EcoWatts: An IoT-Driven Platform for Chemical Wastewater Sensing and Sustainable Power Generation

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Abstract

Here is a complete hardware-level analysis of a chemical waste monitoring system based on ESP32. Multiple modules like gas (MQ135), pH, temperature (DS18B20 / MAX31865), and flow (YF-S201) are interfaced with human-readable interfaces like an OLED display and GSM-based alerting mechanisms. Hardware integration, calibration processes, and response logic are focused on. System testing was conducted in laboratory conditions, wherein pre-determined levels effectively initiated real-time remediation measures to ensure smooth and fault-free operation.As a complement to monitoring, this research proposes a new system of energy recovery using chemical wastewater as a steam turbine-based electricity generation feedstock. Other complementary technologies like anaerobic digestion, waste heat recovery, and chemical-to-thermal energy conversion are also addressed. Application of these approaches to steam turbine technology exhibits their prospects for enhancing technical effectiveness while providing environmental sustainability in energy generation.

Keywords

Chemical Waste Monitoring, ESP32 Microcontroller,2. Gas and pH Sensors, Real-Time Environmental Sensing, IoT-Based Monitoring System3., Flow Rate Measurement, Temperature Sensing4., GSM-Based Alert System, Embedded System Design, 5.Automated Waste Mitigation, Chemical Wastewater, 6.Energy Recovery, Steam Turbine, 7.Sustainable Energy, Waste Heat Utilization,8. Power Generation, Industrial Waste Management, 9.Thermal Energy Conversion.