PROJECT ABSTRACT

Water Treatment Plant Electrical Control Model

A tabletop working model of a water treatment plant's electrical control system — PLC-based pump sequencing, float-switch level control and a wired panel with contactors, MCB and overload protection — delivered as a built-to-order student project with the model, wiring diagrams, report, PPT and viva kit.

01. Title

Water Treatment Plant Electrical Control Model

02. Introduction / Background

A water treatment plant is, electrically speaking, a coordinated pumping and control problem: raw water must move through coagulation, flocculation, sedimentation, filtration and disinfection stages in the right order, tanks must neither overflow nor run dry, and chemical dosing must follow a schedule. Real plants are therefore run from PLC-based control panels with motor protection, level interlocks and alarm annunciation. Electrical engineering students study contactors, overload relays and ladder logic in theory, but few ever wire and commission a complete multi-stage control panel. This project closes that gap with a tabletop working model: transparent stage tanks with real pumps, float switches and a wired control panel that demonstrates sequencing, level control, timed dosing and protection at demonstration scale.

03. Problem Statement

Manual operation of a multi-stage water process invites dry running of pumps, tank overflows and inconsistent dosing. The project addresses this by building a scaled electrical control model that demonstrates the standard industrial answers — automatic pump sequencing with interlocks, float-switch level holding, timer-based dosing, per-circuit motor protection and alarm annunciation — so the student can wire, program, commission and explain a complete control panel.

04. Objectives

- Build a four-stage tank model (raw water, flocculation, sedimentation/filtration, storage) with single-phase pumps and PVC piping.

- Implement automatic pump sequencing with interlocks in PLC ladder logic (or timer-relay logic), so a downstream pump cannot start against a dry suction.
- Provide float-switch level control on each tank: start on low level, stop on high level.
- Wire MCB plus thermal overload relay protection on every pump circuit, with per-stage lamp indication and a hooter on trip or overflow.
- Demonstrate timed chemical dosing with a peristaltic dosing pump and a filter backwash cycle.
- Deliver the complete student kit: working model, wiring diagrams, PLC program, report, PPT and viva Q&A.

05. Proposed Methodology

The hydraulic model is laid out as four transparent tanks in series with a pump between stages. Level logic is straightforward: each tank's float switches define low and high setpoints, and the PLC starts the feeding pump at the low setpoint and stops it at the high setpoint. Interlock rungs prevent a pump from starting when its suction tank is empty or its discharge tank is full. A timer relay drives the dosing pump on an adjustable cycle into the flocculation tank, and a second timer periodically reverses the filter flow path for the backwash demonstration. Overload auxiliary contacts and overflow floats latch an alarm rung that lights the red stage lamp and sounds the hooter until acknowledged and reset. Commissioning follows a written procedure: float positions are set with the tanks at known levels, each interlock is tested by simulating its condition, and the full automatic cycle is run end to end.

06. System Architecture / Working

The system has four parts. (1) Hydraulic model: acrylic tanks, single-phase pumps, PVC piping with manual valves. (2) Control: a ladder-programmed PLC (Siemens S7-1200 class) or an equivalent timer-relay panel implementing the sequencing, level and timer logic. (3) Protection: MCB and thermal overload relay per pump circuit, 24 V DC control supply. (4) Annunciation: green/red/amber lamps per stage, START/STOP push buttons, manual/auto selectors and a hooter. Water recirculates through the stages for demonstration; the model is a control-system demonstrator, not a potable-water device.

07. Hardware / Software Requirements

- PLC, Siemens S7-1200 class with ladder programming software (or timer-relay panel version)
- 3–4 single-phase pumps (approx 0.5 HP class), peristaltic dosing pump
- Float switches (approx 2 per tank), contactors, MCBs, thermal overload relays
- Push buttons, selector switches, indicator lamps, hooter
- Transparent acrylic tanks (approx 10–20 L), PVC piping and manual valves

- 230 V AC single-phase supply; 24 V DC control circuit
- Basic hand tools and multimeter for wiring and commissioning

08. Expected Outcomes

A working tabletop model that sequences its pumps automatically, holds tank levels, doses on timer and annunciates trips; a documented panel wiring diagram and PLC program; and a commissioning procedure the student executes and reports. The model demonstrates control behaviour at tabletop scale — flows and timings are illustrative, and no industrial performance figures are claimed.

09. Applications

- Teaching aid for PLC ladder logic, motor control centres and panel wiring practice
- Demonstration of level-control sequencing and interlock design
- Base platform for extensions such as SCADA/HMI supervision or GSM alerts
- Exhibition piece for project expos and lab demonstrations

10. Future Scope

- SCADA/HMI supervision with trend logging of levels and pump runtimes
- Flow-paced dosing using a flowmeter instead of timer-based dosing
- Variable-frequency drives on the transfer pumps
- Turbidity-triggered backwash using a turbidity sensor
- GSM/SMS alerts on trips for remote monitoring demonstrations