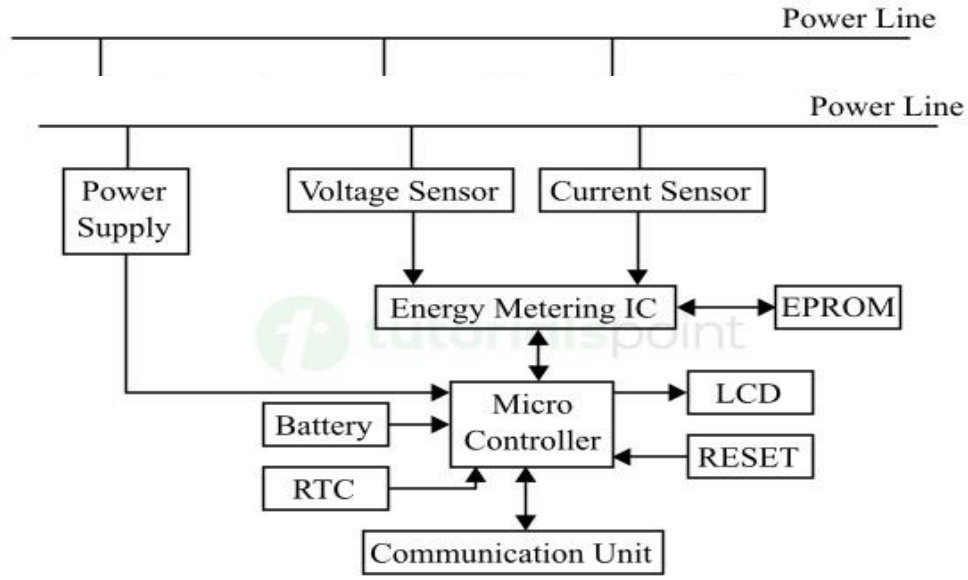
ARCHITECTURE OF SMART METERS:



1. POWER SUPPLY UNIT:

It is the main component of a smart energy meter. Its primary function is to convert the input power supply into a low value suitable for the internal electronic parts of the meter. It provides power to all other components of the smart meter to function.

2. VOLTAGE SENSOR:

It is provided in the smart meter to measure the system voltage.

3. CURRENT SENSOR:

It is provided to measure the amount of current flowing in the load circuit.

4. ENERGY METERING IC

This component uses voltage and current sensors data to calculate energy consumption and record this data for reporting and billing purposes.

5. EPROM:

It stands for Erasable Programmable Read Only Memory. It is used to store permanent data related to smart meters' configuration settings.

6. BATTERY:

It is provided in smart meters to keep powering up the internal critical components like real-time clock, memory, etc. during power outages.

7. REAL-TIME CLOCL(RTC):

It is provided to keep the current time and date up to date which is essential for accurate timestamping of energy consumption.

8. MICROCONTROLLER:

It acts as a central processing unit in the smart meter. It processes data received from sensors, controls and manage operations of all other components of the meter.

9. LCD DISPLAY:

It is provided to create an interface between human and machine. It shows energy readings and other information to the consumer.

10. RESET:

This component is provided in smart meter to reset its microcontroller and other components to their initial state in case when their any operational issues in the meter.

11. COMMUNICATION UNIT

This component of the smart meter is responsible for exchanging data between smart meter and utility company's control center. This component enables features like two-way communication and remote meter reading.

The smart meter consists of a metering device inside it which accurately measures the energy consumption by using digital technologies. Here is the step-by-step working of a smart meter –

- The voltage and current sensors of the smart meter measure the voltage and current values in the circuit.
- These values are then multiplied by using a digital IC to calculate the power consumption in watts.
- The power consumption is integrated over a certain period of time to calculate the total energy consumption in kilowatt-hours.

DATA TRANSMISSION TECHNOLOGIES IN SMART SYSTEM:

Smart meters measure the data related to energy consumption and transmit them to the utilities central control system by using any of the following communication methods –

1. POWER LINE CARRIER COMMUNICATION:

PLCC is the most commonly used communication technology in smart grids. It allows smart meters to transmit their data to the central control center through existing power lines. Thus, it eliminates the need for establishing additional communication infrastructure and becomes a cost-effective and reliable communication method. However, the performance of this communication channel can be influenced by electrical noise and distance of data transmission.

2. RADIO FREQUENCY COMMUNICATION:

In this method, the data is transmitted from smart meters to control center through radio frequency signals. It is a wireless communication channel. This communication method is best suited for long range communication and large-scale deployment due to its cost-effectiveness. However, it is highly susceptible to interference from other wireless communication channels. Thus, it requires devices like gateways, repeaters, etc. to ensure reliable communication.

3. BROADBAND CONNECTION:

It is another common communication method used to transmit data from smart meters to control centers. The common examples of broadband connections are digital subscriber line (DSL) and fiber optic cables. This method provides high speed data communication, but it requires a high capital investment for infrastructure development, especially in the area where broadband coverage is limited.

4. CELLULAR NETWORKS:

Modern smart meters are also equipped with cellular communication technologies like 4G, 5G, etc. for data transmission.