Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Research Paper

Engineering

KEYWORDS : On –Off, PID, LabView, DAQ (Data Acquisition)

Labview Based Pid Controller For Cylindrical Tank Level Controlling

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ABSTRACT

The primary aim of our project is to implement virtual instrumentation controllers for cylindrical tank system. 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 level and then controlling the position of a gate valve that releases water in to the tank. The flow of project execution is: The cylindrical tank is fitted with a capacitive level sensor. This assembly takes the level readings from tank and it is converted in to 4-20 mA range, then it transmits in to the DAQ card. The designed controller will be generating the necessary controlling signal with respect to the level 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.

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.

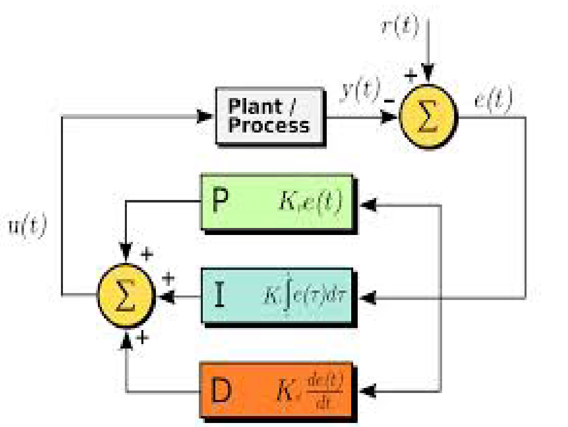

Fig 1: PID controller

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 Level Process Station

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

A Supply tank is used for storage water. It is situated below the main setup assembly. Transparent cylindrical level tank is supported on the support plate of the setup assembly. Graduated level is provided on the tank to indicate tank water level . The level tank has an outlet at bottom,[1] which opens in to the supply tank. Capacitance type level sensor transmitter is mounted on the level tank. The level of water is sensed and transmitted to DAQ unit for controlling and monitoring of level.

A pneumatic control valve is used to control the flow of water to the level 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.

Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Figure 3 shows the process block diagram of overall system. A Capacitive sensor is placed in the tank which is connected with the level transmitter. The output of the level transmitter is an electrical Signal (4-20mA).The output of the level 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.

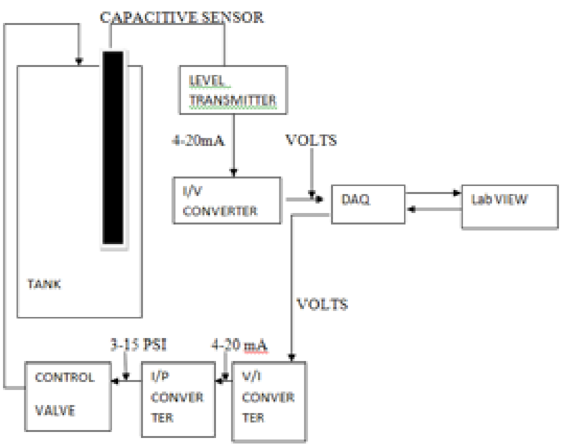

Fig 3: Process Block Diagram

3. SOFTWARE CONFIGURATION AND IMPLEMENTATION

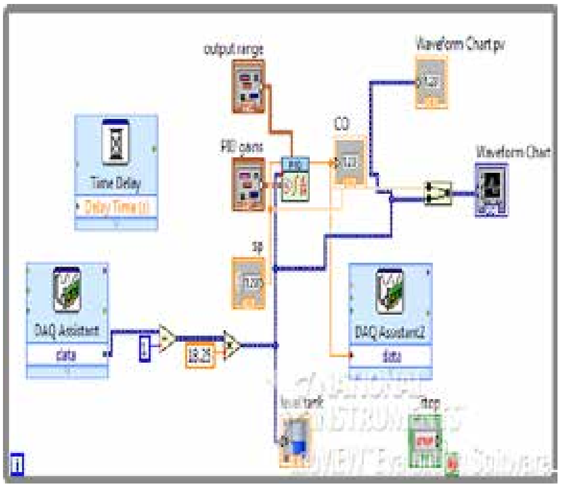

Fig 4: Block diagram

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.

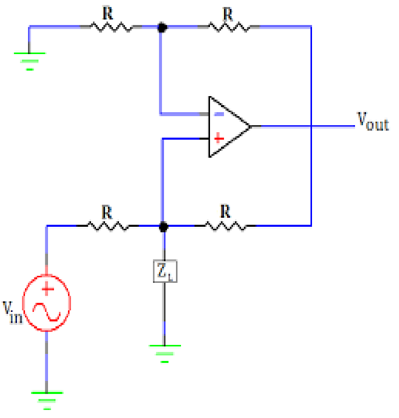

Fig 5: V – I Convertor

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

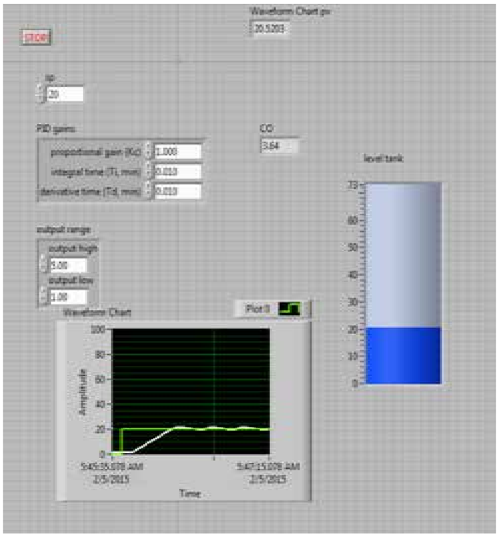

Fig 6:- Front panel

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 level 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 level. 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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