**TOPIC: SMART WATER MONITORING AND OPTIMIZATION SYSTEM IN HOUSEHOLDS BASED ON IOT AND AI**

**1. Objectives**

* Develop a system for real-time monitoring of water quality and flow.
* Apply AI to predict water consumption.
* Integrate remote control systems to optimize water usage and conserve resources.

**2. System Architecture**

**a. Hardware Components:**

* **ESP32** as the central unit for data collection and transmission.
* **Sensors:**
  + **Flow Sensor** to measure water consumption.
    - Suggested: **YF-S201 DN15 Water Flow Sensor**.
  + **Water Quality Sensors** (pH, TDS, turbidity) to assess water conditions.
    - Suggested: **ASAIR AZDM01 Turbidity Sensor, TDS Sensor**.
  + **Water Level Sensor** to monitor tank water levels.
    - Suggested: **JSN-SR04T V3.0 Waterproof Ultrasonic Sensor**.
* **Control Devices:**
  + **Solenoid Valve** for automatic water shutoff/opening based on consumption thresholds.
  + **Water Pump** for automatic water supply control.

**b. Software Platform:**

(*Professor may suggest removing or replacing some components to simplify the data system and make it easier to build.*)

* **Home Assistant + Node-Red**: Interface management and automation.
* **InfluxDB + Grafana**: Real-time data storage and visualization.
* **Docker + Ubuntu**: Deploying the system on a remote server.

**c. Communication Method:**

* **MQTT**: Communication between ESP32 and the server.
* **Wi-Fi/LoRa**: Connecting sensors and controllers.

**3. AI and Big Data Applications**

* **AI-based Prediction**: The system forecasts the required water level for the next day based on consumption data.
* **Water Safety Detection**: AI analyzes sensor data to detect abnormalities and send alerts.
* **Operational Optimization**: The system automatically adjusts pumps and solenoid valves to save water.

**4. System Benefits**

* **Reduce Water Waste** through smart control.
* **Timely Water Safety Alerts**, ensuring users’ health.
* **Automation**, allowing easy monitoring and control.