TWO LOOP(ELEMENT) CONTROL USING PLC AUTOMATION

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ABSTRACT

Over the years the demand for high quality, greater efficiency and automated machines has increased in the industrial sector of power plants. Power plants require continuous monitoring and inspection at frequent intervals. There are possibilities of errors at measuring and various stages involved with human workers and also the lack of few features of microcontrollers. Thus this project takes a sincere attempt to explain the advantages the companies will face by implementing automation into them. The boiler control which is the most important part of any power plant, and its automation is the precise effort of this project.

Keyword :- *Plc, Scada,Drive, VFD, I/O devices.*

1. INTRODUCTION

It is required to maintain the level in the boiler drum at the desired reference value. Regulated inlet water flow to the drum help us achieve the desired reference level in the drum. It is expected to design a control system which would let us control the level in the drum & run the pump of inlet water flow at maximum efficiency with use of optimum energy consumption. Liquid temperature is another parameter necessary to be controlled.

Automated control system design should ensure supervisory control at different levels of operation. For fast communication & future extension of the operator levels universal communication protocols needs to be used. In order to control the level and temperature loop Prgrammable Logic Controller (PLC) will be used. Ladder logic and Functional Block Diagram (FBD) languages will be used to develop the control sequence of the loops. Supervisory Control & Data Acquisition (SCADA) will be communicated with PLC on MODBUS/ OPC protocol for monitoring and controlling of the process. SCADA screen development, adressing, tagging & communication parameter will be done. Variable Frequency Drives (VFD) will be incorporated to drive the pump for inlet water flow. Variations in speed & change in flow rate is acheived by the use of the VFD. Energy saving criterion is also fulfilled with the use of VFD. Communication of PLC with VFD & VFD macro configuration will be worked upon. The variable frequency helps to control the level of the liquid in a tank by varying the supply frequency of the motor and subsequently controlling the speed of the motor and level of water in the tank. the controlling task is carried under two mades viz. Auto Mode and Manual Mode.

2. OBJECTIVE

The basic objective is to control the level in the drum of the boiler with regulated inlet flow of water. Temperature of the liquid should be kept at the desired reference level. Using the automation tools all the process parameter involved will be monitored. Level and temperature loops will be controlled with sequence

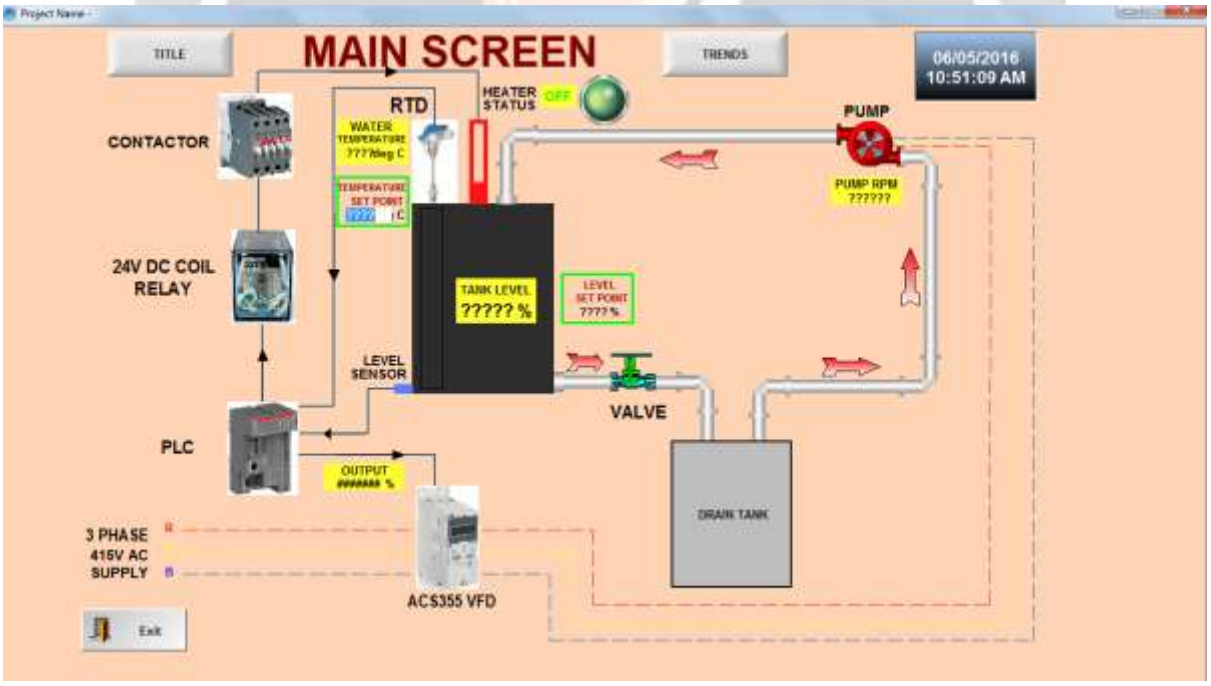
of logic in the controller. Energy saving control system will be developed for the inlet water pump. Universal open protocols to be used for high speed communication & future scope for expansion of automation tools.

2. LITERATURE SURVEY

In this sponsored project, we have received the major components that werequire for implementation of the whole system. We studied the features and specifications of those components and also their advantages; ending the more reliable and advantageous. It also lists some of the more advanced technologies that may have an application in these systems.

- PLC will be used to control level and temperature of water.
- Ladder logic and FBD languages will be used to develop control sequence.
- SCADA will be used for used for monitoring and controlling the process through MODBUS communication with PLC.
- VFD will be used to drive the pump & control SPEED and PRESSURE.
- These are the 2 loops that are going to be controlled.

3. BLOCK DIAGRAM



3.1 Block Diagram Description:

a) Tank: The tank here is the reservoir of the hydraulic substance that isused in the control loop.

b) PLC: Programmable Logic Controller (PLC) is used to control theparameters of temperature and level loop. In temperature loop; PLC,after receiving the indication of auto/manual mode, gives signal toVFD. Similarly in level control, after receiving the level signal from thetransmitter, its output is given to VFD.

c) RTD: Resistance Temperature Detectors or RTD for short, will measure the temperature of water in the tank and the output is given toPLC/PID.

d) VFD: A variable frequency drive is an electronic controller that adjuststhe speed of an electric motor after receiving input from PLC/PID.Variable-frequency drives provide continuous control, matching motorspeed as per our demand.

e) Level Transmitter: It detects the level of water in tank and gives corresponding electrical output to PLC/PID.

f) Heater: Knowing the set point of water temperature, heater is regulatedby PLC.

g) Pump: Pump with a 3-phase electric motor withdraws water out of thetank in accordance to thd demand of the system. Its speed is controlledby VFD.

h) Contactor: It is an intermediary between the components and theirrespective power supplies.

i) SMPS: The power distibution to all the system components is donethrough SMPS.

4 Software Design

The software used in our system for PLC programming is Codesys and for SCADA is Indusoft. Prior to the use of this codesys software; algorithmand chart was prepared which has been included.

4.1 Indusoft SCADA:

The InduSoft Web Studio product overthe following features and functions:

_ Integrated Windows development environment with toolbars, dialogs,and menu.

_ Full-featured objects and dynamics (the ability to modify object properties, execute commands, or inset values to tags used to build screenson the y at runtime.)

_ Symbol library with more than 100 symbols and dynamic objects, suchas pushbuttons, meters, sliders, switches, text and numeric displays,LED style indicators, pipes, bumps, icons, vehicles, valves, frames.

_ Powerful and exible Tags Database (Boolean, Integer, Real, and Stringtags), array tags, classes, and indirect tag-pointers.

_ Real time project documentation and Screen resolution converter.

4.2 CoDesys for PLC:

Thus you can develop a PLC program in CoDeSys for a drive-hardwareand also control this during running. The programming can be done using languages of PLC. The complete program logic is handled in the PLC program and just the pure motion information is executed by library functions.

WithCoDeSys, a broad spectrum of ancient tools for program development

is at hand. Programming is possible on-line as like as o_-line. An integrated

PLC-simulator allows to test critical program sections line without intererupting production systems. Operating and graphical display is provided bythe CoDeSys user interface:

_ Setting of operating conditions by batch processing and recipe administration.

_ Visualization of the state of program and plant.

_ Charting and archiving of plant data by variable trace the control isoperated independantly from the user interface.

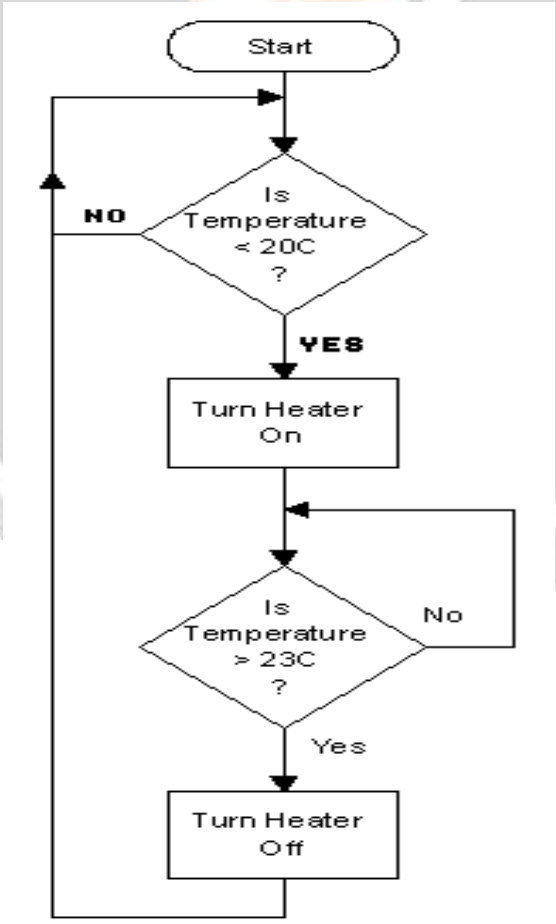
_ Headless and manual operating are supported.

4.3 Algorithm:

For Temperature loop:

1. Start
2. Temperature Sensed
3. Temperature above or below set point
4. If Below then Relay ON
5. Contactor ON
6. Heater ON
7. If Above then Relay OFF
8. Contactor OFF
9. Heater OFF
10. End

Flowchart :



For Level loop:

1. Start
2. Level sensed

3. Signal given to PLC
4. Signal given to VFD
5. VFD in trip mode or Run mode
6. If in Trip mode, set Yellow Lamp ON
7. If in Run mode, set Green lamp ON
8. Pump ON
9. End

Flowchart

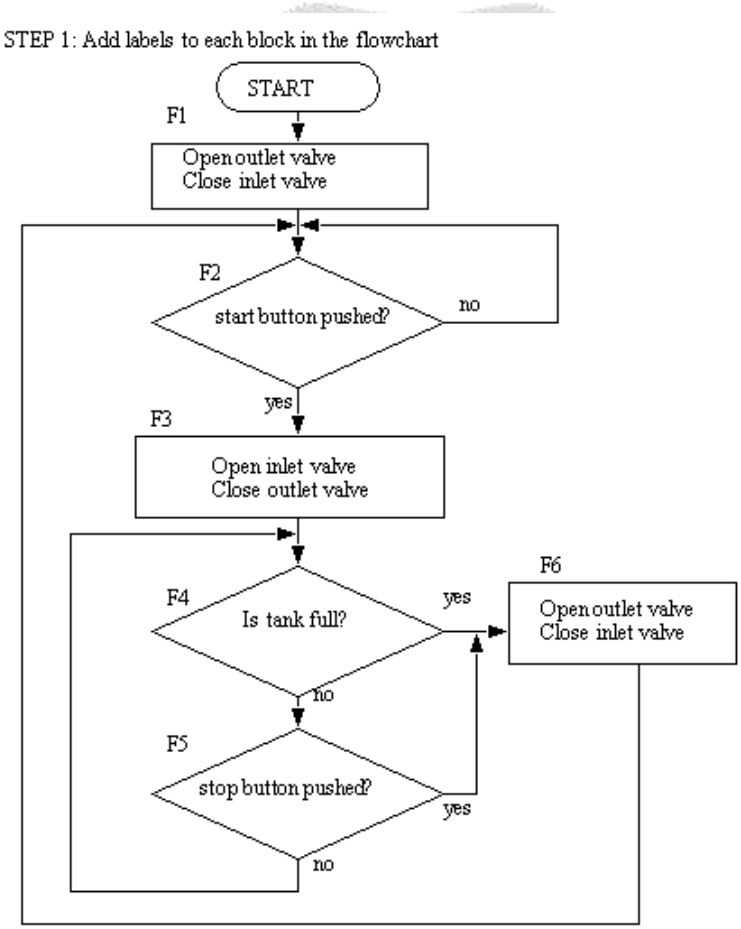


Fig4.8 Level Flowchart

5. Application and Future Scope

Higher efficiency and Optimization of the project, if used in giant processes can be obtained by using advanced control strategies. The implemented system has a wide range of applications in the field of Manufacturing and Process industries. Following are some of the industries which could make use of this project such as petroleum industries, food and processing industries, sugar industries, pulp and paper industries, oil refineries etc.

1. PLCs may need to interact with people for the purpose of configuration, alarm reporting or everyday control.

2. Most modern PLCs can communicate over a network to some other system, such as a computer running a SCADA (Supervisory Control And Data Acquisition) systemor web browser.

3.Use of PLC in storing water facility needs to store water in a tank. The water is drawn from the tank by another system, as needed, and our

The main advantage of automation are:

 Replacing human operators in tedious tasks.

 Replacing humans in tasks that should be done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities,under the water, etc)

 Making tasks that are beyond the human capabilities such as handling too heavy loads, too large objects, too hot or too cold substances or the requirement to make things too fast or too slow.

 Economy improvement. Sometimes and some kinds of automation implies improves in economy of enterprises, societyor most of humankind. For example, when an enterprise that has invested in automation technology recovers its investment; when a state or country increases its income due to automation like Germany or Japan in the 20th Century or when the humankind can use the internet which in turn use satellites and other automated engines.

6. Conclusion

The system is an ancient and optimized performance based system that can be implemented in giant systems to control process parameters. It can be implemented or upgraded over the conventional devices.

7. Limitations

It must be remembered that this analysis is limited. A greater depthof understanding and evaluation can only occur with utilisation of otherresources such as comparisons with budget forecasts and the statement ofchanges in position. Only after this process can a full appreciationof the company's current need and possible future occur.

8. ACKNOWLEDGEMENT

We expressed a deep sense of gratitude to honorable S.S.Shingare our guide and head of the department of electrical engineering. He has been a consistent source of motivation and inspiration to us.
We thank him for giving us a friendly space, providing laboratory facilities and believing on us that we have potential to develop this model of our project.

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