ORIGINAL ARTICLE

Implementation of Water Distribution Monitoring Framework Using PLC

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ABSTRACT

Sustainable management of clean water supply from resources has become the major issue facing all over the country. The problem is related to poor water distribution and lack of monitoring practices,wasteful utilization, furthermore absence of asatisfactorily incorporated water circulation framework. By applying industrial automation method, the distribution of water circulation along with supervisory control can be improvedcan be enhanced consequently bringing about sufficient reduction in the water wastage,overflow and keeping upthe water supply in concerned areas.

In proposed research, we present the water circulation sustainable. The designed application detects the requirement of water pressure with multiple motor control option. By applying autonomy such as SCADA with the incorporation of PLC and variable frequency driver to control water stockpiling, the allocation of water distribution and monitoring can be improved thus, there results in decreasing the level of water wastage. It is based on the core technology of themodern era. The programming is done on XG5000 and HMI is designed on INFO-U.

Keywords: SCADA, XG5000, PLC, HMI, INFO-U.

Introduction

Distributed Control System (DCS) is broadly utilized as a part of numerous mechanical domainwhere checking and detail gathering procedure is required. DCS is a framework which alludes to the specific practical circulated control system outline that exists in mechanical process plants. This idea obviates the need to assemble information and control the system on an extensive scale. Run from object-oriented task to a more confounded process incorporating organizing, correspondence, checking, information gathering, information logging and continuous data display.

The system that gives sufficient controlling and checking different aspects usually incorporates visual data and in addition persistent data indication. Audio and visual alert likewise being set at the desired level and the control of the pumping framework is incorporated.The setting depends on the end user requirement. Appropriate checking is fundamental to guarantee water maintainability being reached, with disbursement linked to detecting and automation. Such automated system involves water observatory system utilizing Programmable Logic Controller (PLC) and SCADA.

Keeping in mind the end goal to automate the control of the water level stock tank and the pump station, there is a need to design a controller and monitor which utilizes the Programmable Logic Controller (PLC) and SCADA (Supervisory Control and Data acquisition.)

The essential target of this project lies in the controller part of the system, the assimilationof sources of input and output, executes furthermore the data acquisition device are additionally considered. The choice of specialized strategy and selection of communication method will incredibly rely on upon the usefulness. All the selected technique and the most appropriate devices and innovations utilized as a part of the system will be clarified in points of interest in the next section. The major technologies utilized as a part of this system are Supervisory Control and Data Acquisition (SCADA), Programmable Logic Controller (PLC) and Variable frequency drive.

This system is additionally a new thought that we are consolidating parts of electrical and electronic hardware together. It will help you to see how we can operate water pump utilizing PLC. We can deal with the water pressure required through PLC. The framework additionally permits the reassure to be physically segregated from the organ itself. The main association was through VFD an electrical link from the support to the transfer and contact on-screen character, with some early organ reassures using a different twist supply to work blend of theframework.

Ordinary water supply system is standing up for various issues related to filtration, pumping of water, theflow of water and testing of water.

Standard water supply division contains three particular section for water supply. Firstly the pumping station, which does the sucking of water from thewater source. The second area is a filtration division in which estimation of pH and chlorine is done. The third zone is the movement section through which water is circled in all the city wards. Starting now these three regions are working freely. The critical issues in thewater supply system are spillage, wastage of water or none- uniform supply of water and in bigger part open is using thesuction motor to suck water from central supply association, which diminish in water weight.

Functional Block Diagram

The overall working of the developed system must be depicted by following functional block figure 1. Our project is applicable to control required water pressure with more than one motor pump (multi-motor controlling

system).
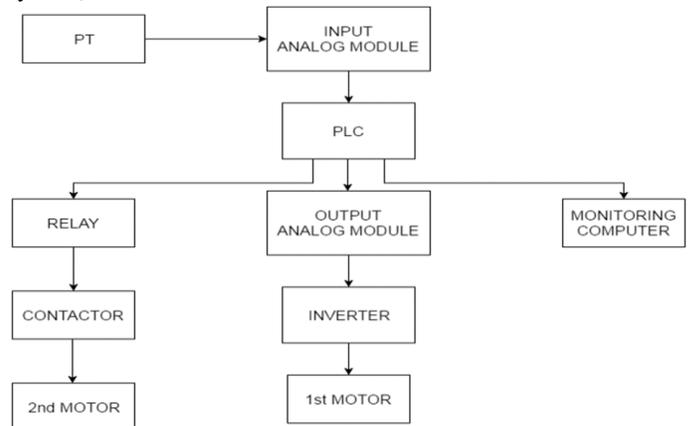
Figure 1. Block diagram of the proposed framework.

Description of Components

Programmable Logic Controller LSIS XGB

A Programmable Logic Controller or comprehensively known as PLC is a propelled PC that is most significantly utilized in abroad assortment of theprocess, for example,electromechanical methodology, to control diverse types of equipment, devices in mechanical office successive development frameworks. Not at all like to broadly useful PCs, the PLC is planned for different information input and output combinations, can stand higher temperature, immunity to electrical noise, and resistant to vibration and damping effects. It is an example of a continuous system controller since yield comes to fruition must be conveyed inlight of information conditions inside specified time, for the most part, theunintended operation will come about. We use LSIS XGB Series PLC in our project. It has built in PID Controller.

Supervisory Control & Data Acquisition

Supervisory control and information procurement is basically atype of modern industrial & mechanical control system. This framework can associate numerous sort of mechanical & distributed control system, this system is always ready to control extensive scale forms that can incorporate different destinations

This framework can be able to monitor water pressure level at required set point by the programmer in view of the system prerequisite. The concept of multiple motor control will be much beneficial to water distribution framework.

Analog Module

Analog Module of PLC (Programmable Logic Controller) is a critical piece of it. It can ready to get and transmit

information in voltage or in thecurrent frame. It gives exhibit changes/variety of voltage or current signs to PLC. As indicated by stepping stool rationale of PLC simple module makes analog output.

Variable Frequency Drive Inverter Starvert Ic5

The Starved Ic5 is typically motor controller that drives an electric motor by changing the frequency and voltage gave to the motor. It is used as a piece of this wonder since it doesn't require to keep running at full speed, and after that, you can hack down essentialness costs by controlling the motor with a variable frequency drive, which is one of the advantages of Variable Frequency Drive. VFDs permit you to compose the speed of the motor driven hardware to the load need. There is no other system for AC electric motor control that permits you to fulfill this

Pressure Sensor

A pressure sensor, as the name recommends, is a device that faculties and measures (as a rule of gasses or fluids). The pressure sensor in electronic circuits is an incorporated circuit that goes about as a transducer, that is, it duplicates (as an electrical signal the signal it gets as an element of forced weight. A pressure sensor is otherwise called a pressure transducer, pressure transmitter. A Pressure Gauge is a mechanical instrument which shows gas or liquid pressure.

Contractor

It is an electromagnetic solenoid type switch, have acoil to be energized to latch contact to the load and supply, thecontractorhas three terminals for contact any heavy load. Also, have auxiliary points for further working.

Circuit Breaker

The circuit breaker is basically a switching device which can be worked manually and consequently and protection of electrical power system separately. As the modern power era deals with the huge amount of current, therefore, special consideration should be given during designing of thecircuit breaker to save the substantial current delivered during the operation of thecircuit.We use Molded Case Circuit Breaker of 20amp 3-pole main breaker, 6amp 2-pole, 4amp 2-pole, 2amp single pole.

Relay

A relay is an electromagnetically incited switch. It is a basic electrical device use for signal processing. Relay are intended to withstand heavy power surges and harsh environment condition. We use anelectromagnetic 24vDC powered relay.

Three-Phase Motor

The 3-phase induction motor is exceptionally normal, because of their basic construction, longer life, and low maintenance, as compared to DC motors. Most of the time where DC motors were the standard, they are being supplanted with 3-phase induction motors, particularly where fine grain speed and torque control is required. To vary the frequency of motor according to the pressure we must need three- phase motor.

HMI

Human Machine Interface (HMIs) broadly refers to any graphical device that allows a user to interact with a machine's real-time control system and have been prevalent in manufacturing applications for decades. An HMI consist of a touch screen interface and an HMI computer, which communicates with the controller of the machine or Programmable Automation Controller (PAC). The HMI computer and the PAC both operate on an embedded platform, such as windows CE

Role of Info-U

The intent of Info-U is to mimic real world devices as a method of creating software graphically It is composed of avirtual instrument such as knobs, meter, and oscilloscopes, all of which can be presented in theInfo-U front panel. It provides agraphical user interface to underlying code and a commonly used as the main interference in HMIs. Info-U can display values from thereal-time controller on an operator interface and can easily incorporate alarms and measurements for protection system.Implementation of an automotive HMI requires an interface, an HMI computer, and a method of the communication between the HMI computer and the PAC. It can be effectively used as event management and alarm indication.

A router is an electronic device that connects at least two networks in forwarding packets among them as indicated by the data in the headers of the packets and routing links. The router is crucial to the operation of the internet and another complex system.

XG5000

. XG5000 is a software tool intended to program and troubleshoot XGT PLC system. It gives the attentive and dependable entry strategy, join both the console and mouse for theend user entry device. Regardless of what, at field side or office environment can work easily capability. It additionally gives the interfacing method for PLC and PC with assortments As far as connections are concerned, there are hardwire connection, modem connection, and internet connection.

Water Boosting Station

The existing water boosting stations in our country have anobsolete electrical control system which does not have any present calculation of required water pressure. Mostly, stations are not working in good conditions. They do not possess actual status checking procedure.

Discussion

Hardware Connection & Programming Section

The programming section will give you clear view about

the use of XG5000 and INFOU followed by the illustration of the preparation of model, its simulation and connection with the hardware as shown in figure 2.

Checking Test Plan

A systematic approach has been utilized for designing water circulation framework. Our project is based on integrated approach. Electrical & electronics components are well tested individually and mounted.
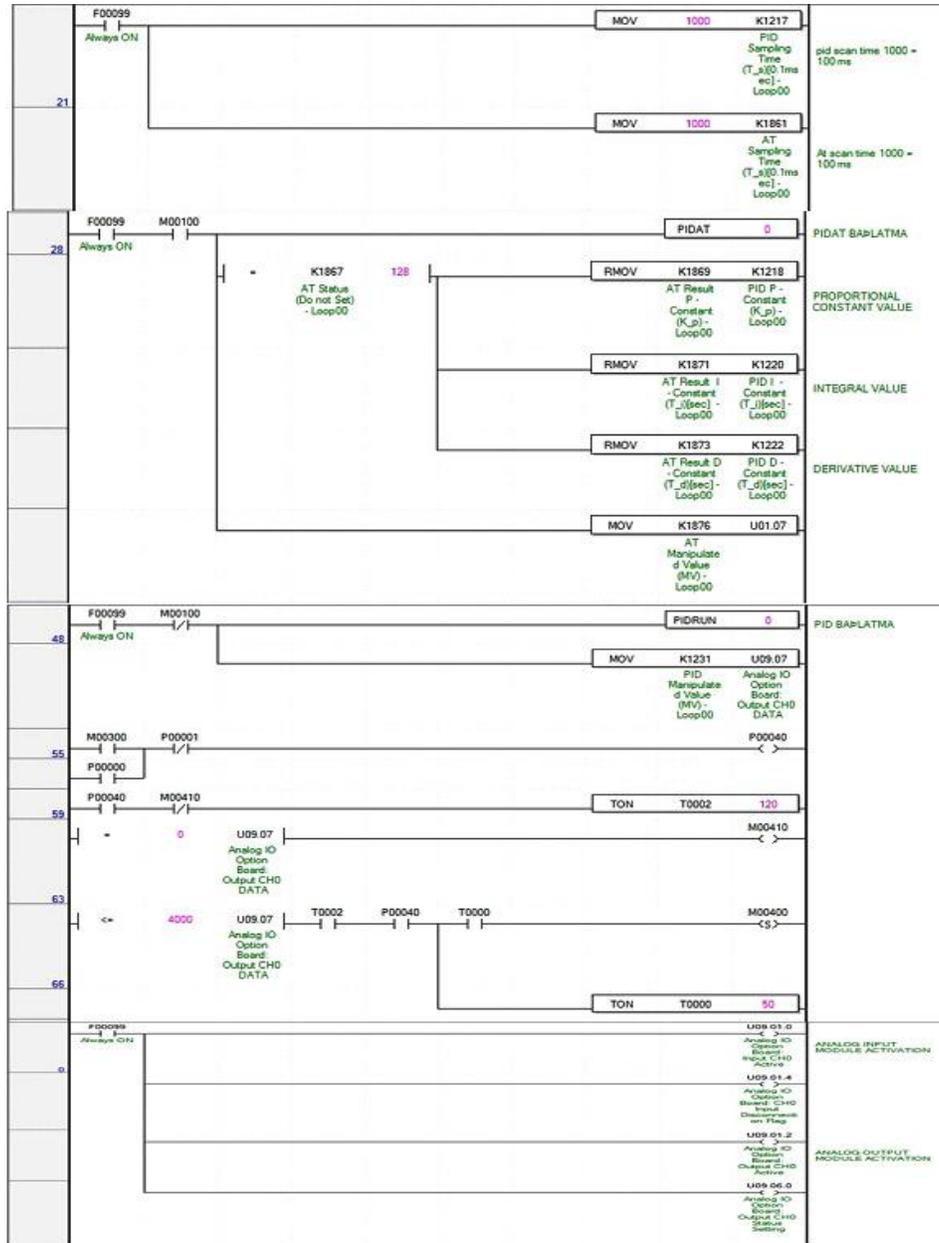

Figure 2. Simulation result of the proposed framework.

System Checking

Components can be seen by figure 3, 4, 5and 6 of water circulation framework are well tested to check the flow and pressure of water.Motors, Pressure Sensor, Pressure transmitter, Interfacing of PLC, Interface Inverter, Pressure Gauge, Water Pressure

Integration Testing

After the individual testing, the control framework experienced integrated testing. All the circuits were mounted, associated with the PLC and Inverter circuit is well tested.

Figure 3: Circuits for water circulation framework

Figure 4 Pressure sensor for water circulation framework.

Figure 5. Pressure transmitter for water circulation framework.
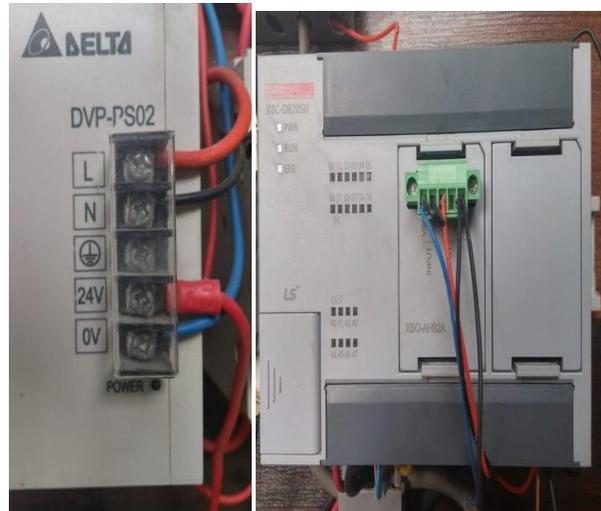
Figure 6: pressure transmitter for water circulation framework

Figure 7: Readings obtained from water circulation

Results

The system performed the desired tasks according to the instructions. All the sensors work in an integrated way, PLC sends signals to the inverter and inverter drives motor pump. If the desired instruction is to slow down the water pressure, the second motor is automatically on to regulate the required pressure. The complete procedure can be wirelessly monitored on PC as shown in figure 7.

Conclusion

utilization of automated systems like PLC & SCADA to regulate the supply of clean water. It increases the productivity and provides automation of work ease in access and reduce human efforts. Itincreases the productivity which leads to a decrease in production time thus reduces human effort. This system also helps in monitoring the water circulation framework from remote distances.

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