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Use of PLC and SCADA in Mechanization of Elevated Services Reservoir

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ABSTRACT: Automation plays a vital role in process and manufacturing industries. Automation has revolutionized the world in almost all the productivity with the increased reliability, improved quality and efficient as well proper utilization of the resource. The water given to the each region was not managed properly depending on the requirement leading to wastage of the water and insufficiency of the water to another region. Using Programmable Logic Controller (PLC) we made automatic control of the elevated service reservoir which was done earlier manually and we also did collection, analysis and control of the data using Supervisory Control and Data Acquisition (SCADA).

KEYWORDS:PLC, SCADA, Level transmitter, Flow transmitter, Pressure transmitter.

I.INTRODUCTION

In urban area water supply has been made through Elevated Service Reservoirs (ESR). The pure water from water treatment plant (WTP) is carried through water lines and elevated reservoirs are filled with water in different timings of the day and night. When elevated service reservoir is completely filled water, the water is supplied by opening valve of the ESR by valve-man but sometimes due to carelessness of these valve-man difficulties are encountered in regulating water supply. Hence there is need to overcome this problem using programmable logic controller (PLC) which takes and executes the decision without any human intervention. We have used various automation devices like the ultrasonic level transmitter, pressure transmitter, and electromagnetic flow transmitter. Earlier the level was measured by the level gauges which are replaced by the ultrasonic level transmitter which gives précised and accurate value. PLC is again interfaced to SCADA (Supervisory Control And Data Acquisition System) unit so as to monitor, control and collection of level, pressure and flow of the water.The main advantage of using SCADA is that all the parameters measured can be stored in its memory and used whenever required. SCADA provides multipurpose utility management and operating flexibility for monitoring the system.

The objective of this work is to reduce human interference by using various electronics instruments, PLC and GPRS system.This gradually decreases the human faults and errors. Also, carry out analysis of the day to day data of water level, inlet water pressure which is very beneficial for carrying out the analysis as well as managing the amount of water in that region if there causes some insufficiency. Real time monitoring, central monitoring of automation of ESR and to send the data from workplace to control room and concerned fields engineers.

II.LITERATURE REVIEW

It considers a network with N mobile unlicensed nodes that move in an environment according to some stochastic mobility models. It also assumes that entire spectrum is divided into number of M non-overlapping orthogonal channels having different bandwidth. The access to each licensed channel is regulated by fixed duration time slots. Slot timing is assumed to be broadcast by the primary system. Before transmitting its message, each transmitter node, which is a node with the message, first selects a path node and a frequency channel to copy the message. After the path and channel selection, the transmitter node negotiates and handshakes with its path node and declares the selected channel frequency to the path. The communication needed for this coordination is assumed to be accomplished by a fixed length frequency hopping sequence (FHS) that is composed of K distinct licensed channels. In each time slot, each

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node consecutively hops on FHS within a given order to transmit and receive a coordination packet. The aim of coordination packet that is generated by a node with message is to inform its path about the frequency channel decided for the message copying.

Furthermore, the coordination packet is assumed to be small enough to be transmitted within slot duration. Instead of a common control channel, FHS provides a diversity to be able to find a vacant channel that can be used to transmit and receive the coordination packet. If a hop of FHS, i.e., a channel, is used by the primary system, the other hops of FHS can be tried to be used to coordinate. This can allow the nodes to use K channels to coordinate with each other rather than a single control channel. Whenever any two nodes are within their communication radius, they are assumed to meet with each other and they are called as contacted. In order to announce its existence, each node periodically broadcasts a beacon message to its contacts using FHS. Whenever a hop of FHS, i.e., a channel, is vacant, each node is assumed to receive the beacon messages from their contacts that are transiently in its communication radius.

III.PROPOSED BLOCK DIAGRAM

The Fig. 1 shows the block diagram consists of level transmitter, pressure transmitter, flow transmitter and the GPRS module.

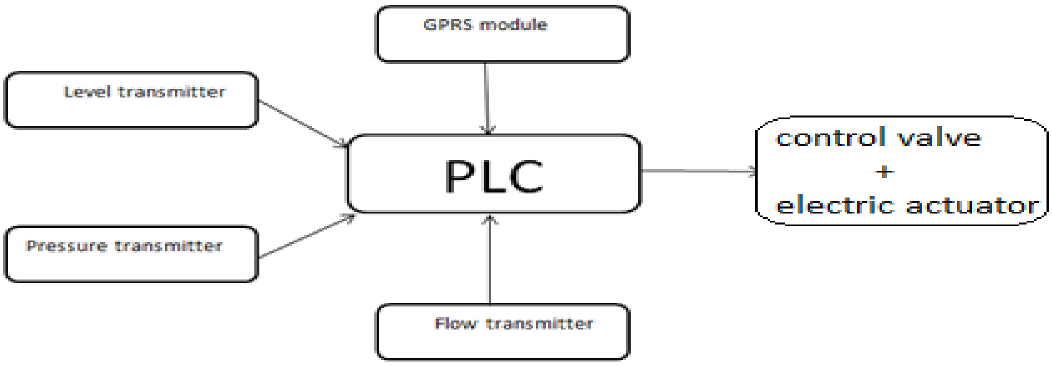

Fig.1. Block diagram

A. Level Transmitter

Ultrasonic level transmitter is shown in Fig. 2 which is used manufactured by the Forbes Marshall. In this, ultrasonic waves are transmitted and received and used to measure the level of the water. The level of the water in elevated service reservoir is also displayed on the SCADA.

Fig. 2 Ultrasonic level transmitter

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B. Pressure Transmitter

The pressure transmitter used in DP cell manufactured by the SIEMENS. This DP cell works on the principle of the pressure difference on both side of transmitter and thus the pressure of incoming flow is measured. Fig. 3 shows the Siemens pressure transmitter

Fig.3. Siemens pressure transmitter

C. Flow Transmitter

Electromagnetic flow meter manufactured by the Khrone Marshall is used to measure the flow of incoming water which is shown in Fig.4. According to the given set point of the flow will be compared with the flow measured with the transmitter .This will be also displayed on SCADA screen.

Fig.4. Electromagnetic flow meter

D. GPRS System

General Packet Radio Service (GPRS) system is communication medium used to transfer the data to the operator station which is SCADA room where all the data is collected ,gathered and displayed on the screen. In GPRS, the data is in the form of packets, which is usually a 2.5G. Fig. 5 shows the GPRS modem.

Fig.5. GPRS modem

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E.Programmable Logic Controller

The PLC accepts the input from flow transmitters, pressure Transmitter, level Transmitter and compares it with the benchmarks already fed into the PLC. The error between the actual reading and benchmark will modulate the final control element to Codesys software linked with the PLC. PLC is also programmed to send messages if the problem occurs when system in progress.

F. Electric Actuator

The electric actuator we are using is manufactured by the Marsh. Fig. 5 shows Marsh electric actuator.

Fig. 6 Marsh electric actuator

IV.WORKING OF THE SYSTEM

The water is supplied to ESR through inlet pipe where electromagnetic flow meter and pressure transmitter are installed. The flow and pressure are measured through the inlet pipe. The working of electromagnetic flow meters is based on Faraday’s Second Law of Electromagnetic Induction. It states that, a conductor moving in a magnetic field with the direction of its motion perpendicular to the magnetic field generates an EMF across it and the direction of the EMF is perpendicular to both, the magnetic field and the direction of motion. The generated EMF is proportional to the magnetic flux density, B, the velocity of conductor v and the length of the conductor l. In the flow meter the magnetic field is generated by exciting the coils and the conductor is the liquid itself, under measurement with the length equal to the diameter of pipe .EMF = B.v.d, where d is the diameter of the inner wall of flow meter. The pressure transmitters has one diaphragm, whenever it deflects the length is changed and pressure is measured. Ultrasonic level transmitter which is located at the roof slab of the ESR measures the level of water in ESR. When ultrasonic pulse signal is targeted towards an surface of water, it is reflected by the surface and echo returns to the transmitter. The time travelled by the ultrasonic pulse is calculated, and the distance of the surface of water is found. Hence level of water is measured. (Level = Speed of sound in air x Time delay / 2). Whenever the level, flow , pressure and water supply timings are verified, the final element ‘control valve’ with the help of the electrical actuator which is situated at the outlet pipe. Flow as well as pressure is also measured at the outlet pipe.

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V. RESULT AND DISCUSSION

Table 1. Different values at different time of flow meter, pressure transmitter, level transmitter

Sr. no.	Different timings	Level transmitter	Pressure transmitter	Flow meter	Position of the control valve
1	5am	5m	2.5kg/cm²	2500 LPH	100%
2	6.30am	4.8m	2.5kg/cm²	2448 LPH	100%
3	7.30am	4m	2.5kg/cm²	2420 LPH	100%
4	9am	3.5m	2.5kg/cm²	0 LPH	0%

From the table it is revealed that f low meter shows the approximately same reading resulting the level in the ESR decreases constantly by half an hour.

VI.CONCLUSION

We conclude that by this idea of automation of elevated service reservoir, water will be saved and used carefully. Now we can also have a watch on the current status of water supply through SCADA. All the required information can now be received directly from the work field without even being there physically. The overall control can be carried out with ease. The water distributed to each region is managed properly depending on the requirement without leading to wastage of the water and insufficiency of water to other regions. This process is carried out with high efficiency because of the reliable automation component ie. PLC. Due to the use of HMI with PLC it has become easy to get all information accurately and at high speed. Combination of GPRS system with all this has created ease of work and has also reduced the time taken to get information at higher extent. All this high technology automation has helped in reducing human interference and thus providing a correct alternative to safeguard our basic necessity 'water'. We can also change the parameters as per requirement per area to avoid wastage and in some cases scarcity of water.

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