

## Comparison of Various Technologies for Smart Energy Meter Gateway

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### Abstract

Among all basic requirements of human being, electricity is also a most basic requirement. Traditional meter reading system is used now-a-days. In the traditional meter reading system, human operators read utility consumption and billing takes place. More time is consumed by this type of system. This paper is discussed about various techniques of Gateway for Smart Energy Meter to quick transmission of energy meter data.

**Keywords:** Automated energy meter reading system, ARM7 based gateway, Electricity temper detection, Web-Server, IEEE1888-6LoWPAN, GSM, PIC Microcontroller, Visual Studio .NET, C#.

### Introduction

Electricity becomes primary need for human being. Traditional meter reading system is used for collecting data from various meters. This is more time consuming method. Here, there are various method discussed about Gateway of Smart energy meter. Gateway is providing a link between Energy meter and provider to transmit data from energy meter to server. Billing also takes place by using this type of system.

### METHOD-I: Using ARM7 Microcontroller

In this method the system model consists of three different units like home communicable unit, central controlling unit which is gateway and web server. Home communicable unit consist different parts like energy meter, power supply, 8051 microcontroller, LCD, RF module, EEPROM , Relay, etc. LCD screen is used to display the meter readings of energy meter and it stored in EEPROM simultaneously. The readings of energy meter are sent to the gateway through RF link from where it is send to web-server. For detection of tempering effect button is provided at door of energy meter. In case of normal state, button is in pressed condition and button is released when tempering occurs with the meter and it sends alarming signal to the

server via gateway. 8051 microcontroller is used for controlling all this functions. 8051 is coded using Embedded C. when supply voltage exceeds threshold voltage Relay is provided for power cut.

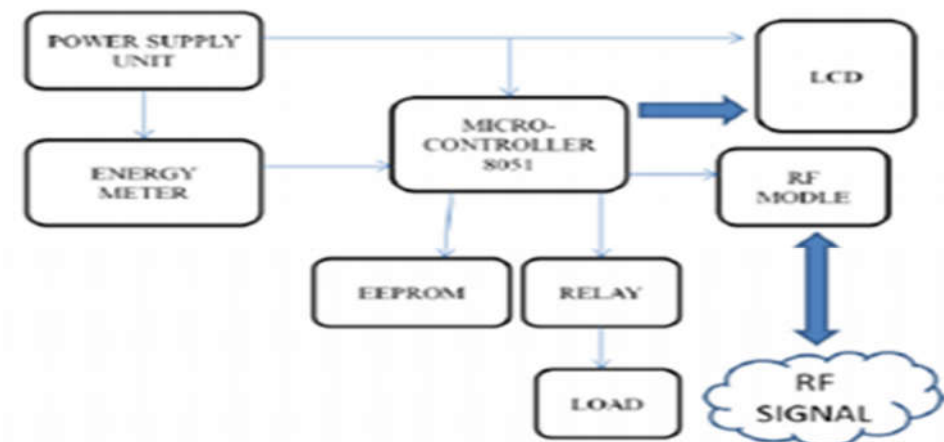


Figure 1: Block diagram of Home Communicable Unit

Gateway is consists of different parts like ARM7 microcontroller, RF module, power supply, LCD segment, EEPROM and GSM module. Meter readings from all home communicable units are collected here and then sent to server simultaneously through GSM via SMS. It also stored in EEPROM non-volatile memory.



Figure 2: Central controlling unit (Gateway)

To control whole system remotely web-server is developed. It has details like name of customer, address, contact numbers, unique meter identification number and type of meter whether prepaid or postpaid, etc. Server updated database after every 3 minute through SMS it received via gateway. When communication between meter and server is proper it shows “Healthy” status. In case of meter tempering meter status changes to “Alarm” from “Healthy”. Bill generation takes place in the beginning of every month and sent to customer via SMS. By using HTML web-server is developed and database is created using MySQL.

With the help of this type of proposed system automatic bill generation takes place at the beginning of each month and customers also known about their generated bills via SMS.

## METHOD-II: Using IEEE1888-6LoWPAN

The architecture of system includes a Smart Meter(SM) which acts as a gateway to transfer the data of meter reading from 6LoWPAN network communication Field Buses (FB) to control center storage through the IEEE1888 on Wi-Fi communication. The communication with small sensors or actuators using 6LoWPAN embedded internet device FB forms IEEE packets and communicates with the Storage and APP using Wi-Fi [2]. Microcontroller STM32F407ZG (ARM-Cortex, M4 architecture series) functioning as the SM's CPU.

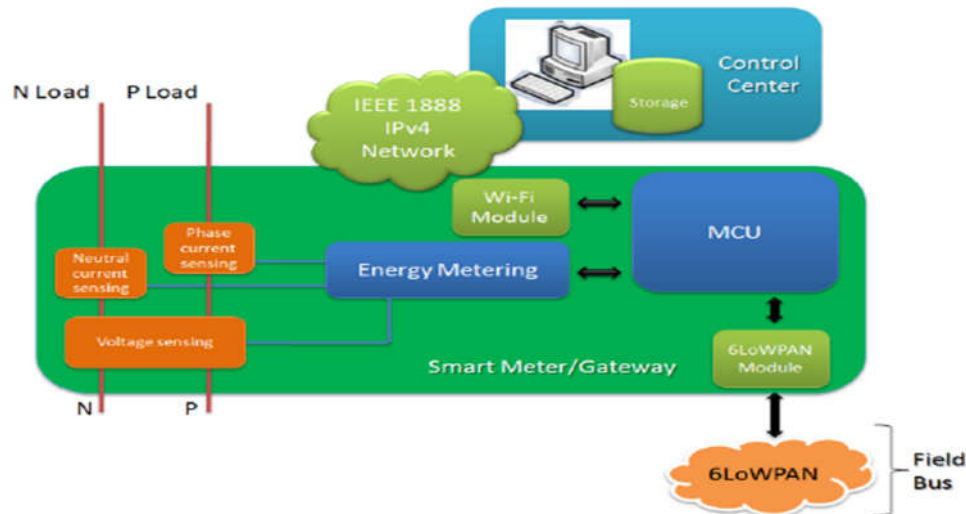


Figure 3: System Architecture of Method II [2]

By using SPI communication it is connected with STMP01 energy metering IC. STMP01 is used to calculate electricity related quantity like voltage and current. To transfer electricity consumption and 6LoWPAN FB data to control center Wi-Fi module is used. It uses TCP/IP protocol.

Free-RTOS software is used in this system. It is embedded in MCU (STM32F407ZG). It can calculate data, record and transfer power consumption data to server. It also supports parallel data transmission.

## METHOD-III: Using Pic Microcontroller and GSM

In this system consumer can directly know the amount he/she has to pay at the time of bill preparation itself and also it has a facility to pay the amount online. It has three main parts: a digital GSM power meter installed in every individual consumer unit, SMS gateway and billing server at the energy provider side. It consisting MCP3905A, a display, PIC16F877A and GSM modem. MCP3905A is a single phase dedicated energy metering IC. A 10A class I single phase meter is designed with embedded GSM modem which utilizes the existing GSM network to send its power usage value as SMS to the energy provider wirelessly [3]. GSM unit is interfaced to the microcontroller via a MAX 232 convertor. Data is also stored in EEPROM.

The target PIC is programmed by PICKit 2 version 2.61. The meter PIC Microcontroller unit is programmed via the In-System Programming (ISP) interface. For all kinds of operation GSM modem is controlled by using AT commands.

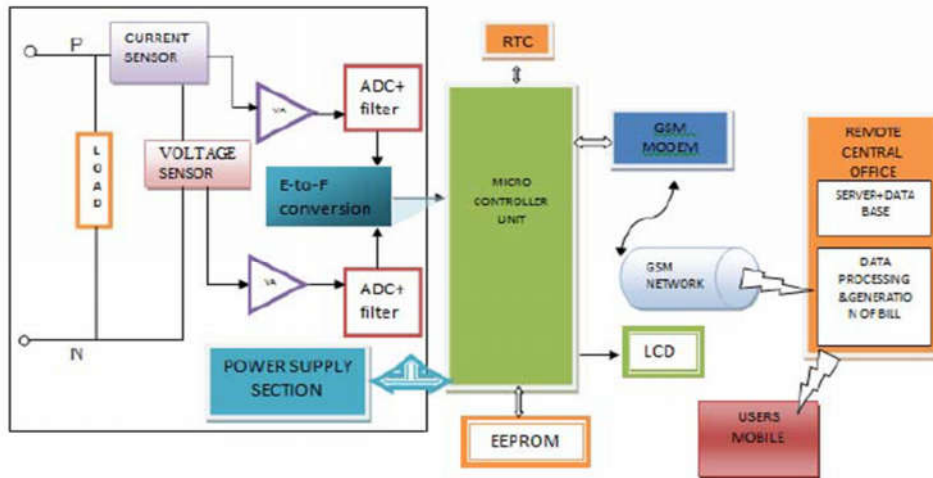


Figure 4: Detailed design blocks of Method III [3]

Embedded C is used for firmware. The web portal is developed by using Microsoft Visual Studio .NET 2008 Integrated Development Environment (IDE). Data base is created by using Microsoft SQL Server 2005. After the initial login procedure the administrator can connect the GSM modem to the web portal through serial port/USB. Automatic bill generation takes place through auto processing of the background data by simple selection of consumer name and month. Prepared bill is sent to the user's mobile for a particular month of usage.

## CONCLUSION:

By using ARM7 controller speed and processing ability of overall system is very fast. Incorporating GSM module with gateways reduces more cost. Power tempering detection is also possible. With the help of this system model automatic bill generation takes place.

By using IEEE1888-6LoWPAN monitoring of energy power consumption is done in real-time. According to the IEEE1888 standard protocol it relays data from 6LoWPAN sensors to the Internet by using IPv4.

By using PIC and GSM the concept of e-metering is fulfilled. In this system software solution is facilitate so that the consumers can access the webpage and pay the bill anytime from anywhere without visiting billing office. After processing of data, consumers get a SMS of total monthly power usage and due bill.

With the help of this type of metering system energy meter becomes automated and data of energy meter are directly transferred to server by using gateway.

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