

PLC Based Automatic Corporation Water Distribution System Using Solar Energy

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Abstract

In the Present scenario, availability of drinking water is very huge problem in many states including Tamilnadu. Many people have been suffering a lot to bring water in time. The monitoring of water can prevent the occurrence of stealing and leaking of water effectively for the household. This paper portrays about the PLC based automatic corporation water distribution system, which helps us to distribute the water automatically according to the needs of the particular locality. In traditional system there is no proper method followed for the distribution of water. In order to overcome the difficulty in the conventional system, the PLC based automated system using Embedded controller is used for distributing the water to the people equally according to their utilization. The Embedded controller is already pre-programmed to do the operations and results are shown in ladder diagram using picosoft software. In order to make the system more efficient and pollution free, solar energy is used as an alternative source for power supply operation of the PLC unit.

Keywords: Embedded controller, PLC unit, Solar panel, Float meter and Leakage sensor.

I. Introduction

Most of the areas are lacking in getting sufficient water supply in India. Even though the Government has taken necessary steps to supply the water, some of the regions in India are not getting water supply even for drinking and other domestic usage properly. Generally the water is stored in corporation overhead tank and distributed to nearby areas. In order to overcome the normal conflicts facing during water supply and to minimize the water leakage in the corporation water distribution pipe. With the rapid changes in

industrial automation and information technologies in recent decades, the control of all equipment have been performed through the use of industrial computers. Most applications use PLCs to connect with computers for monitoring and controlling loads. In our research idea, we are using Programmable Logic Controllers (PLC) for distributing the corporation water to the public in efficient manner, as they are inexpensive, easy to install and very flexible in applications.

To measure the accurate water supply to the distribution process, float meter is used and this meter gives indication to outlet valve to open and close. Specifically, our research idea focuses the proper method of water distribution system using PLC and methodology required to protect the leakage of water and constant pressure maintenance while water distribution. As the water is distributed by time shift method in the conventional system, we are facing lot of problems such as wastage of water, water theft by pumping motor, leakage of water etc. All these things are making the scarcity of water. So, in order to overcome the disadvantages in the earlier systems, we are going to distribute the water using our proposed system. We have undergone survey to calculate the total amount of water needed for the particular locality/street. To obtain the proper distribution of corporation water to all people, we are placing a float meter in the corporation storage tank to measure the water level in the tank and by the float meter reading water is getting distributed according to the utilization of the people.

The proposed idea describes the PLC based system for monitoring and controlling the corporation water distribution system and implementation of the configured hardware and software. Water distribution network consists of Pipeline structure with controlling valves for drain

points. One storage tank is used to supply the water with float sensor to sense the water level. To avoid the wastage of water, leakage sensor is placed in the water distribution pipe line. Pressure regulating switch is fixed on pipeline in order to sense the differential pressure drop within a pipeline and provides the information to PLC in order to take controlling action. The PLC correlates and controls the operational parameters to the speed requested by the system and monitors the system during normal and abnormal conditions (overloading and dry running). Since in the concept of green building our proposed idea can be implemented with the solar energy. The operation of the PLC, relay unit and solenoid are working by the DC power generated from the solar panel.

II. Literature Survey

In TruptiPatil *et al.* [1], demonstrate the system uses ARM 11 microprocessor of low power and high performance as the main chip, and designs software with $\mu\text{C}/\text{OS-II}$ real-time operating system to achieve remote real-time monitoring for water consumption of enterprises. The system will use ZigBee and GSM through GPRS system for communication protocol. The ZigBee is used since the application does not need high speed data rate; need to be low powered and low cost. Each ZigBee node will be connected to the collector node and from collector node the data will be sent to the central computer by using GSM through GPRS. GSM network with its vast coverage in most countries and also its competitive ever growing market, is becoming popular as a medium for machine to machine applications which utilize the GSM network to send its water usage reading using short message service back to the energy provider wirelessly. In addition, during the debugging process, the electromagnetic flow meter has non-linear output because of interference by a strong current, so this system uses the first order Taylor expansion for the working point in order to linearization.

In Prashantpalkar *et al.* [2], proposes the way to improve the water distribution system is by using industrial PLC and PC system, which includes all network components like flow sensor, GSM modules, pH sensor etc. The water theft can be monitored by the flow variations given by the flow sensors mounted on the channels. The system includes Remote Terminal Units (RTU), flow transducers and actuators distributed on a wide geographical area, control and power panels for the pump stations etc. The reliable instrumentation connected to PLC or RTU assure real time monitoring of the main technological parameters of large water distribution networks. The data

acquired of SCADA system (Supervisory Control and Data Acquisition) represent the support for optimization of the process and data-driven Decision Support System (DSS).

In HassaanTh.H.Thabet *et al.* [3], describes the High stories in multi story buildings in most of the Middle East countries suffer from water shortage due to bad and old designs in water supply systems. An automatic regulation water supply system based on PLC (Programmable Logic Controller) & VFD (Variable Frequency Drive) is proposed. This paper explains water supply systems energy conservation principle of a pump with speed control according to disturbances. This system can supply water to the building with constant pressure and save energy efficiency. This system was tested for 24 hours a day for three weeks with capacity of (20 -120) L/min of water, and about 10 meters building height. The pressure of the supply network is about 1.2 Bar.

In Sukhumar *et al.* [4] portrays the automatic energy management system. Solar energy is used as alternate renewable energy and the energy obtained from solar energy can be directly utilized as dc supply for handling dc machines. The DC power is further converted to AC with the help of inverter. This process takes place automatically with the help of advanced microcontroller. The microcontroller is programmed in such a way to detect the kind of power supply needed for machines (i.e.) whether AC or DC supply. If there is no need of power supply to the machines solar energy can be directly stored in the battery for later use. This technique is applicable for both in residential and industries purpose. For the implementation of the system Embedded controller is used and simulation is done by Keil C μ Vision 4 software is applied for different mode of operations. In order to reduce the bus bars and wastage of power, this system provides a solution to operate efficiently into different modes. The result of our research idea will be done in Keil C software.

III. Hardware Description of Proposed System

The Fig.1 demonstrates the overall functioning of the PLC based automatic corporation water distribution system. This automatic system consists of float meter which measures the water level in the corporation tank and sends the water content level to the PIC microcontroller. The Embedded controller is pre-programmed in such a way to do the automatic

operations and distribute the water according to the public needs.

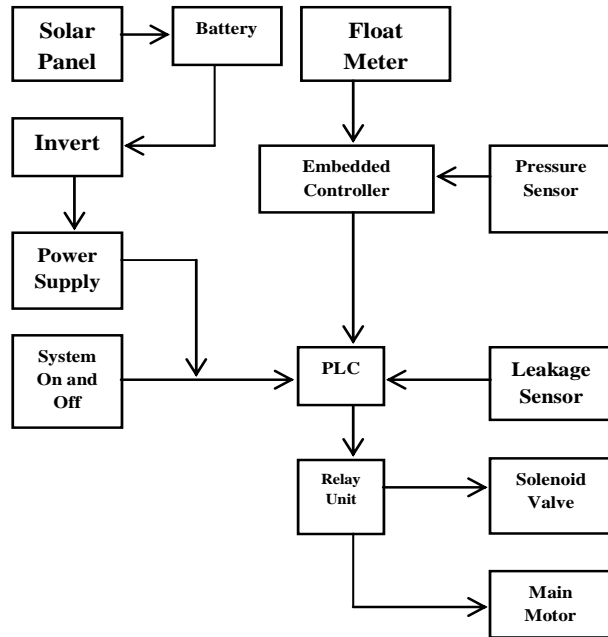


Figure. 1 Block diagram of proposed system

Float sensor is also placed in the water tank in order to find out the water level in the tank. There are two float sensors placed in the upper end of the tank and lower end of the tank respectively. If the water in the tank reaches lower end of the tank automatically motor turn on and start to fill the tank. Similarly, if the water level reaches the upper end point automatically motor turn off in order to prevent the overflow of water. To obtain the proper distribution and utilization of corporation water to all people, a float meter is placed in the corporation storage tank and measures the water level in the tank. Float meter is mainly used for the accurate measurement of the water distributing system and to indicate the outlet valve open or close process.

Leakage sensor is placed in the water distribution pipe line in order to find out the leakage in the water distribution pipe. Pressure regulating switch is fixed on pipeline, which senses the differential pressure drop within a pipeline and provides the information to PLC to take controlling action. To make the system more efficient and pollution free, solar panel is used as an alternate source for power supply. DC power, obtained from solar panel, is stored in the battery for the operation of PLC, relay unit and the solenoids. Further the stored DC power is getting converted into AC with

the help of an inverter, which is supplied to the motor to turn on.

IV. Proposed PLC based water distribution system.

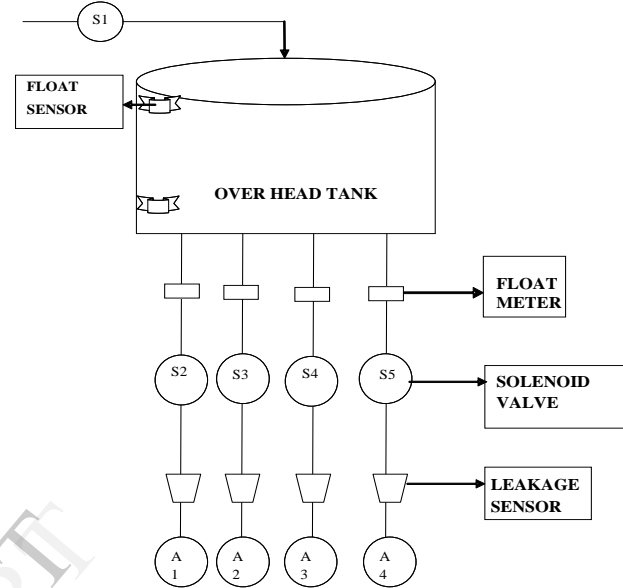


Figure.2 PLC based water distribution system

**Total capacity of the corporation tank:
(1 lakh litres)**

Table 1. Distribution of water level from the tank capacity

Areas	Capacity of Water in litres
Area 1	50 thousand litres
Area 2	15 thousand litres
Area 3	25 thousand litres
Area 4	10 thousand litres

V. Result and Analysis

Keil C μ vision 4 – An Introduction

The Keil C development tools for the 8051 microcontroller family support every level of developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels and Single-board Computers support ALL 8051-compatible derivatives and help you get your projects completed on schedule. With the Keil tools, we can generate embedded applications for virtually every

8051 derivative. The Keil Software 8051 development tools are designed for the professional software developer; any level of programmer can use them to get the most out of the 8051 microcontroller architecture. Keil C μ Vision 4 helps to provide the various simulation output.

Program for Embedded Controller using Keil C μ Vision 4

```
#include<REG51.h>
#include<stdio.h>
void main(void)
{
    SCON=0x50;
    TMOD=0x20;
    TH1=221;
    TR1=1;
    TI=1;
    while (1)
        void main (void)
}
printf ("\n PLC based automatic corporation water
distribution system using solar energy\n");

/* Initialization of Solar panel for power source*/
..
..
/* Initialization of Top Float Sensor */
..
..
..
..
/* Initialization of Bottom Float Sensor*/
..
..
..
..
/* Initialization of Leakage Sensor*/
..
..
..
..
/*Data base of Area1*/
..
..
/*Data base of Area2*/
..
..
/*Data base of Area3*/
..
..
..
/*Data base of Area4*/
..
..
..
..
}
```

PicoSoft

The PicoSoft programming software offers to create, save, simulate, document and transfer Picocircuit diagrams to a Pico controller. We can trigger a status display of the running circuit diagram and display the parameters of all function relays used. PicoSoft programming software offers additional functionality and programming ease for our PicoGFX™ controllers. This software is backward-compatible with standard Pico controllers and lets we establish communication between your PC and your controller.

Simulation Results

The ladder diagram shows the entire process of automatic corporation water distribution and output of the PLC.

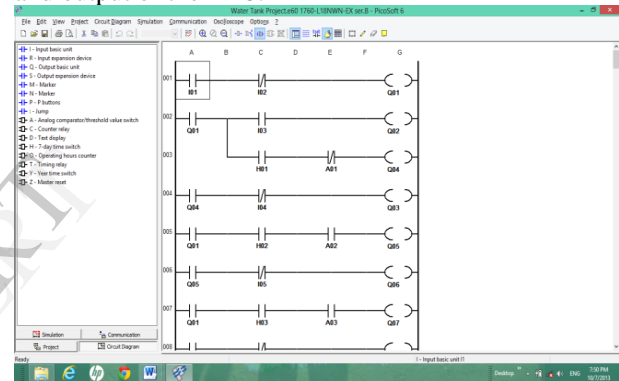


Figure.3 Ladder diagram of automatic corporation water distribution system

VI. Conclusion

The proposed method of automatic corporation water distribution system can reduce the water resources substantially and make the water management more effective and convenient to the public. Our research idea specifically designed for distributing the water equally according to the utility of the public needs and monitors the water distribution without any man power. This method is possible to solve the problems of traditional methods of corporation water distribution system. We hope the proposed idea can make a great change in the corporation water distribution system and can give the benefit to the government by reducing the wastage of water, manpower and time consumption. More over the system uses solar energy as an alternate energy for the power supply, which is pollution free, and reduces global warming. The results show the simulated and implemented system in the water distribution system with improved efficiency and increased accuracy for the public.

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BIOGRAPHY



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