

# Design and Implementation of Continuous Monitoring To Supply Potable Water With Smart Utility Water Billing System

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*Abstract* - Water is one of the important resource and basic essential need for all living organisms including human being. The water must be in certain parameters and it consider as potable water. A person who drinks pure and hygiene water can stay strong and healthy. Nowadays there are various implementation is available to determine the water quality but there is a lack in real time challenges to maintain the quality of supplying the water to the houses. So here the paper proposes a system design which uses pH sensor, turbidity sensor and conductivity sensor for determine its quality of the water. The system uses the solenoid valve for regulating the pipeline for supplying the potable water. The water flow sensor is connected with the solenoid valve to measures only the quantity of water which consider as potable by the organization. The system maintain its data information and calculates the utilization charges for supplied potable water and it send to the users through wireless communication in every periodic intervals. The paper proposes a system monitored by the private organization using IOT platform to maintain the successful supply of potable water and smart water billing system to prevent from real time challenges.

*Index Terms* - IOT, Ph sensor, Turbidity sensor, water flow sensor, GSM, ESP8266 Wi-Fi module, Arduino Mega.

## INTRODUCTION

Generally the water supply management is maintained by the authority of the water board whereas in many metro cities, the private sector is maintaining the supplying of water through all over the cities. This private organization is the authority to collect the charges or tax for supplying water from the houses. Even though there is a various technology developments, there is a lack of overcome from real time challenges. The water pollution is the major cause for the people who are vulnerable. Due to water pollution there is a chance of contamination in drinking water and the person who drinks the contaminated water without the knowledge of it makes the person caused by various waterborne diseases. To prevent from using contaminated water this paper designs a system to monitor the quality of the water whether it use of drinking purposes. The system also monitors the volume of the water which consumed by the users and it calculates the charges for the potable water. Internet of things made a vital role in this system. This system is maintained by the organization to monitor the water supply, quality of the water and quantity of the water supply to the users. These information are maintained and monitored by the IOT platform

## PROPOSED SYSTEM:

This proposed paper designs and implements a system to monitor the various water parameters of the drinking water. The system uses the pH sensor, conductivity sensor, temperature sensor, Turbidity sensor for monitoring the parameter of the water. To built a system, The system needs a controller to execute, formulate, access the data and store and retrieve the data. Here the system uses the Arduino mega 2560 as a system controller. The system uses the ESP8266 Wi-Fi module to sends the information of data to the IOT platform. To determine the quantity of water supplied by the organization, the system uses the water flow sensor for monitoring the quantity of water. Though the system designs for maintaining the quality supply of water, it calculates only the quantity of the portable water. The system uses the solenoid value for the regulating the pipeline according to the parameter values monitored by the sensors the controller formulates the solenoid value to supply the water. The user can see the information of water parameters using LCD display. The proposed system will calculates the quantity of water and its charges for utilization is done by the system controller. The system controller will send the information of quantity and its charges to the user via wireless communication. here the system uses the GSM module for the wireless communication. The figure 1 shows the block diagram of the proposed system which consists of input module, output module and controller used. This block diagram helps to know about the outline sketch of the proposed system design.

## BLOCK DIAGRAM :

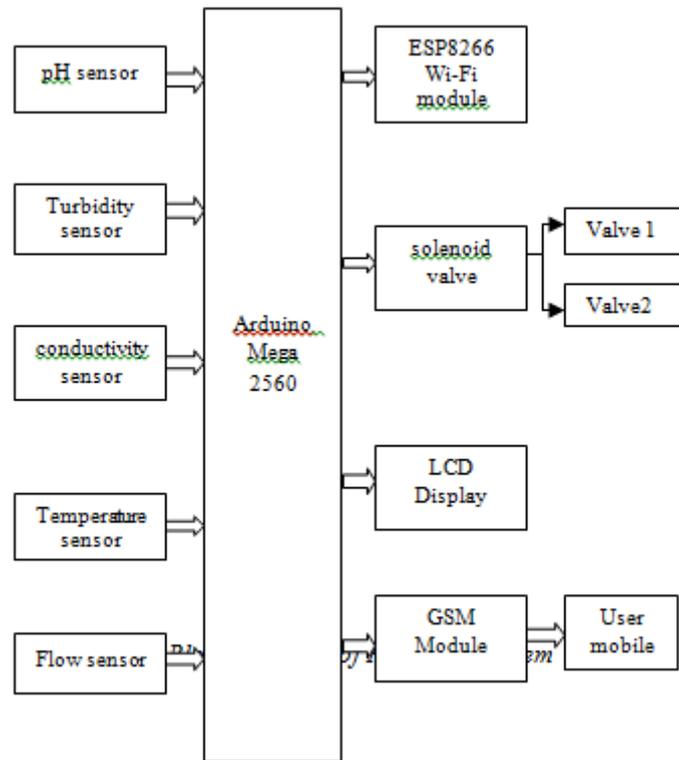


Figure 1 – Block Diagram of Proposed System

## DETAILED DESCRIPTION OF HARDWARE USED

### I. *Arduino Mega 2560:*

A mandatory component must be need to design a embedded system is a controller. In the various microcontroller module classification Arduino development board is unique controller board which integrated with all the important features. Here this system uses the Arduino mega 2560 as the controller of the system. The Arduino Mega 2560, which integrated with 54 digital I/O pins, 16 analog I/O pins, 4UARTS with inbuilt crystal Oscillator of 16Mhz and a reset button. This Arduino board aids to manage the data from the various sensors and helps to store/retrieve or send the data to another device for the further purposes.

### II. *ESP8266 Wi-Fi Module:*

In data transmission, generally the transmission of data from one another is classified in to two types via wire or wireless. Here in this system uses the wireless medium of transmission of data to the webpage. The system uses he ESP8266 Wi-Fi module for data transmission. This ESp8266 is the cheapest Wi-Fi module which helps for the various projectoriented activities. This module uses the technology of TCP/IP protocol for the data transmission. It has its own inbuilt memory with TCP/IP protocol Stack.

### III. *SIM800L GSM Module:*

This system helps to monitor the reading of water supply and its corresponding rate per liter to the house owner. For this application, the system needs the communication module thus its uses the SIM800L as the GSM module for communication. It is a unique creative module which helps to send/receive the message and can able to make a call and vice-versa.

It haveadvantage as low cost, quad band frequency and small foot print. This SIM800L module which configures a feature of FM and one PWM function, it integrates with one serial port modern compatibility for configuring 2 serial ports. It has the added feature of audio channel which includes two microphone input, output for speaker. This SIM800L Module has a ability to configure and able to program the GPIO. Here this module receives the data from the controller and sends the message via SMS to the prescribed mobile number.

### IV. *pH Sensor:*

In general, the sensor which helps to measure the hydrogen ion concentration in any solution. It derives that whether it is acidic or basic. Actually the sensor determines the pH value range from 0- 14pH. In this condition 0 to 7 will be considered as acid solution, which have higher hydrogen ion concentration in solution and vice versa for 8-14pH. This sensor also aids for to determine the quality of the drinking water. by using the range of pH value, the range 7pH is determined as a neutral and it is considered as the normal drinking water. Though, this sensor helps to analysis the quality whether the water is portable.

V. *Conductivity sensor:*

Normally there are various ions, minerals are dissolved in water. In that ions are classified as positive and negative concentrated ions which can determine the quality of the water. Usually this conductivity sensor having the two electrode probe in it. it will placed in water if there is ions in water then the conduction will take place through the probe. otherwise if there is no concentration in water then it determined as a pure portable water. this conductivity sensor monitors the water ion concentration and sends the data to the controller in PPM units.

VI. *Temperature sensor:*

In water quality monitoring, the temperature does a major role. If the temperature of the water increases automatically the conductivity of water also increases because, the temperature is propositional to the conductivity of the water. To maintain the reliability and accuracy of the water, the temperature sensor is used to calibrate the conduction sensors accuracy of measurement.

VII. *Turbidity sensor:*

Usually the visible of eye on tiny particles is impossible. If there any tiny particles mixed with the water then it leads to contamination. So here the system uses the turbidity sensor which helps to monitor the particles which mixed in the water. Generally the sensor is classified in to two namely photodiode and photo transistor. The light which emits from photo transistor will flow through the water easily to the photo diode. if there is any tiny particles in the water then there will be a disturbance of receiving the emitted lights from transistor to the photo diode. By this principle the system determine the contamination of tiny particles in water.

VIII. *Water flow Sensor:*

The system monitors the water quality through water flow sensor. This flow sensor is usually made up of main integration of hall-effect sensor and the rotor wheel. Whenever there is a flow of water in the pipeline, the rotor wheel will rotates depends upon the pressure of water flow. The rotor wheel having the construction of magnet enclosed in it which helps to generate pulse by hall effect sensor whenever it comes near to it. So depends upon the rotation and the generation of pulse determines the quantity of water which flows through the pipeline. here the system uses the YF-S201 model as the water flow sensor.

IX. *Solenoid valve:*

There are numerous output control variables are available in the automation process. This system designs and implements that if there is any change in the water quality it regulates the output valve to another pipeline. Here the system uses the solenoid valve as the regulating module. There are various classifications in solenoid valve. Here the system uses the 3-way solenoid valve which consists of one input valve and two outlet valve. Normally it will open the A output valve if there any changes in the quality of water it energizes the solenoid valve to pour the water in B outlet valve.

X. *LCD Display:*

The LCD display is used to see the data information of any solution or results. Here the system uses the LCD display for view the data of various quality parameters of the sensor and quantity of water supply to the particular to use. This system uses the 16\*2 LCD display as the output module. This LCD display is integrated with the Arduino and it controls the LCD through commands.

XI. *Elucidation of Software used:*

**Arduino IDE:**

The name embedded system which integrates both hardware and software in the system. The Arduino IDE is an integrated development environment, software used to sketch any program for the Arduino boards. This software IDE aids to sketch the program, verify the program code and its helps to fetch the program to the Arduino mega board.

### Ubidots platform:

In the numerous cloud based management technique, here the system application uses the UBIDOTS IOT Cloud Platform. It helps to monitor the data information of various parameter of water, quantity of water supplied to the house through the IOT platform. This UBIDOTS have five classification which includes Devices, Variable, Synthetic, Dashboards, Variable engine and events. This Ubidots Platform uses their option of maintaining the data store and retrieve the data in it.

### Functioning Approach of Proposed System:

After completion of fetching code to the Arduino mega controller board, the system starts executing the program according to the proposed system. Generally the system uses the quality monitoring sensors namely pH, Conductivity, Temperature, Turbidity sensor and uses the quantity monitoring sensor as the water flow sensor. Once the system starts, the sensors monitor the various parameter of the water which pour through the pipeline and sends the data to the controller. The controller checks the threshold value of the parameter whenever there is changes in the threshold value, the controller will energizes the solenoid valve to pour the water in another outlet. The water flow sensor is fitted in the portable water pipeline which used for drinking purpose. So whenever the water pour through that pipeline it generates the data to the controller. The Arduino mega board manages the data and sends the data to the Ubidots IOT platform with the aid of Wi-Fi module. The user can monitor how the quality of water is supply in the house and also the quantity of water and its charges according to their utilization.

The controller also sends the information of the whole data through the GSM Module which includes total liters supplied and also the charges applied for it.

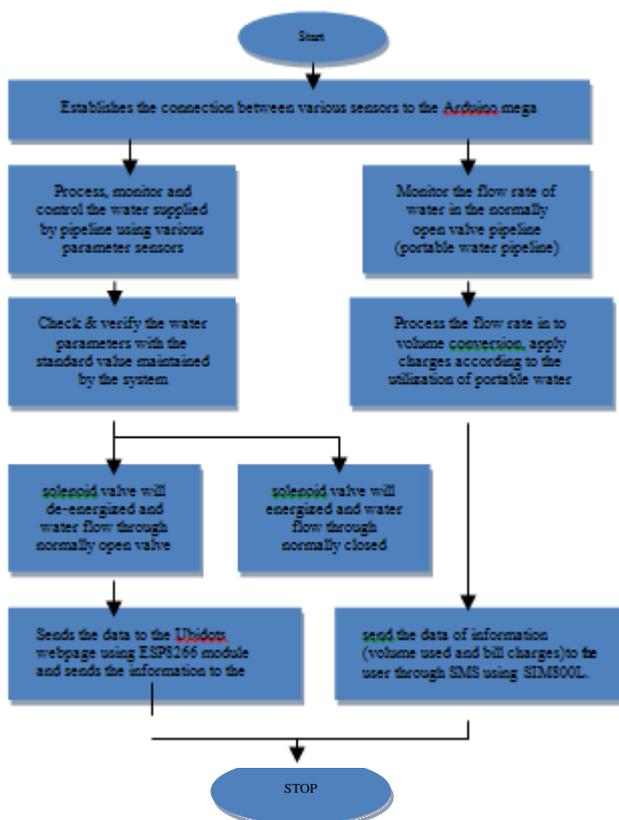


figure 2 – Flow chart of proposed system

The figure 2 explains the working flow mechanism of proposed system

### RESULTS AND DISCUSSIONS:

After the proposed system designed and implemented, the following results are taken using the output modules which have use in the system.



*figure 3.1*

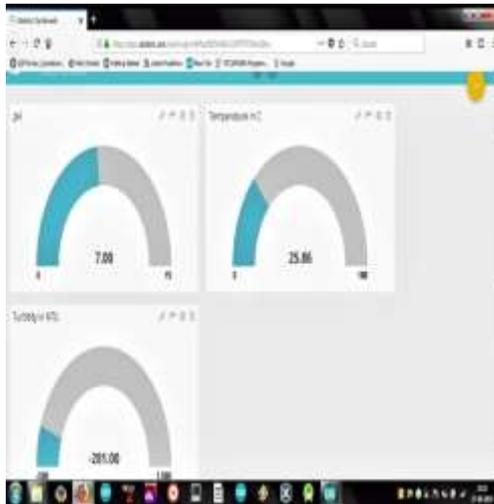


*figure 3.2*



*figure 3.3*

The figure 3.1,3.2,3.3 shows the various parameters of water through LCD display which can be view by the user side.



*figure 4.1*

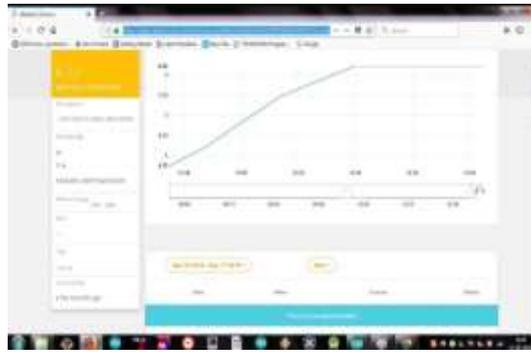


figure 4.2

The figure 4.1, 4.2 shows the results which managed by the water board organization through Ubidots webpage. The organization can manage and monitor through online.

The below figure 5 shows the SMS received by the user for their consumption of potable water in liters and its charges.



figure 5

## CONCLUSION

The continuous evaluation of supplying potable water to the users which aids to prevent from using of polluted water. The system charges the bill only for the qualified potable water and ensures the quality of drinking water. It mainly aids to prevent from various water related diseases and also this potable water helps to be more hygiene and makes the person healthy.

## FUTURE ENHANCEMENT

This proposed system defines that can implement the same process in all over the cities to maintain the quality of supplying water. It helps to maintain the records for the future use. This system can also implement for monitor and control the water pouring for the agriculture which helps to cultivate healthy organic vegetables, fruits and many more.

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