Design and Implementation of an Automated Intelligent Control Panel for Sewage Treatment Plants

Jayanth A Kanago[1], S G Srivani[2], Nithin Vincen[3]

[1]M.Tech Student, Electrical and Electronics Dept., RV College of Engineering, Karnataka, India
[2]Professor & HOD, Electrical and Electronics Dept., RV College of Engineering, Karnataka, India
[3]Technical Specialist, IPCS Global, Karnataka, India

Abstract - **The modern sewage treatment plant demands advanced automation for efficient and reliable process operation. This paper presents the design and implementation of an intelligent motor control panel leveraging Programmable Logic Controller (PLC), Variable Frequency Drive (VFD), Human Machine Interface (HMI), and Supervisory Control and Data Acquisition (SCADA) systems. The project encompasses electrical design, PLC ladder logic programming, HMI/SCADA configuration, and hardware validation, targeted towards the biosolids digester and water treatment processes. Simulation studies and real-time implementation validate the seamless integration and robust performance of the proposed system, enabling improved process control, safety, and energy efficiency for industrial wastewater management. The results highlight the system's ability to achieve robust process sequencing, improved monitoring, and reduced manual intervention demonstrating its scalability and suitability for modern water treatment automation.**

Index Terms: PLC, VFD, SCADA, HMI, Sewage Treatment Plant, Biosolids Digester, Design, Automation, Control Panel, Ladder Logic

1. INTRODUCTION

Industrial automation has fundamentally transformed the operation and management of wastewater treatment plants, significantly enhancing efficiency, reliability, and safety. In sewage treatment plants (STP), automation enables precise process sequencing, remote monitoring, and optimized resource usage. The increasing complexity of treatment stages such as biosolids digestion, chemical dosing, and water recycling necessitates the deployment of programmable and flexible control systems. [1]

The present work details the development of an intelligent control panel for STP automation using a synergistic approach involving PLCs, VFDs, HMI panels, and SCADA software. The primary goal is to ensure automated, energy-efficient, and reliable operation of biosolids digester facilities. The design incorporates industry standards in electrical panel construction, comprehensive PLC ladder logic, and operator-friendly visualization tools. This integration supports advanced features like real-time process feedback, alarm handling, historical data logging, and minimal manual intervention. [2-4]

1.1 Overview of Industrial Automation

Industrial automation in water and wastewater treatment plants has revolutionized the way critical processes are managed, controlled, and optimized. Automation technologies such as Programmable Logic Controllers (PLCs), Supervisory Control and Data Acquisition (SCADA) systems, Variable Frequency Drives (VFDs), and Human-Machine Interfaces (HMIs) enable real-time monitoring and control of various treatment processes including filtration, chemical dosing, sludge digestion, and effluent discharge. By integrating these technologies, facilities can ensure consistent water quality, enhance operational efficiency, reduce manual intervention, and comply with environmental regulations. Moreover, automation supports predictive maintenance and energy optimization, making it an indispensable element in modern wastewater management infrastructures. [9-10]

2. METHODOLOGY AND BLOCK DIAGRAM

- Requirement Analysis & Planning: The project began with analyzing the client-provided P&ID

(Process & Instrumentation Drawings) and mechanical elevation drawings to define the automation scope and identify the control requirements for biosolids digestion.

- Electrical Design & Panel Layout: Using AutoCAD Electrical, all essential schematics such as single-line diagrams, PLC panel wiring, VFD and MCC schematics, and interconnection diagrams were created. The loop diagrams helped in mapping signal flow, while a 3D panel GA layout was developed for physical implementation.
- PLC Programming (Ladder Logic Development): Ladder logic was programmed using RSLogix 500 for Allen Bradley PLCs and WPLSoft for Delta PLCs. Timers, interlocks, and sequential control were implemented to automate the operation of pumps, blowers, valves, and heaters.
- HMI Design & Integration: The HMI was developed using DOPSoft, offering touch-based control and monitoring of the process. GUI elements were linked to PLC tags, ensuring real-time interaction and feedback visibility to the user.
- Hardware Implementation & Testing: The logic was downloaded to the Allen Bradley MicroLogix 1200 PLC and connected with field devices. Communication between HMI and PLC was established via RS232 and Ethernet (RJ-45). Functionality of each I/O was verified.
- System Validation & Simulation: The complete process was simulated in SCADA (Wonderware InTouch) and validated through physical hardware tests. Refinements were made based on timing, fault handling, and user interface performance.
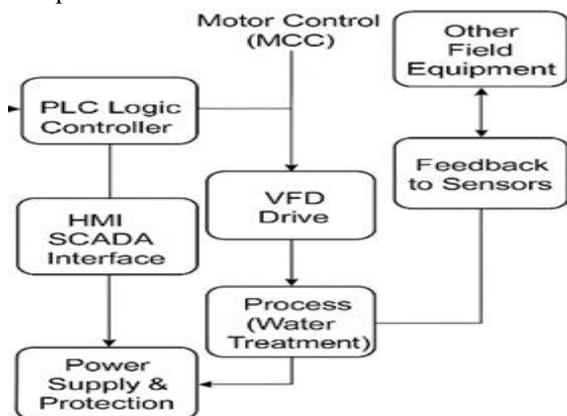

Fig -1: Block Diagram

The block diagram shown in Fig. 1 illustrates the overall architecture of the intelligent control system for sewage treatment automation. The system integrates various components that work in a coordinated manner to achieve reliable and energy-efficient motor control. At the core of the system is a Programmable Logic Controller (PLC), which processes inputs from field sensors and executes control logic. The Human-Machine Interface (HMI), connected to the PLC, allows real-time monitoring, parameter setting, and manual overrides via SCADA integration. Power to the system is supplied through a dedicated Power Supply and Protection block, ensuring safe and uninterrupted operation. The control logic regulates a Variable Frequency Drive (VFD), which modulates motor speed based on process demands. The VFD is responsible for controlling pumps and motors within the Water Treatment Process, optimizing energy consumption, and enabling smooth operation. Feedback signals from sensors (e.g., level, pressure, flow) are continuously monitored and sent back to the controller to adjust control actions dynamically. The system also interfaces with Motor Control Centres (MCCs) and other field equipment, ensuring robust coordination across all components.

2.1 Design Specifications

The design phase of the intelligent motor control panel demanded careful consideration of both electrical and mechanical parameters. Key design specifications included panel dimensions suited for wall-mounting and free-standing configurations, rated voltage of 480 V AC, and component sizing based on estimated load currents. Essential control and protection components such as miniature circuit breakers (MCBs), solid-state relays, contactors, SMPS units, terminal blocks, and overload relays were selected in accordance with IEC standards.

Wire sizing was determined considering voltage drop and permissible current carrying capacity. Colour coding of wires was implemented as per standards to distinguish between phases, neutral, earth, and control signals. The design adhered to industry best practices including segregation of power and control circuits, clear wire routing through panel ducts, and use of ferrules and markers for simplified troubleshooting and commissioning.

2.2 Loop & Interconnection Diagrams

Fig -2: PLC Panel, MCC & VFD

Loop and interconnection diagrams are derived from the one-line schematics and P&ID provided by the client. These detailed diagrams mapped each signal (DI, DO, AI, AO) from the field instrument to the terminal block, PLC input/output module, and HMI/SCADA tag, ensuring clear signal routing and troubleshooting ease. Instrumentation signals from sensors such as level transmitters, flowmeters, and pressure switches were assigned to specific I/O terminals. These diagrams were developed using AutoCAD Electrical, maintaining strict adherence to tagging standards and wiring conventions. The loops included signal conditioning circuits wherever required and clearly indicated shielded cable terminations and grounding points.

The diagrams shown in Fig. 2 illustrates the structured network and signal flow between Programmable Logic Controller (PLC) panels and associated field equipment in the automation system. This diagram emphasizes the interconnections and pathways required for robust and reliable communication within the sewage treatment automation environment. It outlines the detailed wiring connections and cable routing between MCC & VFD equipment and associated field equipment. This interconnection

schematic is crucial for clear visualization and implementation of cable management, ensuring effective installation and operational reliability.
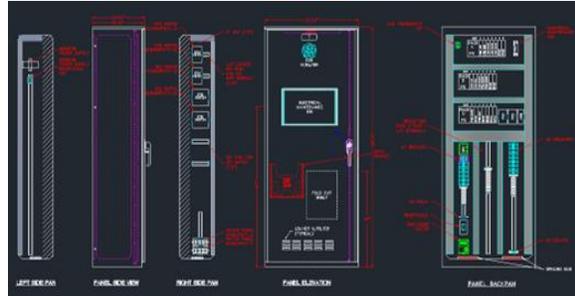
2.3 Panel General Arrangement in 2D & 3D

Fig -3: Control Panel GA Drawing

The General Arrangement (GA) layout shown in Fig. 3 represents the comprehensive physical design of the Control Panel, developed after analysing all relevant loop and interconnection diagrams. This layout ensures the organized and efficient placement of components, maintaining accessibility, safety, and space optimization.

The GA drawing includes the front view, side views, elevation, and backpan arrangement of the control panel. Major components like PLC racks (RACK A, B, C), DC/AC relays, HMI, patch panels, AC/DC

breakers, and receptacles are clearly represented. Additionally, the layout incorporates a fold-out shelf, louvers with filters, fan with thermostat, and DIN rails to house auxiliary equipment and allow for future expansion.

To enhance visual validation and facilitate mechanical fitting assessment, a 3D model of the control panel is created in AutoCAD as shown in Fig. 3. The model replicated the physical arrangement of all components, ducts, and wiring paths. This helped in identifying spatial constraints and provided a realistic view of the final assembled panel, ensuring a collision-free layout.

The 3D implementation was especially useful for client presentation, engineering reviews, and validation of assembly procedures. It further contributed to BOM (Bill of Materials) verification and informed the manufacturing and installation teams.

2.4 Implementation

The implementation phase utilized the following software tools:

1. AutoCAD Electrical was used for designing schematics, GA layouts, loop and interconnection diagrams.
2. RSLogix 500 facilitated the development of ladder logic for Allen Bradley MicroLogix 1200 PLC.
3. WPLSoft was used for an alternate Delta PLC programming scenario.
4. DOPSoft was employed to design HMI GUI screens for operator control and status indication.
5. Wonderware InTouch SCADA enabled real-time monitoring and simulation of the process automation, replicating the logic of the sewage treatment plant.

Tags were created and linked between the PLC and SCADA for effective I/O mapping. Multiple process screens were developed simulating stages like sludge filtration, blower operation, and chemical dosing.

Post-design, the control panel was interfaced with hardware using Allen Bradley MicroLogix 1200 PLC. Panel wiring continuity, voltage level verification, and I/O signal testing were conducted. Communication between SCADA and PLC was validated using RS232 interface and RSLinx driver configuration.

The ladder logic was tested under simulated inputs to verify response logic, fail-safe conditions, and interlocks. HMI and SCADA responses were synchronized with PLC outputs, completing the closed-loop verification. The results confirmed the successful integration of control logic, field wiring, and monitoring interfaces.

3. SIMULATION ANALYSIS AND HARDWARE INTERFACING RESULTS

The simulation analysis & hardware interfacing is done to validate the design and automation functionality of the intelligent motor control panel for a biosolids digester facility. In the presented project, Wonderware InTouch SCADA software is employed to automate and monitor the Biosolids Digester Facilities in a Sewage Treatment Plant (STP). It plays a pivotal role in:

- Supervising and visualizing the functioning of pumps, valves, blowers, and VFDs.
- Displaying real-time system statuses (e.g., tank levels, motor states) through intuitive HMIs.
- Interfacing with the Allen Bradley PLCs and Delta PLCs for bidirectional control and feedback.
- Ensuring operational safety via alarm notifications and operator control panels.
- Logging process data for further analysis and performance improvement.
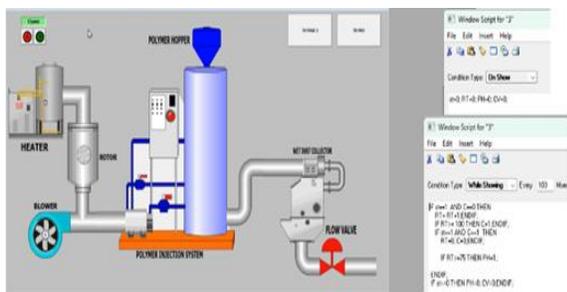
3.1 SCADA Process Automation
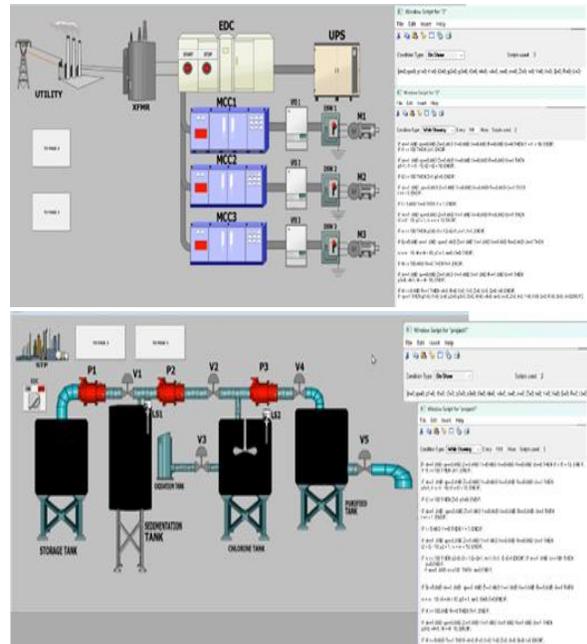
Fig-4: Process Automation

In the present work, three essential processes of water and wastewater treatment have been automated and simulated as shown in Fig. 4. Each process is designed to represent critical control actions in real-world treatment plants, emphasizing monitoring, control, and operational safety.

1. Motor Control and Energy Distribution Process:
The first interface simulates the electrical power distribution and motor control architecture in a sewage treatment plant. Here, electrical supply from the utility is stepped down via a transformer and fed into an EDC (Electrical Distribution Center) which is protected by UPS backup. Three MCC (Motor Control Centers) – MCC1, MCC2, and MCC3 – each control a VFD (Variable Frequency Drive) that drives motors (M1, M2, M3) through respective disconnect switches (DSW1–3). The control of each motor is programmed using scripting logic to ensure sequential operation, load safety, and UPS synchronization. The associated SCADA scripts manage conditions such as timer-based activation, failure detection, and automated shutdown in case of overloads or loss of input signals. This module ensures uninterrupted power to critical loads and seamless motor startup/shutdown control.

2. Water Treatment Process with Level Sensors and Valves:
The second SCADA panel simulates a typical multi-stage pretreatment process involving sedimentation, oxidation, and chlorination. The water flows from the Storage Tank through Pump P1, into the Sedimentation Tank, which is monitored by Level Sensor LS1. Based on LS1's reading, Valve V1 and Pump P2 are actuated to transfer water to the Chlorine Tank. Mixing operations are performed here, monitored by Level Sensor LS2, followed by flow to the Purified Tank via Pump P3 and Valves V3–V5. Each component is programmed with conditional logic in the SCADA script, which considers tank levels, valve positions, pump status, and interlock conditions. This simulation enables operators to observe the treatment sequence in real-time, intervene during abnormalities, and ensure proper tank filling/emptying based on preset thresholds.

3. Polymer Injection and Air Treatment System:
The third simulated process involves a Polymer Injection System, which is critical for coagulation and sludge dewatering in wastewater treatment. The process starts with a Heater and Rotor, assisted by a Blower, to heat and circulate the mixture. Polymers are injected from the Polymer Hopper into the treatment stream via controlled pumps. The mixed air and water are then processed through a Wet Dust Collector, with flow regulated by a Flow Valve. The SCADA scripting uses internal variables such as RT (Run Timer), PH (polymer hopper working), and CV (Control Valve working) nothing but Flow Valve to simulate process states. Conditions like RT > 100 trigger shutdown or increase the PH by 1, ensuring chemical dosing is within safe operational limits. The GUI is touch-controlled in the software window, offering real-time adjustments and emergency override features.

Now, the fully integrated design shown in the Fig. 5 represents a comprehensive automation layout of a Sewage Treatment Plant (STP) using PLC and SCADA systems. It incorporates the complete workflow from power distribution (via utility, transformer, and UPS) to control via MCCs (Motor Control Centers) and VFDs (Variable Frequency Drives) for motor operations (M1–M4). Water flows through multiple treatment stages including sedimentation, oxidation, chlorination, and purification, with each stage controlled using pumps (P1–P3) and motorized valves (V1–V5). Sensors and actuators communicate with a centralized PLC to ensure precise control. The polymer injection system, blower, heater, and wet dust collector are integrated to improve sludge treatment and air quality. This design emphasizes centralized control, real-time monitoring, and enhanced process efficiency using SCADA automation, making it highly suitable for industrial wastewater management. [6]
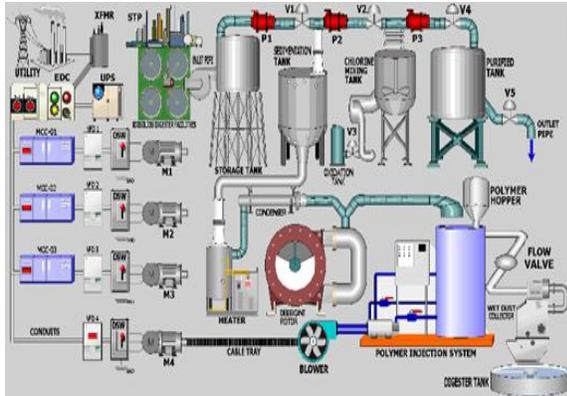
Fig-5: Biosolids Digester Facilities Design

3.2 PLC Programming – Ladder Logic

To control and automate the various stages of the sewage treatment process, ladder logic programming is developed using RSLogix 500, a powerful tool for Allen-Bradley PLCs (SLC 500 & MicroLogix series). The application in this project is:

- Controlled the sequencing of motor starters (M1–M4), valves (V1–V5), heater, rotor, polymer injection timing and flow valve.
- Used timers and internal relays to emulate real-time delays and interlocks.
- Integrated with SCADA Wonderware InTouch via RS Linx to sync data and monitor/control the system from HMI.

RSLinx Classic is a communication software developed by Rockwell Automation that acts as a bridge between automation devices (like PLCs and HMIs) and other software applications, including programming software like RSLogix and HMI software like FactoryTalk View. It is essential for establishing communication and data exchange within industrial automation systems. The application in this project is:

- Downloading ladder logic for pump and valve control from RSLogix to MicroLogix 1200.
- Monitoring timer execution and output coil status on-screen.
- Debugging ladder logic using live input/output status.
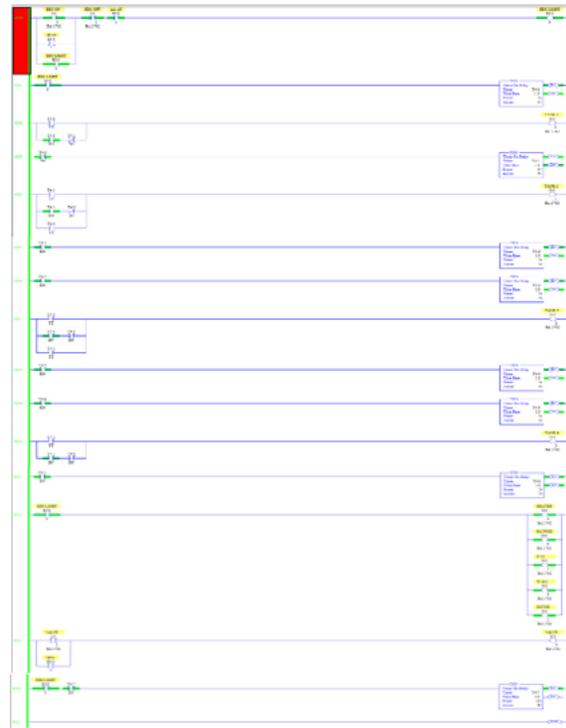- Linking HMI screens in SCADA (Wonderware InTouch) with PLC tags via RSLinx.

Fig-6: PLC Ladder Logic Program in RSLogix

The PLC ladder logic program shown in Fig. 6 represents the sequential operation of an automated STP process. The process begins with the initiation of the EDC (Electrical Distribution Center), which activates the system and lights up the EDC indicator. A series of on-delay timers are used to introduce sequential delays, ensuring that various tanks (such as Storage, Sedimentation, Chlorine, and Purified tanks) operate one after another in a defined timeline. Each timer, once completed, triggers the next phase of the process, gradually energizing the respective output coils to control the tanks. Simultaneously, control elements such as the heater, blower, rotor, and polymer injection system (PIS) are activated in coordination to assist in the drying and filtering phases of the biosolids treatment. At the final stage, the flow control valve is operated to release treated water to the outlet pipe, with a safety time delay ensuring the entire system runs smoothly. This PLC-based logic ensures a fully automated sequence of wastewater treatment, minimizing manual intervention and ensuring energy-efficient operation through VFDs and real-time control. [2]
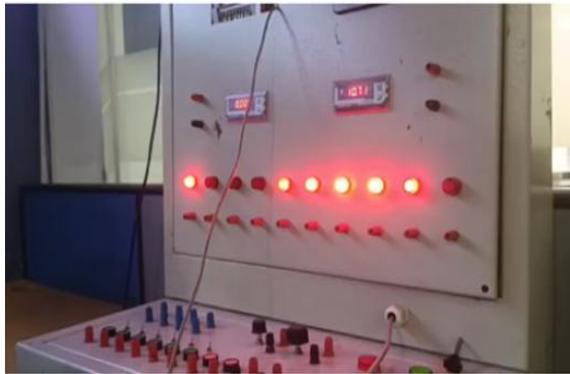
3.3 PLC Hardware Interfacing

Fig-7: Allen Bradley MicroLogix 1200 PLC Testing Kit

The Allen Bradley MicroLogix 1200 Programmable Logic Controller (PLC) shown in Fig. 7 served as the core hardware component for implementing and validating the control logic developed for the automated sewage treatment process. This compact PLC integrates the CPU, power supply, and I/O terminals within a single unit, offering 24 input and 15 output points sufficient for handling various industrial automation devices such as pumps, valves, blowers, and sensors. It is compatible with different input voltages, including 100–120V AC, 200–240V AC, or 24V DC, making it versatile for a wide range of applications. For communication, the PLC supports RS-232 and dedicated communication pins that interface seamlessly with RSLogix 500 software for program development and real-time monitoring. The interfacing process begins with the power setup, where a Switched Mode Power Supply (SMPS) converts AC mains voltage into a regulated 24V DC supply. This DC power energizes the PLC and its connected devices, ensuring reliable and stable operation. Input components, such as push buttons and toggle switches from a testing kit, are wired to the input terminals (e.g., I:0/0, I:0/1) and act as stand-ins

for real-world sensors like level indicators and flow switches. On the output side, LEDs are connected to terminals (e.g., O:0/0, O:0/1) to simulate field actuators such as motors, heaters, and control valves. When the programmed ladder logic activates an output, the corresponding LED illuminates, visually confirming the execution of control operations. The RS-232 communication cable links the PLC to a computer running RSLogix 500, allowing ladder logic programs to be uploaded, modified, and tested. The testing kit plays a crucial role in debugging, allowing manual toggling of inputs and observation of PLC responses via LEDs. This setup enables a controlled environment to verify the functionality and sequence of operations prior to field deployment.

In this project, the MicroLogix 1200 PLC is instrumental in simulating and verifying the automation logic for the sewage treatment plant. It is used to test ladder logic sequences that control process elements such as pumps, blowers, polymer injecting systems, and valves. Through this simulation platform, the system's behaviour is validated under different operating conditions, ensuring accuracy, responsiveness, and reliability before full-scale implementation in the field.

3.4 Human Machine Interfacing

Human Machine Interfacing (HMI) serves as a critical bridge between industrial control systems and the operators who monitor and manage them. It provides a graphical interface that displays real-time process parameters, system statuses, and control options, thereby enabling users to interact intuitively with complex automation systems.

In this project, HMI is implemented using Delta DOPSoft software to design a touchscreen-based interface, which is linked to the Delta HMI panel. The GUI facilitated real-time control of equipment such as heaters, blowers, polymer injection systems, and control valves through start/stop buttons and visual indicators. The HMI system communicates with the PLC (Delta DVP 16SP) to read inputs and send control commands via digital communication protocols. Operators can monitor tank levels, valve positions, and equipment status, and can also issue manual overrides when needed. The HMI thus enhances process transparency, reduces human error,

and supports effective decision-making by presenting critical information in an accessible and interactive format. Its role in this project is pivotal in validating and managing the automated sequences visually, ensuring smooth, real-time interaction between the user and the automated sewage treatment process. The process automation project leverages two essential software tools from Delta Electronics: WPLSoft and DOPSoft.

The ladder logic implemented using WPLSoft as shown in Fig. 8 serves as the core control algorithm for the Human Machine Interface (HMI)-based operation of the automated sewage treatment process. The ladder diagram consists of a sequence of timers (T0 to T6) and memory bits (M0 to M3), which are triggered based on input signals (X0 and X1) and programmed to activate respective outputs (Y0 to Y11) in a timed sequence. The operation begins when input X0 is turned ON, simulating a start command. If conditions X0, X1, and M2 are TRUE, memory bit M0 is latched to initiate the sequence. This sets T0, a timer with a 5-second delay (K50), after which output Y0 is activated. Sequentially, each timer triggers the next in line: T0 triggers T1, which triggers T2 and T3 simultaneously, followed by T4, T5, and finally T6. Each of these timers is set with a 5-second delay, allowing for controlled and staged activation of process components. As each timer completes, corresponding outputs (Y0 to Y3) are energized, representing the activation of physical devices such as motors, valves, or blowers in the actual sewage treatment plant. Further down the ladder, M0 being TRUE allows outputs Y4 to Y7 and Y10 to be activated, maintaining ongoing system functions during the process. Output Y11 is triggered by a separate condition involving input X1 and memory bit M3, likely serving as a reset or stop condition.
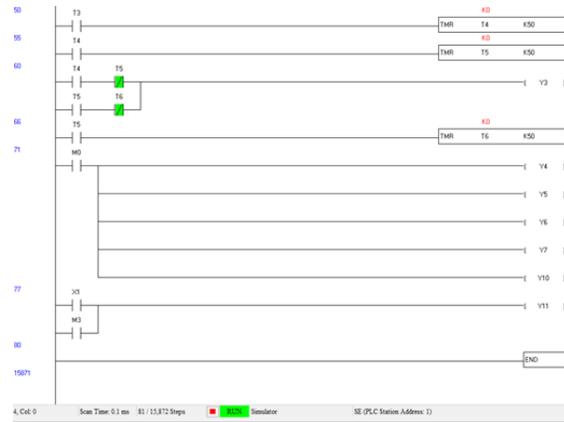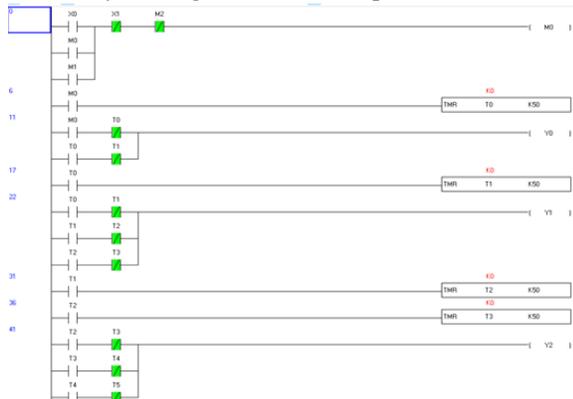

Fig-8: Delta PLC Ladder Logic in WPLSoft

This structured timing logic ensures that the process components operate in a logical and synchronized manner, reducing the possibility of conflicts or errors. This approach provides a practical and effective method to simulate real-time sequencing of operations, making it ideal for use in HMI-controlled automation for wastewater treatment.

Fig-9: Delta HMI Testing Kit

The Delta HMI Testing Kit illustrated in Fig. 9 demonstrates the successful integration of Human Machine Interface (HMI) technology into the automated sewage treatment process. This kit serves as a vital interface between the operator and the Programmable Logic Controller (PLC), enabling intuitive process monitoring, control, and diagnostics. The left side of the image displays a custom-built HMI test panel comprising multiple pushbuttons, selector switches, indicator lamps, and a mounted Delta HMI screen. These hardware elements collectively simulate an actual industrial control environment, allowing

real-time interaction with the process during testing and commissioning.

The right section of the image focuses on the Delta DVP 16SP PLC wiring and connectivity aspects of the testing setup. Industrial-grade Ethernet cables with RJ-45 connectors are used for establishing reliable and high-speed communication between the HMI and the PLC. This Ethernet-based interfacing ensures seamless data exchange critical for automation responsiveness and reliability. Additionally, the terminal blocks shown in the image facilitate secure connections for eight input terminals and six output terminals, enabling the integration of various field-level devices such as sensors, actuators, and control switches.

This testing kit plays a key role in validating the functionality and timing of the control logic before deployment in the actual sewage treatment setup. In this project, the Delta HMI is configured to communicate with the Delta PLC system, enabling both visualization and control of the automated process. The HMI interface shown in Fig. 10, developed using DOPSoft software, provides operators with a graphical user interface to monitor parameters such as pump and valve status, tank levels, and system alarms. Moreover, the setup allows for manual overrides and troubleshooting during commissioning, enhancing the safety and flexibility of the system. Through this configuration, the Delta HMI Testing Kit ensures that the automation system is both functional and operator-friendly, aligning with the real-world demands of modern water and wastewater treatment plants.

Fig-10: Delta HMI GUI

This touch-screen GUI is tailored to allow operators to monitor and control various process parameters in real-time. The interface features clearly labelled START and STOP buttons for initiating and halting

the process, alongside a matrix of icons representing different motors, pumps, and valves involved in the system. Each graphical element on the display is interactive, enabling users to issue commands with a simple touch. The lower row includes dedicated controls for key equipment such as the heater, rotor, Polymer Injection System (PIS), Wet Dust Collector (WDC), and control valve (CV). The color-coded buttons and symbols provide intuitive feedback on the operational status of each component, improving situational awareness and reducing the risk of operator error. Overall, this HMI screen serves as the central hub for seamless and efficient process management, integrating both monitoring and control functionalities in a user-friendly format that enhances operational safety, reliability, and responsiveness.

- Real-time Monitoring: Each component shows ON/OFF or active/inactive status visually and useful for plant operators to know which part of the process is running.
- Touch Control: Operators interact via a touchscreen to control operations without needing to access PLC software or hardwiring.
- Link to Ladder Logic: Each button or icon is mapped to a specific PLC output/input in WPLSoft. For example: Y0 to Y11 might be linked with motors, valves, heater, etc. and M0 is used for system enable logic (linked to the start button).

4. CONCLUSIONS

A comprehensive automation solution is developed for a sewage biosolids digester facility, encompassing all electrical schematics and structured ladder logic control systems. The project successfully demonstrated hardware interfacing using PLC (Allen Bradley MicroLogix 1200) and HMI integration (Delta HMI via DOPSoft) to achieve process-level control and real-time monitoring. The implemented process flow automation closely mirrors real-world wastewater treatment operations and is readily scalable for industrial deployment.

ACKNOWLEDGEMENT

REFERENCES

[1] M. A. Rahman et al., "Design and Implementation of a PLC based Automatic Industrial Drainage System," 2021 International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD), Dhaka, Bangladesh, 2021, pp. 185-188, doi: 10.1109/ICICT4SD50815.2021.9396930.

[2] Abilash, D. & Kayalvizhi, P. & Rakesh, R. & Balamurugan, (2016). Automation in Biomethanation plant using PLC and SCADA. International Journal of Bio-Science and Bio-Technology. 8. 171-180. 10.14257/ijbsbt.2016.8.2.16.

[3] Dr. Neelshetty K, Avinash, Md Jaleel, Md Mujeeb, Sharanappa "Waste Water Treatment Using PLC And SCADA" Iconic Research And Engineering Journals Volume 1 Issue 11 2018 Page 24-27

[4] Dhandapani, Aravind & Ganeshram, V & Prakash, Thangalakshmi & Balaji, Chouhan & Govindarajan, Rajendran & Rajkumar, Perumal. (2022). SBR SEWAGE TREATMENT PLANT AUTOMATION USING PLC AND SCADA. 54. 2096-3246.

[5] Ravi Kishore Kodali "Smart Waste Water Treatment" 2017 IEEE Region 10 Symposium (TENSYMP) Pages: 1 – 5 Year: 2017Telecommunication Engineering ISSN: 2051 3240, vol.44, Special Issue 2.

[6] D. Baily, E. Wright, "Practical SCADA for Industry", Elsevier journal of Process Plant, May 2003.

[7] Prabavathi, R., Duela, J. S., Chelliah, B. J., Saranya, S. M., Sheela, A. (2021). An intelligent stabilized Smart Sewage Treatment Plant (STP). 2021 4th International Conference on Computing and Communications Technologies (ICCCT). https://doi.org/10.1109/iccct53315.2021.9711758

[8] Cicceri, G., Maisano, R., Morey, N., & Distefano, S. (2021, August). A Novel Architecture for the Smart Management of Wastewater Treatment Plants. In 2021 IEEE International Conference on Smart Computing (SMARTCOMP) (pp. 392-394). IEEE.

[9] Olsson, G., Nielsen, M., Yuan, Z., Lynggaard-Jensen, A., & Steyer, J. P. (2005). Instrumentation, control, and automation in wastewater systems. IWA publishing.

[10] M. Chattal, V. Bhan, H. Madiha and S. Shaikh, "INDUSTRIAL AUTOMATION & CONTROL TROUGH PLC AND LABVIEW", 2019 2nd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), 2019.