

# Advanced Water Quality Monitoring and Controlling System

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**ABSTRACT:** In the present scenario, public RO purifiers are available everywhere and the concern is whether the water is 100% good enough for human consumption. Water pollution is one of the biggest fears for the green globalization. In order to make sure the safe supply of the drinking water the quality needs to be monitored in real time. In this paper, we have designed a low cost system for real time monitoring of the water quality and controlling the water outlet using Arduino. This systematization consists of several sensors which are used in measuring the chemical parameters of the water. The chemical parameters like temperature, PH and turbidity of the water are measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. The measured chemical parameters are compared with the standard values of RO water. If the water is matched with standard values then the outlet of storage tank will open. Otherwise a notification message is sent to concerned person of Municipal Corporation and also the outlet of storage tank will close.

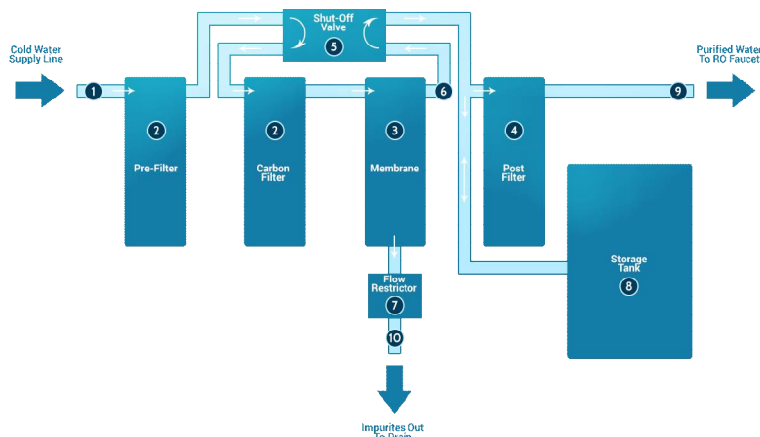
**KEYWORDS:** pH sensor, Arduino, Turbidity sensor, Temperature sensor, Flow sensor and GSM module

## I. INTRODUCTION

Water is one of the most dominant needs for any living being to survive. Over two thirds of Earth's surface is covered by water; less than a third is taken up by land. As the world's population continues to grow, people are increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities – not so they take up less room, but so their quality is reduced. As drinking water crisis is main problem in India as people don't care about the quality of water they get. Due to this, the people are made to suffer from water born diseases like Cholera, Malaria and Dengue fever. On the other side, the government is also not caring about this problem, which leaves common public helpless. The main issue here is there is no one to monitor the drinking water system regularly. Public RO systems offer drinking water at low cost and obviously people go for it without any awareness. To overcome this problem, we opted a new system for monitor and controlling the quality of drinking water.

## II. RO WATER SYSTEM

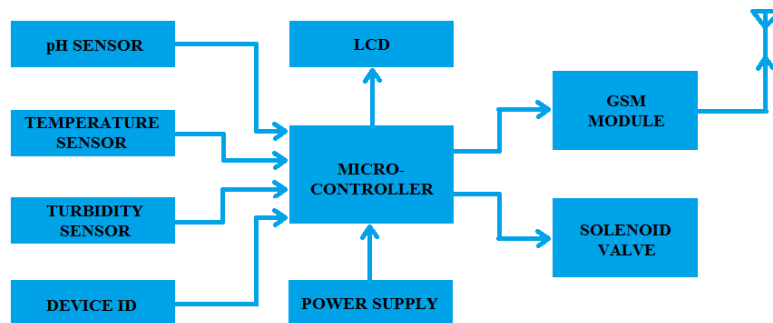
Reverse Osmosis (RO) is a water purification process that removes contaminants from water by using pressure to force water molecules by passing a semi permeable membrane. During this process, the contaminants are riddled out and blushed away, leaving clean, tasty drinking water. Reverse osmosis is capable of removing up to 99 percent of 65 different contaminants, including lead, fluoride, chlorine, dissolved salts, and more. There are generally four stages in the Reverse Osmosis process. They are Sediment filter, Carbon filter, Reverse Osmosis membrane, Polishing filter.



**Fig 2.1:** Reverse Osmosis System with Basic Components

### III. PROPOSED SYSTEM

This method deals with the storage tank of the RO system. The sensors – Turbidity sensor, pH sensor and Temperature sensor are placed inside the storage tank. These sensors are interfaced with Arduino microcontroller. The outputs from the sensors are compared with the predefined values of Turbidity, pH and temperature. If the value doesn't match, an SMS containing the readings of the parameters along with the system ID (Address) is sent to the concerned person (M.Corp) via the GSM module. At the same time, the output of the storage tank is closed. Through this solution, we make sure the healthy water reaches the people.



**Fig 3.1:** Block diagram

### IV. COMPONENTS OF ADVANCED WATER QUALITY MONITORING AND CONTROLLING SYSTEM

#### 4.1. ARDUINO

##### 4.1.1 ARDUINO NANO

The Arduino Nano is a surface mount breadboard compatible version of the ever-popular Arduino micro controller. It's small, has integrated USB, and is breadboard friendly. It has more or less the same functionality of the Arduino Duemilanove, but in a different package. Physically, it's missing the power jack, but it can still sense and switch to the higher potential source of power. It's perfect for embedding into your next project. Arduino is an open-source physical computing platform based on a simple i/o board and a development

environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux). Features: ATmega328 microcontroller 14 Digital I/O Pins (6 PWM outputs) 6 Analog Inputs 32k Flash Memory 16Mhz Clock Speed Automatic reset during program download Power OK blue LED Green (TX), red (RX) and orange (L) LED Auto sensing/switching power input Small mini-B USB for programming and serial monitor ICSP header for direct program download Standard 0.1" spacing DIP (breadboard friendly) Manual reset switch.

#### **4.1.2. ARDUINO SOFTWARE (IDE)**

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board.

#### **4.2. pH SENSOR**

pH is a measure of hydrogen ion concentration; a measure of the acidity or alkalinity of a solution. pH meter, electric device used to measure hydrogen-ion activity (acidity or alkalinity) in solution. Fundamentally, a pH meter consists of a voltmeter attached to a pH-responsive electrode and a reference (unvarying) electrode. The pH-responsive electrode is usually glass, and the reference is usually a mercury–mercurous chloride (calomel) electrode, although a silver–silver chloride electrode is sometimes used. When the two electrodes are immersed in a solution, they act as a battery. The glass electrode develops an electric potential (charge) that is directly related to the hydrogen-ion activity in the solution (59.2 millivolts per pH unit at 25 °C [77 °F]), and the voltmeter measures the potential difference between the glass and reference electrodes.

#### **4.3. TEMPERATURE SENSOR**

A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal. This electrical signal is converted into digital signal by the Arduino.

#### **4.4. TURBIDITY SENSOR**

Turbidity is the degree to which a transparent liquid scatters light, usually a measure of the amount of suspended material in the liquid. Global Water's Turbidity Sensor is a highly accurate submersible instrument for in-situ environmental or process monitoring. Applications for the turbidity sensors include: water quality testing and management, river monitoring, stream measurement, reservoir water quality testing, groundwater testing, water and wastewater treatment, and effluent and industrial control. The turbidity sensor directs a focused beam into the monitored water. The light beam reflects off particles in the water, and the resultant light intensity is measured by the turbidity sensor's photodetector positioned at 90 degrees to the light beam. The light intensity detected by the turbidity sensor is directly proportional to the turbidity of the water. The turbidity sensors utilize a second light detector to correct for light intensity variations, color changes, and minor lens fouling. Since the turbidity sensor uses light to detect the water's turbidity ensure that the minimum amount of external light possible is exposed to the monitoring site.

#### **4.5. SOLENOID VALVE**

A solenoid valve is an electromechanical controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core in its centre. This core is called the plunger. In rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts a force on the plunger. As a result, the plunger is pulled toward the centre of the coil so that the orifice opens. This is the basic principle that is used to open and close solenoid valves.

#### 4.6. GSM MODULE

GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

#### V. WORKING

All the sensors are fitted inside the storage tank. The values measured by the sensors are analog in nature which is fed to the ADC. The digital output from the ADC is given to the Arduino microcontroller. The readings measured by the sensors are compared with the threshold values that are pre-programmed. Whenever a mismatch happens, an SMS is sent to the concerned person through GSM module simultaneously blocking the storage tank outlet. The current status of the quality of the water is regularly displayed on the LCD panel and alert LED starts blinking. The SMS consists of the system ID as well as the Address where the system is located. The mismatched readings are also included in the SMS

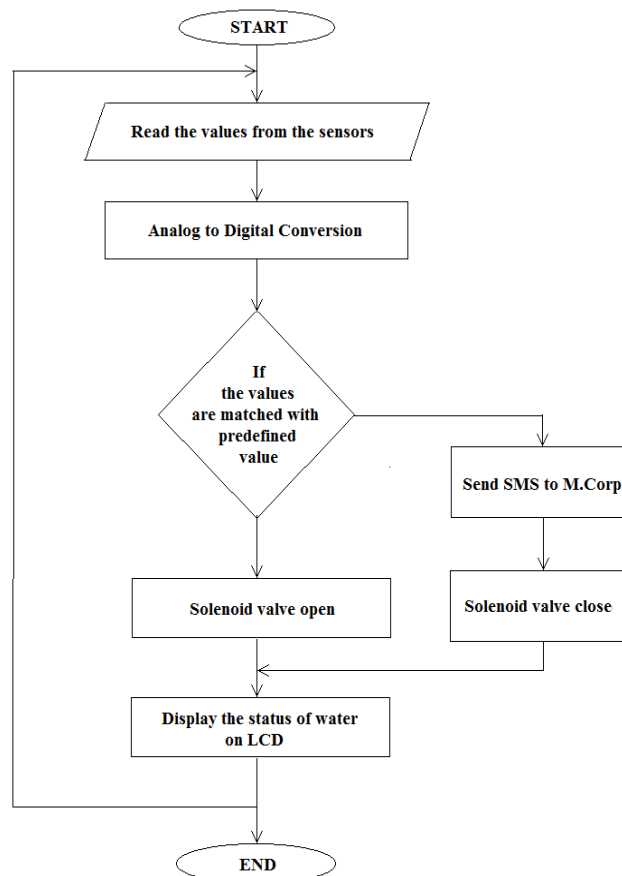


FIG 5.1: Flow chart

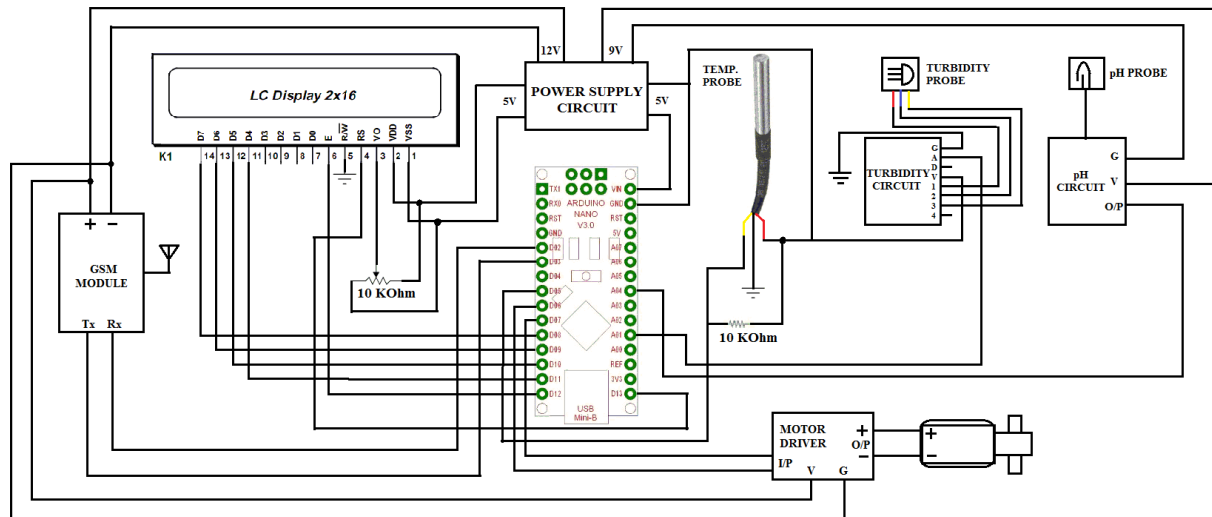


FIG 5.1: Circuit Diagram

## VI. ADVANTAGES

In this paper, the concept of the water quality monitoring and controlling using Arduino has been presented. This system is less complex in design and the implementation cost is low. As the system is notification enabled the measured parameters/values of the water, available in the water storage tank/plant is compared and these parameters/values are sent to the authority who is responsible to that, as a message. This helps to control the plant/storage tank based the quality of the water.

## VII. CONCLUSION AND FUTURE ENHANCEMENTS

In this paper, the concept of the water quality monitoring and controlling using Arduino has been presented. The system employees several sensors like pH, Turbidity and Temperature sensor along with the Arduino board. With this implemented system the quality of water is measured for several parameters and compared with the standard values and based on the results the system controls the water outlet. As a future enhancement this water quality monitoring and controlling system can be combined with the traditional water supply sources which are used for domestic purpose.

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