

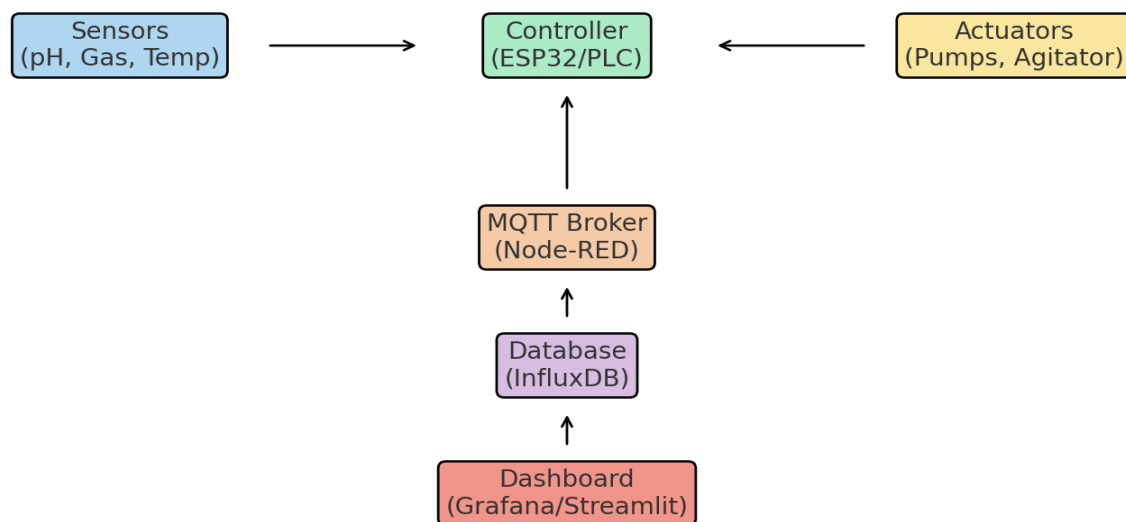
■ Grand Design IoT – Waste Food to Energy

1. Objectives

Maintain digester pH within optimal range (6.8–7.2). Trigger automatic actions when thresholds are exceeded.

2. Architecture

Sensors (pH, Gas Flow, Temp) → Controller (ESP32/PLC) → MQTT Broker → Database → Dashboard. Actuators (feeding pump, buffer pump, agitator) are controlled based on pH logic.



3. Control Logic

- Recovery (pH < 6.6): Stop feeding, activate buffer pump.
- Steady (6.8–7.2): Micro-feeding, agitator cycles.
- Underfed (pH > 7.5): Incremental feeding.

4. Data Flow

Sensors → Controller → MQTT → Node-RED → Database → Dashboard → Alerts.

5. Roadmap

1. MVP with ESP32 + pH sensor + pumps + Streamlit dashboard.
2. Pilot scale: add gas flow, Node-RED, InfluxDB.
3. Industrial: PLC, HMI, predictive AI.