Automated Water Treatment plant

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Abstract - *Water plays an important role in any industrial process, whether it is used for manufacturing purpose or cleaning purpose. The discharged water from the industries contains toxic substances in it, it will be harmful to surrounding environment. Before discharge it to environment, if it is treat helps to reduce the pollution, this requires an advanced treatment plant. An advanced water treatment plant needs sophisticated and advanced control system. One of the advanced control system is Distributed Control System (DCS) which is used to monitor and controlling the critical parameters of the plant. The main purpose of this work is to increase the processing capacity of the plant and to avoid the human interaction for the safer plant operations. The concept of redundancy is the major concern of this work. This control system provides the operator with a facility of graphic view, trend recording and alarm management to control the complex process efficiently and remotely.*

Key Words: Distributed Control System, Water Treatment Plant.

1. INTRODUCTION

A control system means it gives commands to any actuators or sensors and controls the final control element such as vales, pumps, motors and agitator etc. Process control is an integral feature of industrial manufacturing and processing of products. In industries they commonly used certain control parameters such as flow, pressure, temperature and level etc. A controller is a device that compares the input and output value that maintains the process variable as its set point. The controller helps to reduce the offset in the system. Distributed Control System is to optimize performance in the presence of time delays [1]. The key to higher productivity and lower operating cost is a carefully designed by using Man Machine System [2]. Based on a systematic study of the existing control system and the reference to manual operation experience of on-site skilled operator, an improved fuzzy three impulses control structure that comes from the drum level control [3]. The conventional Proportional-Integral-Differential (PID) control method is hard to satisfy performance have to be addressed effectively, challenges like significant time delay and dynamic disturbances from combustion variation in boiler [4]. The automation of effluent treatment in petroleum refinery plant that is designed to treat the effluent water before its discharge [5]. The intelligent DCS is used to control the tank level in the large oil terminals [6].

1.1 Analogue control system

In an analogue control system operational amplifier are used to control the function. In this the process parameters are measured by transmitters or sensors. The transmitters produce 4 to 20mA current signal with respect to 0 to 100 percentage of the measuring process parameter. This 4 to 20 mA current signal sends to the signal converter that converts 1 to 5v dc supply to operational amplifiers. This operational amplifier is doing calculation refer to the corresponding input and output and controls the field instruments.

1.2 Digital Control System

Digital control system uses a microprocessor to do the control function. In this transmitter sends 4 to 20mA current signal to the signal converter. This signal converter converts the current signal into voltage signal and sends to ADC. This ADC converts the analogue signal into digital signal. This digital signal is given to microprocessor for processing and it sends the signal to DAC, through DAC it controls the field equipment.

2. Methodology

In the implementation of the water treatment plant execution methodology has been followed and it includes but not limited to the following modules.

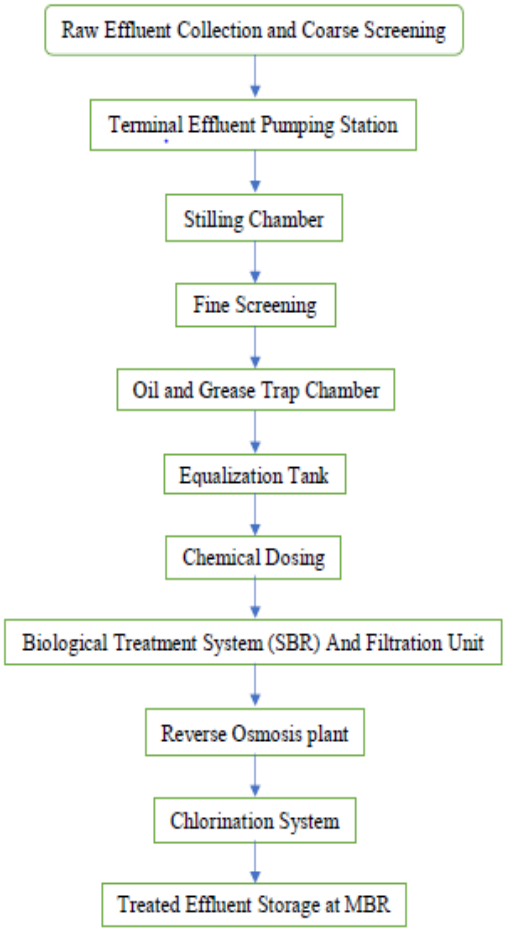

Fig -1: Process Flow Chart.

3. Basic components of DCS

A. **Field Control Station (FCS):** Central Processing Unit is also known as Field Control Unit, which is used to control the process. Which is the interface interface between the field instrument and the control room. All the programming and logics are generated by the software that can be stored inside the memory of the FCS [8].
B. **Human Interface Station (HIS):** It is a Man-Machine Interface called HIS. It is used for controlling and monitoring purpose. It shows all system and process alarms for easy to understand the operator for controlling the parameters.
C. **Engineering Station:** Engineering station is one from this all other operating stations are connected. If any changes in the logics and sequence programming and system configuration changes can be done from hear.
D. **Communication Bus:** The Field Control Stations and Human Interface Stations are connected through a network. This will communicate all the process parameters to and from the field and operator station.

1. System Architecture and Configuration

A. System Architecture

DCS System Network is divided into two main networks [7]:

1. Control Network- Refers to the core functioning of field instruments.

2. Plant Information Network- Refers to the Central Information Management of the plant.

In designing the control network, the following parameters are considered:

1. Network Loading – Understanding traffic flow and allocating bandwidth

2. Reliability and Availability – Provision of the redundant data paths

3. Network Monitoring – Managing network route and avoiding component failure

4. Ethernet Cabling – Configuration of cables used in the project.

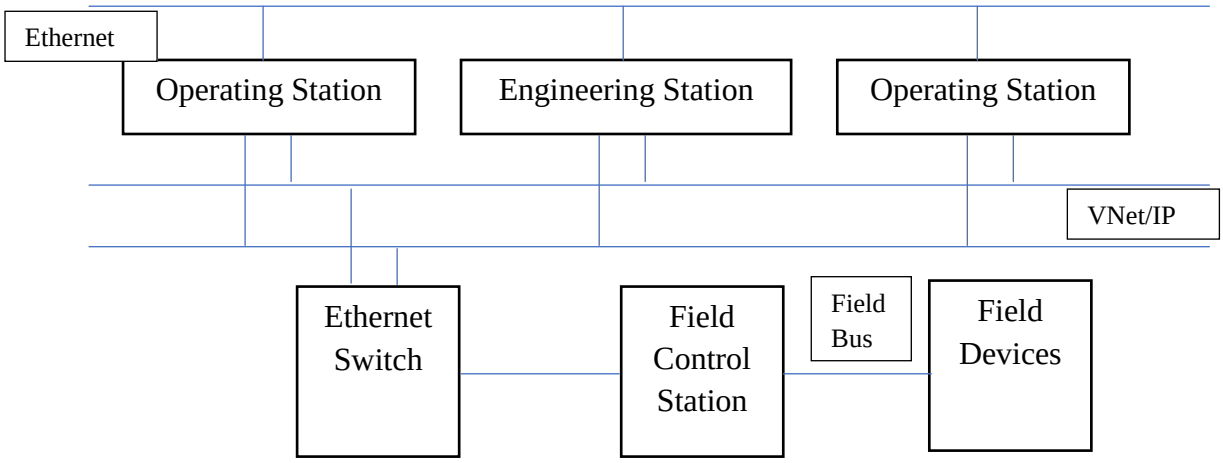

Fig -2: System Architecture.

4. CONCLUSIONS

It can be concluded that a control system can be implement to any processing industries. This control system is used to monitor all the processes going on in the plant. Out of the many control systems, Distributed Control System (DCS) is the most efficient and user friendly. DCS Systems monitor the entire operation of the plant. By using this system we can achieve the processing capacity of the plant and also increasing the utilization of the equipments this reduces the overall operating cost of the plant but it requires the periodic maintenance. A special application called Human Machine Interface helps to observe the ongoing process of the industry.

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