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Labview Based Pid Controller for Flow Process Station

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ABSTRACT

The primary aim of our project is to implement virtual instrumentation controllers for flow process station. This Virtual Instrumentation PID controller implementation is possible on software called LabVIEW developed by National Instruments. We have used a Data Acquisition board (DAQ) for interfacing with the hardware. This DAQ card is product of the similar company National Instruments. An automatic control is accomplished by sensing the water flow and then controlling the position of a gate valve that control the flow of water through pipe. The flow of project execution is: An orifice plate is fitted in the water flow line that produces differential pressure with respect to the flow. This differential pressure converted in to 4-20 mA range using flow transmitter , then it transmits in to the DAQ card. The designed controller will be generating the necessary controlling signal with respect to the flow sensor output. The controlling signal will be acquired by DAQ card. The DAQ card transfers it to the I / P converter which will transfer the electrical pulses 4-20mA into pneumatic signal 3-15psig to actuate the control valve.

KEYWORDS : PID, LabView, DAQ (Data Acquisition)

1. INTRODUCTION

PID controller is a most widely used controller in process industry. Here "P" stands for proportional control action, "I" stand for integral control and "D" stands for derivative control action. It has tuning constants which brings the process value as lock to the desired set point. [2] Location the parameters of PID are called as tuning of PID controller, which controls the relevant control actions. The most important requirement is that the controller should act in such a behavior that the process value is as close to the set point as possible. Proportional action simply amplifies the error based upon the gain. P mode generates offset. Integral action magnifies the effect of long-term steady-state errors, applying ever-increasing effort until they reduce to zero. The derivative part is concerned with the rate-of-change of the error with time: If the measured variable takes longer interval to approach the setpoint then the derivative action would speed up the controller effect so that the process variable will quickly reach the set point. Derivative term makes a control system perform much more intelligently. High value of Derivative constant would make controller action oscillatory. Fig 1: shows the general architecture of PID controller.

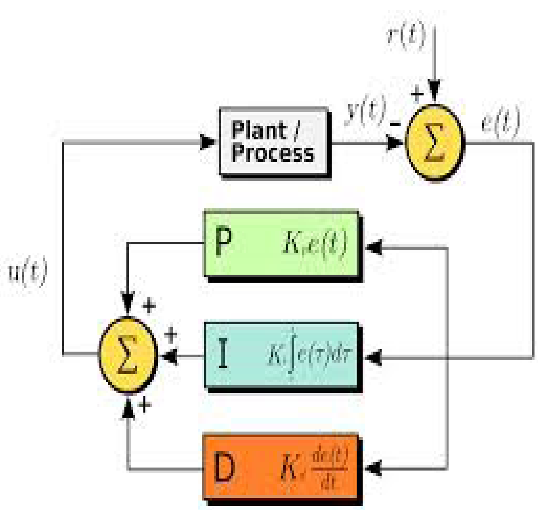

Fig 1: PID controller

This work enables the operator to operate the process stylishly with an ease. Instead of giving manual inputs to the PID, this designed PID can adjust the input parameters just by mouse clicks.

2. PROCESS SETUP

Fig 2 Flow Process Station

The major components of flow Process Station are described as follows:

The flow process station consists of a centrifugal pump, water reservoir, a control valve and process piping made of steel. The process instrumentation includes a flow meter and a differential pressure transmitter. A Supply tank is used for storage water. It is situated below the main setup assembly. The head tank has an outlet at bottom, which opens in to the supply tank. The differential pressure transmitter pick up flow through the pipe. The flow of water is sensed and transmitted to DAQ unit for controlling and monitoring of flow.

A pneumatic control valve is used to control the flow of water to the flow tank. The current to pressure converter (E/P converter) receives signal from computer through interfacing unit. It converts DAQ signal in to controlled output pressure.

Figure 3 shows the process block diagram of overall system. An orifice plate is placed in the tank which is connected with differential pressure flow transmitter. The output of the flow transmitter is an electrical Signal (4-20mA).The output of the flow transmitter is connected to I/V convertor to convert 0-5V respectively for DAQ. The desired set point is given in the Lab VIEW. Here the lab view act as the controller from the Lab VIEW we will be getting voltage (0-5V) which is converted into current (4-20mA) by V/I converter. That 4-20mA is converted into 3-15 psi respectively by using I/P converter the output of I/P converter is given to control value which is the final control element.

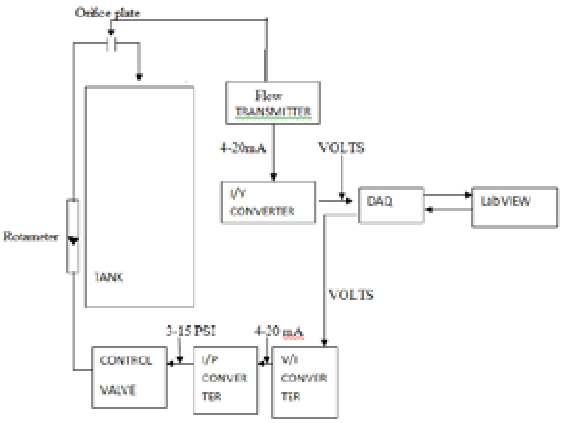

Fig 3: Process Block Diagram

3. SOFTWARE CONFIGURATION AND IMPLEMENTATION

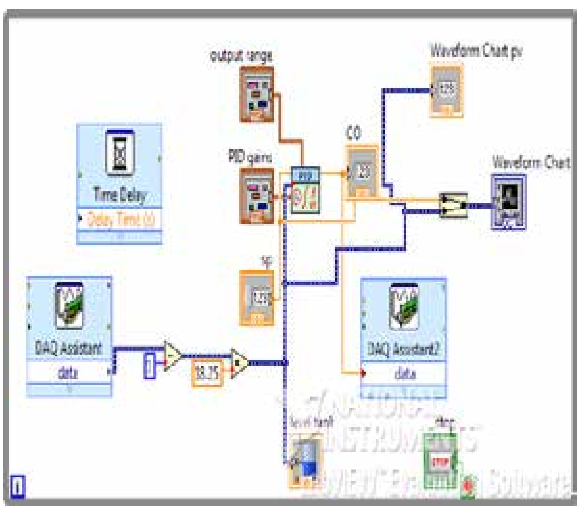

Fig 4: Block diagram

Fig4 shows the block diagram of the designed PID controller, which is used to executes arithmetic and logical operations. The input that is the Process variable is accepted by the DAQ card using DAQ assist. And the output of PID is fed to the DAQ card using another DAQ assist. This output is then converted to current signal using V/I converter.

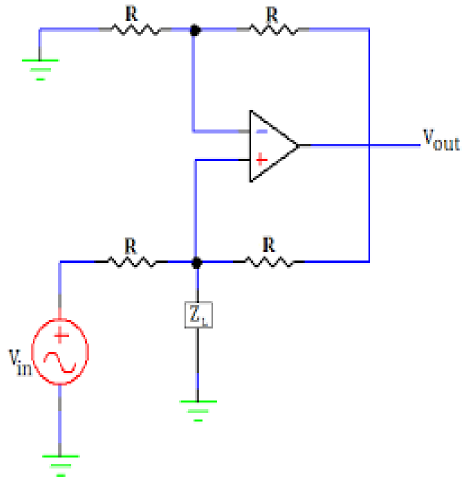

Fig 5: V – I Convertor

Fig 5 shows the circuit diagram of V/I converter using opamp. These circuits convert DAQ 1-5 V output in to 4- 20 mA range. The output of V-I Convertor is fed to I/P Convertor which converts 4 – 20mA to 3 – 15 psig Air pressure. This will supply Air signal to Control Valve

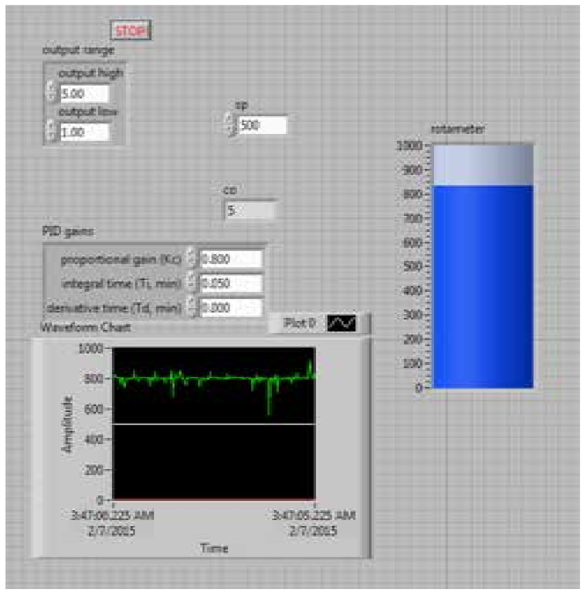

Fig 6:- **Front panel**

Fig 6 shows the front panel of the system. In this system we can control and monitoring the parameters of the PID controller. It also includes actual tank flow and graphical output representation of the system.

4. BENEFITS OF THE APPLICATION

This scheme replaces the conventional PID instrument with a virtual controller. It saves time of manufacturing of instrument. Since the PID logic can be designed on LabVIEW in a very short period, as the manufacturing of instrument needs plenty of skills which cannot be implemented in a short span of time. Practically this application needs no maintenance and very easy to upgrade. Whereas instruments need timely maintenance and their up-gradations is very difficult.

5. CONCLUSIONS

By using LabView indicators, controls and block diagram functions a virtual PID is implemented and tested. This paper replaces the conventional PID instrument with a virtual controller. The developed new system is highly flexible and easy in controlling the flow. It saves time of manufacturing instrument, since the PID logic can be designed on LabView in a very short period. This PID controller is flexible and easy to use. Practically this application needs no maintenance and very easy to upgrade. These results will be useful to do the required modifications in process industries for efficient control. The test results can help study the PID control, its control using Labview based PID can be used in many practical industrial applications. The graphical user interface of LabView enhances the use of the software. Future scope can be further study of the process and implement better controller using LabView.

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