CONTEMPORARY REAL TIME ELECTRIC METER FOR POWERFUL SUPERVISION OF MAXIMUM POWER DEMAND CONTROLLER

Moorthy, P and S. Muralidharan

Dept. of Electrical and Electronics Engineering

Madha Engineering College, Kundrathur, Chennai – 69, Tamil Nadu, India

ABSTRACT

Research and development where been carried out in the field of electric meter such as Remote wireless Energy measurement from Meter, Electricity meter based on Radio Frequency Identification (RFID),Global System for Mobile Communication (GSM) based Electric Metering System. But none of found to be an effective tool to eliminate the problems associated with power demand. In this paper, we propose a solution is to solve the problems associated with maximum power demand by designing an energy meter that effectively handle the power consumed by the consumer with the power available on that time. Giving the flexibility to the consumer to determine which devices or loads to be operated in a particular time which reduces the misuse of the power and effective power saved can be given to other places or industries for the better of the country's growth. Prototype hardware is developed to demonstrate the efficient of the system.

Keywords: Demand response, Energy Metering system, Power scheduling, Data Communication**.**

INTRODUCTION

With the advancement in Science and Technology, Electric Energy has become the one of the essential means to carry out the today life. Electricity as rise to the place where the economics of the country depends on its availability and usage. Power Demand affects the life of people to carry out their normal activity. Industries are being greatly affected. And many people are under the situation is loss their life hood. Power Demand is the main crisis that our country is facing (Mohsenian-Rad and Leon-Garcia , 2010). The main aim of this project is loss the problems associated with power demand and misuse of electrical energy.

And make people practice conservation of Electric Energy. Since 2008, the state grid corporation of China has carried out the overall construction work of the power user electricity consumption information acquisition system, the smart electricity meters which widely used in this system had been unified designed according to the new smart electricity meter technical specification (Peretto, 2010).

With the arrival of the information and technology era, residential demand for high quality and reliability of electrical energy increases day by day. At the same time, the pressure of global natural resources and environment is also increasing rapidly. Smart grid is a system that includes a physical power system and information system that links a variety of equipment's and assets together to form a customer service platform. Smart grid will likely incorporate some new technologies in communications, distributed systems, advanced metering, automation, distributed storage, safety, and security, to allow a considerable increase in the reliability and robustness of the power network, which will in turn lower the energy costs .With the emergence of the smart grid, residents can reduce their electricity cost by scheduling the pattern of their home electricity usage, based on the real-time electricity prices (RTEP). With this motivation, several schemes for scheduling in-home power consumption have been proposed. By using the power scheduling method would effectively reduce both the electricity cost and peak-to-average ratio (PAR), thereby, strengthening the stability of the entire electricity system (Xiong *et al.,* 2011).

Demand Response: Demand response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based rates or other forms of financial incentives. Demand response programs are being used by electric system planners and operators as resource options for balancing supply and demand. Such programs can lower the cost of electricity in wholesale markets, and in turn, lead to lower retail rates. Advanced metering infrastructure expands the range of time-based rate programs that can be offered to consumers and smart customer systems such as in-home displays or home-area-networks can make it easier for consumers to changes their behavior and reduce peak period consumption from information on their power consumption and costs (Aswani and Rathan, 2014).

These programs also have the potential to help electricity providers save money through reductions in peak demand and the ability to defer construction of new power plants and

power delivery systems .Specifically, those reserved for use during peak time. However, the purpose of the DR is not only to lower electricity demand from customers at peak demand times, but also to prevent higher power demand peaks even if the price is low.

MATERIALS AND METHODS

Architecture to Manage Energy Consumption: The objective of deploying energy management system in the home is to minimize the expense of electricity and reduce the PAR by scheduling the pattern of electricity usage based on a priori supplied EP to ensure power system stability and security (Figure 1).

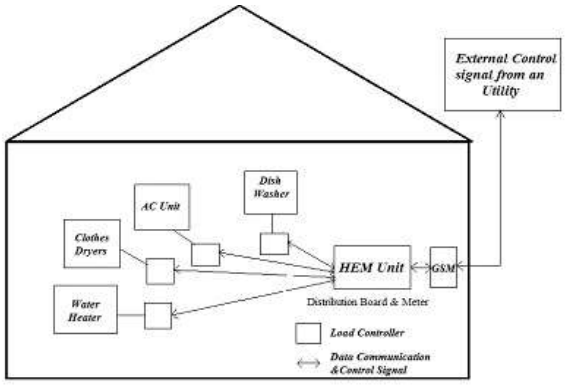

Fig 1.HEM architecture

Energy management system (EMS) mainly comprises Metering Infrastructures (MI), Relay drives, GSM module, Microcontroller and Electrical loads.

A. Metering Infrastructures (MI): To monitor and calculate the amount of supply consumed by the consumer has been shown by the meters. Most probably Electricity meters operate by continuously measuring the instantaneous V, A and E.

a) Current Transformers (CT): A current transformer (CT) is used for measurement of electric currents. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry.

b) Potential Transformers (PT): Voltage transformers are used for protective-relaying purposes, the "instrument potential transformer," also called simply "potential

transformer is a conventional transformer having primary and secondary windings. The primary winding is connected directly to the power circuit either between two phases or between one phase and ground, depending on the rating of the transformer and on the requirements of the application. Potential Transformer or Voltage Transformer is used in electrical power system for stepping down the system voltage to a safe value which can be fed to low ratings meters and relays. Commercially available relays and meters used for protection and metering, are designed for low voltage.

B. Relay Drives: Relays are electromagnetic switches used as protective devices, indicating devices and as transmitting devices. Protective relay protect good component from the effects of the circuit components that have failed. Transmission relay are used in communication systems. Indicating relay may be used to identify a component which has failed. Transmission relay may be used to identify a component which has failed

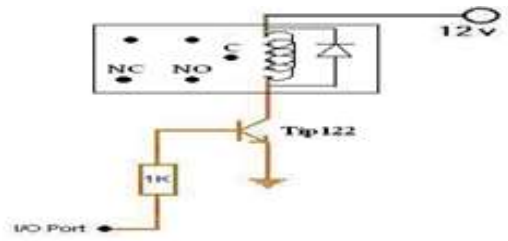

Fig 2.Relay Circuit

Contacts which are opened and close others, Contacts which are opened when energized are called “Normally Open” (NO) or simply open contacts. Contacts which are closed when energized are called “Normally Closed” (NC) or simply open contacts.

C. Communication unit: GSM (Global System for Mobile Communications, originally Grouped Special Mobile), is used a communication unit in our project. Communication unit establishes the connection between the HEM unit and the Load controller and helps HEM unit to send command signals according to DR and load priority. It is a standard set developed by (ETSI) to describe protocols for second generation digital cellular networks used by phones. The commands send by the Master (TNEB) is received by the GSM module connected in the metering system. These signals can be processed by the microcontroller.

D. Microcontroller: Controller is an automated switch which works according to the command from the HEM unit. HEM unit pass signals to the load controller in order to control

the operation of load. It provides the basic power management functions (i.e., monitor, control, communicate) via a standard electrical outlet. The microcontroller is the heart of the power saving unit, which get the data from sensor and driver the control circuit. It is an integrated chip that is often part of an embedded system. The microcontroller includes a CPU RAM, ROM, I/O ports and timers like a standard computer but they are designed to execute only a single specific task to control a single system they are much smaller and simplified so that they can include all the functions required on a single chip.

E. Consumer Load priority and Operating Mode Settings: Before implementing the proposed HEM demand response algorithm the homeowner will set their load priority such as (manual priority, automatic priority) and load ON operating mode. The priority can be represented based on peak hour, mid peak and off peak. The appliances such as Air conditioner, Air coolers, Water pump, Water heater, Washing machine, Dish washer and UPS charger are considered for this system, for the water pump the load ON time can be set e.g., 10 A.M similarly for the water heater the load ON time can be set as 5.0 A.M.

Circuit Diagram: With the emergence of the smart grid, residents can reduce their electricity cost by scheduling the pattern of their home electricity usage, based on the real-time electricity prices.

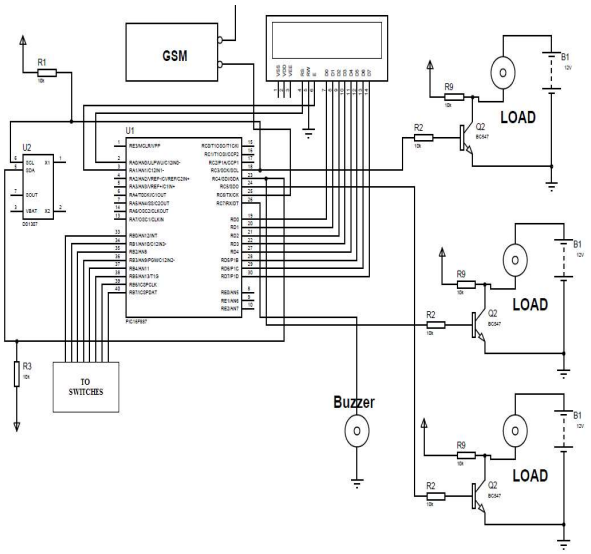

Fig 3.Circuit Diagram for Proposed System

Initially the Tami Nadu Electricity Board and the user side can be connected through the GSM connections. The TNEB will send the power scheduling time to the user, which received by the power demand meter. Based on the command from TNEB the demand meter which set the system in limited mode or custom mode (Aswani and Rathan, 2014). The watt

hr meter connected in the system will note the power usage of the user. Based on these readings the demand meter will trip the loads to reduce the power consumption of the user.

A. Working: After initializing, the power demand meter circuit, it should synchronize the microcontroller with the GSM. By sending MASTER & SLAVE command, set one person as master and other one as slave. The master unit will the Tamil Nadu electricity board and slave will be the consumer. From the Master mode send a command to SIM in the circuit to set the power meter as in custom mode or in limited mode. By means of command setting, the power will be scheduling among the appliances (Zhuang Zhao *et al.,* 2013). However, the purpose of the demand response is not only to lower electricity demand from customers at peak demand times. This power demand meter reduces the use of inverter and save electricity for future use. By this power demand meter, many things can be controlled and monitored continuously.

CONCLUSION

In this paper, we have proposed a real-time appliance scheduling scheme for residential Demand Response based on the optimal stopping approach. In the proposed work, wireless meter reading system is designed to continuously monitor the meter reading and to shut down the power supply remotely whenever the consumer crosses the set power limit. As the basis for electricity usage scheduling, the demand response information would be delivered to each home. With an energy management system installed in the home, residents can make use of this information via an in-home energy management controller, which uses both prices and user preferences to schedule power usage. The objective of deploying energy management system in the home is to minimize the expense of electricity and reduce the peak-to-average ratio by scheduling the pattern of electricity usage based on a prior supplied electricity prices to ensure power system stability and security. Surely the proposed system can be a reliable solution for future Energy Management System in Home Area Network.

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