SMART METER BASED ENERGY HUBS PEROFRMING ENERGY INTEROPERABILITY TO IMPROVE CONSUMER FRIENDLY ENERGY SECTOR

IITM Technology Available for Licensing

PROBLEM STATEMENT

- **Smart grid technology** is rapidly developing, with meter reading and billing processes being manual and time-consuming.
- Smart energy meters have taken over this process, allowing for **intelligent electronic devices to meter, store, and communicate data with the central system.**
- Conventional postpaid smart meters are used in residential, commercial, and industrial sectors, where users use energy units and pay for them.
- **Prepaid smart meters are gaining popularity as they allow consumers to prepay for electricity usage and monitor usage in real-time**, reducing unexpected bills.
- Prepaid smart energy meters offer advantages like prepayment for specific usage times, **but power supply cuts off when energy units are depleted, necessitating energy interoperability with neighbouring prepaid smart meters.**

TECHNOLOGY CATEGORY/ MARKET

Technology: Smart energy meters for performing energy interoperability with neighbouring smart energy meters

Category: Energy, Energy Storage & Renewable Energy

Industry: Smart meter manufacturer

Application: Utility Billing and Customer Management,Smart Homes and IoT Integration,

Market: The global market size is expected to grow from **99.34 Million units in 2024 to 129.59 Million units by 2029**, at a **CAGR of 5.46% during the forecast period (2024-2029).**

INTELLECTUAL PROPERTY

IITM IDF Ref. 2609
Application No: 202441002589

TRL (Technology Readiness Level)

TRL- 4, Technology validated in lab

Research Lab

Prof. Shanthi Swarup K,
Dept. of Electrical Engineering

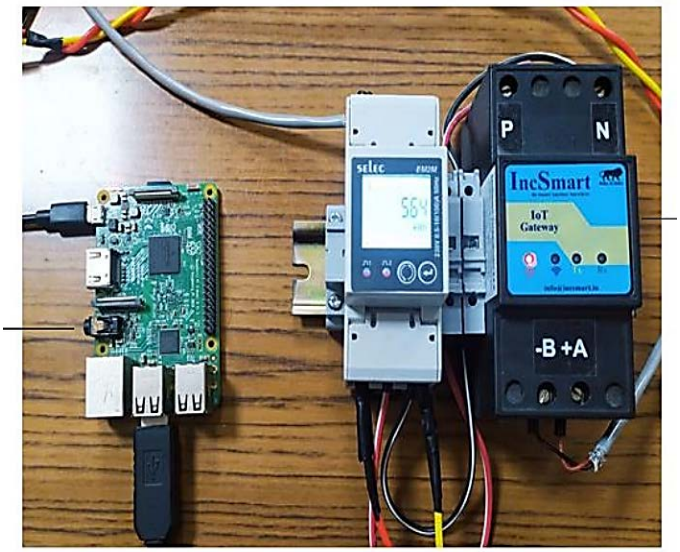
TECHNOLOGY

A smart energy meter is a device that enables energy interoperability with neighbouring smart energy meters.

It consists of a memory and a controller that communicates with the memory.

The controller assigns a predetermined number of energy units to the meter, monitors usage, determines balance, sends requests to neighbouring smart energy meters, and receives the requested number from at least one neighbouring smart energy meter, ensuring energy efficiency and preventing power outages.

Fig 1 shows a Raspberry Pi enabled Prepaid Smart Meter (PPSM)



CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Figure 2 shows a smart energy meter (101) communicating with neighbouring smart energy meters (102) via a communication network (121) for energy interoperability.

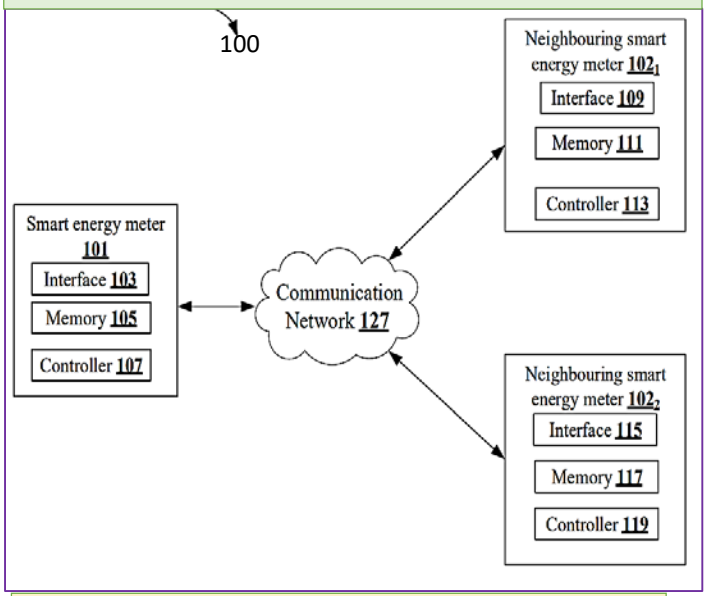


Figure 3 shows a block diagram of a smart energy meter

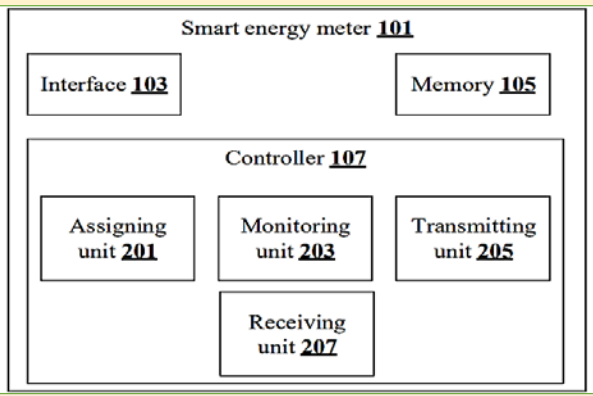


Figure 4 shows a block diagram of Neighbouring smart energy meter

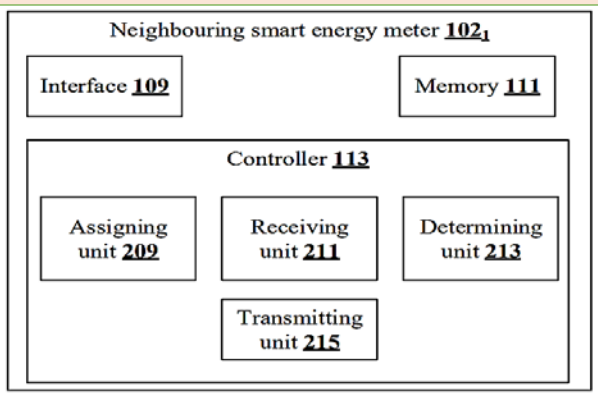


Figure 5 shows a flow chart for the method 300 for energy interoperability with neighbouring smart energy meters 102.

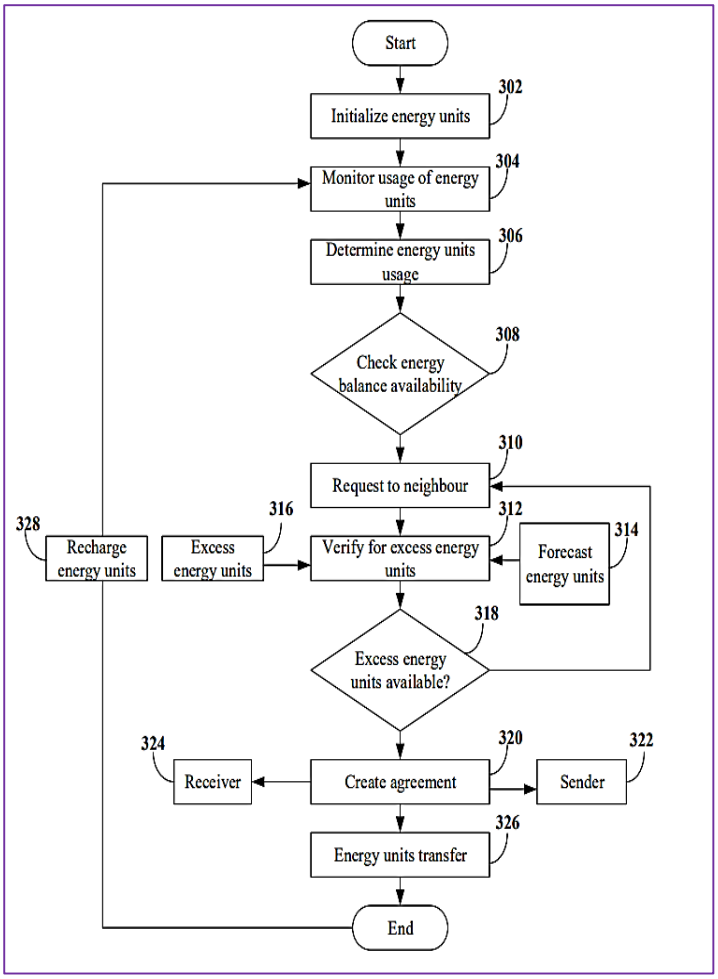
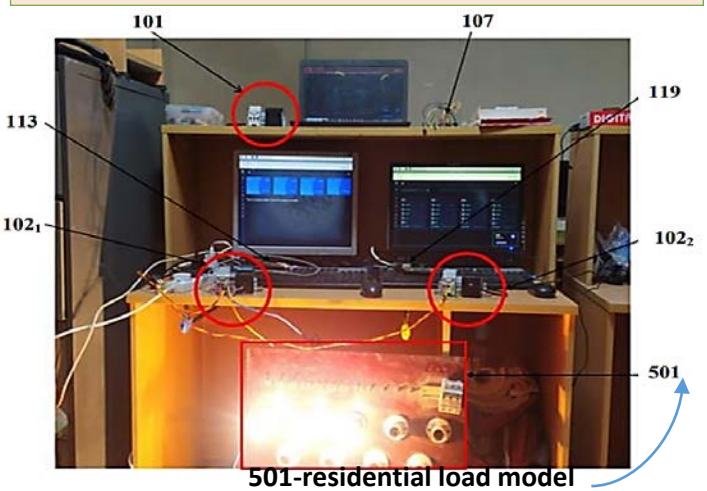


Figure 6 illustrates an experimental setup for transferring energy units to a prepaid smart energy meter.



501-residential load model

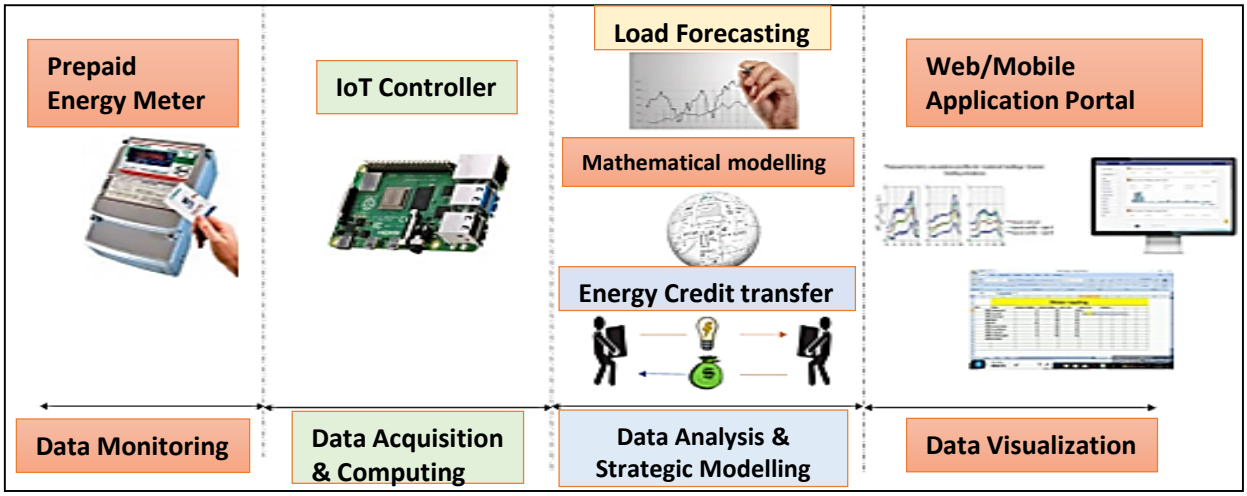
CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Key Features / Value Proposition

Fig 7 shows a Energy interoperability among P2P consumers



Advantages

Real-time Energy Usage Tracking

- Real-time monitoring and communication capabilities for energy usage tracking.
- Promotes a decentralized energy ecosystem for energy efficiency, resource sharing, and community cooperation.

"Reducing Dependence on Centralized Energy Grids"

- Transferring excess energy units among consumers.

Prepaid Energy Credits Foster Neighborhood Cooperation

- Fosters cooperation and collaboration within neighborhoods through the transfer of prepaid energy credits.

Promoting Shared Responsibility and Efficient Energy Use

- Reduces energy waste.
- Optimizes energy distribution.

"Energy System Facilitation"

- Facilitates information exchange and coordination among interconnected energy devices.
- Allows consumers to prepay for energy before consumption and communicate with different energy systems.

"Enhancing Energy Transactions"

- Facilitates transparent, secure, and equitable energy transactions.
- Implemented in any suitable hardware, software, firmware, or combination thereof.

Fig 8 shows a format of the energy consumption data log of three PPSMs.

Date	01-04-2023 - 22-04-2023				
Slot No	From	To	PPSM 1	PPSM 2	PPSM 3
1	01-04-2023 05:00	02-04-2023 04:59	1.27	4.81	2.69
2	02-04-2023 05:00	03-04-2023 04:59	1.58	3.09	3.87
3	03-04-2023 05:00	04-04-2023 04:59	1.51	3.90	2.88
4	04-04-2023 05:00	05-04-2023 04:59	1.24	6.11	4.13
5	05-04-2023 05:00	06-04-2023 04:59	1.06	4.07	4.15
6	06-04-2023 05:00	07-04-2023 04:59	1.16	5.76	2.66
7	07-04-2023 05:00	08-04-2023 04:59	1.03	5.26	2.57
8	08-04-2023 05:00	09-04-2023 04:59	1.33	3.10	3.22
9	09-04-2023 05:00	10-04-2023 04:59	1.25	5.48	2.52
10	10-04-2023 05:00	11-04-2023 04:59	1.27	3.86	3.8

CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719