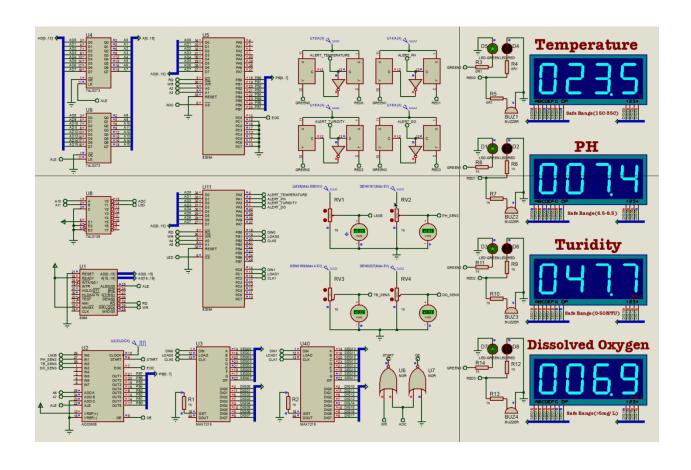
A Multi-Parameter Water Quality Monitoring System Using 8086 Microcontroller and ADC0808



System Architecture:

- Uses sensors (Temperature, pH, Turbidity, DO) to measure water quality.
- Employs an ADC0808 to convert analog sensor signals to digital.
- Uses an **8051 microcontroller (AT89C51)** to process and display data.
- Drives 7-segment displays using MAX7219.
- Triggers alerts using comparators (LM339), LEDs, and buzzers if readings are out of safe range.

Detailed Flow

1. Sensors & Signal Conditioning

Each sensor is connected through a voltage divider (variable resistor for calibration):

- RV1 + LM35 \rightarrow Temperature sensor
- RV2 + pH Sensor \rightarrow pH level
- RV3 + Turbidity Sensor
- RV4 + DO Sensor

These output analog voltages proportional to the measured parameters.

2. Analog Multiplexer (U2 - ADC0808)

- Accepts 8 analog input channels (A0–A7).
- Converts selected analog signal to digital using 8-bit resolution.
- Controlled via select lines (A, B, C) from the microcontroller.
- **OE, START, EOC,** and **ALE** are control signals for synchronization.

3. 8086 Microcontroller (U1)

- Central processor that:
 - Selects ADC channel.
 - Starts conversion.
 - Waits for **EOC** (End of Conversion).
 - Reads converted 8-bit value.
 - Sends data to display.
 - Checks thresholds and activates alarms.

4. Display Driver (U3, U40 - MAX7219)

- MAX7219 takes SPI input from 8051 and drives 7-segment displays.
- 4-digit 7-segment display used for each parameter.
- Each parameter has its own MAX7219 driving it (DIG0-DIG3).

5. Alarms (Comparators + LEDs + Buzzers)

- LM339 quad comparator is used for each parameter.
- Receives:
 - One input from sensor signal (via voltage divider).
 - One input from reference voltage (threshold).
- If the sensor value exceeds the reference:
 - Comparator output goes HIGH.
 - Drives RED LED + BUZZER for that parameter.
 - o Activates corresponding alert signal to microcontroller.
- Alerts:
 - ALERT TEMPERATURE
 - o ALERT PH
 - ALERT TURBIDITY
 - ALERT_DO

6. Multiplexing & Control Logic

- 74LS373, 74LS573, 74LS138 (U4, U5, U8, U9, U11) handle:
 - Data/address multiplexing.
 - Output enable control.
 - Chip selection.
- Used to expand addressable memory/data lines for the 8051.

7. Control Logic for Timing (U6, U7)

- NOR gates combine control signals:
 - Ensure correct timing between ADC START, WR, ALE signals.
 - Avoid data corruption during ADC reading.

Displays

7-Segment LEDs

- 4 separate sections showing:
 - o **Temperature** LM35 (display in °C)
 - o **pH** pH Sensor (0–14 scale)
 - o **Turbidity** in NTU (Nephelometric Turbidity Units)
 - **Dissolved Oxygen** in mg/L
- Each has:
 - o 4-digit display
 - o Green/Red LED based on safety range
 - o Buzzer for alert
 - o Safe range labeled for reference

Threshold Values and Alert Conditions

Parameter	Safe Range	Alert Condition	Signal
Temperature	15-35°C	<15 or >35 triggers alert	ALERT_TEMPERATURE
рН	6.5–8.5	Outside this range	ALERT_PH
Turbidity	0-50 NTU	>50 triggers alert	ALERT_TURBIDITY
Dissolved Oxygen	>5 mg/L	<5 triggers alert	ALERT_DO