Meter with Load Theft Detection Using Zig-Bee

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Abstract— In our project we use electrical power theft detection system used to detect an unauthorized tapping on distribution lines. Implementation area of this system is a distribution network of electrical power supply system. Existing system is not able to identify the tapping. This system actually finds out which consumer make tapping before the meter and use electricity without pay.

This is a real time system. Wireless data transmission and receiving technique is used. This will provide an additional facility of wireless meter reading with the same technique and in same cost. This will protect distribution network from power theft done by tapping, meter tampering etc. According to the market requirements of Energy Meter there is necessity of smart Energy Meter. Nowadays the system will use ZigBee system for communication protocol. The ZigBee is used since the application need high speed data rate need to be low powered and low cost. In this project presenting the remote wireless Energy Meter Reading System. This aims at resolving the shortcomings of the technology of the traditional Energy Meter Reading, by combining the characteristics of the ZigBee technology and IEEE802.15.4 standard with AVR Microcontroller ATmega16. The hardware implementation was designed, and then analyzed the use cases for Energy Meter.

Keywords: Energy Meter, Interfacing Device, Data Communication Media, Remote PC with compatible software.

I. INTRODUCTION

Energy Meter reading is one method reading and processing data automatically with computer and communication. It is the improving the level of reading and energy consumption and also the necessity of rapid development of computer and communication technology too. It not only may relieve reading person's labor intensity, reduce the reading mistake, but also has the advantage of high speed and good real-time. With the project of the wireless Energy Meter reading for wireless communication technology, complete the design of automatic Energy Meter reading system. Through researching

The characteristic of main wireless communication protocol, ZigBee is chosen as lower layer communication protocol. With these applications, the standard is optimized for data rate, low power consumption, security and reliability. Here describes the functional requirements to solve the technical

issues related to the market applications. In our system, the meter data is passed from the meter to an MIU (Micro controller), which may be external to the meter or integrated within the body of the meter. In addition to the meter data, other pertinent information may be stored within the MIU, such as any tamper or load theft conditions. This device forms the interface between the meter and the communications network. Technical losses in T&D are computed with the information about total load and the total energy bill.

While technology in on the raising slopes, we should also note the increasing immoral activities. With a technical view, Power Theft is a non-ignorable crime and at the same time it directly affected the economy of a nation. Electricity theft a social evil, so it has to be completely eliminated. Power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any Human control .The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumer then earlier, in highly populated country such as INDIA. In Maharashtra, there are more than crore meters for electricity that are read every month, at a cost in salaries, transportation and other expenses that tops Rs. 3848.4 crore (2006-2007) . A meter-reading system would still require someone driving by every meter and getting a reading through a hand-held receiver, but even newer technology - called an live meter reading system (AMR) - would eliminate even that need. An LMR is a sophisticated communication link directly from the meters to the central office computers that will also speed locating service interruptions, faulty meters and service theft, as well as allowing for expanded services, such as flexible billing dates, time-of-use rates and prepaid accounts. Meters could also be turned on or off directly from the office rather than having to send out an employee to do it manually. ZigBee wireless meter reading refers to the use of short-range wireless communication technology and computer network technologies to read and process metering data automatically. Wireless automatic meter reading technology can not only save human resources, but more importantly may improve the

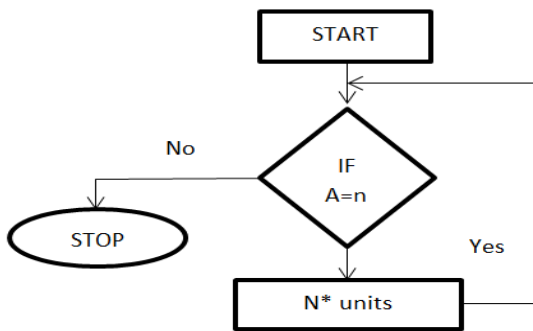
accuracy and real time of the meter, enabling management sector to access to data messages timely and accurately. No cable wiring can save human and material resources, so investment is considerably economical. Wireless communication links can be quickly built, engineering cycle significantly shortened, and has better scalability compared to a wire-line system. If fault occurs, only check wireless data module for causes quickly, and then restore the system back to normal operation.

II. SYSTEM WORKING

Our system work in three parameter the parameters are as follows:-

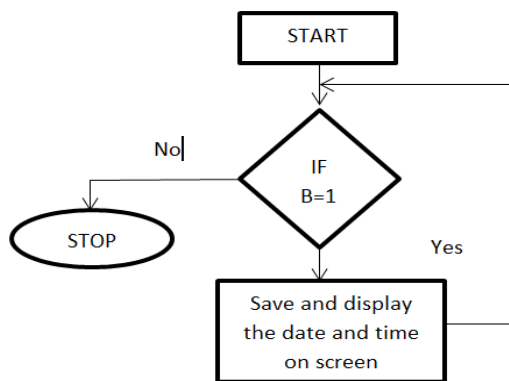
1. The electric used by the consumer and all the status are monitor.
2. If someone is manipulating with the energy meter then it can identify.
3. If someone is stealing the electricity.

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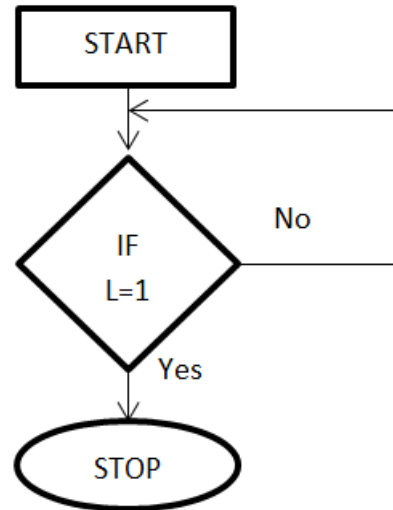
If A=1(one unit burns) then the 1 unit is generated and we can set the unit as per the requirement. For example now a days 1 units =7 rupees so in our project we set 1 unit = 7 rupees.

2. If someone is manipulating with energy meter then it can identify.



If someone is manipulating with energy meter then the B=1(microcontroller is active) then the date and time is record in the computer, so with the help of that we can easily identify the problem in the energy meter.

3. If someone is stealing the electricity.



if someone is stealing the electricity then at that time the L=1(microcontroller active) in that time the microcontroller giving the command to stop the energy meter.

The software which we are using in our project that is the “c sharp (c#)”. C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved as a standard by Ecma (ECMA-334) and ISO (ISO/IEC 23270:2006). C# is one of the programming languages designed for the Infrastructure# is a general-purpose, object-oriented programming language. Its development team is led by Anders Hejlsberg. The most recent version is C# 7.2, which was released in 2017 along with Visual Studio 2017 version 15.5.

The name "C sharp" was inspired by musical notation where a sharp indicates that the written note should be made a semitone higher in pitch. This is similar to the language name of C++, where "++" indicates that a variable should be incremented by 1. The sharp symbol also resembles a ligature of four "+" symbols (in a two-by-two grid), further implying that the language is an increment of C++.

Due to technical limitations of display (standard fonts, browsers, etc.) and the fact that the sharp symbol (U+266F # MUSIC SHARP SIGN (HTML ♯)) is not present on most keyboard layouts, the number sign (U+0023 # NUMBER SIGN(HTML)) was chosen to approximate the sharp symbol in the written name of the

programming language. This convention is reflected in the ECMA-334 C# Language Specification. However, when it is practical to do so (for example, in advertising or in box art), Microsoft uses the intended musical symbol.

The "sharp" suffix has been used by a number of other .NET languages that are variants of existing languages, including J# (a .NET language also designed by Microsoft that is derived from Java 1.1), A# (from Ada), and the functional programming language F#. The original implementation of Eiffel for .NET was called Eiffel#, a name retired since the full Eiffel language is now supported. The suffix has also been used for libraries, such as Gtk# (a .NET wrapper for GTK+ and other GNOME libraries) and Cocoa# (a wrapper for Cocoa).

III. PROPOSED SYSTEM

AMR stands for **A**utomatic **M**eter **R**eadings. A device which remotely obtain meter readings and transmits this data to the system's computer via communication media such as phone lines, power lines, GSM, or dedicated cables for processing. AMR devices can detect outages, remotely connect and disconnect services, detects tampering as well as other uses. Economic benefits include increased cash flow, lower labor and equipment cost, increased accuracy and lower costs. Some customer satisfaction benefits include improved service quality, more customer choices and faster response time. A typical Automatic Meter Reading (AMR) set up can be conceptualized using the following block diagram.

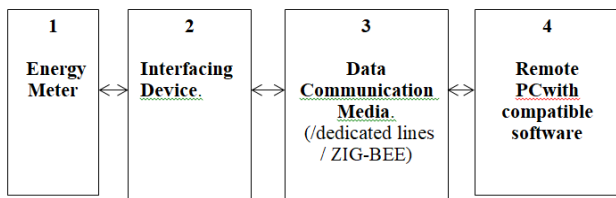
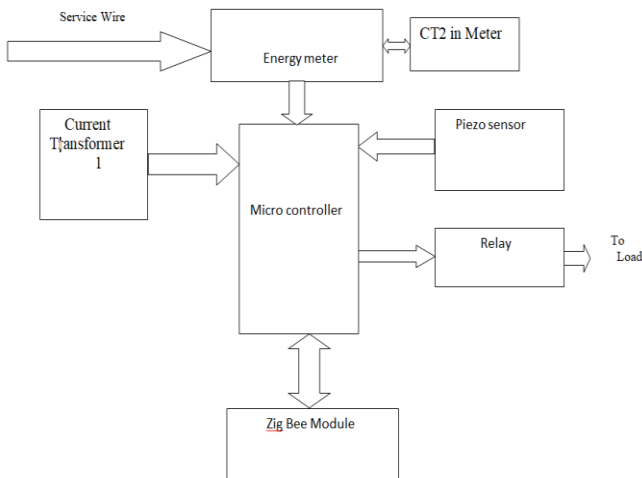


FIG 1: BLOCK DIAGRAM OF AMR SYSTEM



From block diagram we can see that the AMR system consist of following components

1. Energy Meter
2. Interfacing Device
3. Data Communication Media
4. Remote PC with compatible software

1. Energy Meter:

Energy meter is a device which is used to measure the energy consumed by the customer .Basically energy meter is of two types Electro-Mechanical meter and Digital meter. Now a days digital meter are used because they are having high accuracy, with limited control and theft detection capability at nodes.

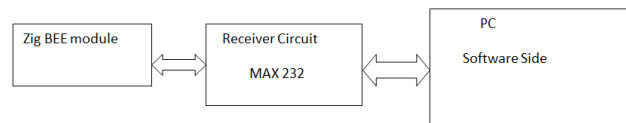
2. Interfacing Device:

It is a device which takes out readings from meter and passes those readings to the remote pc through communication media. It also consists of a circuit which can switch ON/OFF power supply of customer.

3. Data Communication Media:

For transporting the data from the energy meter to the Host PC a communication media is necessary. Communication can be done by two ways, a. Wired Communication: power lines, phone lines, dedicated lines. Wireless Communication: RF, GSM, GPRS. Service provider can use any communication media depending upon the services available to the service provider.

Receiving Side



4. Remote PC with compatible software:

The heart of the meter reading station is the Meter Reading Software which resides in the PC at the Meter Reading Station. It is a standalone system which is responsible for collecting meter reading, storing them to the data base, calculation of bills, switching ON/OFF of power supply, and providing analysis facility.

IV. ZIGBEE MODULE

In this project the data will be transmitted from the meter to the main server using wireless technology. The past several years have witnessed a rapid growth of wireless networking. However, up to now wireless networking has been mainly focused on high-speed communications, and relatively long

range applications such as the IEEE 802.11 Wireless Local Area Network (WLAN) standards. The first well known standard focusing on Low-Rate Wireless Personal Area Networks (LR-WPAN) was Bluetooth. However it has limited capacity for networking of many nodes. There are many wireless monitoring and control applications in industrial and home environments which require longer battery life, lower data rates and less complexity than those from existing standards. For such wireless applications, a new standard called IEEE 802.15.4 has been developed by IEEE. The new standard is also called ZigBee, when additional stack layers defined by the ZigBee Alliance are used.

The XBee (ZigBee) uses a wireless 2.4GHz transceiver to communicate with another XBee (ZigBee) module. Furthermore, XBee (ZigBee) modules are capable of communicating with more than one XBee (ZigBee) module. Thus, it means you can create a network of XBee modules all over the place as long as they are in range, of course.

Some features of XBee are:

- 802.15.4 Protocol created by the IEEE foundation.
- Data rate of 250KBps (Kilobits per second).
- Can be used indoors and outdoors.
- Range is from 100ft-300 for standard XBee modules and 300ft-1 Mile for XBee Pro Modules (depending on where it's used and the line of sight from one XBee to the next XBee).
- The standard XBee has a 1mW transmit power and the XBee Pro has a 60mW transmit power.
- No configuration is required out of the box.
- Default baud rate is 9600bps. Although, you can change the configuration of how fast you want to transmit but for this tutorial we will just leave the baud rate at default.

Pin Diagram of ZIGBEE

The pin out of the Zigbee module is shown below:

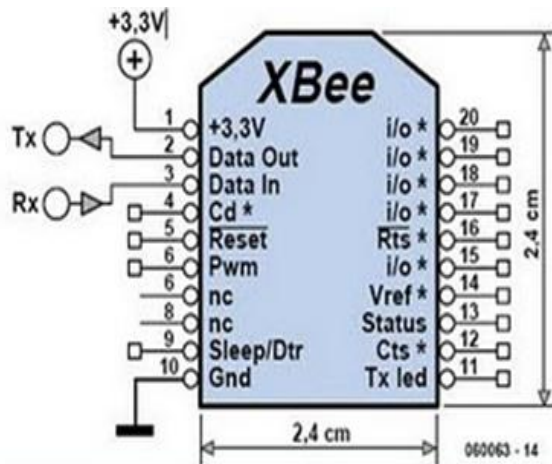


Fig. Pin Out of ZIGBEE

V. ADVANTAGES

- Smart automated processes instead of manual work.
- Accurate information from the network load to optimize maintenance and investments.
- Customized rates and billing dates.
- Detection of tampering of Meters.
- Demand and distribution management.
- Improved fraud detection

VI. APPLICATIONS

- These solutions require a much smaller staff of meter readers, who merely need to walk or drive
- Ability to monitor daily demand, implement conservation programs, create usage profiles by time of day.

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