

# An Arduino Based Monitoring, Leakage and Theft Detection for Water Supply

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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 with good water quality as well as to prevent the unnecessary wastage of water. In this project we proposed to develop an embedded based remote water monitoring and theft prevention system by recording the flow rates at the consumer/user end. The system consists of several sensors which are used measure the various physical and chemical parameters of the water. The parameters such as temperature, turbidity, dissolved oxygen and pH value of the water can be measured. By the help of water level sensor we can find whether there is sufficient water in the tank or not.

Keywords: Theft prevention, Sensor, Turbidity, PH Sensor

## I. INTRODUCTION

There is a rapid growth of population in urban region. Due to this there is a demand of water in those areas, which needs a continuous and efficient water supply. The water is needed to be good in quality and should in appropriate in time without wasting it. The monitoring of water resources should help in prevention of water theft and leakage. There are some entities which helps to examine the efficiency of water supply networks such as availability and storage capacity of water tanks with continuous supply of water. There is some difficulties faced by many people such as improper water supply and water quality and over consumption of water in some urban areas.

In this project we introduce a system which can eliminate the above disadvantages of the present water distribution system. To do this we are using arduino mega 2560 and various sensors which are helpful for water quality monitoring methods, sensors can be used. Sensor is an ideal detecting device which

can convert non-power information to electrical signals which can easily be processed, transformed, controlled, displayed, and transferred. The sensors which we are using are flow sensor to measures the flow of water in the system and pH meter is used to measure the physical and chemical parameters of the water supply and water level sensor is used to measure the water level in the tank. With the help of GSM and GPS we can receive any change in any of the sensors values and we can get the accurate location of the area where the problem is occurred.

## II. NEED OF THE SYSTEM

In 21st century population growth is very high. Very few people are getting pure drinking water; this is big problem in today's situations. In this system there are different sensor used to detect water quality, flow and water level in the water distributing system. due to large population there is also situations where there are occurrence of theft in water and leakage. In order to overcome this we introduced a system which

eliminates the above disadvantages and provides good quality and continuous water supply in urban areas

### III. LITERATURE SURVEY

<sup>1</sup>The paper titled *“Implementation of automatic water distribution with RTC using 89S52 microcontroller”* proposed a design in which Initial start for automatic water distribution for a city is designed using microcontroller 89S52 [Santosh A. Tamble et al, 2008]. Hence supply of water has done separately to the different areas. It removes the manual requirement of man power. It is implemented for three different regions. When the system become ON it ask for the time setting to turn OFF & ON the water supply for particular area. As the same instant the clock timer will start for the specified time period. When the specified time limit reach the system will become OFF for particular area. This technique has several disadvantages like water theft, Improper distribution which gets overcome using further technology.

<sup>2</sup>To overcome the above said disadvantage,the paper titled *“Water distribution system using ARM 7”* proposed a design where The water supply to residence and commercial establishment are provided at a fixed flow rate. The water Theft is a main problem which is done by the connecting a motor pump sets to the waterlines by a certain user [E. Stancel et al, 2008].

<sup>3</sup>This is being implemented by ARM controller which keeps the records of the flow rates calculated by the flow sensor at the customer end. ARM controller sends the commands to the solenoid valve if the flow exceeds the given range [Ms. Trupti Patil et al, 2013]. The ARM controller enables the transmitter signal for intimate to water supply board. At the same time they enable the driver unit to close the solenoid valve. The solenoid valve is ON/OFF by TRAIC .the flow rate condition are displayed by the PC and the GSM MODEM is used to provide information to the responsible officers to take the action [J.P.Shri Tharanyaa et al, 2013]. This technique has the disadvantage that it could not find the exact location

of the water theft and also there was an improper distribution of water.

<sup>4</sup>To overcome above disadvantages we proposed a design which can monitor the exact location of water theft. We have implemented the idea of using satellite navigation system (GPS) and have executed it efficiently. Whenever a theft problem occurs, the GPS gets activated and traces the exact location of theft. Moreover, to eradicate water shortage problem, infared sensors are utilised.

### IV. PROPOSED SYSTEM

Before explaining the proposed system let us give how water flows into the taps in houses. Cities usually source water from rivers, lakes, and ground water reservoirs. From these water sources, the water is pumped from pump houses into treatment plants through pipes. Water is cleaned at the treatment plant and from there it is piped into reservoirs. The reservoir is the storehouse for the treated water. Water is pumped from these reservoirs to the overhead tanks spread across the city. The water then gets distributed to houses and factories through a network of pipes working on gravitational force. In some cases, the water is directly supplied from the reservoirs to the houses. As all the cities are working on a smart city concept, our system focus on, Internet of things which is new scenario to make city as a smart city with different application. Main objective to implement this project is to design and develop a low cost reliable and efficient technique to make proper water distribution by continuous monitoring and also controlling it from a central server so that we can solve water related problems. Proposed system consist of a Arduino used as mini computer, different sensors such as water level sensor, flow sensor, and turbidity sensors are used. Arduino collects the data from sensors and send it Arduino. This system solves problem of Overflow,any theft, over consumption, Quality of water and makes a proper distribution. Continuous monitoring and controlling from a central server is possible using this system.

The rapid growth of wide urban residential areas imposes the expansion as well as modernization of water supply facilities and theft. Along with this one more problem is identified in the water supply channels, some people use ½ HP to 1 HP pump to suck the water directly from the channel of their home street. In many papers many authors used PLC and Sensors systems for water distribution network. Their system included remote terminal units, specific transducers and actuators distributed on a wide geographical area and control and power panels for the pump stations. And also improved the earlier work by using GSM modules to send message regarding theft or leakage to responsible officer's in the control room. In our work we have implemented the system using Atmega controller. The solenoid valve is driven using TRIAC and the controller was responsible for signal to intimate to water supply.

The system is provided with an electrically operated solenoid valve to supply water to the consumers. The valve turns on/off by the central processing station PC to supply the water for a particular time period. The system is provided with another electrically operated solenoid valve to stop the water supply whenever the flow rate exceeds a predefined limit. The microcontroller will switch ON/OFF the solenoid valve using a transistor as a switch. It is proposed to employ a GSM modem for wireless communication so that the information can be passed to particular responsible officer's cell phone for immediate action as well as to the central processing database.

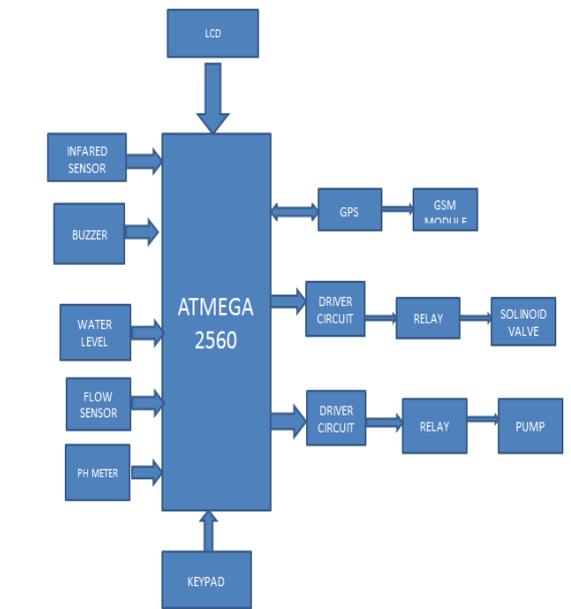


Fig1: Proposed block diagram

## SYSTEM DESCRIPTION

### HARDWARE COMPONENTS

1. ATMEGA 2560
2. FLOW SENSOR
3. WATER LEVEL SENSOR
4. PH METER
5. GSM MODULE
6. GPS
7. SOLENOID VALVE
8. PUMP
9. BUZZER
10. INFRARED SENSOR
11. LCD
12. MAX 232

### 1. ATMEGA 2560

The **Arduino Mega 2560** is a microcontroller board based on the **ATmega2560**. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

### 2. FLOW SENSOR

In many late model automobiles, a Mass Airflow (MAF) **sensor** is used to accurately determine the mass flowrate of intake air used in the internal combustion engine. Many such mass **flow sensors** use

a heated element and a downstream temperature **sensor** to indicate the air flowrate.

### 3. WATER LEVEL SENSOR

**Water Level Sensors.** **Level sensors** are used to detect the **level** of substances that can flow. Such substances include liquids, slurries, granular material and powders. **Level** measurements can be done inside containers or it can be the **level** of a river or lake.

### 4. PH METER

A *pH meter* is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as *pH*. The difference in electrical potential relates to the acidity or *pH* of the solution.

### 5. GSM MODULE

**GSM/GPRS module** is used to establish communication between a computer and a **GSM-GPRS** system. Global System for Mobile communication (**GSM**) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of **GSM** that enables higher data transmission rate.

### 6. GPS

It is a global navigation satellite system that provides geolocation and time information to a *GPS* receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more *GPS* satellites. Obstacles such as mountains and buildings block the relatively weak *GPS* signals.

GPS is one of the most fantastic utilities ever devised by man. GPS will figure in history alongside the development of the sea-going chronometer. This device enabled seafarers to plot their course to an accuracy that greatly encouraged maritime activity, and led to the migration explosion of the nineteenth century. GPS will effect mankind in the same way. There are myriad applications, that will benefit us individually and collectively.

### 7. SOLENOID VALVE

The valve that has been selected here is 2/2 way Normally Open (NO) Valve. It enables the water flow in its resting position. It has two ports (one inlet port and one outlet port) and only one orifice seat. A short

electrical impulse enables the solenoid valve to be opened or closed. The residual effect of a permanent magnet is sufficient for maintaining the valve in a particular working position with no electrical energy consumption. The opposite polarity of the electrical impulse will make the valve to retain its original position (i.e.,) to open the valve.

### 8. PUMP

a mechanical device using suction or pressure to raise or move liquids, compress gases, or force air into inflatable objects such as tyres.

### 9. BUZZER

an electrical device that makes a buzzing noise and is used for signalling.

### 10. INFRARED SENSOR

An **infrared sensor** is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting **infrared** radiation. **Infrared sensors** are also capable of measuring the heat being emitted by an object and detecting motion. **Infrared** Radiation.

### 11. LCD

An LCD, or Liquid Crystal Display, is a type of screen that is used in many computers, TVs, digital cameras, tablets, and cell phones. LCDs are very thin but are actually composed of several layers. Those layers include two polarized panels, with a liquid crystal solution between them. Light is projected through the layer of liquid crystals and is colorized, which produces the visible image.

The liquid crystals do not emit light themselves, so LCDs require a backlight. That means that an LCD requires more power, and could potentially be more taxing on your phone's battery. LCDs are thin and light, though, and generally inexpensive to produce.

### 12. MAX 232

The **MAX232** is an integrated circuit first created in 1987 by **Maxim** Integrated Products that converts signals from a TIA-232 (RS-232) serial port to signals

suitable for use in TTL-compatible digital logic circuits

## V. DIScription AND FLOW CHART

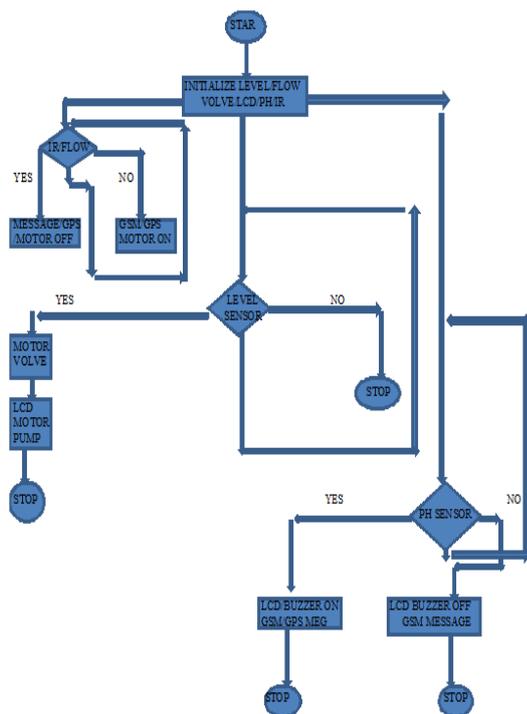


Fig2:Flow chart

System will automatically turn on/off the solenoid valve of supply water control so that for a certain amount of time consumer can use the water. For given time, if any consumer uses motor pump to draw excess amount of water then system will automatically identify theft. If theft has been identified, system will take appropriate action such as turning off the solenoid valve of theft. At the end of a fixed duration of time GSM module will send message regarding average flow rate and usage of particular consumer to the central database. Also when theft is identified GSM module will send message to particular responsible officer's mobile phone.

The real time pipeline arrangement, it has two solenoid valve (one input side and another near output side), turbine flow sensor. It has been implemented with one node. Shows the microcontroller section of the proposed system. It has a TRIAC switch, controller section and a GSM modem. In a case if a theft is occurred then the controller will send a signal to the TRIAC circuit to close the Solenoid valve nearby that node. Then a

message will sent using the GSM to the officer mobile indicating about the theft and where the theft occurs.

## VI. ADVANTAGES:

1. More convenient:
2. Reduces the man power required to switch on the valves to distribute water to the area.
3. Reduces the manual calculation of water bill/payment.
4. Helps in finding out the water pollution.
5. Helps in reducing wastage of water
6. Leakage/theft Detection very easy

## VII. APPLICATIONS

- ✓ This can be used as water management system and can help in minimizing the water wastage taking place.
- ✓ This model can help us in providing a more efficient way of water management and easier ways of bill payment through the use of mobile phone.

## VIII. FUTURE SCOPE

- ✓ This project when developed on a larger scale can be practically implemented in the Municipal Corporation of any village, town or city.
- ✓ The same system can be implemented for automated town electricity management system.

## IX. CONCLUSION

By this we conclude water supply monitoring and fraud system was built. Using proposed system, we can make centralized water control and fraud detection system. We can ensure fair water supply to all users by preventing water fraud and ensuring by taking necessary action. This real-time automation implemented in the system avoids wastage of water and man power.

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## BIOGRAPHY

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