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AUTOMATION OF WATER TREATMENT PLANT USING PLC

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Abstract - *In this paper, we present a technical communication in the automation industry which explains the technical aspects of automation control system in water treatment system development, improving management levels, and enhancing process efficiency. Today, most of the water treatment plants in the world are used for water conservation projects, which are enabled by automation control systems, to provide safe, continuous, high-quality water to municipal clients and for multiple applications. The water treatment process is necessary for a variety of processes other than industrial processes (such as gardening, washing, etc.).In India, there are over 50 environmental acts that must be followed by industries. The government requires companies to treat their waste water and to reuse it for other industrial processes, such as gardening. In a water treatment plant, various processes have to be monitored and controlled regularly. Therefore, handling the plant manually becomes a tedious job. Manually pacing a plant becomes a tedious task thus PLCs automate the process to eliminate human error, increasing efficiency and accuracy. This paper describes ways to implement PLCs into existing real-time models of a water treatment plant. PLCs allow for the continuous monitoring and control of parameters, as well as efficient monitoring and control.*

Key Words: **Automation, Programmable Logic Controller, Reverse Osmosis.**

1.INTRODUCTION

In the industrial sector of water treatment plants, there has been a steady increase in the demand for high quality, greater efficiency, and automated machines. There is a possibility of errors occurring with measurements and at various stages that involve human workers and also a lack of features on microcontrollers. As such, continuous monitoring and inspection at frequent intervals are necessary. In the industrial sector, PLC applications are extensively used to automate repetitive processes such as furnaces, bottle filling plants, elevators, and nuclear power plants. A good example is the automation of water treatment plants using PLC, which is one of these industrial automation applications. Here automation plays a vital role, as high pressure control is a crucial task. There are many fields where pressure and water level are both controlled simultaneously. Due to this, handling the product manually becomes a tedious job, and human errors can result in the processing taking longer than expected, so automation plays an important role in this process. The automation of the process reduces time consumption, increases repeatability and accuracy, and eliminates human errors.

1.1 PROBLEM STATEMENT

The aim is to implement PLC to the existing model of Water Treatment Plant, which has a capacity of one m3 per hour, i.e. in one hour, we can obtain 1,000 liters of purified water.

1.2 OBJECTIVE

- To improve efficiency.
- To reduce human errors.
- To improve reliability.
- To save precious resources.

1.3 WATER TREATMENT METHODS

a)Boiling: Purification of water in this way is one of the earliest methods known to mankind, and it can be used in almost any situation, even in an emergency, without special equipment. Ideally, the water should be allowed to boil for three minutes to kill off any harmful bacteria.

b) Distillation: Water is also purified by distillation, which involves the use of a distilling tank. In this method, water is poured in the bottom of the tank, where it is heated until it reaches its boiling point. A portion of the tank is used to create steam, which is collected there for collection. Once it has condensed, the steam becomes pure water, which is then stored until it is needed again.

A. *c) Reverse Osmosis*: A membrane separates two parts of a two-part tank that is used in this process to purify water.

The membrane allows clean water to filter through while holding back contaminants. The untreated water enters the tank on one side and is forced through the membrane. After entering the second half of the tank, the treated water is collected and stored for consumption.

D) *Ultraviolet Light:* A clear container is filled with water, then the water is exposed to ultraviolet light, which destroys harmful organisms, thereby disinfecting the water. Insufficient UV light may not kill the bacteria in water if it is applied to the water insufficiently. This method has one drawback - the power required to generate UV light. Multiple factors are involved in the purification process, such as the amount of purified water, its initial condition, and the size and intensity of the light.

1.4 OVER VIEW OF WATER TREATMENT PLANT

All water treatment processes aim to remove existing contaminants so that the water will be fit for its intended use.The return of used water to the natural environment without causing harm to the environment is an example of such a use.All four methods of water treatment are used to treat the water. Reverse osmosis is used during the process.

2. BLOCK DIAGRAM

Figure 1 shows the block diagram of the project. The Block Diagram mainly consists of the power supply, inputs, outputs, hardware and PLC.

*a)Power Supply:*Power supply blocks provide the necessary power supply for various circuits.

b)Inputs:It has inputs, such as Level sensors for checking tank levels, Flow sensors to measure water flow, and Low Pressure and High Pressure switches for determining pressure.

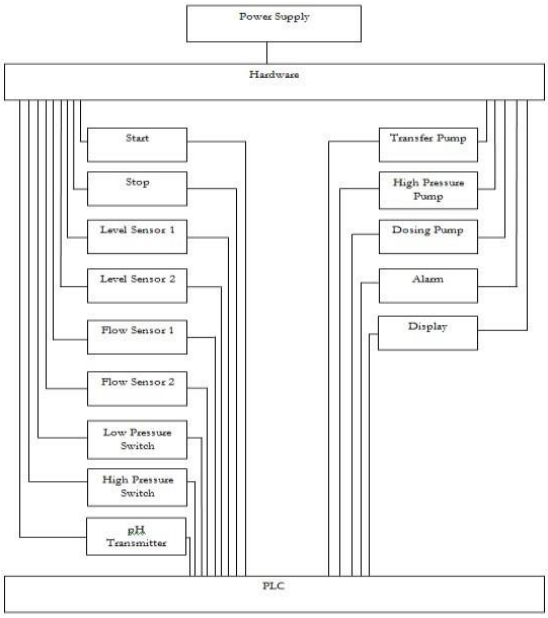
c)Outputs:An LCD display and motors, pumps, and alarms serve as output devices.

*d)Programmable Logic Controller:*The sequence of operations is controlled by a PLC.

3. BLOCK DIAGRAM DESCRIPTION

A block diagram of the system is shown in Figure 1.The Start and Stop buttons control the system's ON/OFF status.Level Sensor 1 is used to measure the water level in Raw Water Tank.The Raw Water Pump will be activated if the level is low, otherwise an error will be displayed LPS fault and Low Pressure.

The Low Pressure Switch also helps to monitor the pressure of water to the High Pressure Pump. If the strain is low then the excessive stress Pump will dry run and there are probabilities of it being damaged. The excessive strain transfer continues a test at the higher cease of the strain of the high stress Pump.



Block Diagram of system

The go with the flow Sensors 1 and a couple of are used to monitor the flow of product and reject. The product is the handled water and reject is the waste water. the level Sensor 2 gives us the level of the water in handled Water tank. If the tank is complete, the plant will be stopped and will display a message TWT complete on the show. This also avoids the wastage of dealt with water. The Dosing Pump will no longer be switched on till and unless the high strain Pump is switched ON. The Alarm is going on on every occasion the system accounts an blunders. The pH transmitter continuously displays the pH of the product.

4.PROGRAMMABLE LOGIC CONTROLLER

Programmable Logic Controller (PLCs) has initiated the success of automation in industrial systems. due to their flexible programming frequent modifications in automation system are possible.This flexibility lets in the PLC to control

all of the techniques within the plant, in addition to to provide information to external systems thru analog indicators or serial strings.A PLC interacts with the outside world via its inputs and outputs. basics of a percent function are persistent scanning of a program. The scanning system includes three primary steps:

Step 1: Testing input popularity

within the first step the percent checks each of its input to test the repute if on or off. this indicates it honestly tests if a transfer or a sensor and many others., is activated or now not. The statistics that the processor consequently obtains through this step is stored in memory as a way to be used inside the following steps.

Step 2: Programming execution

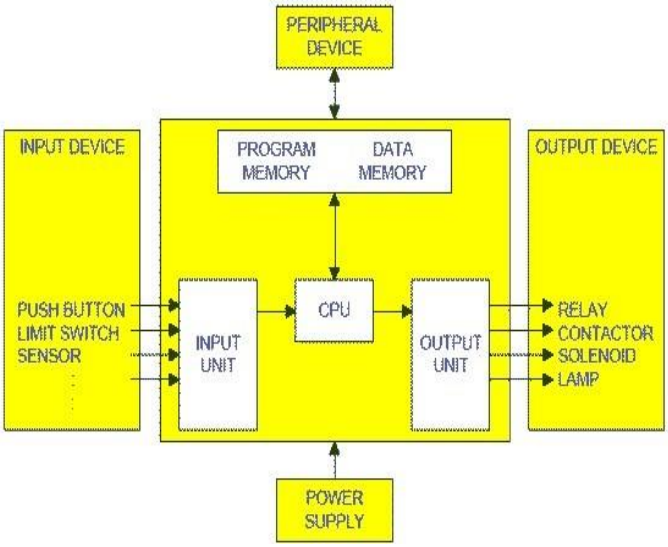
The PLC here executes a software coaching by way of practice. based totally at the application and the fame of the input received inside the preceding step, suitable action is taken. The motion might be activation of positive outputs and the consequences can be dispose of and stored in memory to be retrieved later in the following step.

Step 3: Checking and Correction of output fame

Finally, the PLC check the output signals and makes the modifications wished. changes are accomplished primarily based at the enter reputation that had been read at some stage in the first step and based on the end result of this system execution in step . Following execution of step three % returns a starting of the cycle and usually repeats those steps. Scanning time = Time for appearing step 1+ Time for acting step 2+ Time for acting step3.

Advantages supplied by way of PLC

- Cost effective for controlling complicated systems.
- Bendy and may be reapplied to govern different structures speedy and effortlessly.
- Computational talents permit more state-of-the-art manipulate.
- Troubleshooting aids make programming simpler and re- duce downtime.
- Dependable additives make these likely to perform for years earlier than failure.



Basic Diagram of PLC

5. CONCLUSION

From the evaluation carried out, it become observed that water impurities are discarded via the filters and reverse osmosis device and it's miles supported through the analysis result.using PLC we have automated the water remedy procedures and triumph over the obstacles of manual processing.The biggest benefit of using this device is the performance is 98%-99%, thus saving the treasured resource, Water.

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