

# Smart Energy Meter Using Global System for Mobile Communication

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**Abstract** - In this project Hybrid Smart Home and Prepaid Energy Meter Using GSM has been presented to adoptively reduce the Negligent and unnecessary power consumption in home. The proposed system has three main components namely Sensor Block, wireless system (GSM) and Energy meter. Microcontroller and sensor units are used to implement smart home, based on sensor outputs the electrical appliances are controlled. On the other hand, wireless modules have been used to implement the wireless system using GSM. The main goal of this system is to control home appliances by using SMS.

**Key Words:** Smart Energy Meter, GSM, Microcontroller, Sensors

## 1. INTRODUCTION

The world has become a global village due to revolution in the technology, in this revolution the IT (Information Technology) played an important role. Similarly the revolution in IT makes mankind dream come true to have an automated home. Home automation use microprocessor-based intelligence to integrate or control electronic products and systems in the home. The incentive behind home automation is efficient utilization of electricity. So a variety of research and many solutions had proposed on home automation. These systems use PC, mobile internet, GSM, Bluetooth and ZigBee network etc. Generally, home automation research targeted many needs, some applications fulfil the sophisticated and luxury requirements, other focuses the special needs like elderly and the disabled etc.

Wireless communication reduces the complexity related to the installation and maintenance compared to its wired counterpart. A typical home automation system comprises battery operated and low power sensors and actuators. Bluetooth, Wi-Fi, and ZigBee are the popular choice for the backbone of such systems. Wireless network based smart home systems have become very popular as they provide comfort, security, and safety. Moreover they support remote monitoring facilities. The availability of cheap sensors, actuators, and modules has reduced the gap between the luxury and mass market segmentations of home automation technologies. However, home automation system has some limitations too.

## 2. Prepaid Electrical Billing System

In recent years many attempts have been made to design the energy meter with instant billing technique but till now the designed energy meters are not efficient and do not provide replacement. Now-a-days the number of Electricity consumers are increasing in great extent. It is hard to handle and maintain

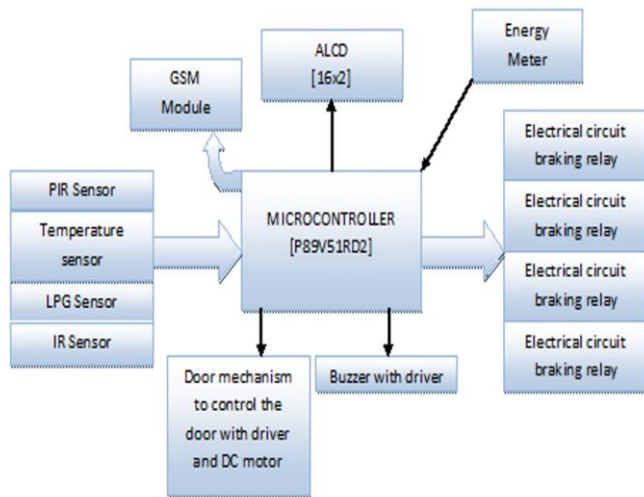
the power due to growing requirements. Maintenance of the power is an important task as the human operator goes to consumer's house and produces the bill as per the meter reading.

The billing process takes much time if the consumers are not in the house while taking readings on energy consumption. It requires a lot of time and more labour to analyse energy consumption and generating the bill. If the consumer did not pay the bill, the Foreman needs to go to their houses to disconnect the power supply. These consumes time and difficult to handle. The manual operator cannot find the Un-authorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply. Some of the energy meters which had been implemented are prepaid but it needs Smart card to recharge it.

The major disadvantage of that method is that it needs internet and the computer interface. In this paper we propose a method which uses GSM Network which eliminates the need of internet. This system consists of Energy Meter and the GSM network. The system provides efficient power meter reading, and usage notification using GSM network. GSM modem utilizes the GSM network to send equivalent unit for the recharged amount to the microcontroller and send message to the consumers end. The message consists of details like recharged amount and power consumption.

## 3. Methodology

Power usage reading is made by microcontroller embedded system. Smart billing (SMS) and prepaid (first pay & then use) methodology. Consumer will be intimated about his usage through SMS, so that consumer can minimize his consumption. Since consumer had already paid, he will not be negligent & use power whenever necessary, so that wastage of electrical power can be avoided. In smart home, opening and closing of gate is automated and controlled by an authenticated remote. Using some smart technology and sensors, automatic switching will be done if there is human presence. Using temperature sensors, these fans & warmers can be controlled automatically according with temperature variation. In our system, LPG leakage will be detected & all the electrical power sources into that home automatically cut down with an SMS triggering to the owner, so that accident can be controlled.



**Fig -1:** Block diagram of the model

The present power usage reading is made manually by moving to the consumer locations. This requires large number of labour operators and long working hours to accomplish the task. Manual billing is sometimes restricted and delayed by bad weather conditions. The printed billing also has the tendency of getting lost. Over the last few years, Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut off by a relay. Readings made by human operators are prone to errors. This project addresses the above mentioned problems. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats.

Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. The use of Prepaid Energy meter is still controversial. On the one hand, those that support the diffusion of prepaid meters claim that they benefit both consumers and utilities because they help users to consume more efficiently and to improve the management of their budget, while allowing firms to reduce financial costs. On the other hand, those that are against prepaid meters argue that their adoption is expensive for firms and risky for low income consumers, as the insecurity and volatility of their income may force them to make little use of the service, or ultimately, bring about involuntary self-disconnection. In Smart Home, Microcontroller and sensor units are used to implement smart home, based on sensor outputs the electrical appliances are controlled. On the other hand, wireless modules have been used to implement the wireless system using GSM. The main goal of this system is to control home appliances by using SMS.

## 4. Hardware Components

### 4.1 MICROCONTROLLER

The P89V51RD2 are 8051 microcontrollers with 64kB flash and 1024B of data RAM. A key feature of the P89V51RD2 is

its X2 mode option. The design engineer can choose to run the application with the conventional 8051 clock rate (12 clocks per machine cycle) or select the X2 mode (six clocks per machine cycle) to achieve twice the throughput at the same clock frequency. The flash program memory supports both parallel programming and in serial ISP. Parallel programming mode offers gang-programming at high speed, reducing programming costs and time to market. ISP allows a device to be reprogrammed in the end product under software control. The capability to field/update the application firmware makes a wide range of applications possible.

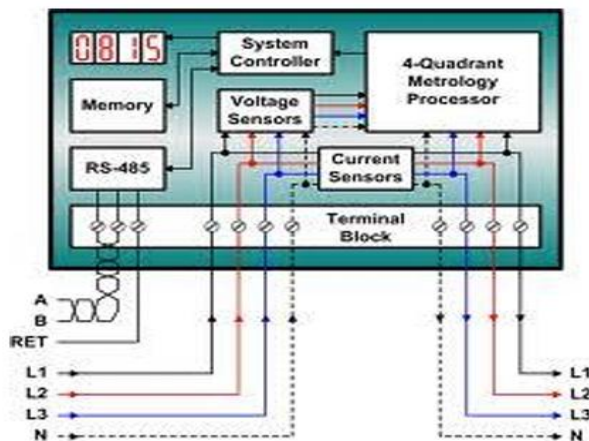
### 4.2 Memory Organization

There are two internal flash memory blocks in the device. Block 0 has 16/32/64 kB and is organized as 128/256/512 sectors, each sector consists of 128 B. Block 1 contains the IAP/ISP routines and may be enabled such that it overlays the first 8 kB of the user code memory. The data RAM has 1024 B of internal memory. The device can also address up to 64 kB for external data memory. The device has four sections of internal data memory: 1. The lower 128 B of RAM (00H to 7FH) is directly and indirectly addressable. 2. The higher 128 B of RAM (80H to FFH) are indirectly addressable. 3. The special function registers (80H to FFH) are directly addressable only. 4. The expanded RAM of 768 B (00H to 2FFH) is indirectly addressable by the move external instruction (MOVX).

### 4.3 ENERGY METER

An Electricity meter or Energy meter is a device that measures the amount of Electric Energy consumed by a residence, business, or an electrically powered device. Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour. A periodic reading of electric meters establishes billing cycles and energy used during a cycle. In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response shedding of loads during peak load periods.

Alpha numeric LCD (ALCD) is used to display information about project. The LCD used is 16x2, 2 rows and 16 columns. So in each row we can display 16 characters. The 1 byte data line of LCD is connected to the Port 2 of the microcontroller. The enable pin of LCD is connected to the Port 3.7 of the microcontroller. The RS pin of the LCD is connected to the Port 3.6 of the microcontroller.



**Fig -2: Energy Meter**

### 4.3 GSM MODEM

GSM stands for Global System for Mobile Communications formerly called as Group Special Mobile. This is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (or "2G") digital cellular networks. The GSM standard initially was used originally to describe switched circuit network for full duplex voice telephony to replace first generation analog cellular networks.

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking. A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem is like a dial-up modem. The basic difference between them is the dial-up modem sends and receives data through a fixed telephone line while the wireless modem sends and receives data through waves. Like a GSM mobile phone, a GSM modem also requires a SIM card from a wireless carrier to operate.

### 5. Results

In this Project, some Smart home automation has been implemented and tested, They are as below, Opening and closing of Gate is Automated and Controlled by an IR remote. Using Smart technology and sensors, Automatic swicthing of Home Lightings will be done if Vibrations detected (Human Presence). Using Temperature Sensors, These FANs & Warmers can Be controlled Automatically According With Temperature Variation. LPG leakage will be detected using LPG sensor & All the Electrical power Sources into that Home Automatically Cut Down With An SMS triggering to the Owner, So that Accident can be controlled.

The energy meter was tested by using an electric light bulb of 100 watts. The supply voltage 230 V was supplied. First of

all a Energy meter was used to measure the power consumed by the load. In the prepaid energy meter module the microcontroller is an master controller. Few units of Electricity are recharged through SMS using GSM. Then energy consumption was measured after every 10 seconds. Total 2 pulses occurred at every 10 seconds in energy meter which is Assumed as 1unit of energy consumed. The computed energy consumption is read from the Microcontroller and display through LCD. Microcontroller will trigger an SMS to Consumer when recharged balance units are 80%, and will disconnect the power supply if recharged balance reaches 0% through relay.

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