Replacement of Circuit Board by using PLC in HYDAC filter in DIP and Paper machine

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Abstract: The project gives out the testing and fabrication of working mechanical pump sealing filter system (Hydac water filter system) along with its purification which had been used to prevent the overheating of Mechanical Pump and for the production of Paper in Industry. Mechanical Pump Sealing Filter System consists of Pump associated with the Shaft, Sealing, Bearings and the Carbon brush. This Pump is mainly used to transfer the water from one place to another. Water requirement and consumption are more in the Paper Industries, so the Pump continuously in working state. To reduce the heat, cooling water is circulated throughout the process into the sealing. This cooling water must be free from fine particles, sands and dust. So the water should be filtered. The Hydac Filter is used to filter the water. Hydac Filter system has automatic Back-Flushing process. This means it automatically cleans the dust particles settled in the filter. To control the all process, the control board circuit and the programs are used. According to the program the water filtered and given to the Pump Sealing to reduce the heating. Because of high cost and low life time we are replacing the circuit board by using the PLC. The PLC program is simple to execute and trouble shooting is also very easy. There are four valves which are controlled by the Program. At a time, the control valve begins a backwash to clean the medium of collected particles and to emigrate the bed and rejects channel that has formed. The backwash is done by the water is sending down to the riser tube from which it enters the filter tank at the bottom. The force of water pulls to media bed, swirling and tossing the granular medium. The water flows to the control valve from the filter tank, which routes through the filter drain line, the particles which are present in the bed are washed to drain. For several minutes the backwash intense rinsing and tossing of the medium.

Index Terms: PLC-Programmable Logic Controller, Hydac filter, PLC LOGO software, Reverse osmosis, Automatic backflushing, Distributed control system.

I. INTRODUCTION

In day to day life, water is the main source for the industrial and domestic appliances. But now a days water is getting polluted because of industrial wastes, sewage wastes, plastics, domestic wastes, etc., Water pollution is increasing day by day because of draining the contaminated substances into the water areas, such as river, lakes, ponds, etc., Water pollution is defined as the contamination of water bodies, usually as a result of human activities. For example, Releasing inadequately treated waste water, chemicals and pathogens as well as physical parameters into natural water bodies can lead to degradation of aquatic eco system. Water pollution is the leading worldwide cause of death and diseases. The production of paper is totally depend on the water source. The volume of the paper is thin and fine, so the usage of water must be dust free. Hence we have to filter the water used in the production of paper.

The mechanical pump is used to take water from the river and it is given to the filter source then the outlet of the filter gives the purified water by collecting contaminated particles such as metal pieces, dusts, fine particles, etc., inside the filter and allows the purified water out. The operation of the pump is done by some mechanism and absorb energy to put on mechanical work moving the fluid. Pumps operates by using many energy sources which includes manual operation, electrically, engines or wind power. Mechanical pumps serves in a wide range of applications such as pumping water from the river, dam and reservoir in paper industry.

Rotation of the shaft leads to difficult in leakaging. So the shaft is sealed with the carbon-ceramic. Whenever a rotating shaft moves the fluid, mechanical seals plays a key role in sealing process includes fluids in, keeping contaminants out or both. In a particular interval the system is maintained by back-flushing the filter because the dust particles are filled on the slotted tube filter elements of the back-flushing filter. For this back-flushing process Hydac filter is used. The Hydac filter is a self cleaning system for extracting particles from low viscosity fluids.

The major contribution of the operational reliability is to robust construction and the automatic back flushing capability and it also reduces the operating and maintenance costs. When the elements are contaminated the process of cleaning starts automatically during backflushing the flow of filtrate is not interrupted. The fluid to be filter flows through the slotted tube passing from the inside to the outside.

II. LITERATURE REVIEW

A state monitoring method of fire water supply system based on hydraulic pressure mean value

To ensure the safety and reliability of fire fighting is the status of realtime control of urban fire water supply system and rescue of great significance. This paper proposes a method of monitoring the status of urban fires fighting water supply system based on water pressure mean. The principle and relations method of sliding filter for hydraulic pressure sensor is theoretically analysed and also amphatically studied the time domain law of hydraulic pressure signal. The variation in the water pressure mean

value in different state of water system were studied in detail. By the actual leakage test the effectiveness of algorithm was verified successfully. The result show that the method can obtain the status of the fire water supply system accurately and monitor the abnormal state of the system in real time which provide a reliable information guarantee for the fire rescue operation command.

A systematic approach to develop plc program for automation of a backwash water treatment plant

Programmable Logic controllers (PLC) are the type of computer control process, which are small but relative cheap, environmentally horror and and easy to program, operate and maintain and repair. the process of controlling computer in the first and foremost control devices such as Motors, solenoids, palms, valves, lights and heaters eccentric. The program ebility of PLC allows fast changes in relay ladder logic process and driven equipment without the need for high price and time consuming rewiring. The target of this paper is to develop the simulate and implement PLC software for automation of water treatment plant and its achieved. The development of algorithm in this paper may be used to progress the PLC based software for any control process.

Automatic filtering of starch in a paper manufacturing industries using distributed control system

The paper is the thin material produced by pressing together the moist fibres of cellular pulp. The cellular pulp is derived from wood, rags or gases and drying them into flexible sheets. Starch coating is the final step carried out by the paper manufacturing process. The starch coating is important in determination of thickness. The thickness of the paper is measured in terms of GSM (grams per square metre). For filtering the solid particles, simple math filters are used. this feel this will filter the solid particles in the liquid starch continuously full stops for better filtering it has to be cleaned periodically in certain interval of time the filter cleaned manually by three times. This lead to the action of coating process and the resulting in laws of production. The proposed system explains, increasing the number of filters and flash this filters using distributed control system. In order to flush the filter it is used to control the opening and closing of control valves.

Ceramic water filters for point-of-use water treatment in limpopo province, south Africa

The paper explains about the plan of a ceramic water filter factory in Mashamba village, Limpopo province, South Africa. In rural settings, the contamination of water should available only at the point of use (pou), and still the purification of water in limpopo province is big difficult. The ceramic water filters which has been locally prepared had been proved to improve the microbiological quality of water when used as pou water treatment technology. To seperate the 99.9% of pathogens the ceramic water filters have been used. The university of venda (univen) and university og virginia(UVa) students had implement a collaboration on embarked. They also build a socially and financially sustainable ceramic filter factory (cff) that manufacture ceramic filter for household-level water treatment. The factory was successfully completed in August 2011 at the site of Mukondeni co-operative community based pottery project (ccbpp) in Mashamba village. The leadership of the CCBPP was run by the plan of CFF .the factory operation system is low cost efficient and technical knowledge is required. Laboratory testing of filters is targeted to be conducted by univen and uv a students on a regular basis. The purification technique of water is highly context- dependent and further training research and management on production of ceramic filter is essential.

PLC & SCADA based automation of Filter House, a section of Water Treatment Plant

Rajasthan is an arid state and making possible of drinking water is a government priority. Under bhageri ka naka (rajasthan) rural water supply scheme, to produce and deliver 16.21. MLD of treated water in the clean water reservoirs near treatment plant there is a transmission system. There are three methods in the water supply scheme 1).intake pump house 2).water treatment plant (WTP) 3).clean water pump house (CWPH). This presentation explains about the working of filter house is using in PLC & SCADA. The automation of filter house is based on the PLC-SCADA it is a combination of water treatment plant. The SCADA system based on PLCs are used by the automated water treatment plants which are advanced communication systems and PC-based software. PLC has been popularly used and played an important part in the automation industry in now-a- days. Many advantages like low cost and high reliability, many automation machine manufactures are still refering the use of PLC.

PLC Programming For A Water Level Control System: Design and System Implementation

In industry, the level of control water is a type of process that is extensively studied in the literature. This report mainly focus on the design and implementation of PLC based water level control system. Here we have two primary objectives: one is overall mechanical design of the system. Another one is the PLC system design and implementation. The finite element analysis is performed the water tank to check the area which has high leaking risk in the mechanical design part. a flow simulation in the water tank is attached to analyze the effect of the transient pressure on the sensors. at the water tank is intended in simulink and the simulation results shows that the PID controllers can regulate the water level to the desired position. At last, PLC ladder diagram is programmed, and the effectiveness of the design verified experimentally. This report shows a designing process of PLC based level control system. The initial idea of developing a PLC is to simply a process control by using PLC to replace electrical relays. PLCs become a significantly used controller in most industries.

III. EXISTING SYSTEM

The project gives out the testing and fabrication of working mechanical pump sealing filter system (Hydac water filter system) along with its purification which had been used to prevent the overheating of Mechanical Pump and for the production of Paper in Industry. Mechanical Pump Sealing Filter System consists of Pump associated with the Shaft, Sealing, Bearings and the Carbon brush. This Pump is mainly used to transfer the water from one place to another. Water requirement and consumption are more in the Paper Industries, so the Pump continuously in working state. Because of this heat production is more. To reduce the

heat, cooling water is circulated throughout the process into the sealing. This cooling water must be free from fine particles, sands and dust. If the water is contaminated it damages the shaft and the brush. So the water should be filtered.

In Industry, the Hydac Filter is used to filter the water. Hydac Filter system has automatic Back-Flushing process. This means it automatically cleans the dust particles settled in the filter. To control the all process, the control board circuit and the programs are used. According to the program the water filtered and given to the Pump Sealing to reduce the heating.

Block diagram

The block diagram of existing system consists of
➢ Mechanical Pump,
➢ Control board,
➢ Power supply,
➢ Inlet valve,
➢ Outlet valve,
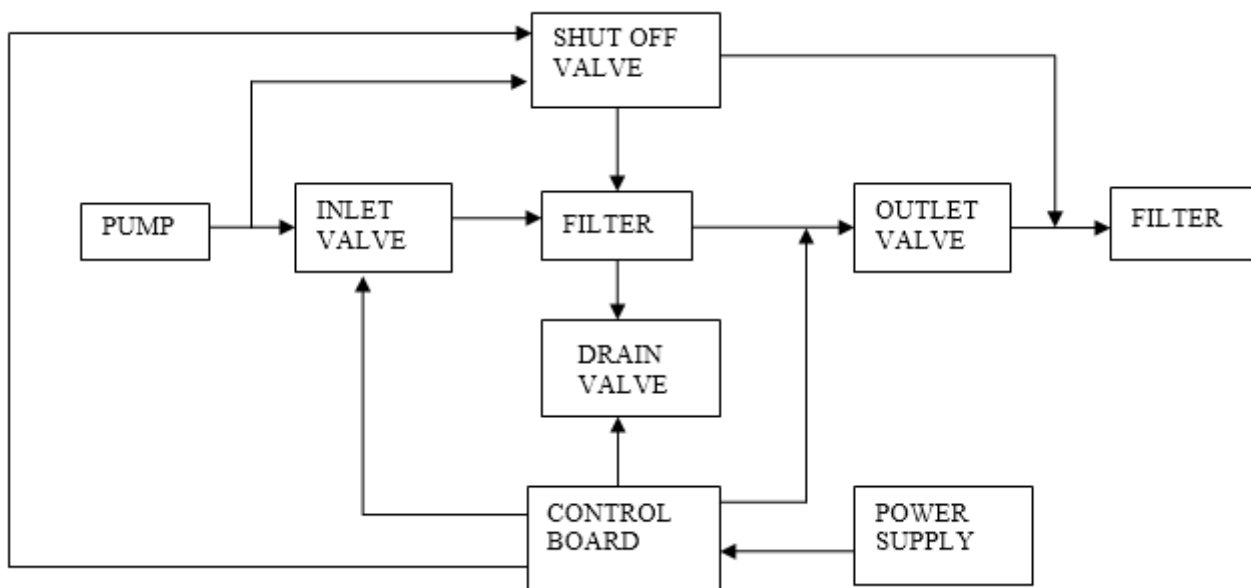➢ Shut off valve,
➢ Drain valve.

Figure 3.1 Existing system Block Diagram

Features

The existing system has the following distinct features
➢ Easy to monitor,
➢ Less man power required,
➢ Filter accuracy is high,
➢ Easy to understand.

Drawbacks

The existing system has the following drawbacks.
➢ Trouble shooting the faults in the control circuit is difficult.
➢ Initial cost is very high.
➢ Maintenance cost is also high

IV. PROPOSED SYSTEM

As the proposed system is same as the existing system expects the control board. The small variation is that instead of control board here PLC is used. Because, the PLC program is simple to execute and trouble shooting is also very easy. There are four valves which are controlled by the Ladder Logic Program. . In the time of holding and trapping the particles in the filter bed, this filter operates in the service mode. Also, since water's nature is to follow the path of least resistance. After a time it begins to cut channels through the medium. The process of flowing water through the medium which is in the media bed from is called channeling process and also it can reduce the effectiveness of the filter considerably.

At a time, the control valve begins a "backwash" to clean the medium of collected particles and to emigrate the bed and rejects channel that has formed. The backwash is done by the water is sending down to the riser tube from which it enters the filter tank at the bottom. The force of water pulls to media bed, swirling and tossing the granular medium. The water flows to the control valve from the filter tank, which routes through the filter drain line, the particles which are present in the bed are washed to drain.

For several minutes the backwash intense rinsing and tossing of the medium that lasts for several minutes. In a standard filter, the typical backwash is about ten minutes.

After the backwash, a "rinse" of the bed is indicated by the control valve. During which water flows downward through the medium, up through the riser tube, and it will out the drain. The purpose of this rinse is to rinse. Then it will settle the bed and prepare it for return to service flow.

Features

The proposed system has the following distinct features,
➢ Easy to monitoring and control
➢ Easy to maintenance
➢ Very high accuracy
➢ Smaller in size and easy to program

Block diagram

The block diagram of proposed system consists of
➢ Mechanical Pump,
➢ Power supply,
➢ Inlet valve,
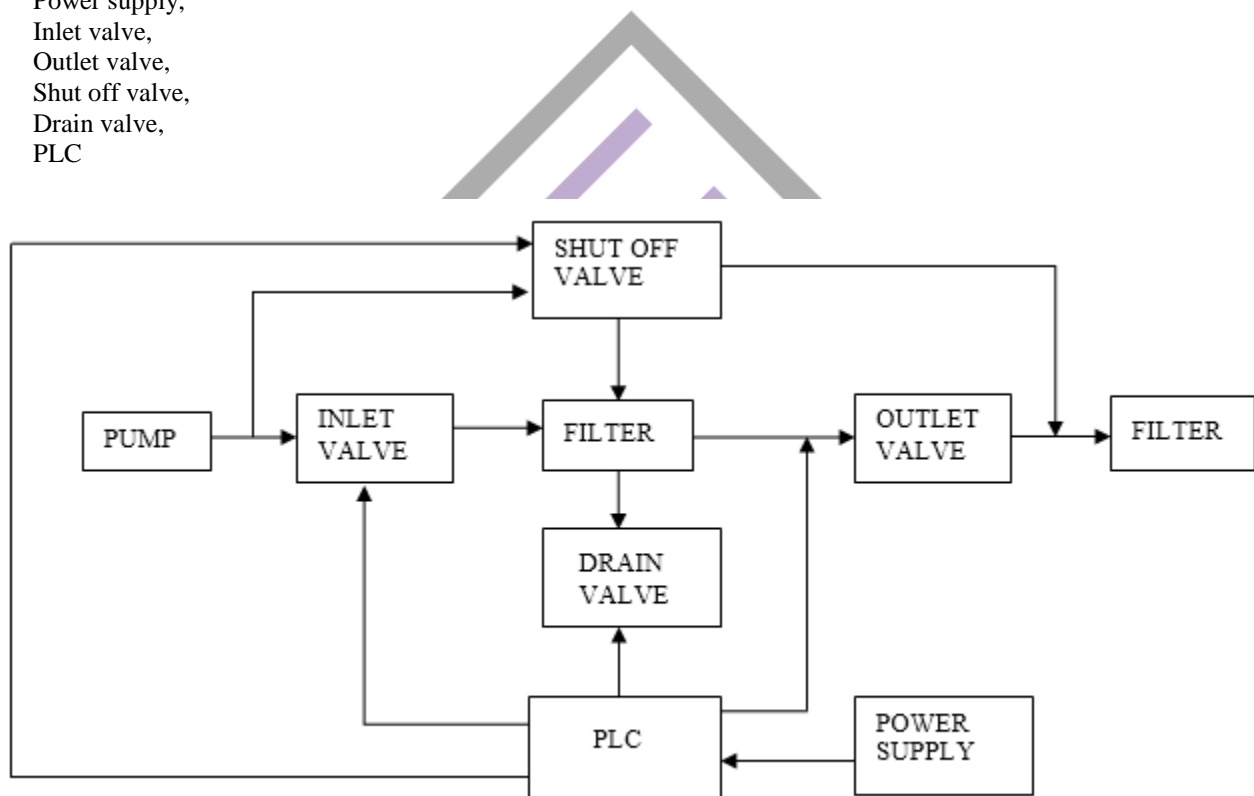➢ Outlet valve,
➢ Shut off valve,
➢ Drain valve,
➢ PLC

Figure 4.1 Proposed system Block Diagram

V. EXPLANATION
Power supply

A power supply is a device that supply electrical and also the types of energy to an output load or the group of load. Low dc voltage is required for the digital circuits to operate. For the occurrence of appropriate voltage supply a power supply unit is required. Here power supply is given to the PIC controller for controlling purpose.
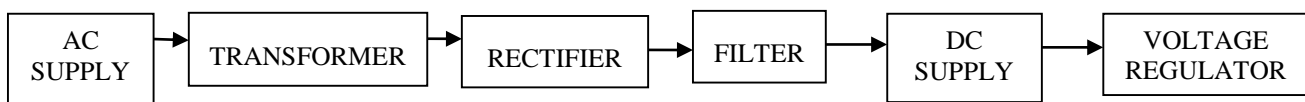

Figure 5.1 Power supply block diagram

The commonly used term is electrical energy supplies. Digital circuits are work in low DC voltage. To provide a appropriate voltage supply the power supply unit (PSU) is needed. The unit contains transformer, rectifier, filter and regulator. AC voltage typically of 230v is connected to a transformer which steps that AC voltage down to the desired AC voltage level. This ends up with dc voltage has some ripples or ac voltage variations. The ac supply after the rectification, filtration and regulation are

obtained by the DC supply.

Solenoid valve

A solenoid valve is an electrochemical device in which the solenoid uses an electric current to generate a magnetic field and there by operate a mechanism which regulates the opening of fluid flow in a valve. The characteristic of solenoid valve has variation in the electric current they use, it also generate strengthen of magnetic field which they generate and they control characteristics of fluid. The valve can use two-port design to regulate a flow and use three or more port design to switch flows between ports.

Figure 5.2 Solenoid valve

Water pump

Pump is used to move fluids (liquid or gases) or sometimes slurries. Pumps operate by some mechanism and consume energy to perform mechanical work moving the fluid. Pumps operate through many energy sources which include manual operation, electricity, engines or wind power.
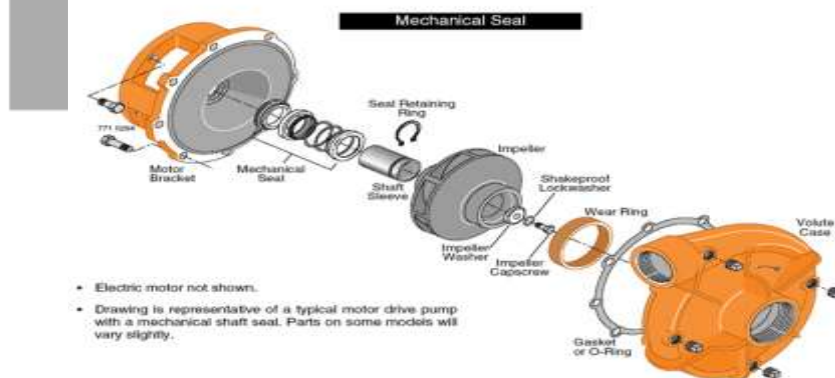

Figure 5.3 Mechanical pump

Figure 5.4 Mechanical seal

Proximity switch

When proximity switches make contact with the certain distance of an object its open and closes the switches of an electric circuit. Proximity switches commonly used in manufacturing equipment, robotics and security system and filter elements. Actual filtration and dewatering function in the housing is performs by filter elements. It also consists of several pleated filtration and supports the layer
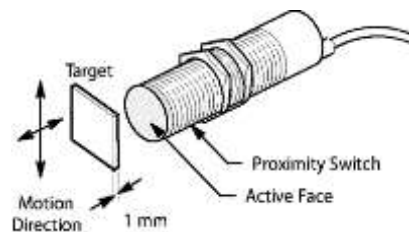
Figure 5.5 Proximity Switch

ON/OFF Valve

An on/off valve is similar to an electrical switch. It is a device which not only allows unit interrupted flow but also acts to stop the flow all together. This type of valve is often used for guiding the fluid to various locations, stopping/starting batch process and to activate shutdown (automated safety) functions. Plug, Gates, ball valves provide similar characteristics
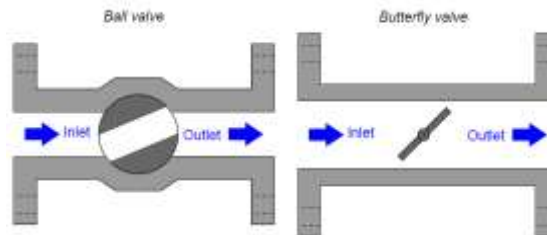

Figure 5.6 On/Off valve

Filter

Reverse osmosis is a type of water purification method. It utilizes yeah partially permeable membranes to except molecules, ions and large particles from water. It can also remove different types of chemicals which are dissolved in the water. An external pressure is applied which reverse the natural flow of pure solvent. This method is called reverse osmosis
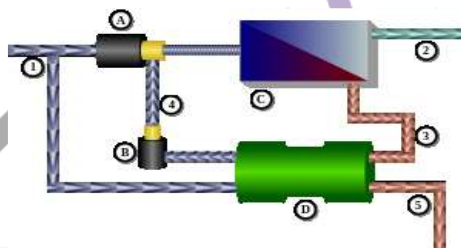

Figure 5.7 Reverse osmosis

PLC – PIC16F628A

In this project we are using the PLC-PIC16F628A. It consist of self-contained 18-pins with memory processor and applications with the automation. It is mainly used for embedded system. It has high performance, CMOS flash-based 8-bit microcontroller and low cost.

The PIC16F628a has 4MHz internal oscillator, two 8-bit and one 16-bit timer, USART, two comparators, 128 bytes of EEPROM data memory, PWM. The programmable low voltage reference that make it suitable for appliances, automotive, consumer and industrial applications. When the temperature range is -40 to 125 °C the PIC16F628a features operating range around 2 to 5.5 V.
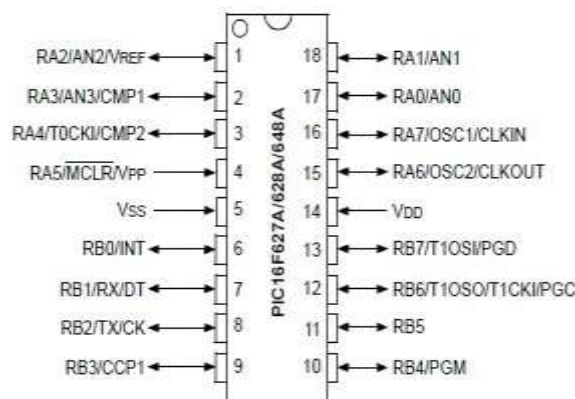

Figure 5.8 Pin diagram of PIC16F628A

Hydac filter

In this filtering process we are using the Hydac filter. For extracting particles from low viscosity Fluids the autofilter RF3 is used which is self cleaning system. The combination of robust construction and automatic backflushing capability makes a major contribution to operational reliability and reduce operating and maintenance cost. Automatic cleaning starts as soon as the elements

become contaminated. The flow of filtrate is not interrupted during the backflushing procedure.

A range of filters of different sizes allow flow rates of up to 10000 m³ per hour. Contaminating particles from the process medium filtered the slotted tube or super mesh elements in the filter. The filtered fluid is passed through the slotted tube filter elements of the black flushing filter, passing from the inside to outside. During this process particles of contaminant collect on the inside of the filter elements. The differential pressure between the contaminated and clean sides of the filter increases when the level of contamination increases.

Figure 5.9 Hydac Filter

The AutoFilter RF3 is designed for continuous, maintenance-free filtration for all type of industries. Operational reliability and reducing operations and maintenance cost has a major contributions in rugged design and the backflushing capability. The rate of the water of system compounds, pipelines and valves speed up the contamination particles in operating fluid. The use of the automatic backflushing filter, autoFilter RF3 increase in service life and maintenance intervals significant. The AutoFilter RF3 is a self-cleaning system for removing solid contamination from fluids.

Hydac Filter Application

The AutoFilter RF3 is preferably used at the treatment of service and process water. It is used within the fresh water supplying and water circulation. The integration of the filters protects the components and optimizes maintenance intervals and downtimes.
- Steel industry
- Power plant
- Long distance energy supply
- Paper industry
- Environmental technology
- Chemical industry
- Automobile industry
- Coal mining
- Alpine technology

VI. SOFTWARE DESCRIPTION

PLC LOGO software

PLC stands for Programmable Logic controller. It is a digital computer used in industries. it is applied for controlling the manufacturing process such as robotic devices, assembly lines or any functions that requires high level reliability ease of diagnosis and programming. Small automation process can be supported by LOGO software with simple and in innovative configuration and operations. It include the engineering software: logo soft comfort, logo web editor, Logo access tool.

The ideal programming offered by this Logo software can be utilized to implement simple automation process in manufacturing sectors and in Building Technology. The switching programs can be created and simulated after downloading. The testing can be done online. The documentation works are also simple and fast with the logo software switching program creation for the single mode and network mode, on the personal computer is possible using this LOGO software.

Application of logo software
- Astronomical clock time offset
- Automatic shift register
- Different scale analog value
- Basic light circuits
- Control of a sliding gate
- Cutting tool
- Bending machine
- Traffic signals
- Decimal - BCD converter
- Intelligent foot switch
- Bell system for schools

PLC logo function Program
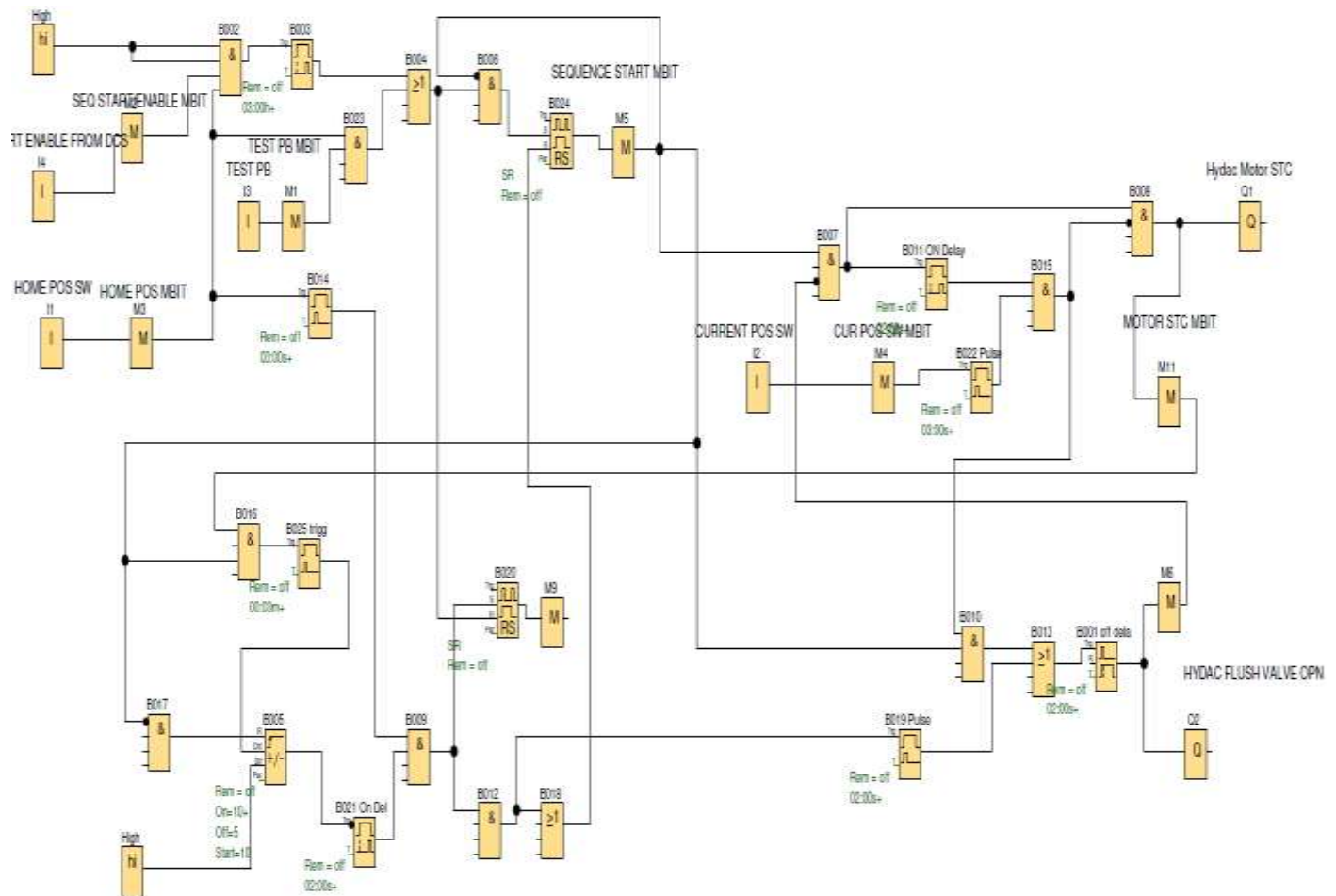
VII. CONCLUSION

The quality of paper is mainly based on water source and fibers. This project is useful to predict and optimize the contaminants in the water through the filtration process, the field test is done to verify the feasibility of the model. Improving the system by combining the PLC with the conventional ones, constitutes the kind of strategic goal that may lead to better treatment of water quality. Through the optimization for filter backwashing control, can reduced the operating cost. The filtration block with PLC, has the great effect for the prediction and control.

VII. FUTURE ENHANCEMENT

In future, the same project will be programmed by Distributed Control System (DCS). As it has more efficiency than using PLC. Its major advantage is that all the PLC and Micro controller based systems will be monitored through the DCS but the cost efficient is high.

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