Water Pollution: Psychological effect on human health & live reporting using IoT Technology

G.M.R. Josephine[a], Mrs. C.M. Anitha[b] , Dr. M. Padmaja[c], Dr. BBRG. Vijaya Lakshmi[d] Dr. K. Sreelatha[e] and Dr. V. Nagalakshmi [f]

[a]Assistant Professor, Department of Psychology, Ch.S.D.St.Theresa's College for Women (A), Eluru, A.P, India
[b] HOD, Department of Physics, JMJ College for Women (A), Tenali, A.P, India
[c]Assistant Professor, Department of Home Science, Ch.S.D.St.Theresa's College for Women (A), Eluru, A.P, India
[d] Associate Professor, Department of Botany, Ch.S.D.St.Theresa's College for Women (A), Eluru, A.P, India
[e]Associate Professor, Department of Physics, Ch.S.D.St.Theresa's College for Women (A), Eluru, A.P, India
[f]Associate Professor, Department of Chemistry, Ch.S.D.St.Theresa's College for Women (A), Eluru, A.P, India

Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 20 April 2021

Abstract: India is a country which is named after the river Indus which represents a rich culture well connected with water bodies [1]. It is the nation with 18% of the world's population and it also accounts for 4% of water resources available worldwide. The 4% water for 18% population provides only 1720 cubic meters of fresh water per person every year [2]. The biggest threat to water resources in India is water pollution. The most immediate and extensive reason for water pollution in India is sewage and its improper treatment. The industrial, agriculture, medical, radioactive, and solid wastes are directly dumped into rivers which causes the maximum damage to the quality of water present in different water bodies. The biggest sewage producing cities in India produce 38, 354 Million Litres per Day (MLD) sewage but out of that around 30.78% only gets treated under Urban Sewage Treatment (UST) and the remaining meets the freshwater to make it highly polluted and poisonous for human and aquatic creatures [3]. Our proposed system is an initiative to identify the quality of water using pH level of water using high precision pH analyzers and report this content using worldwide coverage connectivity medium, Internet of Things (IoT). Internet of things. The system proposed is a portable device that is linked with a Wi-Fi-based IoT system to report and update the quality of water present in any water body where it is planted. The live reporting can be broadcasted world-wise to aware about their water body is safe to use or not. This can also alarm the public against any dangerous chemical mix-up with water and save their lives.

Keywords: Million Litres per Day (MLD), Urban Sewage Treatment (UST), aquatic creatures, pH, Internet of Things (IoT)

1. Introduction

When the water of river Ganga begins at *Devprayag* where it is in its purest form no one can guess it will become one of the most polluted rivers all over the world [4]. With the increasing length of the Ganga from the Himalayas to Bangladesh, the distance of 2525 Kms. The holy river keeps contaminating.

Figure 1. Pollution of Rivers in India [10]

There are some points where the pollution attains the level of 31 million bacteria in just 100 millimeters of water. The longest river of India which recharges the groundwater and provides water for drinking, agriculture, and household works is polluted to its maximum capacity means in many ways we intake this pollution into our bodies as well.

Figure 2. Pollution of Rivers in India [11]

Most of the disease like diarrhea, dysentery, typhoid, cholera, and poliomyelitis kills more than 500 thousand worldwide and they are the water-born disease. The major water pollutants are comprised of pesticides, viruses, parasites, chemicals, plastics, polythenes, phosphates, nitrates, and a lot more unknown substances [5]. Improper sewage treatment, dirt dumping, clothes washing in river steers, and waste disposal are the most immediate cause of water pollution in India. In recent times government started many initiatives to kick start the stagnant process of river cleaning. ‘’Namami Ganga’’ is also such an initiative to free the longest river of India from dirt and pollution. The initial process to clear Ganga was initially started in 198 itself with the name of Ganga action plan 1, a hefty sum of 4000 crores has already been invested till 2014 but Ganga became dirtier and dirtier despite several plans and initiatives [6]. Cleaning a 2525 km long river is not possible by any government plan alone but, is a matter of public responsibility. Our proposed paper deals with research on the identification of the most impure water bodies their location and level of pollution. The reporting of the pollution level is demonstrated during the research. We also deal with several impurities and concerned diseases produced by water pollution. In our next session, we deal with the literature survey about the paper with all detailed analyses of previous works carried out in the field so far.

2. Literature Survey

[1*] Kofi Sarpong Adu-Manu et al*. explained in their paper about smart river monitoring systems with the help of wireless sensor networks. The study was conducted in Weija Dam, Ghana. To increase the power capacity of sensor nodes solar panels were used. The water quality was measured on different parameters like pH, conductivity level, calcium level, Temperature, Fluoride level, and Oxygen content. The result was cross-referred for the condition of aquatic life and water plants available in the water body during the test. Multiple sensors were deployed in the water body to capture several parameters in the real-time scenario. The wireless transmitted data is then received on the local monitoring station (BS) using local communication. Then through an internet connection, the complete data is remotely transmitted to the remote monitoring station and cloud. The complete data is retrieved on the user's system for further processing of information. The overall information is processed for five months straight to test its usability and effectiveness. It was observed that due to the quality reduction in water, the contamination increased in some parts of the water body. This was clearly stated in the report. This resulted in a high number of deaths of fishes and aquatic plants. [7]

[2] *Derara Chalchisa et al.* wrote in his paper about the test of water quality in the storage tanks to ensure the safety of urban water supplies. They mainly took the case study of Ethiopia where water is a big issue to solve. Most of the health issues are based on drinking contaminated water. In Urban areas mainly there are pipelined water connections but the water contamination in the distribution process mainly this issue is to be analyzed in detail. They reached the fact that all the samples of drinking water were contaminated by microbes. The samples collected from the exit of water tanks had more microbes compared to the microbes present at the entry of the water tanks. This result demonstrates the leakage in water tank and pipelines where microbes enter the water supply chain. Water contamination causes severe health issues and deaths as well. The water quality analysis obtained from the sample was matched with the WHO standard of drinkable water but none of the samples matched the quality. All the water samples were found to be substandard and unsafe for drinking. The major reason for the damaged water quality was due to leaks in the valve seals, uncapped connections, uncovered storages, exposed pipes, and damaged support/tanks. It was also proposed that if these issues are properly analyzed then this can solve the water contamination to its maximum extent. [8]

[3] *K. A. Mamun et al.* explained in detail the smart system of water quality monitoring. They took the case study of Fiji surface water. In their analysis, they explained that in recent years, water around Fiji has been reasonably contaminated and needs proper observation to predict the damage already done. Fiji is located in the Pacific Ocean and it requires different parameters to analyze the water quality in different locations. The water quality needs to be matched against the standards provided by Fiji national drinking water quality standards (NDWQS). The main parameters to be analyzed for water quality identification are the potential of Hydrogen (pH0, Temperature, Oxidation Reduction Potential (ORP), and conductivity. the proposed research on based on the five locations of Fiji to analyze the water quality using the above 4 parameters. the sensors are powered by solar panels and batteries to provide uninterrupted reporting of the water quality report. the water surface data is analyzed from the sensors and provided to the cloud storage system. then the cloud-stored data is further segregated into the form of graph representations and provided to the users through android applications and web pages. all the sensor nodes replicate the same process and report the concerned data from their geography for reliable results and analysis. [9]

3. Operation and Working Principle

In this system, we use different sensors for measuring the position of aquaculture. The pH sensor is the key sensor to consider the water quality by dipping it in the water. If the water is polluted the pH value drops and water becomes much acidic. If the water acidity increases or the pH value drops further from pH value 5 then the automatic motor starts to replace water. It also has an IoT feature to upload data online and maintain a record of pH value and automatic motor starting. It has an automatic water level controller to control the water level to its optimum level. This study gives the preferred data at any moment from any part of the world and screening their concern instantly at any part of the location.

3.1. Circuit Diagram

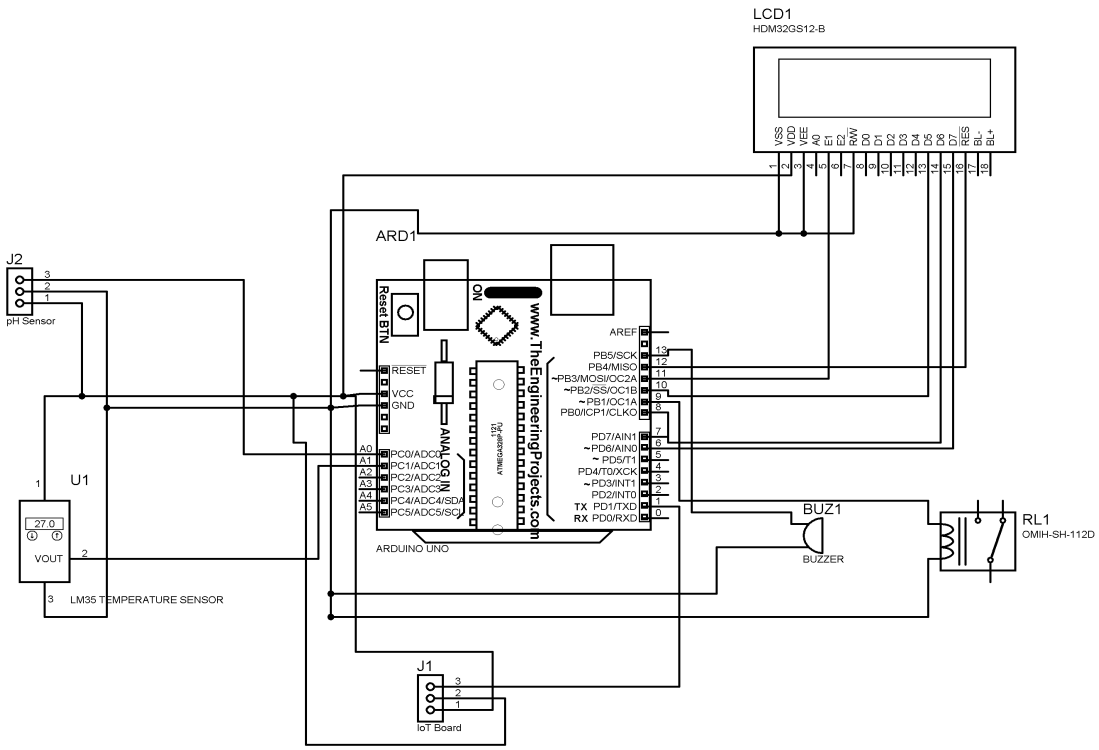

Figure 3. Overall System Circuit Diagram

The circuit diagram represents the overall system connection and pin configurations. The components and their assembling with a line diagram are drawn in the figure. It represents the Atmega microcontroller as the central intelligence core and thinker of logic controls. The relay connection, IoT page, display, and sensing unit is well labeled and demonstrated in the circuit diagram.

3.2. Block Diagram

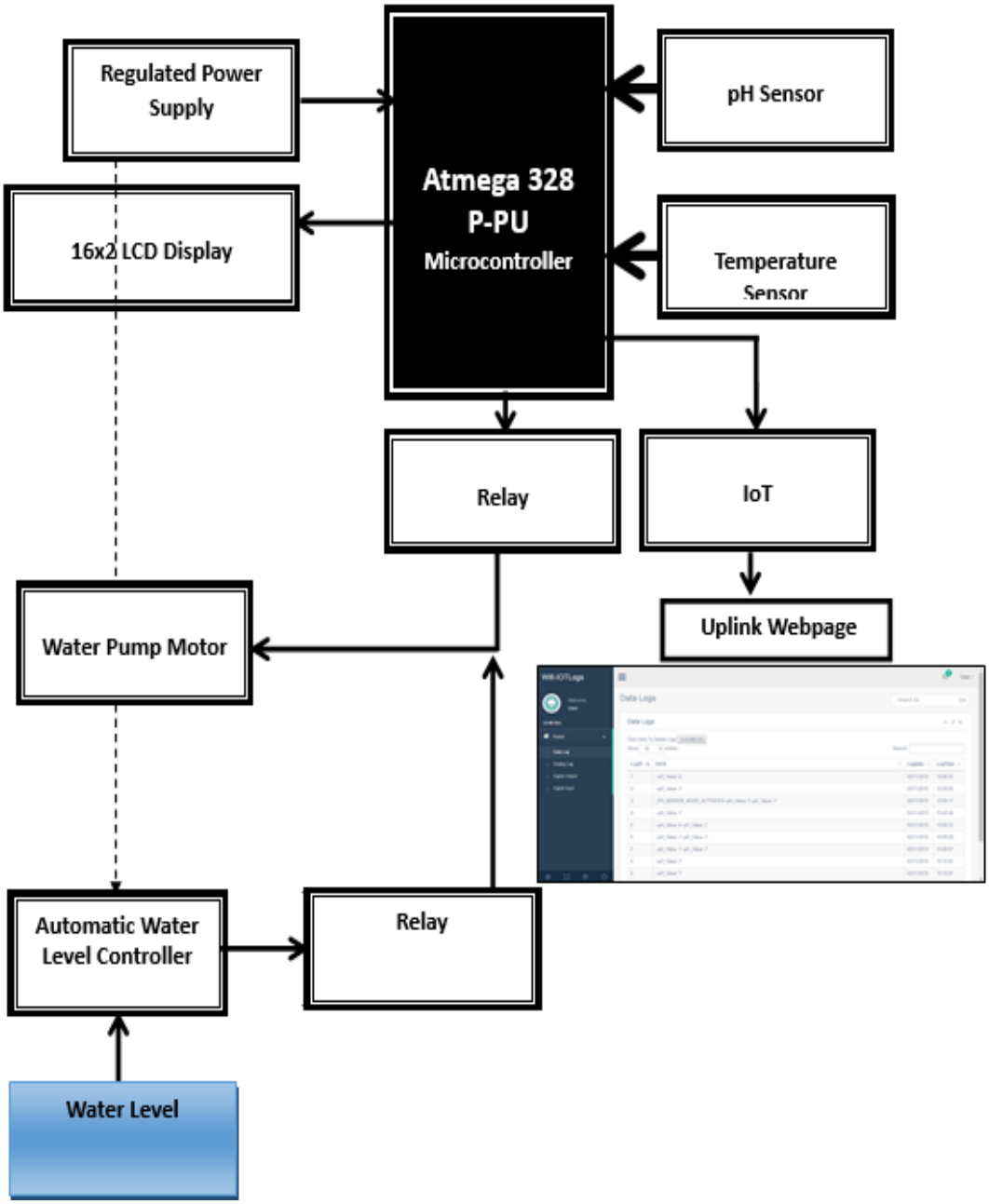

Figure 4. Overall System Block Diagram

Block diagram represents the overall system functionality and working. The components and their schematics are drawn in the diagram. It represents the Atmega microcontroller as the brain of the overall functionality. The IoT updates on the page demonstrate the working of the reporting system as well.

3.3. Microcontroller Program

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
const int analogInPin1 = A0;
int sensorValue1 = 0;
long ll;

void setup()
{
Serial.begin(9600);
pinMode(8, OUTPUT);
pinMode(9, OUTPUT);
digitalWrite(8, LOW);
digitalWrite(9, LOW);
lcd.begin(16, 2);
lcd.setCursor(0, 0);
lcd.print("WATER QUALITY MONITORING")
```

```
lcd.setCursor(0, 1);
lcd.print("MONITORING UNIT");
delay(2000);
lcd.setCursor(0, 1);
lcd.print("RING AND CONTROL ");
delay(1000);
lcd.setCursor(0, 1);
lcd.print("LING SYSTEM FOR ");
delay(1000);
lcd.setCursor(0, 1);
lcd.print("AQUACULTURE");
delay(1000);
lcd.setCursor(0, 1);
lcd.print(" USING IOT------");
delay(1000);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("PH SENSOR STATUS");
Serial.print("*");
Serial.print(" PH SENSOR MODE ACTIVATES");
delay(2000);
Serial.print("#");
}

int hb,hbt,hbtt;
void loop()
{
Serial.print("*");
lcd.setCursor(0, 1);
lcd.print(" PH Value:-          ");
Serial.println("pH Value:-");
sensorValue1 = analogRead(analogInPin1);
lcd.setCursor(11, 1);
delay(20);
lcd.print(sensorValue1/12.5);
Serial.println(sensorValue1/12.5);
delay(5000);
Serial.print("#");
}
```

3.4. Major Advantages

- pH Sensor is the most reliable water quality sensor as it can be dipped in water
- IoT used is the most advanced communication technology
- Possible to maintain a database of all data records
- Possible to control the motor remotely using IoT

4. Discussion and Conclusion

Thus our proposed system of water quality testing and live reporting using IoT is designed. The paper in detail analyses the quality of water quality analysis using IoT systems and reports for public safety. The proposed system is also usable for any geographical location and can be of great use for the high water pollution containing water bodies. As a future enhancement, we can have the attachment of a turbidity sensor to also analyze the physical, visibility-based clarity of water identification. This would make our proposed system more accurate and reliable.

References

1. Wikipedia, “Names for India", https://en.wikipedia.org/wiki/Names_for_India
2. Wikipedia “Water resources in India", https://en.wikipedia.org/wiki/Water_resources_in_India
3. Wikipedia “Water pollution in India", https://en.wikipedia.org/wiki/Water_pollution_in_India
4. Wikipedia "Ganges", https://en.wikipedia.org/wiki/Ganges
5. IBERDROLA “Water pollution: how to protect our source of life", https://www.iberdrola.com/sustainability/water-pollution
6. Banjot Kaur “Namami Gange: 5 reasons why Ganga will not be clean by 2020”, 15 October 2018 https://www.downtoearth.org.in/coverage/pollution/namami-gange-5-reasons-why-ganga-will-not-be-clean-by-2020-61891
7. Kofi Sarpong Adu-Manu et al., “*Smart River Monitoring Using Wireless Sensor Networks*” Hindawi, Wireless Communications and Mobile Computing, Volume 2020, Article ID 8897126, 19 pages, https://doi.org/10.1155/2020/8897126
8. Derara Chalchisa et al., “*Assessment of the quality of drinking water in storage tanks and its implication on the safety of urban water supply in developing countries*” Chalchisa et al. Environ Syst Res (2017) 6:12 DOI 10.1186/s40068-017-0089-2
9. K. A. Mamun et al., “*Smart Water Quality Monitoring System Design and KPIs Analysis: Case Sites of Fiji Surface Water*” Sustainability 2019, 11, 7110; doi:10.3390/su11247110.
10. Wikipedia “Pollution of the Ganges", https://en.wikipedia.org/wiki/Pollution_of_the_Ganges
11. Facebook “*Aqua Solution India*", https://www.facebook.com/aquasolutionsindia
12. ID Soubache, T Thirumurugan, B Annapurna, RK Singh, *“Diabetic Foot Ulcer Treatment Device Using Peltier and Embedded Electronics”,* Journal of Physics: Conference Series 1712 (1), 012041, 2020
13. Dr. B. Annapurna, Asha Priyadarshini Manda, A. Clement Raj, Dr. R. Indira, Dr. Pratima Kumari Srivastava, Dr. V. Nagalakshmi, “*Max 30100/30102 Sensor Implementation to Viral Infection Detection Based On Spo2 and Heartbeat Pattern*”, Annals of RSCB, vol. 25, no. 2, pp. 2053–2061, Mar. 2021.
14. B. Annapurna, T Rama Reddy, Ch. V. Raghavendran, Raushan Kumar Singh and Vedurai Veera Prasad, *“Coordinate Access System for Live Video Acquisition”*, Journal of Physics: Conference Series, doi:10.1088/1742-6596/1712/1/012034, 2020.
15. B. Annapurna, Raushan Kumar Singh, J. Saravanan, Durai Pandurangan, *“A tribrid Paradigm against Inundation wild animal attack and fire disasters”,* International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-9 Issue-2S4, December 2019.