VOLUME AND QUALITY MONITORING OF DRINKING WATER USING ARDUINO WITH SIM900A MODULE

V.Nivedan[1], Dr.R.Kannusamy[2]

[1]Research Scholar, PSG College Of Arts and Science, Coimbatore, Tamilnadu.

[2]Associate Professor, PSG College Of Arts and Science, Coimbatore, Tamilnadu.

Abstract: Water is the most important significant and essential role in human life cycle. Drinking water does the major role in health of human. Impurity of drinking water causes the many major diseases for the human being. cholera, dysentery, Typhoid fever. Guinea, worm disease are some of the diseases caused due to impurity in drinking water. Safe supply and purity of drinking water is prevent the humans from water related diseases. In this paper, the system monitoring the Quality of drinking water using various sensors and modules. The water scarcity is also an important problem in day to day life, to prevent from scarcity sufficient and limited usage of water is monitored by this system. The paper proposes the volume and quality monitoring of drinking water to prevent from consuming of polluted water and also preventing from various water related diseases. It monitors the consumption of water quantity for the particular area through the proposed system to prevent from water scarcity. The proposed monitoring system using various sensors it sends the data information to the controller, the system will transmit the data via wireless communication thus the system can monitor in remote places.

IndexTerms: **Flow sensor, Temperature sensor, PH sensor, Turbidity sensor, Conductivity sensor, Arduino Mega2560 R3, SIM900A Module.**

I. INTRODUCTION

     Drinking water is more essential for human being and one of the mandatory for living. Water is more important and essential resources for industrial purposes, agriculture, food industry and so on. Due to scarcity water usage and volume monitoring is essential for prevent from scarcity. Most of disease are caused by water pollution. Drinking the pollutant water causes the major disease attack for especially for vulnerable people. To prevent from illness drinking the safe supply of drinking pure water is to be monitor. Quality of water should monitor for product manufacturing, agriculture, animal fertilizers etc. In this paper, the system monitors the quality of water supplies to the individual house. Here the system uses various sensors for monitoring the quality of the water they are PH sensor, temperature sensor, turbidity sensor, conductivity sensor these were the sensors used for monitoring the quality of the water. It measures the various parameters of the water quality and it decides whether it is safety to drink for human beings and then the quantity of the water supplied is to be monitored by flow sensor. This sensor will measure the quantity or volume of water supplied by the individual house. The sensor used in the system monitors the water quality and quantity using various sensors it sends the data to the controller device system. Here the system uses the Arduino Mega 2560 R3 as a controller. it collects the data from the sensors and it transmit to the webpage through SIM900A Module. It establishes the wireless connection thus we can monitor the various parameter and volume of the water supplied to the individual houses, tanks or in any particular area. This system is essential for health to prevent from numerous water caused diseases and to built the healthy life.

II. LITERATURE SURVEY

     Water usage is drastically increases because of the increase in population of the people in the world. There are various implementation are proposed by the various people to maintain and monitor the quality of the drinking water. The following existing systems were studied and citied for implement a new innovative system.

     In 2018, K. harini,, P.Anitha designed a system "Water Monitoring System Using Smart Sensors" in that system PH sensor and Turbidity sensor is used to monitor the quality of the system since this system only can monitor limited parameters of the water. To determine the quality of the water the various parameter should be considered.[9].

     In 2017,Vaishnavi V. Daigavane , Dr.M.A Gaikwad designed a system "Water Quality Monitoring system Based on IOT" in that system PH sensor, turbidity sensor, temperature sensor, flow sensor are used since in this only two parameter is checked for the quality of the water[8].

     In 2018,S.I. Samsudin, S.I.M. Salim, K.Osman, S.F, Sulaiman, M.I.A. Sabri has implemented a system,"A Smart Monitoring Of a Water Quality Detector System" in that system uses the Wemos Arduino compatible board which the Wi-Fi module is embedded on the board here Ph and Turbidity sensor is used for monitoring the water quality. Since to improve the quality of the water various sensors have to use for sense the various parameters of the water to determine the quality of the water [7].

     In 2018, ArunPandi.T, Sakthi Vel S.B, Veerappan S, Senthil Rajan A, Amudha priya N designed a "Multi-sensor based water Quality Monitoring in IOT Environment" in this system, PH sensor, turbidity sensor , conductivity sensor, temperature sensor are used to monitor the quality of the water. here Wi-Fi module is used for monitor the information in the webpage.since it can use only for the stored water content and it cannot determine the volume of the water in the particular area.[6].

     In 2018, Tha Sugapriyaa, S.Rakshaya, K.Ramyadevi, M.Ramya P.G.Rashmi proposed "Smart Water Quality Monitoring System For Real Time Applications" in this system for the quality monitoring of water various sensors are added but here the system can only monitor through mobile device there is no LCD is connected with the system and it can monitor only the particular water stored in tank and it cannot monitor the water quantity in the particular tank.[5].

In 2011, Xiwu Hc,has implemented " Design of Automatic Control System for Waterworks based on PLC" here the system helps to control the water bodies which is based on plc. since PLC devices are reliable but implementation of the system will be more costly.[4]

In 2008, Nazleeni samiha Haron, Mohd Khuzaimi B Mahamad, Izzatdin Abdul Aziz, Mazlina Mehat designed "A System Architecture for Water Quality Monitoring System using wired sensors", in this system there were used various sensor for monitoring the quality of the water but they implemented through wired network. In the wired network troubleshooting will be the main problem.[3]

In 2012, Mo Deeqing, Zhao Ying, Chen Shangsong, implemented a system"Automatic Measurement and Reporting system of Water Quality Based on GSM" in this system GSM is used with microcontroller and sensors to monitor the water quality. here the sensed information will be transmit via SMS. since this system uses various parameters it is not affordable for common people usage and transmission of the data is not secured it cannot determine if there is no signal in the mobile device.[2]

In 2016, Jayti Bhatt, Jignesh Patoliya, proposed a system "IOT Based Water Quality Monitoring System " in this system various devices are connected with the Raspberry Pi, and it is connected with the IOT each device having the various sensors connected with the microcontroller and Zigbee. since in this system more number of devices can connect but implementation of the whole system is more complicated and single device problem will collapse the entire device and implementation of the system is more costly it is not affordable for common people.[1].

III.   IMPLEMENTATION OF THE SYSTEM

In the proposed system, there are various sensors used to monitoring the quality and volume of the drinking water for the particular house. Here the system uses the controller as Arduino Mega2560 R3 as a system controller which handles the data from the various sensors. The system measures the acidic & basic alkaline content of the water using the PH sensor. To determine the hotness and coldness of the water by the temperature sensor. To calculate the electric conductivity of the water that means the water may have positive and negative ions in the water content which dissolved salts can be measured by the conductivity sensor. Things, tiny particles some ions can be mixed with in the water that cannot able to visible for the human eye the sensor used to measure the invisible particles is said to be turbidity sensor. The sensor used to calculate the volume of the water consumed by the individual house can be measured by the flow sensor inside that there is a water rotor and half effect sensor The speed of the rotor difference with the flow of the water through the flow sensor valve. By these sensors the system monitors the various parameters of the water and evaluates whether the water is good for drinking or not. The implemented system also can monitor the system in remote place that means we can monitor through webpage using SIM900A module. The Arduino Mega 2560R3 module transmit the information of the quantity and quality of the water through SIM900A module. By use of this module we can store the information for the future implementation also. The system generally classified in to two categories hardware and software. The parameters which sensed by the various sensors and gets the data to the controller which is defined as the hardware part and then the system transmit the whole information to the webpage using wireless communication it is defined in software part. By connecting the both hardware and software part can implement the system and manage the various sensor to monitor the water content in real time application.

IV.   REPRENTATION OF THE BLOCK DIAGRAM

In the research methodology one of the most common way to implement the proposed system by using block diagram representation the below diagram represents the block diagram of volume and quality monitoring of drinking water using Arduino mega with SIM900A module.
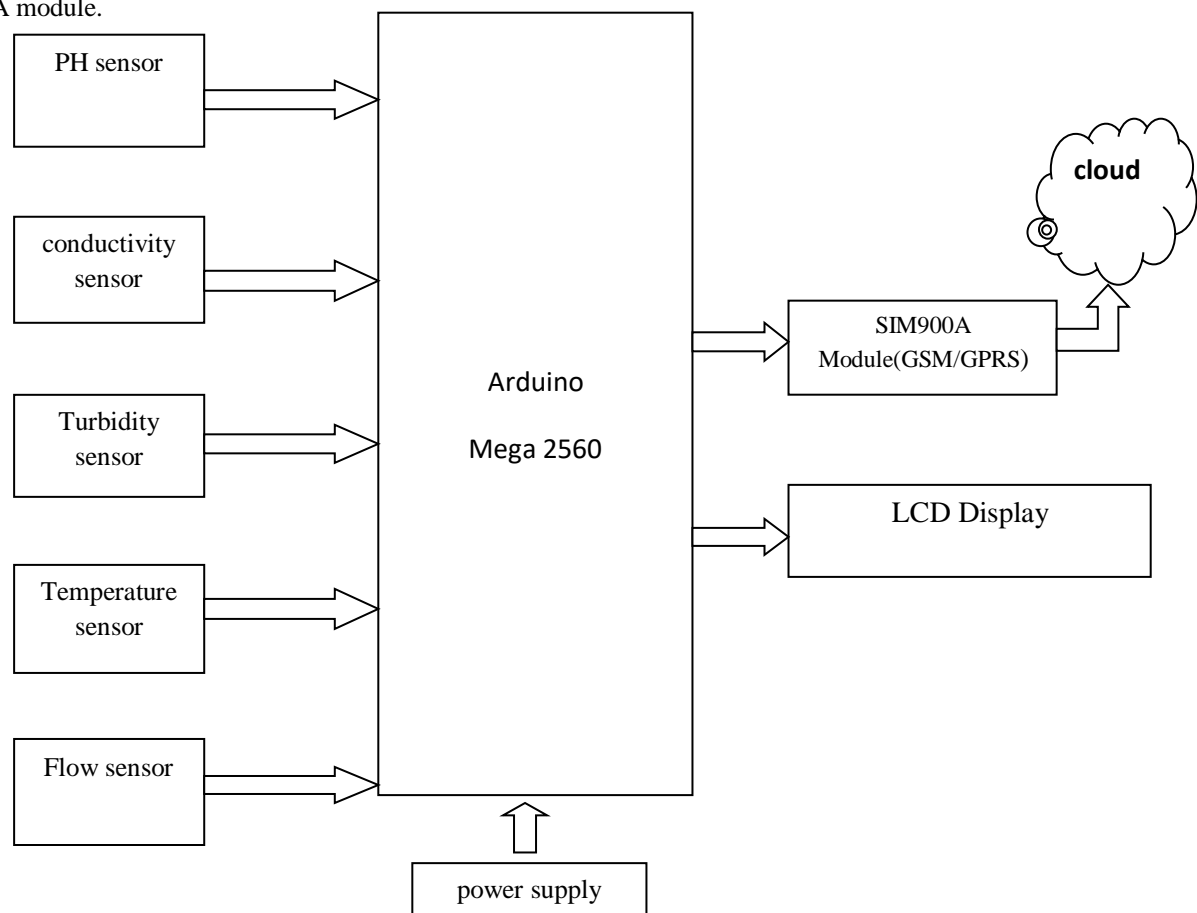

figure 1 block diagram

V.   DESCRIPTION OF BLOCK DIAGRAM

In general the proposed system processes various data from the sensors each sensor having its own principle of working depends upon the sensor fabrication and configuration. it can either digital sensor or can be a analog one. The principle of the sensors is differ from one sensor to another . The module used in this system having more flexibility and configurable capabilities the following description says about the details of the particular sensors and modules used in this proposed system.

a)   ARDUINO MEGA 2560 R3

The system uses the Arduino Mega 2560R3 as the controller to manage the sensors and to store the information of the various parameters of the water. This microcontroller is based on the ATmega 2560 processor. This system handles more sensors to evaluate the parameters of water thus the controller needs more number of input/output pins. this module having the various configuration pins to support the microcontroller This module is easily portable with the computer via USB cable. This module having the inbuilt 16Mhz crystal oscillator. this module having the memory organisation of 256KB of flash memory for compiling code to the controller, 8KB of SRAM and having $KB of EEPROM. It is compatible of I2c and SPI communication. This module is connects the various sensors to the board. The data from the sensors will stores in the Arduino mega module and the controller will executes the solution for the system depends upon the programming code.

b)   SIM900A MODULE

In this system a module is used to transmit the various parameters of the water via Arduino mega controller to the webpage through the SIM900A module. It is used for wireless communication and having a complete dual band system architecture which having both GSM/GPRS accessibilities to communicate with the SIM900A module there were several AT commands for communication either by voice call, message, or data transmission to the webpage. The Arduino controller will establish the connection via through UART/SPI. There are various features in the modules in that some special feature are follows it having the sim card slot to communicate with the another sim card user. it provides the dual band of 900/1900mhz accessibility with lower power consumption of 3.5- 4.5V power supply in the active mode and 1.5 MA in the sleep mode. Here the system uses the module to store the information of the data collected from the sensors, through the controller to the webpage. The system can monitor the paramters of the water in remote places using this SIM900A module.

c)   PH SENSOR

PH is the scale to determine the hydrogen ion activity in an any solution generally, $PH = \log10(1/aH^+)$. Here the system uses this sensor to calculate the PH value of the water. generally the PH value of the pure water should be 7. commonly it should be neither acidic or basic. The PH is indicating the acidity or alkalinity in the water or any solution. The PH sensor consists of two electrodes generally one will be glass and another will be reference electrode the sensor will measures the difference between the two electrodes when it inserted in to the water. normally it is an analog sensor which is manufactured by DF Robot but development is made in this and the digital meter is introduced. It helps more accurate and gives continuous readings. One of the main parameter to determine the quality of the water by PH sensor. Depends upon the PH value of the content it considered as acidic or basic if the PH value is greater than 7 to 14 then it is considered as acidic and when it is lower than 6 is considered as a basic. In the consideration of drinking pure water the range of PH value should be 6.5 to 8.

d)   CONDUCTIVITY SENSOR

The term conductivity determines the flow of electricity in the water based solution or in the normal drinking water. This sensor used to monitor the amount of salts, impurities are dissolved in the normal water depends upon the conductivity of the water the quality of the water determines. The higher conductivity in the water says that there are more number of ions either positive or negative, salt mixtures is added in the solution content or in water. this sensor generally used to monitor the any impurities added in the water which will sensed via conductivity sensor. If the more number of impurities in the water the electrical conductivity will higher in the water. This conductivity sensor is also said to be TDS sensor. TDS denotes the total dissolved solids in the water. Typical range of drinking water is about 5.5 µs/m at 25˚C.

e)   TURBIDITY SENSOR

Generally, there are more number of tiny particles of solids are suspended on water which is invisible to the eyes. Here the sensor used to measure the quality of water, the sensor having transmitter and receiver part in it. By transmit the light in to the water due to tiny particles or any small mixture in the water the light will scattered. The difference between the light transmits part and receiver part determines the turbidity value of the water. whenever the increase in the value of turbidity sensor then the water having the more number tiny or independent particles which are mixed in the water that are invisible to the human visible eye. The value of the sensor increases perpendicular to the light scattered in to the water. This is one of the important parameter for measure the quality of the drinking water.

f)   FLOW SENSOR

In this system to measure the quantity of the water supply for a particular area or particular house the flow sensor is used. The flow sensor is the measuring device to measure the flow rate of the water which passing through the pipeline valve. The flow sensor

consists of water rotor which the rotor will run according to the flow of water through rotor. hall effect sensor gives the output pulse signal according to the rotor runs. This sensor will detect the volume of the water supplied or consumed by the particular area or particular house.

g) TEMPERATURE SENSOR

In this system to monitor and measure the temperature of the water using temperature sensor. there are various sensors to monitor the temperature in water. the sensor will detect the water whether it is cold or hot. here the system uses 109SS-L is used for monitoring the temperature of the water which ranging from -40˚C to +70˚C. The sensor which having the major advantage of fast response time and wide temperature range measurement.

h) LCD DISPLAY

Here the system uses various sensors for measuring the quality of the water, to display the data sensed by the individual sensor the LCD display is used . LCD is a electronic display known as liquid crystal display generally 16*2 LCD display is used for all the application to display the values. In this LCD display at a time 32 characters will display and each line carries 16 characters. The LCD display can communicate with the controller via various AT commands. The controller can control the colour contrast, aligning of data, displaying the data according to the programming code uploaded the controller. The display having the various pin configuration which has 8 data input/output pin with that read/write pins and reset pin.

VI. FLOW CHART REPRESENTATION

The chart used to denotes the flow of the system processes by the sequential way is shown by the flow chart. The flow chart is used to represents the sequential of flow processes held in the system. The various processes of quality monitoring and volume monitoring in drinking water is shown in the following flow chart.

figure 2 flow chart
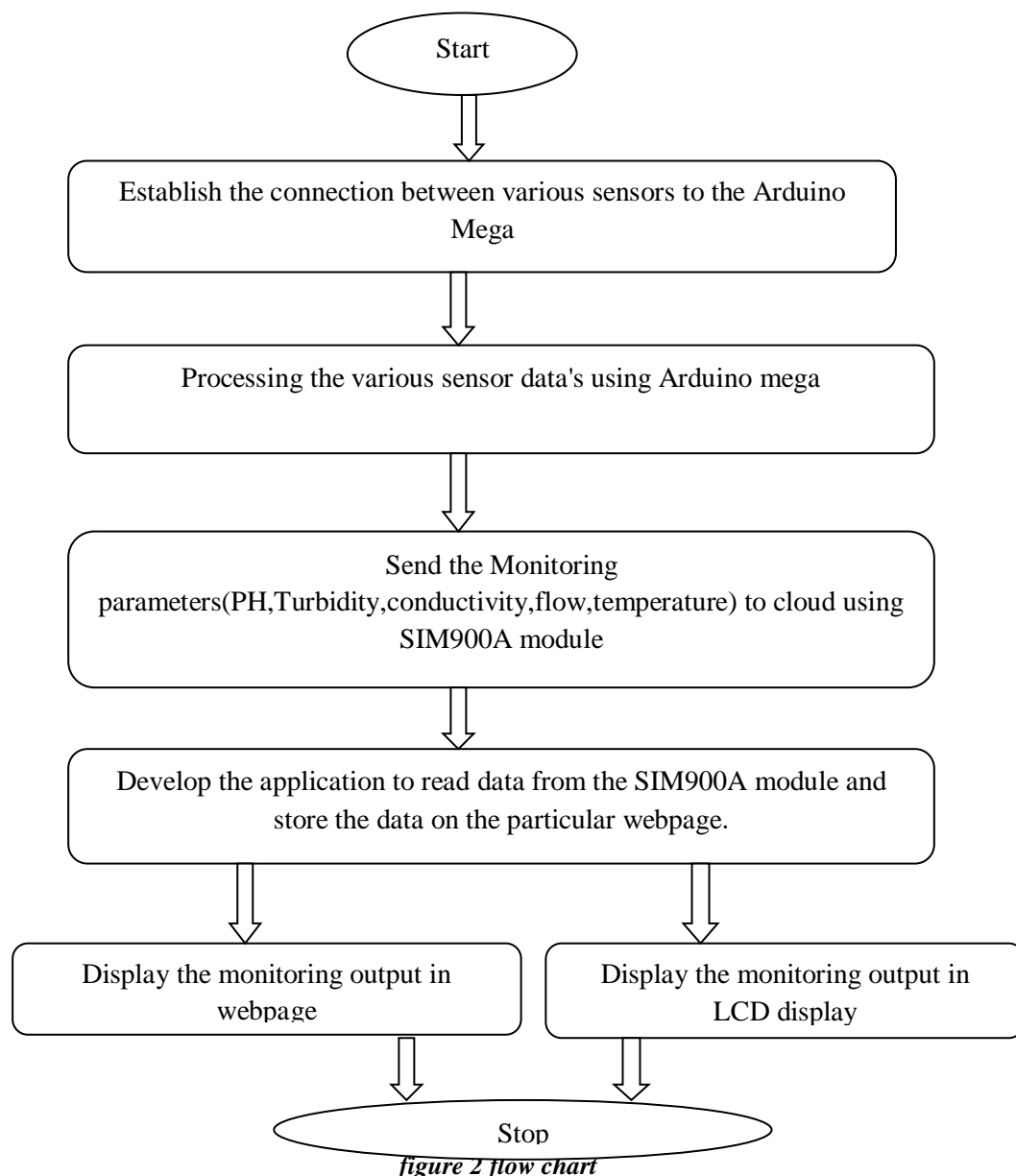
VII.　RESULTS AND DISCUSSIONS

　　After implementation of the system and compiling the software code to the Arduino Mega module. The system will accesses the various sensors to communicate with the microcontroller of the system. The various information which gathered by the sensors will sends the data to the Arduino Mega module. The module will transmits the information of the quality and volume consumption of the water through SIM900A module to the webpage and also the system displays the whole data information of the water to the LCD display. this system is the one of the important application in the pollutant society. To prevent from various water pollution, water causing diseases this system will be the best solution for preventing from it. This system implements the quality of the water and also monitors the quality of the water it helps to build the society in healthy manner. The quantity of water monitoring is used to monitor the water consuming by the various sectors and it can helps to prevent from wasting of water and it also helps from water scarcity.

VIII.　FUTURE WORK

　　Here the system used in the particular house for monitoring the quality and volume consuming of drinking water. In the future work it can implement in the food product manufacturing companies because pure water is essential for food product, it can also implement in the agriculture lands to monitor the water quality for healthy vegetables and fruits and monitoring of water volume helps to control the wastage of water in agriculture lands.

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