# Water Level Indicator
# MINI PROJECT

Embedded Systems Design Projects
**TEE3300/EEE2201**

# Project Proposal

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June 2024 Title of the Project: Smart Water Level Indicator and Control System Using PIC16F87

## Introduction:

### Background:

Water scarcity and inefficient water usage are pressing global concerns. Traditional water level monitoring methods are manual and error-prone, often leading to overflows or dry tanks. The integration of embedded systems and sensors can provide real-time, automated monitoring and control, improving efficiency and reducing human effort.

### Objective:

To design and implement a water level monitoring and automatic pump control system using the **PIC16F877A** microcontroller and **ultrasonic sensor**. The system will display real-time water levels on an LCD, activate LEDs and buzzer alerts, and control a water pump through a relay based on measured levels.

### Justification:

This project promotes **efficient water management**, **automation**, and **cost-effective control** of domestic or industrial water tanks. It supports sustainability by reducing water wastage, manual labor, and energy consumption.

## Project Scope and Deliverables:

### Scope:

- **Included:**
    - Real-time water level measurement using ultrasonic sensor (HC-SR04)
    - Output display via 16x2 LCD
    - Alerts through LEDs and buzzer
    - Motor control using relay based on water level
    - Simulation and testing using Proteus
    - Final implementation on hardware

- **Excluded:**
    - Remote (IoT) monitoring features
    - Control of multiple tanks or variable height adjustment
    - Industrial motor interfacing beyond 5V DC motors

**Deliverables:**

- Fully assembled prototype
- Proteus simulation
- Final project report
- PCB design in KiCad
- Presentation slides and demonstration video

**Hardware Requirements:**

- **Microcontroller**: PIC16F877A
- **Sensor**: HC-SR04 Ultrasonic Distance Sensor
- **Display**: 16x2 LCD
- **Indicators**: Red, Blue, Green LEDs
- **Alarm**: Buzzer
- **Actuator**: 5V DC Motor
- **Switching Device**: Relay module
- **Other**: Breadboard, Jumper wires, Power supply (5V), Resistors
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**Software Requirements:**

- **Development Environment**: MPLAB X IDE
- **Compiler**: MPLAB XC8 Compiler
- **Simulation Tool**: Proteus Design Suite
- **PCB Design Tool**: KiCad
- **Libraries Used**:
    - LCD interfacing libraries
    - Delay and I/O control librarie

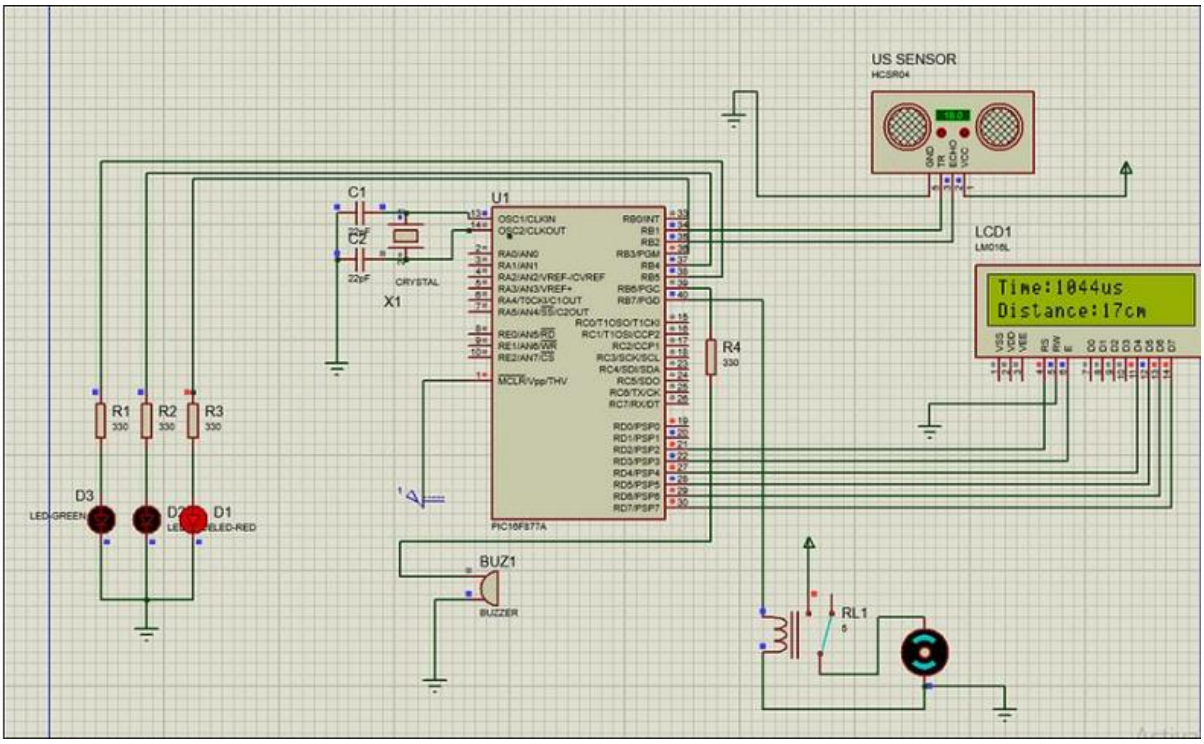
## Methodology:

### Design Approach:

### Hardware Design:

- The ultrasonic sensor is mounted on top of the tank to measure distance to water surface.
- The LCD, LEDs, and buzzer are connected to **PORTD** and **PORTB** of the microcontroller.
- Relay module controls the motor for filling based on predefined water level thresholds.

### Block Diagram:




### Software Design:

- The program initializes ports and peripherals.
- Sensor readings are processed to calculate distance.
- Decision logic activates outputs accordingly.

- LCD displays real-time distance and timing info.

## Timeline:

| Week | Task |
|---|---|
| 1 | Proposal and component collection |
| 2 | Circuit design and Proteus simulation |
| 3 | Coding in MPLAB X and testing in simulation |
| 4 | Hardware setup and integration |
| 5 | PCB design using KiCad |
| 6 | Final testing and debugging |
| 7 | Documentation and report writing |
| 8 | Presentation and final submission |

**Expected Outcomes:**

- Working prototype that automatically monitors and controls water level.
- Real-time LCD display with buzzer and LED alerts.
- Demonstrated improvement over manual methods.
- Final documentation with schematic, code, PCB layout, and simulation results.

**References:**


1. PIC16F877A Datasheet – Microchip Technology
2. HC-SR04 Ultrasonic Sensor Datasheet
3. MikroC and MPLAB X XC8 Tutorials – microcontrollerslab.com
4. Proteus Design Suite Documentation – Labcenter Electronics
5. KiCad EDA Documentation – https://kicad.org