International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 5, July-August 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Low Cost Design of Water Quality Monitoring System

Raghav Arora, Sahil Mehta

Thapar Institute of Engineering and Technology, Patiala, Punjab, India

ABSTRACT

According to the annual rankings of world economic forum, the issue related with quality of water has increased gradually. As per the records, millions of people especially small children die due to the bad quality of water. One of the main reasons is the unavailability of cheap water quality monitoring system available at such locations. Thus, to ensure the safety of people considering water quality, a low-cost design for monitoring water quality has been proposed in this paper. The system uses microcontroller, display LCD, etc. whereas the various parameters considered includes pH, turbidity, TDS and temperature of sample water. The proposed design ensures the low-cost factor of the system along with displaying the quality of water.

KEYWORDS: *Water quality, Monitoring, Microcontroller, Low -Cost, Design, Sensors*

How to cite this paper: Raghav Arora | Sahil Mehta "Low Cost Design of Water Quality Monitoring System" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-5, August 2020, pp.621-623, URL: www.ijtsrd.com/papers/ijtsrd32913.pdf

IJTSRD32913

INTRODUCTION

Water is tasteless and odorless substance which is equally important as oxygen for survival of humans on this planet. Water management is important issue in industrial, agricultural and other sectors. Fresh water is finite resource and water quality is fundamental tool in management of fresh water resources. Many people die every year due to shortage of quality of drinking water. Because of which there is requirement for better techniques for monitoring of water quality. Parameters which need to measure are pH, Turbidity, TDS and temperature. Till now there are many techniques to measure water quality and show that values. Traditionally, sample of water is collected and tested in laboratories manually which might not give accurate results.

This system is automatic, low cost with simple design and easily available components. This system can be used from ground or home level to industrial level for monitoring water quality with an ease. In which sensors are connected with microcontroller to process their values which further show data on LCD connected or on Android Application. This whole process is done without human intervention to give accurate values [1]. The major parameters that decide the water quality are detected using sensors which are easily available and less costly.

BACKGROUND OF WORK

The work in [2] discusses the problem of using automotive system for water quality monitoring, data analyzing and transferring information and proposing a system for monitoring water quality in real time with IOT (internet of things).

The authors of [3] discusses about wireless sensor network (WSN) and its applications, some limitations also, need of cloud computing. Review of sensor cloud infrastructure and its advantages with some challenges regarding existing solutions and approaches for future research.

The author in paper [4] discusses the method to improve water quality through sensor cloud model using embedded design comprises of different sensors. Apart from this some technical challenges and eco-nomic viability is also discussed.

Brief discussion on monitoring of water quality using wireless sensor network powered by solar pan-el, working of the whole system and some advantages of this system has been done by authors in [5].

The main objective of the work presented in [6] is to develop new system with sensors and real time collection of data. Performance, installation, maintenance and validation of sensors are considered to be important parameters and thus also checked. Work in [7] is much similar to previous models and techniques but differs in way of monitoring water quality via IOT (inter-net of things). Data processed by controller can be viewed on internet using Wifi.

The authors in paper [8] discuss monitoring of water quality by data acquisition, observation with IOT (internet of things) setting, sending data to web server and automatic alarm system when sensor will not work.

The authors in paper [9] discuss about applications of Wireless Sensor Network (WSN) in real time, building an automatic alarm-based system for water quality monitoring using WSM for hazardous situations.

The authors in paper [10] discuss about real time automatic water quality monitoring system, by using GSM network alert will be send to monitoring center in hazardous situations.

Thus, based on the above informative review on various models and techniques along with other explored systems, simplified design of low-cost water quality monitoring system needs to be explored. The various components, system design, cost analysis, etc. for beginners under-standing have been covered in this paper.

The paper is organized as, Section 1 and 2 discusses the introduction and background of water quality monitoring system. Section 3 discusses the system description and all the related components along with its circuit diagram. Section 4 presents the conclusion and future scope of work followed by references.

SYSTEM DESCRIPTION AND COMPONENTS

This section discusses the system description of the proposed model including the block diagram (Figure 1), the description of various components and also the circuit diagram for the system (Figure 2). Also, detail information for various components has been presented in tabular form (Table 1).

A. Proposed system

As discussed above, Figure 1 shows the block diagram for the system design.

As per the figure, the various steps involved are given below:

- Overall collection and processing of data is done by microcontroller.
- Temperature, pH, TDS and Turbidity sensors are interfaced with microcontroller.
- Temperature sensor is for measurement of temperature of sample.
- Hydrogen ion concentration in sample is measured by pH sensor.
- TDS sensor for measuring total concentration of dissolved sol-ids in sample.
- Turbulence, cloudiness or thick-ness of water is measured using Turbidity sensor.
- As in block diagram below all the sensors are connected with microcontroller which processes all the values by these sensors.
- These values can be display on LCD screen connected to microcontroller or through Wi-Fi module these values can be dis-played on Application created on mobile.

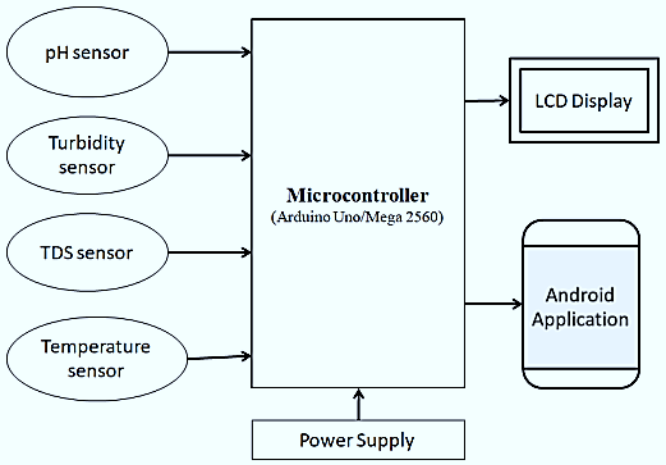

Fig.1. Block diagram

Below, as per the figure, the various components have been briefly defined:

- **Microcontroller**

Arduino Uno is used as microcontroller. Arduino Uno is less costly with multiple analog and digital pins and can easily satisfy the need of this system, it meant to make the applications more accessible which are interactive objects and its surroundings. Mega 2560 can also be used. NodeMCU can't be used be-cause almost all sensors work on 5V and it can give maximum of 3.3V and is with inbuilt Wi-Fi module present.

- **pH sensor**

pH of water is important factor for measurement as it tells about acidity, alkalinity or neutral about sample. pH of all solutions ranges from 1 to 14. The sensor used is SEN0161. There is presence of more positively charge ions in acidic solution than alkaline solution that's why alkaline solution has ability to produce electric current. Furthermore, pH has in-verse relation with temperature that is, as pH increases temperature de-creases and vice versa.

- **Turbidity Sensor**

For measuring turbulence, cloudiness or thickness of water Turbidity sensor TS300B is used. This is connect -ed to microcontroller through analog to digital converter. Generally, Turbidity sensor consists of transmitter and receiver, water turbidity is calculated by measuring the amount of light received by light receiver which was transmitted by light transmitter. Light transmittance and scattering rate are measured; which leads to changes the amount of total sus-pended solids (TSS) in water. Liquid turbidity level increase with increase in TSS. Which prove water with less turbidity is clean.

- **TDS sensor**

TDS is total dissolved solids. TDS tells about concentration of dis-solved solids in water. Taste, Health purposes, maintenance of filters, cooking and cleaning are some important factors for measurement of TDS.

- **Temperature sensor**

Here DS18B20 is used as temperature sensor. Its temperature measuring range is between -55˚C to +125˚C or -67˚F to +255˚ F. The sensor is waterproof and is digital type because of which it gives more precise reading.

Focusing on the main purpose of low-cost design of the system, below table 1 shows the information table for various components considering cost as a parameter too.

Table 1 Component Details

Name	Description	Cost (INR)	Size(in)	Operating Voltage (DC)
Microcontroller	Arduino Uno	400	2.7 x 2.1	5V
Turbidity sensor	TS300B	400	1.51 x 0.87	5.00V
TDS sensor	Gravity TDS sensor	400	1.65 x 1.25	3.3V to 5.0V
pH sensor	SEN0161	500	1.65 x 1.25	5V
Temperature sensor	DS18B20	100	2.7 x 2.1	3.0V to 5.5V

Considering the various components and the working steps for the proposed low-cost design of the system, below the sub-section discusses the circuit diagram of system.

B. Circuit Diagram

The working layout of system is shown in circuit diagram that consists of a micro-controller; we have used Arduino Uno and all other sensors. Voltage terminal of all the sensors are connected to 5V of microcontroller since most of sensors work on 5V, and similarly ground terminal is connected to ground.

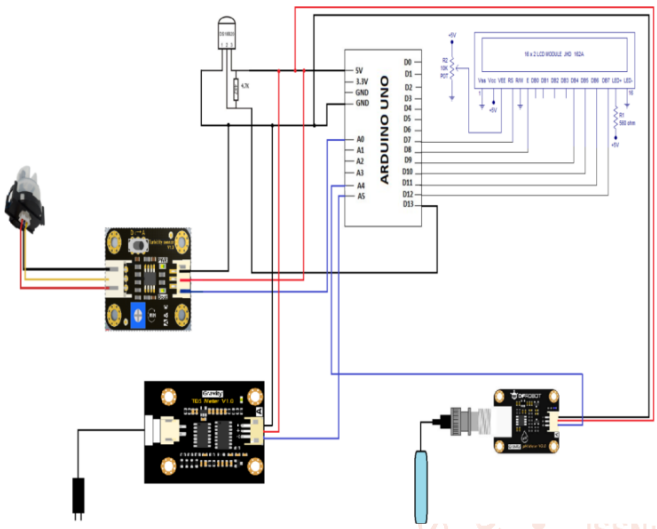

Fig.2. Circuit diagram

These connections can be made using Breadboard. Coming to temperature sensor, DQ pin is connected to digital pin of Uno and for all other sensor left pins are connected to different analog pins of Uno, these basic things are to be remembered during programming of this system. It is simple and easy to made layout. The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

CONCLUSION AND FUTURE SCOPE OF WORK

This paper presents a low-cost system for monitoring water quality in real time which is both practical and economical without any human intervention. Parameters like pH, Turbidity, TDS and temperature based on the sensors are employed for the purpose of testing the quality of water. The major advantage of proposed system is its simple design, low-cost and easy availability of all components. The system design shall prove its worth by delivering accurate and consistent data throughout the testing period within the limited list of components and cost. In future, the work will focus on to enhance the quality of monitoring system whereas further cost cut-ting will be done by developing the alternate of sensors. Such addition to work will allow residents of rural areas to in-take good quality of water and ensure healthy environment.

References

[1] A. N. Prasad, K. A. Mamun, F. R. Islam, and H. Haqva, "Smart water quality monitoring system," in 2015 2nd Asia-Pacific World Congress on Computer Science and Engineering, APWC on CSE 2015, 2016, pp. 1–6.

[2] Pradeepkumar, M., Monisha, J, et.al., "The real time monitoring of water quality in IoT environment," ICIIECS 2015 - 2015 IEEE Int. Conf. Innov. Information, Embed. Commun. Syst., pp. 4419–4427, 2015.

[3] A. Alamri, W. S. Ansari, M. M. Hassan, M. S. Hossain, A. Alelaiwi, and M. A. Hossain, "A survey on sensor-cloud: Architecture, applications, and approaches," Int. J. Distrib. Sens. Networks, vol. 2013, no. February, pp. 1–18, 2013.

[4] V. Daigavane and M. Gaikwad, "Water Quality Monitoring System Based on IoT," ICDCS 2020 - 2020 5th Int. Conf. Devices, Circuits Syst., vol. 10, no. 5, pp. 279–282, 2020.

[5] R. K. Kumar, M. C. Mohan, S. Vengateshapandiyan, M. M. Kumar, and R. Eswaran, "Solar Based Advanced Water Quality Monitoring System Using Wireless Sensor Network," *Int. J. Sci. Eng. Technol. Res.*, vol. 3, no. 3, pp. 385–389, 2014.

[6] F. Regan, A. Lawler, and A. McCarthy, *SmartCoast Project- Smart Water Quality Monitoring System*, no. 30. 2009.

[7] K. A. Mamun et al., "Smart Water Quality Monitoring System Design and KPIs Analysis: Case Sites of Fiji Surface Water," Sustain., vol. 11, no. 24, pp. 1–21, 2019.

[8] A. Purohit and U. Gokhale, "Real Time Water Quality Measurement System based on GSM," IOSR J. Electron. Commun. Eng., vol. 9, no. 3, pp. 63–67, 2014.

[9] S. Verma and Prachi, "Wireless Sensor Network application for water quality monitoring in India," 2012 National Conference on Computing and Communication Systems, Durgapur, 2012, pp. 1-5.

[10] D. Mo, Y. Zhao and S. Chen, "Automatic Measurement and Reporting System of Water Quality Based on GSM," 2012 Second International Conference on Intelligent System Design and Engineering Application, Sanya, Hainan, 2012, pp. 1007-1010.