`	Curent state	GAP	Future state	Action plan
Measurement Precision	Provides basic voltage, current, and energy readings with moderate accuracy	Lacks accuracy for billing, auditing, and control applications	High-precision metering aligned with international standards for energy measurement	• Integrate metering-grade ICs; implement robust calibration; ensure compliance with IEC/IS standards
Bi-Directional Monitoring	Measures only incoming grid power	Not suitable for net-metering or renewable integration	Supports measurement of both import (grid) and export (e.g., solar PV) power	Add bidirectional current/energy sensing; implement logic to separate import/export energy flows
Energy Data Logging	Offers minimal or no historical energy consumption logging	Inability to perform retrospective analysis or predictive modeling	Supports detailed time-series energy data logging (hourly, daily, monthly)	Add EEPROM/SD storage or integrate cloud-based data logging
Communication Protocols	Utilizes legacy or basic serial communication (e.g., RS-232, pulse output)	Limited interoperability and scalability	Supports modern, real-time digital protocols (Wi-Fi, Zigbee, NB-IoT, Ethernet)	Upgrade to secure and efficient communication modules with protocol support and encryption
Billing Functionality	Provides raw energy usage data without pricing logic	Incompatible with advanced billing structures	Supports slab-based, time-of-use (ToU), and dynamic tariff billing	Add RTC module; implement programmable tariff structures in firmware
Load Profiling	Only total consumption is measured	No visibility into load-wise consumption trends	Appliance-level or circuit-wise consumption analysis	Employ per-line CT sensors or implement non-intrusive load monitoring algorithms
System Interoperability	Uses proprietary or standalone architecture	Difficult to integrate with third-party or grid-level systems	Compatible with open industrial protocols (e.g., Modbus, DLMS/COSEM)	Adopt standardized communication and data protocols