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(57) Abstract :
A hybrid microbial fuel cell and turbine system (1) for power generation from sewer pipelines described herein. The system (1) integrates a micro-hydro turbine unit (10) with a microbial fuel cell (MFC) module (20) comprising anode (21) and cathode (22). The turbine (10) converts kinetic energy of flowing wastewater into electricity, while the MFC (20) utilizes electrogenic bacteria to harvest biochemical energy from organic matter, enabling synergistic dual mode energy recovery. A smart flow control mechanism (30) with adjustable baffles/valves (31) and microcontroller (32) dynamically optimizes hydraulic conditions. An IoT enabled sensor network (40) with sensors (41) monitors real time parameters including flow rate, voltage, current, pH, temperature and turbine RPM. Data transmits wirelessly (50) via LoRa/Wi-Fi/GSM for remote monitoring and predictive maintenance. A power management unit (60) regulates, stores, or distributes output to loads like LED streetlights or microgrids. The corrosion-resistant modular housing (70) facilitates retrofitting without pipeline disruption.

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