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Review on Electric Billing Energy Meters

Sneha Atmaram Chautmol[1], Asst. Prof K. A. Dongre[2]
[1]*(M.E Student), Pankaj Laddhad Institute of Technology & Management Studies, Buldana*
[2]*Ram Meghe College of Engineering & Management, Badnera, Amravati*

Abstract: ***The electricity provided for domestic uses or industrial uses is billed by the energy department by installing meters at every consumer's domestic or industrial units. The consumers are billed according to the electricity consumed and fixed per unit price which can change according to the geographical locations and areas. The per unit price is fixed by the energy departments. Energy meters are very important devices for measuring and monitoring the electricity consumed. There has been an evolution in techniques in energy meters and various technological up-gradations have taken place. This paper focuses on various technologies implemented for energy meters and the techniques which are developing or still under consideration.***

I. INTRODUCTION

In today's times with the ever growing technological advancements and rapid industrialisation, there has been a tremendous increase in energy demands and electricity usage has been in every sector. Energy Departments of various cities are responsible for maintaining and providing electricity to consumers. The Energy departments also provide standard installation of energy meters to allotted and registered users. The consumers are then billed according to their own electricity usage in a transparent manner. The billing section gets the information of the consumed units and then the price per unit decides the final bill for each and every user.

With the advent of technology there has been a change in basic design of electric billing meters. The earlier used energy meters were of electromechanical type and with changing techniques of implementation it is now of electronic type. Some of the features which must be available in modern energy meters are:

1) Higher speed.
2) Improved load profile.
3) Automatic billing invoice.
4) Real time energy cost.
5) Load management.
6) Alarm warning.
7) Remote power switches on/off.
8) Tamper detection.

To include these features, the energy meter should automatically send the bills to the user i.e., without any need of manual bill readings. The meters then must be incorporated with reed switch or a sensing mechanism to detect tampering and also should be connected wirelessly to the main station. Different techniques can be implemented to provide bills to the users which can be by providing messages for the bills or providing information to users through apps on registered mobile numbers. The energy billing meters must be first analysed for its techniques and designs as it is going to be implemented as a long term evolution technique. The bills can be implemented in post-paid form or prepaid form. The use of internet as a technology has added another benefit of online payments which can help customers to pay the bills without the need of going and standing in the billing queues. Fig.1 shows the basic two meters.

Fig.1 Traditional Electromechanical meter Vs Electronic meter.

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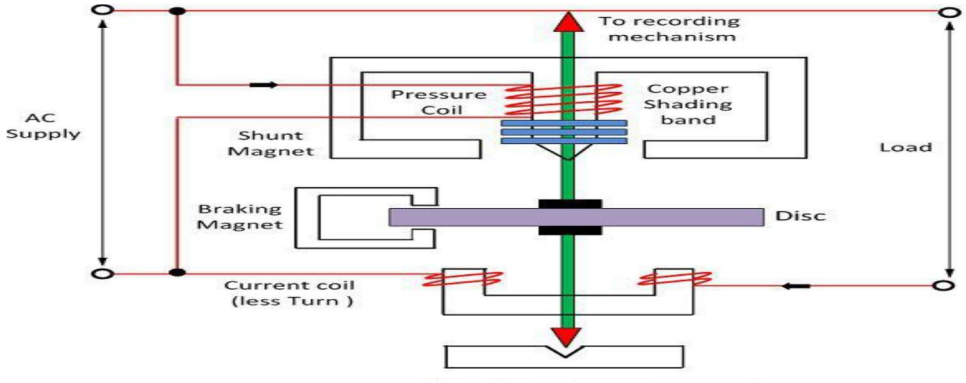
A. Working

The energy meter has an aluminium disc whose rotation determines the power consumption of the load. The disc is placed between the air gap of the series and shunt electromagnet. The shunt magnet has the pressure coil, and the series magnet has the current coil. The pressure coil creates the magnetic field because of the supply voltage, and the current coil produces it because of the current. The field induces by the voltage coil is lagging by 90º on the magnetic field of the current coil because of which eddy current induced in the disc. The interaction of the eddy current and the magnetic field causes torque, which exerts a force on the disc. Thus, the disc starts rotating. The force on the disc is proportional to the current and voltage of the coil. The permanent magnet controls their rotation. The permanent magnet opposes the movement of the disc and equalises it on the power consumption. The cyclometer counts the rotation of the disc [9].



II. LITERATURE SURVEY

The existing systems which are implemented had some disadvantages which are overcome by newly implemented techniques. These techniques have unique features such as tampering detection, bills being sent on the registered mobile numbers and the bill processing done is sent by the meters to the energy department directly. When information has to be sent in wireless manner, many techniques can be implemented where GSM, GPRS, ZIGBEE based systems are worked upon as technology and meters of the future.

A. Energy Meters Employing GSM as a Technique

These systems have a microcontroller to control the circuit functions and process the data of the billing unit. The processed information has to be sent to the main server by the meter unit itself to the energy board. The energy board then checks for the price of per unit charge according to the units consumed and the area for the particular pricing. The information is then available on the server for user accessibility and for future reference. This system is responsible for automating the energy systems and hence can be defined as the first generation of automated energy meter systems. These were not implemented on large scale owing to some of the disadvantages associated with use of GSM technique, hence it needs network coverage and also billing shall be required to send the data from user nodes to the server. Fig.3 shows the basic block diagram of GSM based energy meter systems.

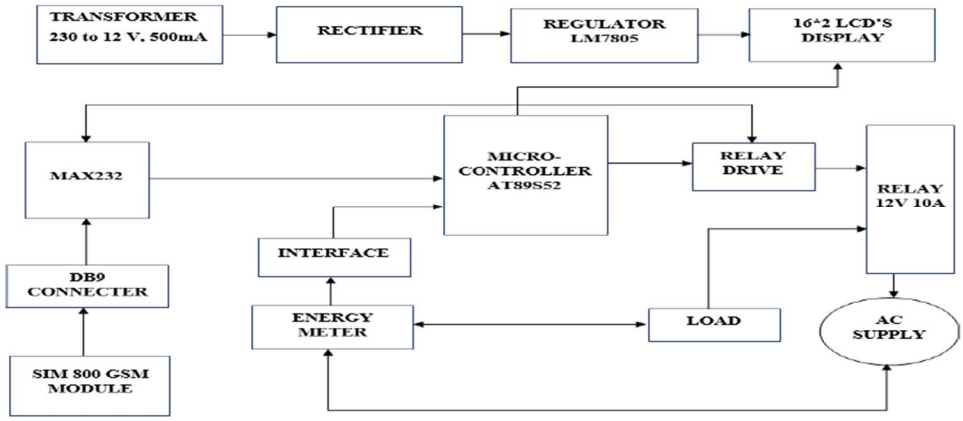


Fig.3- Energy billing meters based on GSM

B. Tampering Detection Mechanism

An important aspect of billing meters should be to avoid thefts by consumers which are responsible for major losses to the energy board companies. There are two types of thefts which are namely external thefts and internal thefts. External thefts are associated to using electricity from electric poles directly. These thefts can be caught easily by vigilance officers but internal thefts are associated to tampering of the meter internally which is not visible physically. To overcome this problem a reed switch is attached to the internal side of the meter case. Whenever a user opens the meter case a trigger message is sent to the energy boards. The energy board can then make its own rules and may disconnect the power supply of the persons who are involved in such offences. Reed switch may be used or any other device which can detect the opening of the case by the consumers like IR sensor etc. The reed switch is found to be more efficient for these applications.

Fig- Reed Switch

Node based energy meters have started floating in the market as a technology but hasn't been selected yet owing to the efficiency of the system and its run on a trial and error basis before implementing it as a long term evolution plan.

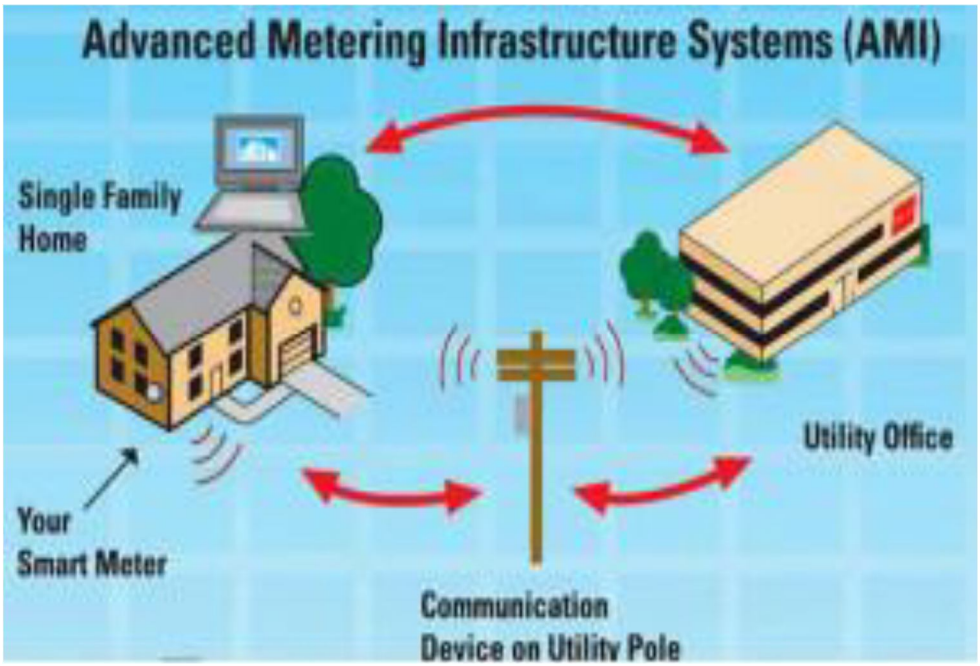


Fig: Advanced Metering systems

III. CONCLUSION

There are multiple techniques to implement smart energy meters but it won't be feasible to change the energy meters of the consumers multiple times and investing on smart energy meters frequently shall not allow long term evolution based scheme for smart energy meters. The existing system needs a technological upgrade but at the same time, designing a feasible system is also very important. This paper discussed the existing technologies and their disadvantages. The GSM based and node based techniques are discussed to analyse their merits and demerits. Also the features an ideal meter should have are discussed in this paper

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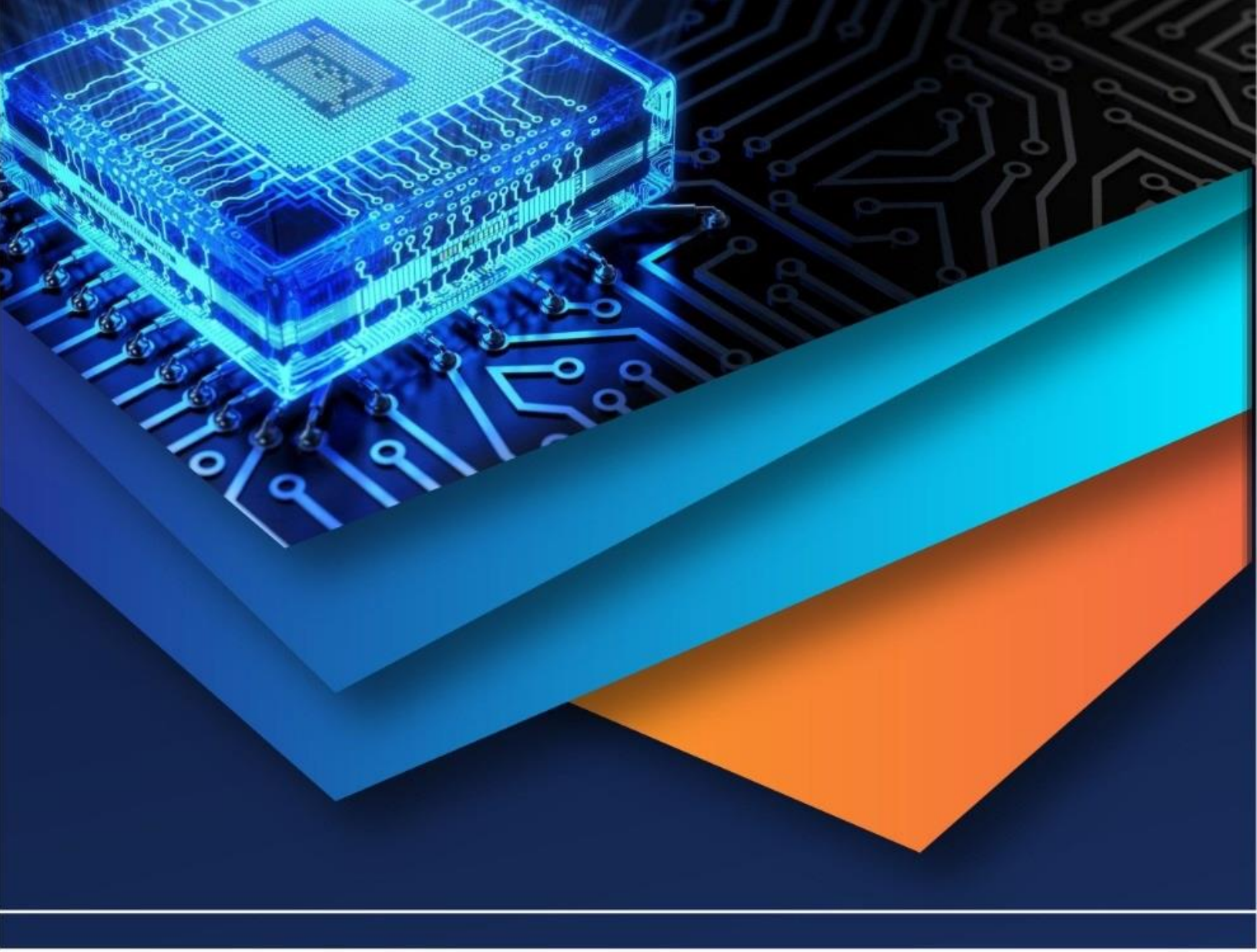

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