



# GSM Based Smart controlled Digital Energy Meter with RFID Chip

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**Abstract:** In the present day scenario, the energy consumption awareness plays an important role as its demand is growing day by day. Huge differences in energy production and consumption urges the need to reduce the power wastage. The prepaid electricity system proposed in this paper aims at reducing the wastage of power due to its theft and control its usage on the consumer side. This increases the overall efficiency of the power system. The RFID card enables a consumer to utilize the energy for which he has paid. A microcontroller continuously checks if his balance is within the threshold limit and he is notified when his balance goes below the limits. Once it exceeds the threshold value, the supply is automatically cut off. The user can then recharge by making an online payment whenever necessary. The LCD continuously shows the units of energy consumed.

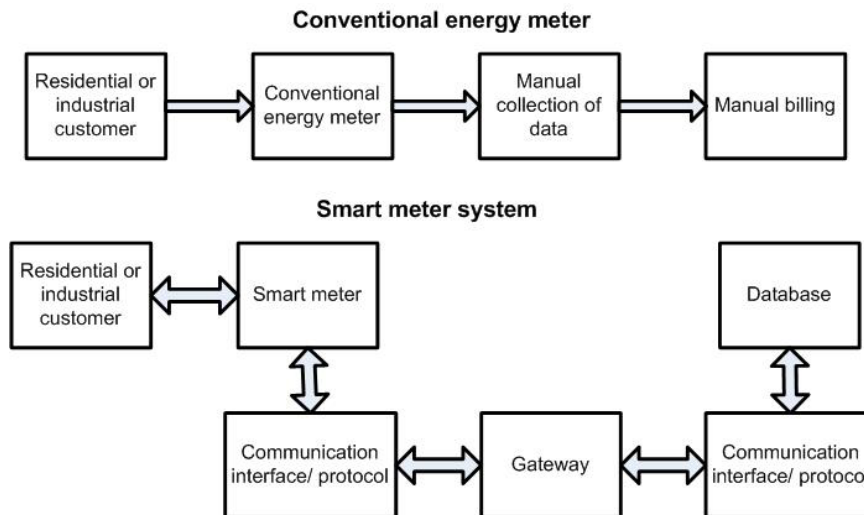
## INTRODUCTION

The term Smart Meter often refers to an electricity meter. Similar meters, usually referred to as interval or time-of-use meters, have existed for years, but "Smart Meters" usually involve real-time or near real-time sensors, power outage notification, and power quality monitoring. These additional features are more than simple automated meter reading (AMR). In 2017, there were 665 million smart meters installed globally. Revenue generation is expected to grow from \$12.8 billion in 2017 to \$20 billion by 2022. Smart meters may be part of a smart grid, but do not themselves constitute a smart grid.

Every month we can see a person standing in front of our house from Electricity board, whose duty is to read the energy meter and handover the bills to the owner of that house. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills. The present billing system is minimally able to detect power theft and even when it does it is at the end of the month. Also, the distribution company is facing many problems in terms of losses. The distribution company is unable to keep track of the changing maximum demand for domestic consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on a timely basis, which will help assure accurate billing, track maximum demand, and detect online theft. These are all the features to be taken into account for designing an efficient energy billing system. The main motive of this system is pay before use. The main objective is to minimize the illegal usage of electricity, reduce power wastage due to its theft and to control the usage of power on the consumer side and thus increase the overall efficiency of power system. The conventional energy meters have not been replaced, but a small modification on the already installed meters can change the existing meters into prepaid meters, so these meters are very cheap.

### Smart meter and GSM Based smart energy meter :-

A smart meter is an electronic device that records information such as consumption of electric energy, voltage levels, current, and power factor. Smart meters communicate the information to the consumer for greater clarity of consumption behavior. Smart meters enable two-way communication between the meter and the central system. Communications from the meter to the network may be wireless, or via fixed wired connections such as power line carrier (PLC).

**Architecture of smart energy meter:****Prepaid billing:-**

This requires the customer to make advance payment before electricity can be used. If the available credit is exhausted then the supply of electricity is cut off by a relay. There are various groups, such as the Standard Transfer Specification (STS) association, which promote common standards for prepayment metering systems across manufacturers.

**Tampering :-**

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**Solution :-**

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods. RFID is one method of automatic identification and data capture (AIDC). Unlike a barcode, the tag does not need to be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of automatic identification and data capture (AIDC). The RFID card is given a default amount of Rs.5. The threshold amount is stored in the microcontroller. The load is connected to the hardware section and the program coded in Python is run.

The RFID card is swiped in the card reader. The amount credited in the card is read and is then passed on to the microcontroller. It checks if the amount is within the limits and if true then the consumer can consume energy. The pulses consumed are read by the energy meter and using an optocoupler it is coupled to the microcontroller. The OLED connected to the microcontroller displays the pulses and the amount being consumed. For each pulse consumed Rs.0.5 is deducted from the main balance and is always cross checked with the threshold value. Once it goes below the limit the relay coil is de-ignited and the supply is cut off, thereby opens the circuit. So the supply is cut off. In order to recharge the information is passed on to the utility section. Using the recharge mode in the software the card is again recharged for the required amount. The time interval between two successive readings are taken as a month. The maximum limit for a month is fixed to be Rs.50. If there is a balance amount at the end of a month then this amount will be credited to the next month with pulses being set again to zero. The buzzer is provided when the recharge amount is about to be over. The figure shows the RFID card and card reader.

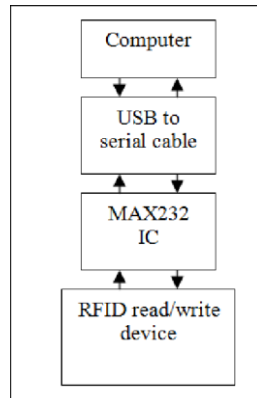
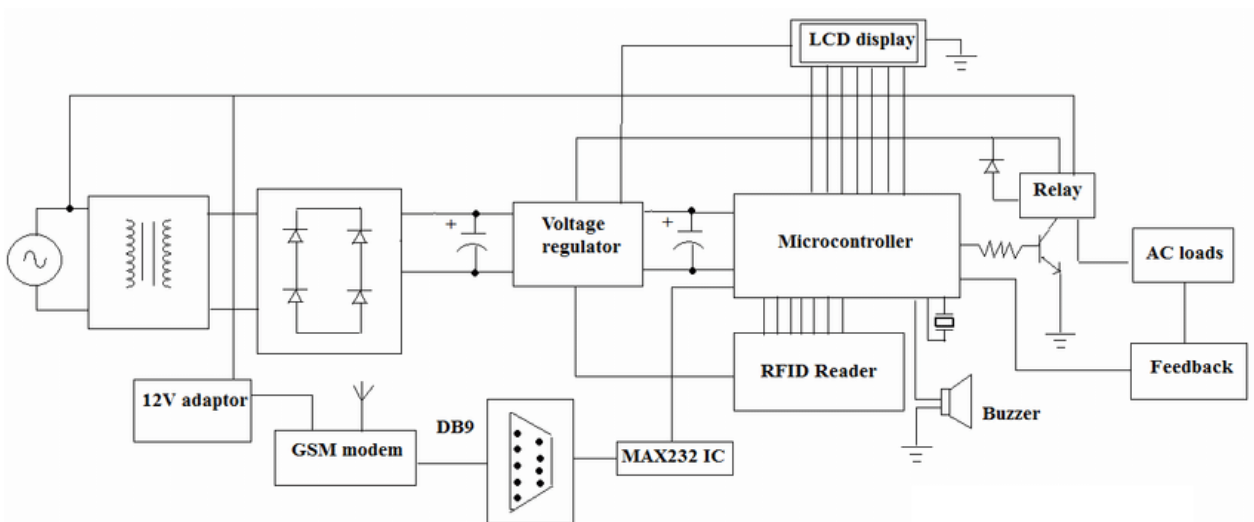


Figure shows, the connection diagram to communicate with RFID read/write device. The implementation shown in Figure 3 is mainly for top up the credit into the RFID card. Notice that in the top up process, no microcontroller is required. The communication between the device and the computer is via a direct connection to MAX232 IC. MAX232 regulates the voltage level between the output of the RFID read/write device and the computer. The arrows shown in Figure 3 indicate the direction flows of data. The communication between the device and the computer is in duplex or bi-direction.

#### WORKING and PRINCIPLE, CONSTRUCTION & OPERATION OF SMART DIGITAL ENERGY METER:-



The working principle of the RFID power meter begins from the AC 240V power source. From the block diagram, the transformer steps down the AC 240V into AC 12V. The diode connected in bridge converts 12V AC sine wave into full wave rectifier waveform. With capacitor connected at the output, the full wave rectifier waveform is converted into DC. The capacitor actually acts as filter which removes the ripple content in the DC. With voltage regulator connect across at the output of the capacitor, the DC voltage is regulated down into 5V. The 5V is then used by microcontroller, relay, MAX232 IC and LCD display.

When the RFID reader is activated or read the correct RFID card, the data from the card is transferred to the microcontroller. The microcontroller will compute the power, credit and trigger the relay so that the AC load is connected to the AC source. Both the power and credit are displayed in the LCD screen. As the credit is low, the buzzer will be activated and an SMS message will send out to the hand phone through GSM modem.

**CONCLUSION:-**

This paper identifies the key benefits of Prepaid Electricity system. This system can control the usage of electricity on consumer side to avoid wastage of power it proves to be a boon in the power sector. The major drawback of a postpaid system is that there is no control of usage from the consumer's side. There is a lot of wastage of power due to the consumers lack of planning of electrical consumption in an efficient way. Since the supply of power is limited, as a responsible citizen, there is a need to utilize electricity in a better and efficient way. The importance of the electricity power leads the researchers to find new technologies to get a better utilization of electrical power and reduce the waste. One of these technologies is the prepaid metering system. There are many methods for recharging the credit and for communication with the server. The proposed prototype electricity prepaid metering system used RFID technology as recharging method.

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