AUTOMATION IN CHEMICAL DOSING AT WATER TREATMENT PLANT USING PLC SCADA

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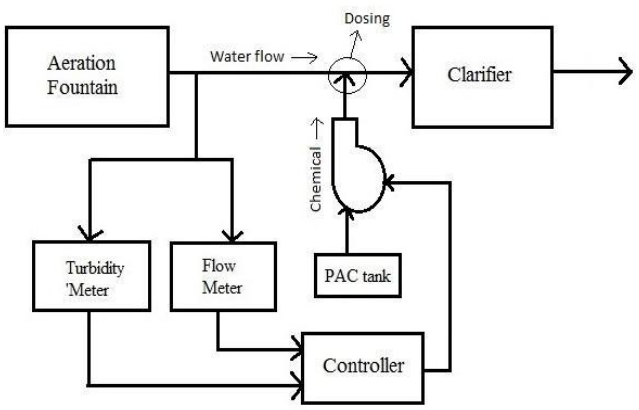
***Abstract*—This proposed work gives information on the automation of chemical dosing in water treatment plant. This is achieved by using PLC (Programmable logic controller) and SCADA (Supervisory control and data acquisition). The paper is based on dosing the chemical according to flow and turbidity of water. The final results will be seen on SCADA screen.**

***Index Terms*—Poly aluminum chloride (PAC), Digital dosing pump, PLC and SCADA.**

I. INTRODUCTION

At present raw water is pumped and feed to aeration fountain and then added with PAC chemical. The PAC chemical is added manually in water. Water samples are collected every hr and tested and dose of chemical is calculated and that amount of dose is injected in water. In unsuitable weather conditions, sudden increase in turbidity occurs and it is not detected and uneven dosage of chemical and wastage of chemical occurs and that is why automation was required and this project is developed. Now this project automates the existing manual system. In this project PAC dose is calculated with reference to turbidity and flow of water. And that amount of PAC chemical is added to water by using DDC pump. The proportion of dosing the chemical is decided from the previous data of chemical dosing done with manual calculations. Due to this technique, wastage of chemical is reduced and human errors are negligible. Appropriate chemical dosing reduces expenses on PAC.

II. SYSTEM DESCRIPTION



A. Chemical dosing setup

This setup consists of aeration fountain, poly aluminium chloride chemical, clarifier, measurement and control elements, pumps and drivers and a developed automation program for chemical dosing. Raw water comes to the aeration fountain. Some 5 to 7 samples are taken of the water of specific quantity (e.g. about 100 ml). In these samples different quantities of chemical is mixed and the samples are observed. The sample which is more pure is considered and accordingly chemical is dosed in the aeration fountain. In clarifier the water from fountain is collected and kept for settlement of mud. After 3.30 hours the scraper is started to collect the settled mud in the centre and drain valve to drain the muddy water out from it. The scraper takes 1 hour to complete 1 rotation. So the scraper and the drain valve both should be on for 1 hour. The turbidity of water from clarifier should be less than 10 NTU.

B. Operation of chemical dosing setup

The dosing process explained earlier is time consuming and human error may occur as the process is manual. So by making it automatic these drawbacks can be reduced. When the system will be made automatic by only measuring the flow and turbidity of water chemical will be dosed. The flow can be measured by flow meter and turbidity by turbidity meter. From these values some calculations will be made and proportionally chemical can be dosed.

III. CONTROL DESIGN

A. Control targets

The main objective in chemical dosing is to produce healthy and clear water with minimum costs. The following control targets should be achieved for this purpose.

- Keeping the effluent turbidity at a desired level. Optimum coagulant usage.
- Compensation of the disturbances such as the flow rate and the raw water turbidity.
- Minimizing the number of transducers for a practical and inexpensive implementation.
- Providing reliable operation.

B. PLC controller

PLCs are widely used in industrial control because they are inexpensive, easy to install and very flexible in applications. A PLC interacts with the external world through its inputs

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and outputs.

It has digital inputs, digital outputs and analog inputs and analog outputs. Here only analog inputs and analog outputs are required. The programming is done by using scaled with parameter (SCP).

The SCP instructions used to produce a sealed output value that has a linear relationship between the input and scaled values. The input value is scaled to a range determined by creating a linear relationship between input min and max values and scaled min and max values. It recognizes the use of integer and floating point values. This command can be used with SLC 5.03 OS302 and SLC 5.04 OS401 processors. The following formula will convert analog input to data to engineering units:

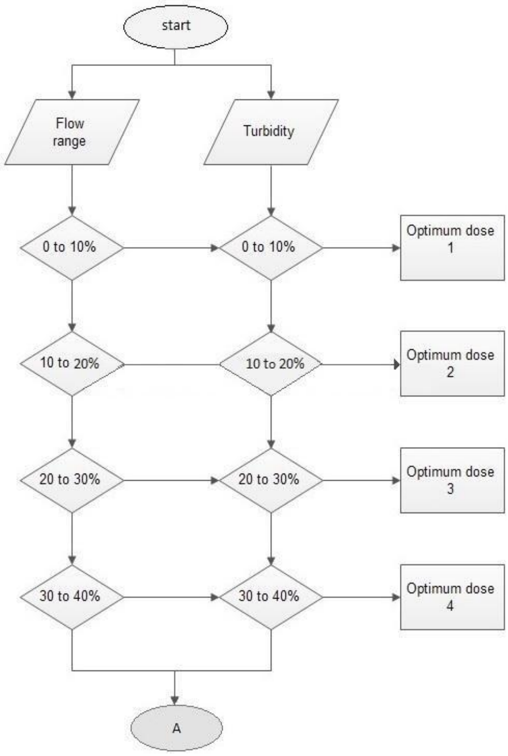
$y = mx + b$
Where
y = scaled output.
m = slope = (scaled max scaled min) / (input max input min)
x = input value.
b = offset (y intercept) = (scaled min) (input min).

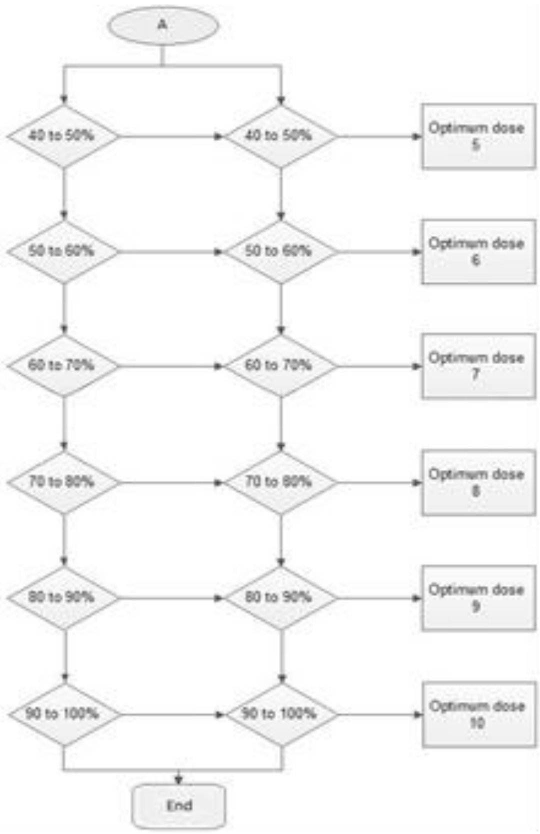
C. SCADA system
SCADA systems are being implemented with a greater regularity in today's ultra-competitive manufacturing environments. While SCADA systems are used to perform data collection and control at the supervisory level, HMIs are typically seen as local user interfaces that allow operators to manipulate the machine or process locally, and perform SCADA programming work to customize the system. A SCADA system at the, machine level consists of a central station for gathering data and managing the overall operation. It also has sensors (these could be remote terminal units or RTUs or PLC) placed in proximity to where the action is. The PLC collects the information locally and then passes it on to the central station, which can be located several miles away.

Some of significant features of modern SCADA system are as follows:

- User friendly (windows/graphics) interface. Automatic control.
- Offline processing.
- Extensive Historical Data manipulation. Extremely quick response.
- Custom SCADA programming capability. Integrated environments.
- Extremely high data throutput. Distributed processing power.
- Automatic voltage and power factor correction.

D. Flowchart





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IV. CONCLUSION

The goal of this project was to develop PLC based software for controlling a chemical dosing system in water treatment plant. The designed controller successfully compensates the disturbances that directly affect the turbidity such as the flow rate and the influent turbidity. The designed controller automatically adjusts the PAC dosage, therefore the filter operator’s work is greatly simplified and a reliable operation is achieved. The control performance is better than the existing dosing system in filter run time, filtered water, and PAC usage. Since turbidity is analysed by controller, the optimum PAC usage is achieved.

V. ACKNOWLEDGEMENT

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