

# CENTRALISED WATER DISTRIBUTION MONITORING AND CONTROLLING SYSTEM USING PLC AND SCADA

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**ABSTRACT**-There is a rapid growth in wide urban residential areas, therefore it is a need to provide better water supply as well as to prevent the unnecessary wastage of water. In case of Apartment buildings or Villas, customers will face problems due to improper water supply management. This proposed Centralised water distribution monitoring and controlling system using PLC and SCADA is used to distribute the domestic water depending on their needs to all the individual houses in an Apartment building or Villas so that everyone will get the required amount of water depending on the number of members residing in each house and accordingly tariff will be applied. The set point is fixed for each house and the water from the storage tank to individual houses is measured with the help of flow sensors. Solenoid valve is used to open or close the valve automatically. If the flow rate for a particular house reaches its set point then a message will be sent to that customer through GSM module and the tariff applied will be hiked for the extra water used henceforth .The system consists of PLC and SCADA .PLC is used to control the distribution of water and SCADA is one of the emerging technologies which is used for complete monitoring .PLC gives the signal to the solenoid valve according to the input from the user through GSM or DTMF module. Here it also creates awareness about conserving water.

**Index Terms**-PLC, SCADA, DTMF module, GSM module, Flow Sensors.

## I. INTRODUCTION

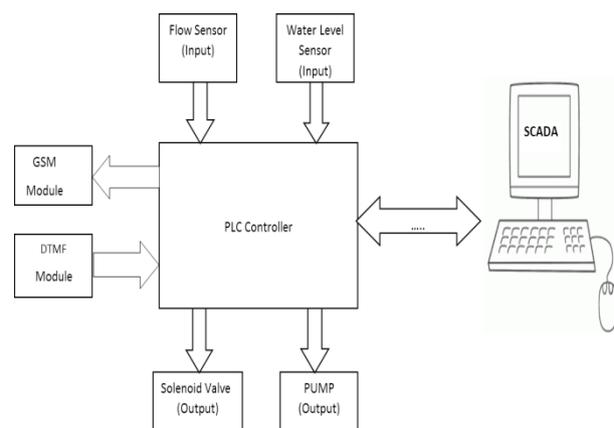
There is rapid growth in wide urban residential areas, therefore it is a need to provide better Water Supply. To fulfill the customer's requirement as well as to avoid faulty conditions there must be a better water supply management. Problem arises in the water supply management system due to improper water supply management and they will have to pay an equal amount irrespective of usage of water by individual houses.

This paper presents a prototype for water distribution system comprising a control system, communication means, piping, actuators, sensors and valves. This system utilizes a communication bus for controlling and monitoring water flow through the piping via control of the actuator and valves. . The reliable instrumentation connected to PLC(Programmable Logic Controller) assure real time monitoring of the main technological parameters of large water distribution networks Control System is further coupled to Supervisory Control & Data Acquisition (SCADA) unit. This paper focuses particularly to a control system for controlling and monitoring components within a Water Distribution System. This system includes Man Machine & Electrical Interfaces to PLC for transmitting/receiving control and status data over communication bus.

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## II. SYSTEM DESIGN AND IMPLEMENTATION



**Fig: Block Diagram**

The above Fig shows the Block Diagram of the project Centralized water distribution monitoring and controlling system using PLC and SCADA. It consist of the following module such as PLC controller ,SCADA software ,GSM module ,DTMF module ,Sensors such as Flow sensor and water level sensor ,actuators such as Solenoid valve and Pump.

**1 PLC (Programmable Logic Controller):** PLC is a solid state device which controls its output on the basis of its input and predefined program. A Programmable Logic Controller is a specialized computer used to control machines and processes. It uses a programmable memory to store instructions and execute specific functions that include on/off control, timing, counting, sequencing, arithmetic, and data handling. Basically, the PLC is an assembly of solid-state digital logic elements designed to make logical decisions and provides outputs. Initially the PLC was used to replace relay logic, but its ever-increasing range of functions means that it is found in many and more complex applications.

In our Project, we are using Wonderware Intouch

**2 SCADA (Supervisory Control and Data Acquisition):** is a system for remote monitoring and control that operates with coded

signals over communication channels (using typically one communication channel per remote station). The control system may be combined with a data acquisition system by adding the use of coded signals over communication channels to acquire information about the status of the remote equipment for display or for recording functions.

The term supervisory station refers to the servers and software responsible for communicating with the field equipment (RTUs, PLCs, SENSORS etc.), and then to the HMI software running on workstations in the control room or elsewhere.

In our Project, we are using Wonderware Intouch

**3 GSM (Global System for Mobile Communications):** is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones

In our Project, we are using GSM SIM 900A

Features:

Dual band GSM/GPRS 900/1800MHz.

Configurable baud rate. SIM card holder.

Built in network status LED.

Inbuilt powerful TCP/IP protocols stack for internet data transfer over GPRS.

**4 DTMF (Dual Tone Multi-Frequency):** is a signaling system for identifying the key or better say the number dialed on a push button or a DTMF keypad. It is a multi-frequency tone dialing system used by the push button keypads in telephone and mobile sets to convey the number or key dialed by the caller. DTMF has enabled the long distance signaling of dialed numbers in voice frequency range over telephone lines. DTMF (dual tone multi-frequency) as the name suggests uses a combination of two sine wave tones to represent a key. These tones are called ROW and COLUMN frequencies as they correspond to the layout of a telephone keypad.

The DTMF module used in our system provides an interface between the tenants and the controller system. It allows the tenants to communicate with the controller for various services such as allocation of required amount of extra water and automatic on and off of solenoid valves

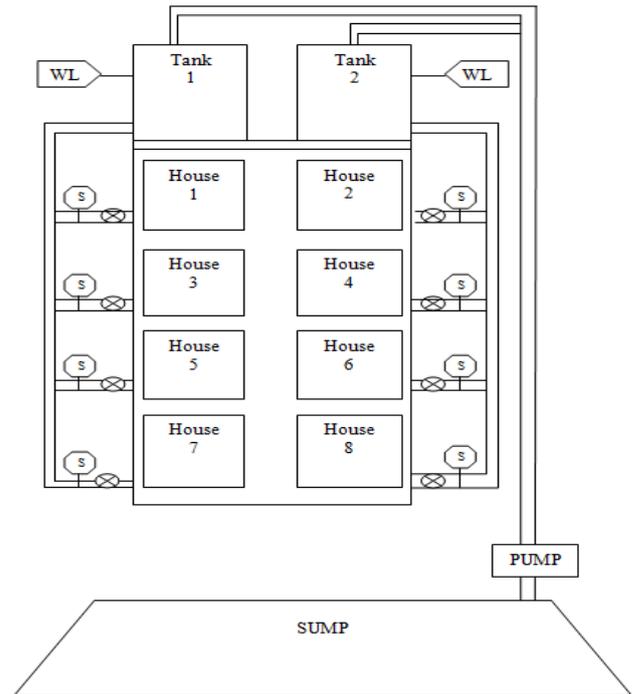
**5 Flow Sensors:** A flow sensor is a device for sensing the rate of fluid flow. Typically a flow sensor is the sensing element used in a flow meter, or flow logger, to record the flow of fluids. A flow sensor is used in this system, in order to measure the amount of water that is entering into each house.

**6 Water Level Sensor:** Liquid level sensors are used to detect liquid levels or interfaces between liquids such as oil and water or liquids and solids. They can be defined as sensors or transducers, or as integrated systems with instrumentation and control capabilities. A water level sensor is used in this system, in order to indicate the amount of water that is present in the overhead tank.

**7 Solenoid Valve:** A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. A solenoid valve is used in this system, in order to control the flow of water of water that is entering into the house from overhead tank. The solenoid valve is operated by a PLC controller depending on the predefined program.

**8 Pump:** A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines or wind power, come in many sizes, from microscopic for use in medical applications to large

industrial pumps. A pump is used in this system, in order to move the water that is present in the sump to the overhead tank.



**Fig: Field Diagram**

The above Fig shows the Field Diagram of the project Centralized water distribution monitoring and controlling system using PLC and SCADA. It shows the implementation on the project in the real world.

Consider an apartment which is consisting of 8 individual houses with 2 overhead tanks and one sump. If this apartment is automated, it will consist of water level sensors, solenoid valve, water pump, GSM module, DTMF module PLC and SCADA. The water which is present in the sump is moved to the overhead tank by the Pump, if the water in the overhead tank is reduced below the predefined level. Hence the PLC controller monitors the status of the water level sensor to operate the pump.

The water entering into the houses are measured through Flow sensors in order to monitor the water that is consumed. The PLC controller takes status of the Flow sensor and generates a water bill depending on their consumption and PLC controls this by solenoid valve. The solenoid valve is operated by a PLC in order to stop the water flow or to allow the water flow into the houses depending on the predefined program and User requirement i.e. whenever there is a leakage problem or when a repair work is going on. Hence each house is fitted with a one solenoid valve to control the water flowing into the house and a flow sensor in order to monitor the water flowing into the house.

The SCADA software gives the complete pictorial representation of the Field to the work place or the control room. So every operation happening in the field can be visually viewed in a SCADA from a control room itself.

### III. IMPLEMENTATION

#### Security System

In this section we are implementing a centralized monitoring and informatory system to monitor the daily usage of water through which we can reduce the wastage.

#### Availability

Most commonly faced problem by the population is the availability of water and the main reason for it is usage without any control.

In this section we are setting a limit for per day usage depending on the number of members in each house. Even then if they need more water using DTMF we are giving an option for requesting more water if needed. So each family will be aware of their consumption.

#### Billing and Report generation:

In this section each houses will be having a virtual record on their consumption of water with help of SCADA (Supervisory Control and Data Acquisition). According to the record a report and bill will be generated for each house automatically.

#### Information System:

In this section we are implementing GSM through which each customer will be given a sms alert when they exceed their monthly limit.

#### IV. BACKGROUND THEORY

Many systems have been proposed to solve the above problems but they have their own disadvantages. We have considered the following papers as reference to our project idea:

1. Automated water distribution system Using PLC and SCADA (2015)
2. PLC Controlled Water Distribution System (2015)
3. Automated Urban Water Supply System and Theft Identification (2015)
4. Theft Identification And Automated Water Supply System Using Embedded Technology(2013)
5. Theft Identification And Automated Water Supply System Using Embedded Technology(2014)
6. Automated Water Supply System and Water Theft Identification Using PLC and SCADA (2014)
7. Water Anti-Theft and Quality Monitoring System by Using AVR and SCADA (2014)
8. Water anti-theft and quality monitoring system by using PLC and SCADA (2013)
9. Conceptual Design and Development of Water Metering System for Multiple Family Residential Buildings (2012)
10. Automated urban drinking water supply control and water theft identification system (2011)

Hence there is a need to develop an efficient water supply management and billing system, so we have come up with the idea of **Centralized water distribution monitoring and controlling system using PLC and SCADA** is used to distribute the domestic water depending on their needs to all the individual houses in an Apartment building or Villas so that everyone will get the required amount of water depending on the number of members residing in each house and accordingly tariff will be applied. If the amount of water allocated for a house exceeds the limit, then a warning message will be sent to that particular tenant and the tariff applied will be hiked for the extra water used henceforth. . Since we can interface large number of input and output modules to PLC controller, it is an efficient controller to solve water management problems in small as well as very large apartment buildings.

#### V. APPLICATIONS:

- Maintains the record of the usage of water.
- Automatic bill generation.
- Avoid wastage of water.
- Easy maintenance.

#### VI. FUTURE SCOPE:

- It can be developed into an Android Application to check the status of the water usage and the applied tariff.

- The charges for water usage can be made either Pre-paid or Post-paid.
- The Grey water treatment system monitoring can also be included.
- The leakage detection system in the pipes can be implemented.

#### VII. CONCLUSION:

The automation of water distribution system eliminates water wastage. Automation system provides continuous water flow according to the set point. This project is automatic so it reduces lots of man power. The water wastages such as leakages, mankind laziness and operating error can be avoided .The automation implemented in water distribution system ensures to provide a best and efficient water supply management system and also the customers will have to pay only for the used amount of water.

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