Smart Energy Meter Updating the Daily Usage Load Control over GSM with PIC Controller

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Abstract – Smart meter gives information regarding the consumption of energy in real time. Digital energy meters give information regarding the consumption of energy to all consumers through mobile phones on regular basis via SMS. To enable remote monitoring of electric meter, PIC may be interfaced with timer installed, which may further be transmitted to phone and TNEB office. In this proposal, a working methodology and approach of PIC system with different communication devices and their protocols has been incorporated.

Index Terms – PIC-Peripheral Interface Circuit; C.T-Current Transformer; GSM-Global System for Mobile Communication; RS 232 Protocol.

1. INTRODUCTION

For efficient monitoring and control of consumers in real time, existing special energy meters are to be replaced by smart energy meter which are to be accessible to distribution control centre through communication link. The communication network can be wired like Ethernet ,power line carrier (PLC) or wireless like wireless fidelity (WIFI), global system for mobile (GSM), Zigbee, Radio Frequency (RF) and power line carrier (PLC) communication have ggenerally been used. Smart meters are able to send their readings over communication lines and recognize addresses to activate /deactivate internal modules. For interfacing smart meters and managing . Collection of data globally and automatic billing, a wireless energy meter with its communication capabilities is designed which monitors the meter readings regularly without manual intervention. A new technology is also implemented that works on Short Message Services (SMS) which intimates the customers about their energy via short SMS daily. A current sensor is used to monitor energy used at each home and passes all through the communication network to a control centre. This system consists of digital meter, relay, and alarm, PIC processor operated on sensor and GSM. A prototype Automatic Meter reading (AMR) system using power lines and frequency shift has been proposed. Optimal rescheduling of residential micro-grid based on readings obtained from smart energy meters has been included. The communication existing between the data concentrator and data collector can also be implemented using PIC in a AMR system connected to master station through GSM. Home automation special and smart energy meter has been presented. A new framework has been developed by using hidden Markov model that manages end user privacy in measurements through metres. A cost effective energy management system is also designed. Automatic meter reading (AMR) with its interface meters and data collection from Data Collecting Devices (DCD) at substations may be quiet fruitful in monitoring consumers.

2. RELATED WORKS

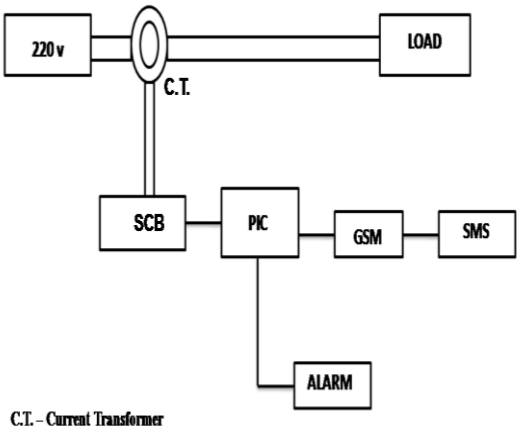
A. Microprocessor in Electricity

In smart grid architecture, it is important to monitor the consumer demand, voltage, power frequency accurately on regular basis. This paper provides solution to compare the daily used units obtained from Smart energy meter and reduce the cost of the electricity bill on monthly basis. This paper also proposes a system where the consumers are given an alarm on exceeding the threshold value of the units obtained from various home appliances.

3. SYSTEM ARCHITECTURE

The existing special energy meters are microprocessor based energy meter. These meters have non-volatile memory which can store the data. Data recorded by the meter is converted to the readable text file form for computation and analysis and then, is emailed to the load dispatch centre. Due to remote location of number of substations, data measured from special

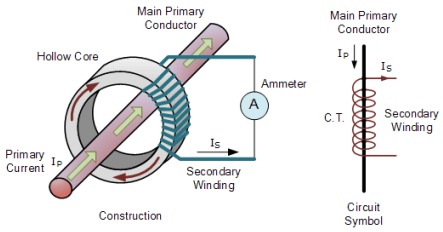
energy meters are to be transmitted via SMS to the near town from where these are to be mailed to the load dispatched centre on a daily basis. Since, readings are automatically taken from special energy meter and mailed to load dispatch centre, it may not lead to human errors. Such errors may result in loss of revenue. Smart energy meter using communication medium, GSM technique forms a two way communications between substation and control centre. It automatically sends the data via GSM to the load dispatch centre.



4. BLOCK DESCRIPTION

Current Transformer

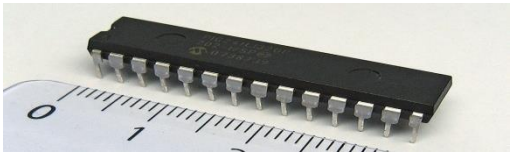
The Current Transformer is a type of "instrument transformer" that is designed to produce an alternating current in its secondary winding which is proportional to the current being m. Current transformers reduce high voltage currents to a much lower value and provide a convenient way of safely monitoring the actual electrical current flowing in an AC transmission line using a standard ammeter. The principal of operation of a basic current transformer is slightly different from that of an ordinary voltage transformer measured in its primary.



Current Transformer

PIC Microcontroller

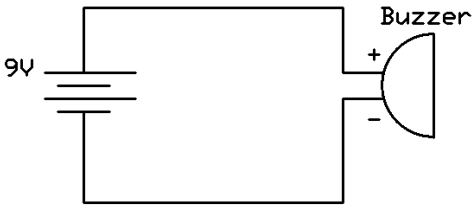
PIC microcontrollers (Programmable Interface Controllers) are electronic circuits that can be programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device.



PIC microcontroller

Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical and piezoelectric.



Buzzer circuit

GSM

The Global System for Mobile Communications (GSM) is a second generation, (2G) standard for mobile networks. GSM standard has the ability to roam and switch carriers by using individual mobile units.

GSM module

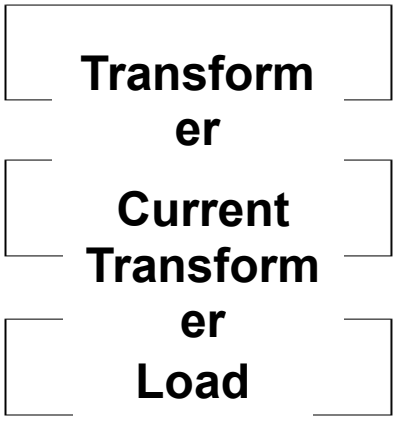
Signal conditioning board

Signal conditioning board is used to convert the analog signal into a way that meets the requirement of the stage of processing. Usually amplification of the signal is done, normally carried out by ADC and a microcontroller. Signal

conditioning can include amplification, filtering, converting, range matching, isolation and any other processes required to make sensor output suitable for processing after conditioning.

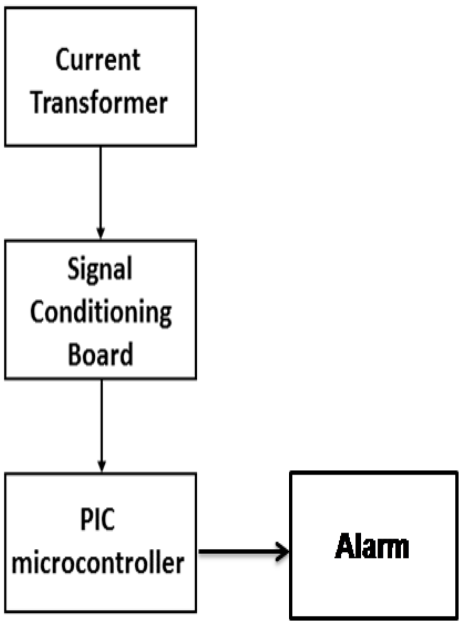
5. MODULE DESCRIPTION

MODULE 1 –



A wireless energy meter with its communication capabilities is designed for monitoring the meter readings regularly without manual intervention. A technology is implemented that works on short message services (SMS). It intimates the customers about the consumption of their energy via a SMS regularly. Current transformer is used to find the amount of current used by the load.

MODULE 2 –



Digital energy meter

In Existing meter the data is recorded in every block -Net active energy (Wh) in 15 min Average frequency in 15 minutes and it records the frequency ranging from 49fHz<f<51Hz.

Smart energy meter

Temporary calculation are made using formulae: Unit readings are calculated in the energy meter

One unit consumption

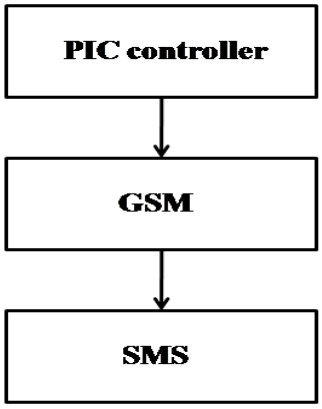
Power= energy/ time

Energy= (P*t)/1000

Cost=E*cost (cent/kwh).

These calculations are done inside the PIC microcontroller, this controller is connected with the signal conditioning board that converts analog to the next level of requirement for processing. PIC controller intimates the buzzer circuit to give alarm signal if the threshold voltage is reached.

MODULE 3



PIC microcontroller uses USART protocol for the calculation of temporary bills and uses ATTENTION comments for sending the temporary bill data as a message to the phones via GSM. These bills are calculated for each day with timer clock inside the microcontroller system.

6. FUTURE WORK

The smart energy meter is further improved by calculating the units used by each of appliances and thereby reducing the power consumption.

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