**Water Quality Monitoring and Auto Fill System Using IoT – Working Principle**

This system is designed to monitor the quality of water by measuring key parameters such as **pH, TDS (Total Dissolved Solids), Turbidity (Tribality in the diagram), Water Level, and Flow Rate**. It also integrates an **auto-fill mechanism** and an **IoT-based monitoring system** to ensure real-time data tracking and automation.

**1. System Components and Their Functions:**

1. **Microcontroller (ATmega328P-PU)**:
   * The central processing unit that collects data from various sensors, processes the readings, and controls the LCD, IoT module, and auto-fill mechanism.
2. **Power Supply**:
   * Provides necessary voltage and current to the microcontroller and other components.
3. **Sensors and Their Roles**:
   * **pH Sensor**: Measures the acidity or alkalinity of water.
   * **TDS Sensor**: Measures the total dissolved solids in water to determine purity.
   * **Turbidity Sensor**: Detects the clarity of water by measuring the amount of suspended particles.
   * **Water Level Sensor**: Checks the water level and helps in the auto-fill mechanism.
   * **Flow Sensor**: Measures the rate of water flow in the system.
4. **LCD Display**:
   * Shows real-time water quality parameters such as pH value, TDS level, and water turbidity.
5. **IoT Module (e.g., ESP8266 or NodeMCU)**:
   * Sends sensor data to a cloud platform like **ThingSpeak** or **Blynk**, enabling remote monitoring through a smartphone or computer.
6. **Auto Fill Mechanism (Controlled via Relay & Solenoid Valve)**:
   * If the water level is low, the microcontroller triggers the solenoid valve to fill the tank automatically.
   * When the water level reaches a sufficient point, the valve turns off, preventing overflow.

**2. Working Principle of the System**

1. **Water Quality Monitoring Process**:
   * The microcontroller continuously receives sensor readings and processes the data.
   * The LCD displays the real-time values of pH, TDS, turbidity, and water level.
   * The IoT module transmits these values to an online cloud platform for remote monitoring.
2. **Auto Fill Mechanism**:
   * If the water level sensor detects a low level, the microcontroller **activates a relay**, which turns on the solenoid valve.
   * Water flows into the tank until the water level reaches the threshold.
   * The relay then **turns off the solenoid valve**, stopping the water flow.
3. **IoT-Based Remote Monitoring**:
   * Users can access real-time water quality data and system status from a web or mobile app.
   * Alerts can be set up to notify users if water quality deteriorates or if water levels are critically low.

**3. Applications of the System**

* **Drinking Water Purification**: Ensures safe water by monitoring TDS, pH, and turbidity.
* **Agricultural Irrigation Systems**: Monitors water quality for irrigation to prevent crop damage.
* **Industrial Water Treatment**: Helps maintain water quality in industrial processes.
* **Smart Cities & Smart Homes**: Automates water management for efficient usage.

**4. Advantages of the System**

✔ **Real-time Monitoring** – Users can track water quality from anywhere via IoT.  
✔ **Automated Control** – Reduces human intervention with an auto-fill mechanism.  
✔ **Cost-Effective** – Uses an ATmega328P, making it affordable for various applications.  
✔ **Improves Water Quality** – Helps maintain clean and safe water for consumption and usage.

**Conclusion**

The **Water Quality Monitoring and Auto Fill System using IoT** is an effective solution for **automating water management** and ensuring **safe water quality**. The integration of IoT allows for **real-time remote monitoring**, while the **automated refilling system prevents shortages** and ensures continuous availability of clean water.