

Water Treatment Plant Operating by Using SCADA

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Abstract: *The Water Treatment Plant is responsible for the operation, repair, and maintenance of the City's water supply system. This includes all parts of the water system supply chain from: The raw water diversion and pumping facilities to the raw water pipelines*

- *The treatment facilities*
- *The finished water pumping facilities*
- *The finished water storage facilities*

Testing of SCADA and Automation system for entire Headwork to WTP and Sump & ESR in this WTP premises with Flow meters, Solar power battery, Power & Signal cable, PRV etc completed as per specification.

Keywords: SCADA, PLC, Actuator, Level Transmitter

I. INTRODUCTION

Treatment for drinking water production involves the removal of contaminants from raw water to produce water that is pure enough for human consumption without any short term or long term risk of any adverse health effect. In general terms, the greatest microbial risks are associated with ingestion of water that is contaminated with human or animal (including bird) faeces. Faeces can be a source of pathogenic bacteria, viruses, protozoa and helminths. The destruction of microbial pathogens is essential and very commonly involves the use of reactive chemical agents such as suspended solids, bacteria, algae, viruses, fungi, and minerals such as iron and manganese. These substances continue to cause great harm to several lower developed countries who do not have access to water purification. Measures taken to ensure water quality not only relate to the treatment of the water, but to its conveyance and distribution after treatment. It is therefore common practice to keep residual disinfectants in the treated water to kill bacteriological contamination during distribution.

II. LITERATURE SURVEY

[1] Automation of Sewage Treatment Plant Using PLC & SCADA Rachana R. Sangitrao Assistant Professor, Dept. of Instrumentation & Control, D. Y. Patil Engineering College, Akurdi, Pune, India The term, Industrial Automation generally refers to the science and technology of process control of various plants such as chemical and petrochemical plants, oil refineries, iron and steel plants, power plants, paper pulp and paper mills, pharmaceutical, food and beverage industries, water and waste water treatment plants, oil and gas fields, etc. Plant Automation is one of the important requirements, which improves the quality of products as well as reduces requirements of manpower. Industrial automation has taken a giant step to control industrial machineries and industrial processes by replacing human operators. Now a day's Programmable Logic Controller (PLC) and SCADA systems are extensively used in industries. Industry people are encouraging use of Programmable Logic Controller (PLC) for plant automation. The origin of PLC comes from the American Automotive Industries. With the advent of industrial automation, we will briefly discuss the Programmable Logic Controller (PLC) used in our plant. This paper explains the work done for Automation of Sewage Treatment Plant using PLC and SCADA. In this work, we have used Schneider Electric's Controller and SCADA, Unity Pro XL and Vijeo-Designer software's.

[2] PLC and SCADA Based Sewage Water Treatment Plant Anuj Hiray¹, Omkar Chinchkar², Parth Butte³, Mrs. Vaneela Pyla⁴ BE Student, Electrical Engineering Department, N.B.N. Sinhgad Technical Institutes Campus, Pune, India^{1,2,3} Assistant Professor, Electrical Engineering Department, N.B.N. Sinhgad Technical Institutes Campus, Pune,

India 4 Wastewater from homes and industries, without proper treatment, when released into water source can cause harm to aquatic life and disturb the pH of water causing water pollution. In India, water treatment plants are located across various cities. Proper control and monitoring of these plants can help us improve the productivity thereby limiting scarcity of water as proficient use 4 Water Treatment Plant Operating by Using SCADA 5 of water can be achieved. Automation in various separation techniques like bar screening, sedimentation, grit removal, chlorination, Oxidation etc. is being carried out by using programmable logic controller . In this paper , the use of PLC and SCADA in sewage water treatment plant is implemented. The obtained purified water is used for domestic and agricultural purpose on the basis of ph.

[3] Waste Water Treatment Using PLC and SCADA Neelshetty K 1, Avinash 2, Md Jaleel 3, Md Mujeeb 4, Sharanapp A, Dept. of Electrical and Electronics Engineering, GNDEC, BIDAR The proposed automation solution for waste water treatment plant involves the use of a series of small control systems that run the facility , PLC (Programmable Logic Controller) continuously monitor the operation of pumps, closures and other devices, collect and execute commands coming from the higher levels, while programmable controllers (PLC) are used to control various processes based on the data and the built -in algorithm. According to the given specifications, a control panel was created in a suitable SCADA software for the control and monitoring of waste water treatment, which requires the communication between the SCADA application and local PLC controller is necessary. A program that provides the appropriate behavior of the valve, placed at the entrance and the control of the pumps was written in a ladder diagram. The alarm and monitoring system is of the highest importance. It covers the most significant facilities of the waste water treatment plant having pumping stations, reservoirs and supply lines and shows that the plant as a whole works well. If something unexpected happens – such as a failure or a malfunction of a vital facility – the system should register and alerts the staffs who work there.

III. BLOCK DIAGRAM

3.1 Block Diagram

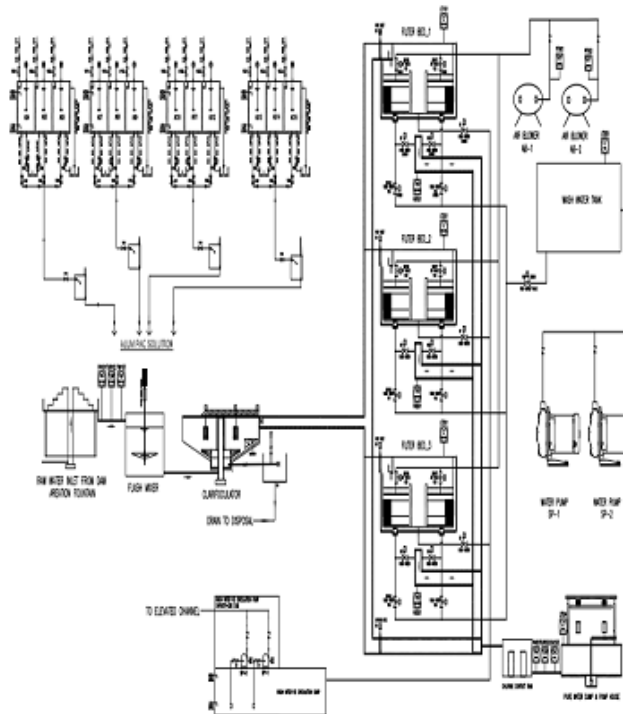
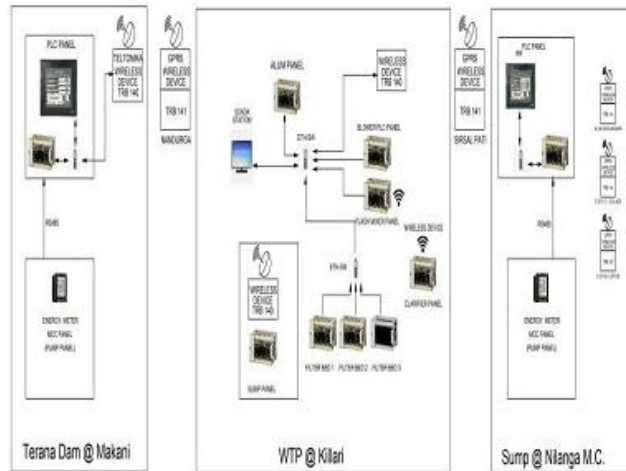


Figure: Killari Water Treatment Plant

3.2 PLC & SCADA Architecture



3.3 Process Working

A. Raw Inlet Section

Water resources for Aeration fountain is from Terana Dam by gravity and pumping station. Inlet water controlled by Sluice valve.

B. Aeration Fountain

Aeration provides oxygen to bacteria for treating and stabilizing the wastewater . Oxygen is needed by the bacteria to allow biodegradation to occur . The supplied oxygen is utilised by bacteria in the wastewater to break down the organic matter containing carbon to form carbon dioxide and water . Without the presence of sufficient oxygen, bacteria are not able to biodegrade the incoming organic matter in a reasonable time.

In the absence of dissolved oxygen, degradation must occur under septic conditions which are slow , odorous, and yield incomplete conversions of pollutants. Under septic conditions, some of the biological process, convert hydrogen and sulphur to form hydrogen sulphide and transform carbon into methane. Other carbon will be converted to organic acids that create low pH conditions in the basin and make the water more difficult to treat and promote odour formation. Bio-degradation of organic matter in the absence of oxygen is a very slow biological process.

C. Flash Mixer Section

Flash Mixer, Flocculators, Agitators A flash mixer is a chamber that contains mechanical stirrers, which is designed to assure fast, thorough, mixing of lime and alum for the purpose of creating floc. After screening out debris and testing the raw water , water treatment really begins at the flash mix chamber .

D. Clariflocculator Section

After mixing alum water goes to clariflocculator . There are two clariflocculator and each clariflocculator four agitator which are controlled by induction motors. One rotary motary for moving bridge. Main purpose of clariflocculator is to settle water. Clariflocculator is a combination of flocculation and clarification in a single tank. In the Clariflocculator, the water enters the flocculator , where the flocculating paddles enhance flocculation of the feed solids. As heavy particles settle to the bottom, the liquid flows radially upward in the clarifier zone.

E. Filter Bed Section

There are total 6 filter bed for filtration purpose. Each filter bed has 8 valves for process , inlet water controlled by raw inlet valves, for pure water 2 pure valves and after washing bed backwash water transfer to river by Drain valve.for

bed washing water controlled by two wash water valves. Two air valves for washing purpose. For bed level and pure water channel flow sensor mounted for each filter bed .Each filter bed has 6.33mld capacity . Sand filter strains out the floc and the particles trapped within it, reducing numbers of bacteria and removing most of the solids. Sand bed filters are an example of a granular loose media depth filter . In addition, they are usually used to purify the fluid rather than capture the solids as a valuable material. Therefore they find most of their uses in liquid effluent (wastewater) treatment.

F. Air Blower and Wash Water Pump Section

The impure water in water treatment plant is purified with the help of bacteria. The bacteria will purify the water by degrading the organic matter present in it. This bacteria requires oxygen during the process and therefore blowers in water treatment plant are employed in aeration tanks to provide sufficient air amount required by the bacteria to convert into oxygen required for the purification process. There are two pumps installed for the filling purpose of wash water tank.

G. Sump and ESR Section

The purified water is stored in a tank which is called as sump, after which the purified water is distributed by pump. In total there are four sumps

1. Shivajinagar
2. ITI college
3. M.C office Nilanga

In addition to that there is one ESR tank for purpose of water storage.

H. Alum Section

Alum is used to clarify water by neutralizing the electrical double layer surrounding very fine suspended particles, allowing them to flocculate (stick together). After flocculation, the particles will be large enough to settle and can be removed.

I. Components

1. Programmable Logic Controller (PLC OMRON CP1L- EL20 DT):

PLC has a microprocessor and controls devices through custom user programs. A PLC receives signals from input devices and makes decisions based on custom programs to control output devices. PLC read all field input devices via the input interfaces, execute the user program stored in application memory, then, based on whatever control scheme has been programmed by the user , turn the field output devices on or off , or perform whatever control is necessary for the process application.

Digital input 12 Digital output 8. The PLC may be used to control a simple and repetitive task, or a few of them may be interconnected together with other host controllers or host computers through a sort of communication network, in order to integrate the control of a complex process. Omron Programmable Logic Controllers (PLC) equipped with higher processing rates and complete transparency . Omron PLC's supply users with many functions and controls from small scale gears to complete production lines. they permit for seamless information exchange within machines and over whole plants.

J. Features

- "CP1L-EM" and "CP1L-EL" have complete with a Ethernet port.
- Pulse output for two axes. Advanced power for high-precision positioning control.
- High-speed Counters. Single-phase for four axes.
- Six interrupt inputs are built in. Faster processing of instructions speeds up the entire system.
- Serial Communications.

- Two ports. Select Option Boards for either RS-232C or RS-485 communications.

K. PLC Selection Criteria

- System (task) requirements.
- Application requirements.
- Electrical requirements.

2. Level Transmitter

A Level Transmitter is simply an instrument that provides continuous level measurement. Level transmitters can be used to determine the level of a given liquid or bulk-solid at any given time. The working principle of level transmitters mentioned above varies according to their underlying principle. For instance, capacitance level transmitters operate through a capacitor, hydrostatic level transmitters depend on the pressure of a fluid in a storage container for level measurement, while ultrasonic level transmitters convert the distance travelled by an ultrasonic wave to determine the level, and so on. However, all these level transmitters measure the level. Level Detection and Measurement by Using a Float Sensor.

A. Selection Criteria

All level measuring instrument is based on certain characteristics of the process material, such as density, pressure, temperature, etc., and its suitability for the same is to be taken into consideration. One can narrow down the options by considering the following factors before selection of right level sensor for level measurement and its suitability.

3. Analog Card

An analog input converts a voltage level into a digital value that can be stored and processed in a computer into voltages. The voltages can then be easily measured by various kinds of hardware, such as a LabJack U3-HV, and then read into a computer. When the analog input signal enters the PLC it goes through an A/D converter or analog to digital converter. This is the component in the PLC analog input card that transforms the analog signal to digital signals. It is these digital signals that will eventually give our binary value representation in the PLC.

4. SCADA Snidal Proface Blueopen Studio

Supervisory control and data acquisition (SCADA) is a system of software and hardware elements that allows industrial organizations to: ... Directly interact with devices such as sensors, valves, pumps, motors, and more through human-machine interface (HMI) software. Supervisory Control and Data Acquisition (SCADA) is a system that aims to monitor and control field devices at your remote sites. SCADA systems are critical as it helps maintain efficiency by collecting and processing real-time data. SCADA is a centralized system that monitors and controls the entire area. The importance of SCADA systems is automation. It allows an organization to carefully study and anticipate the optimal response to measured conditions and execute those responses automatically every time. Relying on precise machine control for monitoring equipment and processes virtually eliminates human error. SCADA systems are used by industrial organizations and companies in the public and private sectors to control and maintain efficiency, distribute data for smarter decisions, and communicate system issues to help mitigate downtime.

A. Selection Criteria

Versatile, but not generic: SCADA software has applications for many industries. You want your system to be versatile so that it can be adapted over time. However, if your system is too generic, it will have limitations. Easy data consolidation: Having your production data all in one place is critical to your everyday operations and mission. Safety: There have been far too many SCADA systems compromised by intrusions, either from the Internet or internal sources.

B. Features of SCADA System

1. Control Feature using Graphical Representation

The main aim of the SCADA system is to establish the control of the different machines of ground level from the main control center. In an industrial process, it is necessary to start and stop a manufacturing or industrial sequence. With the help of SCADA, the operator can start and stop the different industrial sequences from the control center as well as monitor the status of different equipment. Monitoring and controlling equipment from a text -only interface are sometime.

2. Real-time/Historical Trend Feature

The next useful feature of SCADA is Trend. Many times it is necessary for any industrial process that needs to be monitored as well as logged. Trends are essential for any industrial automation system.

3. Alarm Handling

An alarm system is a system designed to direct the attention of the operator to significant aspects of the current state of the plant. SCADA can perform this task with high accuracy .

4. Report Generation

SCADA provides an amazing functionality – Report. The user has to prepare a format in which they want a report.

C. Advantages

1. Track and control manpower costs through a centralized monitoring and control system that reduces the amount of time and energy that personnel must spend on auxiliary equipment operation and maintenance.
2. Reduce potential environmental problems such as overflow , with early detection of failures.
3. It is real-time process.
4. Cost effective for controlling complex systems.

IV. CONCLUSION

With the help of this system we are able to measure water quality parameters like turbidity , pH and dissolve oxygen. Also it gives pure water operating by using PLC & SCADA.

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