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# Smart and Intelligent GSM based Automatic Meter Reading System

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**Abstract:**

This paper presents the development of a fully Automated Energy Meter which is having capabilities like remote monitoring and controlling of energy meter. Automatic Meter Reading system (AMR) continuously monitors the energy meter and sends data on request of service provider through SMS. It saves huge human labour. The data received from an energy meter has been stored in database server which was located at electricity Board station through SMS gate way for further processing by energy provider. Energy provider sends electricity bill either by e-mail, SMS or by post. This system allows to the customers to pay bill online either by credit card, debit card or by net banking. This system provides freedom to electricity companies to take action against lenient customers who have outstanding dues, otherwise companies can disconnect the power of customer .Companies can re-connect the power after deposition of dues. This system also gives the power cut information and tempering alert. So GSM based AMR system is more efficient apropos convention billing system.

Key term: GSM (Global System Mobile), AMR (Automatic Meter Reading), SMS (Short Message Service), Energy Meter.

## 1. Introduction

At present, most of the houses in India have the traditional mechanical watt hour meters and the billing system is not automated [1]. At the end of each month a person from the electricity board goes to every house and takes the meter reading manually. These meter readings are used for electricity bill calculation and this bill sent to consumer house by post. Customer goes to electricity department for paying this bill amount. But in this technique we are required great number of persons for reading the meters. The procedures of sending the bills to customer are very laborious and cumbersome. But a new technology is named Automatic Meter Reading System is discuses. Apart from being a boom, AMR wipes out all the cons of conventional systems. Automatic Meter Reading System is a sophisticated system which allows companies to collect the reading without visiting the site.AMR include various technology for data collection such as power line communication, Zig-bee, Radio Frequency (RF Method) and GSM network but GSM network is best among this technology. So this paper will discuss only GSM based AMR system. Automatic meter reading system helps the customer and energy service provider to access the accurate and updated data from the energy meter.AMR System can send energy consumption in hourly, monthly or on request. This data is sent to central system for billing and troubleshooting. These data are stored into the database server for processing and recording. This technology

mitigates labour cost, collection time, energy theft, avoids late payment. Adding to this it increases data security, improved customer service, reduced revenue losses. This system is not only sending the data but also it does provide power disconnect/connect feature, power cut feature and tempering alert feature. All these advantages give this product an edge over other pragmatically prevailing devices.

## II. Comparison between Automatic Meter Reading System and Conventional Metering System:

Table 1. Succinctly spouts out comparison between Automatic Meter Reading System and Conventional Metering System. Using AMR Technology we can control and monitor any energy meter located anywhere in the world .GSM based energy meter or AMR are provide tempering alert, auto disconnect feature, power cut facility. Automatic meter reading system is access to real time data and received customer complaints. So costs for meter reading will be reduced. AMR system avoids meter reading error and reading data automatically. It's also provides increased security of data

**Table 1.Comparison between AMR and Conventional Metering System**

| S. No. | Features | GSM based AMR System | Conventional Metering System |
|---|---|---|---|
| 1. | Remote Monitoring | Possible (Electricity Department read the meter readings regularly without visiting person) | Not Possible |
| 2. | Control the Domestic Energy Meter | Anywhere in the world | Only at respective Customer house |
| 3. | Tempering alert Feature | It provides temping alert feature. In case of tempering, a SMS alert send to the electricity company | Not Possible |
| 4. | Auto disconnect feature | It provides remote shut-off facilities to rogue customers that have large outstanding dues. | It does not provide auto disconnect feature. |
| 5. | Power cut Information Feature | This system provides the power cut information. | It does not provide power cut information. |
| 6. | Operation costs | Very less because we are accessing the system on request at any time without Visiting person. | More because we require a person for accessing the system. |
| 7. | Data security | AMR system avoid meter reading error and reading data automatically also provides increased security of data | In this system meter reading error possible and its provide less security of data |
| 8. | Man Power | Huge man power required | No man power required |

## III. System Overview of Automatic Meter Reading System:

Figure-1 shows a System overview of AMR. AMR Continuously monitor and record the

energy meter. This can be achieved by using microcontroller unit. Microcontroller unit are interfaced with digital energy meter. Microcontroller unit are interfaced with the RTC by using 2 wire serial interfaces for date and time and RTC memory are also used as data storage permanently. Microcontroller unit are also interfaced GSM modem for remote monitoring and control domestic energy meter. The data received through GSM Modem and network. Data is being sent to the AMR on request and within a particular interval. Once the meter received the request of data from the energy provider, SMS gateway will immediately reply the meter reading with that date and time. The data received from meter is stored in database server through SMS gate way for processing and record. This data received from meter are stored in database server according to Meter ID that is providing to customer house. At the end of each month the server using the detail of database server and calculate the bill amount and send the complete detail of consummation of unit, and total bill amount. User can verify the same AMR possess have transparency on the part of customer and service provider.

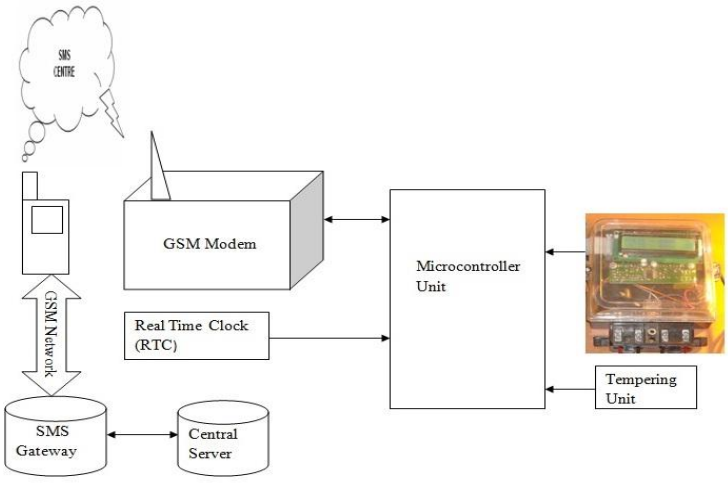


**Figure 1. Block diagram of GSM based AMR**

## IV. Flow Diagram of AMR:

Flow diagram succinctly shows that Energy provider installs the system in particular house. The meter constantly gives the rise in meter reading and no. of units consumed. Electricity department will be requiring data for processing and bill calculation so they send a message for required data .When an interrupt occurs it means microcontroller unit receive a message through GSM modem .So microcontroller read the message and also read message received number and check the authentication .If the number is authenticate ,then it read current data from EPROM and send the data to authenticated number. GSM based AMR sends a SMS alert to energy provider , if system access mobile number is not authenticated. This SMS alert has a detail of un-authenticated numbers but have not data. Fig.2 is working according to programmed written in Embedded C. It also provides the facility of power disconnect to customer that have large outstanding dues. Electricity department sends a code to the energy meter that has large outstanding dues. Microcontroller has a program of matching of this code to power disconnect code. If this code is match then power disconnect to respective meter .It also provide a facility to power re-connect due to deposit the large outstanding previous bill amount. Again Electricity department sent a code to the energy meter that deposits the large outstanding previous bill amount. Microcontroller has a program of matching of this code to power re-connect code. If this code is matches then power reconnect to respective meter. It also provides the power cut information. Meter automatically sent a SMS alert to the energy provider of power cut when the power cut in particular area. AMR also

provide a tempering alert facility to energy provider.

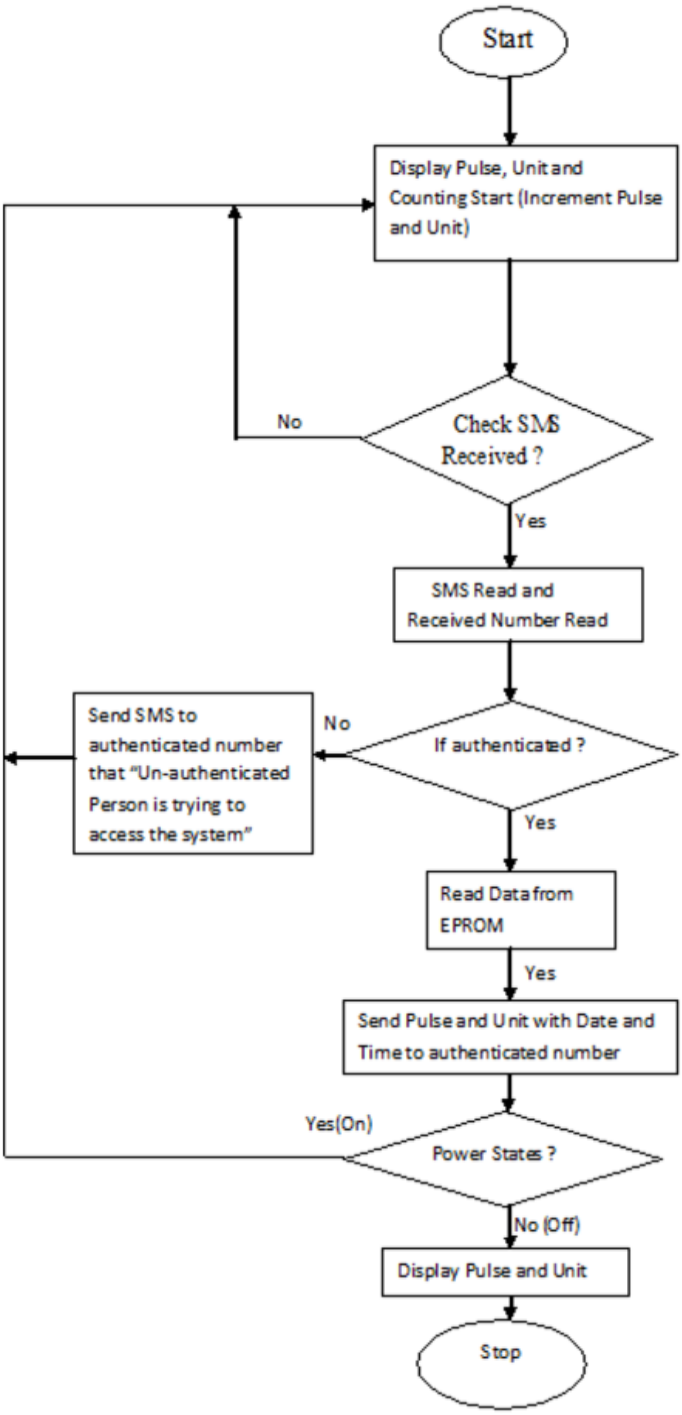


**Figure 2.Flow diagram of Controlling Program of GSM based of AMR**

## V. System Implementation and Results:

In fig.3 shows a complete set up of GSM based energy meter .Microcontroller interfaced with GSM module and energy meter .Pulse and unit in energy meter are continuously increment according to power consumption. For implementation of AMR a SIM card is required for the GSM modem of energy meter .A Identification (ID) number allotted according to SIM contact number. According to requirement of data electricity department sent a message to particular energy meter. When microcontroller received a message its respective port bit are high and an interrupt signal occur. Microcontroller starts to execute to the interrupt service subroutine until it reaches last instruction of the subroutine. After executing of RET instruction microcontroller return to main program that is increment of pulse program. After Every one month data will be received by the electricity company automatically and Electricity Company can be access the system at any time on request.

**Figure 3. Prototype modal of Automatic meter reading system**

After bill calculation the bill sent to customer by post, by mail, by SMS and customer also see bill by login of our account. In fig.4 shows the e-mail alert of bill amount and deposit from electricity department to customer.

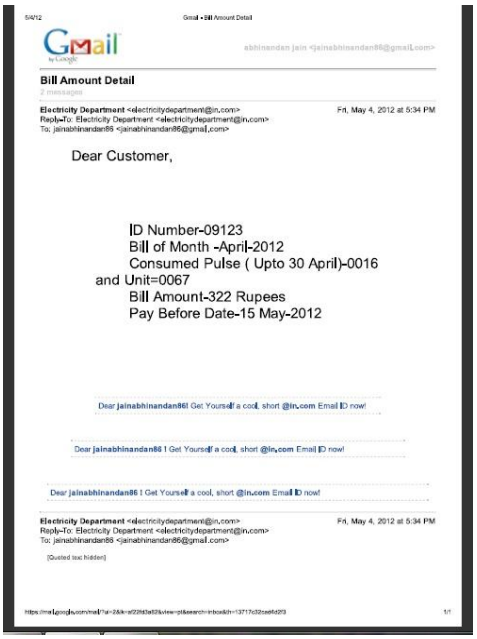


**Figure 4. E – mail alert of bill amount detail send by Electricity Department to customer**

Electricity department also sent a SMS alert to customer mobile number for Bill information that is shown in fig.5. After that person can be pay our bill by access our login into web portable. Electricity bill payment online can be done via online pay where the person first read the statement of the amount pay and then pay the amount of the bill rather than going to the electricity department for pay of bill. Online electricity bill payment can be made through credit card, debit card or by net banking. The acknowledgement is mailed in form of SMS for the online bill payment within 12 hours of transition. This helps to avoid any late fees or payments which may affect your credit rating. So it saves lot of time and energy.

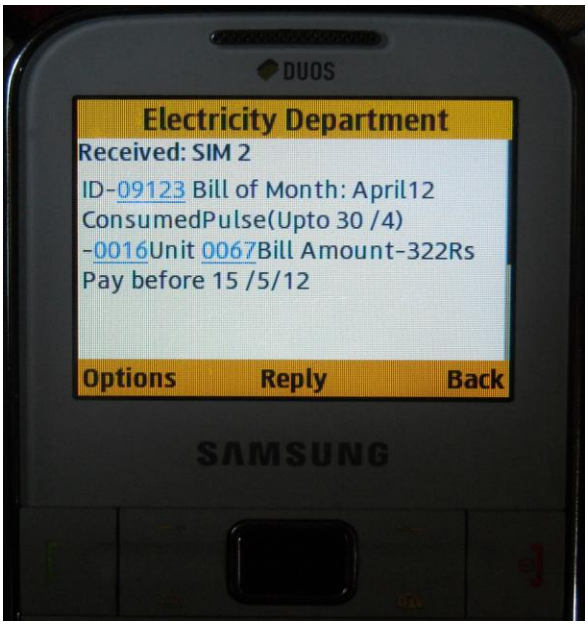


**Figure5. SMS alert of bill amount detail send by electricity department to customer**

## VI. Conclusion:

The development of GSM based energy meter demonstrates the concept and implementation of new power metering system. GSM based AMR have low infrastructure cost, low operating costs, more data security and less man power required. It not only solve the problem of manual meter reading but also provide additional feature such as power disconnect, power connect , power cut alert and tempering alert customer can also pay bill via online login on authenticated web. Data base server can stored the current month data and also all previous month data for future use. So it saves a lot amount of time and energy.

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