# IoT based Smart Water Quality Monitoring and Temperature Controlling System

Ibrar Ahmad, Attia Shahzadi

**Abstract**— Internet of things (IoT) plays a significant role towards automation. In this 21st century every system is moving towards automation using IoT (Internet of Things) to provide ease and comfort in daily life activities. Water is the basic necessity for all living organisms. It is key to the sustenance of life. Fresh water makes up for about 2.5% of the total amount of water on the planet but because of pollution and it requires treatment to make it useable and suitable for drinking. To resolve this issue, we proposed a system for water quality assessment. The proposed system checks several parameters of water condition using different sensors. The collected data is sent to a database which can be accessed through a browser. User gets notified if there are any irregularities in the obtained information so that the user can make an informed decision and contaminated or impure water is avoided.

**Index Terms**— PH Sensor, LM35DZ Temperature sensor, Water temperature Sensor, turbidity Sensor, Water Quality, Automation.

## 1 Introduction

Different types of water pollution like domestic sewage, industrial waste and unsaturated fats are a few of the main factors of contaminated water. Fresh, drinkable and healthy water is a resource which is not easily available to everyone therefore creating a need for proper assessment of water quality. The proposed design is cost-efficient for basic testing of water for everyday use. Internet of Things (IoT) is described as the intercommunication of objects (Things) between one another. Home automation is using advanced technologies to diminish the efforts of human, whereas (IoT) Internet of Things further diminishes these efforts by shrinking them to a mere touch or click via the access of internet. The applied system in the paper is comprised of multiple sensors for the analysis of water like pH level sensor, water temperature sensor etc., which produces the required data and can be inspected in contemporaneous when the data is received at the server. The data available on the server and feasible for viewed via ingress to a browser and internet. A turbidity sensor is used to scale the high or low turbidity level of water. A high turbidity level of water means there are particles of different nature like clay or inorganic materials which make the water appear unclear unlike pure water. A pH sensor is used to aligning the pH level of water necessary for determining whether the water is of alkaline or acidic nature. According to WHO (World Health Organization) pH (Potential Hydrogen) level of water which is suitable for drinking ranges lies from 6.5 to 8.5. The proposed system also uses a conductivity sensor which measures the level of electric conductivity through the water determining the level of salt dissolved in water which shows if the water is satisfactory for drinking purpose or not. The DS18B20 (temperature sensor) will monitor how cold or hot the water is before utilization. Further aspects of the paper are categorized in the following order: section 2 provides information on work related to this project, section 3 provides the description of system accompanied by the modules clarification, section 4 shows the schematic circuit and its operation, section 5 discusses the outcome, section 6 discusses shows conclusion and discusses future scope.

## 2 LITERATURE REVIEW

This section of the proposed system disscuses project related work from different perspectives and comparison with the current working projects. Some of the previous project related work in comparison with proposed system is given as follow:

### 2.1 IoT Based Water Quality Monitoring System for Safe Drinking Water in Pakistan

Abdul Rauf Memon in design a quality monitoring system [1] using different sensors like (temperature, humidity, ultrasonic) and WeMos D1 module measures different parameters from different aspects like chemical, biological, and physical condition of the water.

### 2.2 Development of IoT for Automated Water Quality Monitoring System

Rizqi Putri Nourma Budiarti in proposed water quality management system [2] for the sustainability natural resources in the surface area of water using different sensor. Raspberry fi 3 modules are used to communicate with a server. The author of the implemented system utilizes YSI 600R Sensor for finding pH of the water and Modem Wi-Fi 4G module for communication purposes.

### 2.3 Water Quality Monitoring System Based on IoT

Vaishnavi V. Daigavane and Dr. M.A Gaikwad in proposed water [3] Quality management system to measure various parameters of water using various sensors (turbidity, temperature, pH). Arduino module job is circuitry and Wi-Fi module for online communication.

### 2.4 Smart Water Quality Monitoring System in IoT

### Environment

Cho Zin Myint in implemented reorganized water quality monitoring [4] with high speed programming integrated circuit. The proposed system is implemented to find out five parameter (PH, temperature, water level, turbidity and carbon dioxide) using wireless communication.

### 2.5 Water Quality Monitoring with Internet of Things (IoT)

Kamarul Hafiz Kamaludin in proposed an IoT based wireless communication for water quality [5] in the university campus. Author uses radio frequency identification and Internet protocol for communication purposes. All the sensor and components are tested in the of university of Malaysia campus river using PH and temperature sensors.

TABLE I
COMPARISON TABLE

| Research Paper | Temperature Sensor | Conductivity Sensor | TurbiditySensor | Water Temperature Sensor | pH Sensor | Relay for Cooing | DataBase |
|---|---|---|---|---|---|---|---|
| IoT Based Water Quality Monitoring System for Safe Drinking Water in Pakistan | YES | NO | NO | NO | NO | NO | YES |
| Development of IoT for Automated Water Quality Monitoring System | NO | NO | NO | NO | YES | NO | YES |
| Water Quality Monitoring System Based on IOT | YES | NO | YES | NO | YES | NO | NO |
| Reconfigurable Smart Water Quality Monitoring System in IoT Environment | YES | NO | YES | NO | YES | NO | YES |
| Water Quality Monitoring with Internet of Things (IoT) | YES | NO | YES | NO | YES | NO | YES |

## 3 LIMITATION IN THE EXISTING SYSTEMS

In the past various systems were implemented for water treatment and quality assurance. Various design systems that were implemented previously have some pros and cons depending on the project nature and scope. Past implemented design system has used different sensors, circuitry and communication module for quality maintenance. The proposed system uses ESP8266 Wi-Fi Module for communication purposes, relays, Arduino Mega 2560 for circuitry and sensors like (Temperature, pH, conductivity, turbidity) to check nature of water for monitoring purposes. The describe applied system uses relays to make the water suitable according to the environment temperature before utilization.

## 4 METHODOLGY

This section describes the components mentioned above and for what purpose will they carry out.

- Firstly, when the system is initialized the ESP8266 WiFi Module is used for communication purposes with database. It will establish the connection with database. Then it will upload the data received from the sensors to the database for storing and also displaying on the webpage which can be accessed from any browser with internet capability
- Turbidity sensor is used to check coagulation and small particles in water. Now if coagulation is detected in water the data received on the server will highlight that the level of turbidity present in the water is above the defined range and precautionary measures should be taken.
- Checking of pH level of water using pH Sensor. Normal pH of water is ranges from 6.5 to 8.5 and now if the pH is lower or higher than the normal range then the data from the server will indicate if the water is acidic or alkaline.
- Conductivity sensor will determine the conduction of electricity via minerals and other elements in the water. This test will assume the level of salinity in the water and if it is found high would help avoid drinking of water with dangerous levels of salinity.
- Water temperature sensor is used for sensing the temperature which when sent to the server will help the micro-controller to generate an automated response for the purpose of maintaining the water's temperature.
- The proposed system is competent to maintain the water temperature by using data generated by the water temperature sensor. If the temperature is high than a relay turns on the cooling device attached. In case of lower temperature, another relay turns on the heating device to bring it to a normal range.

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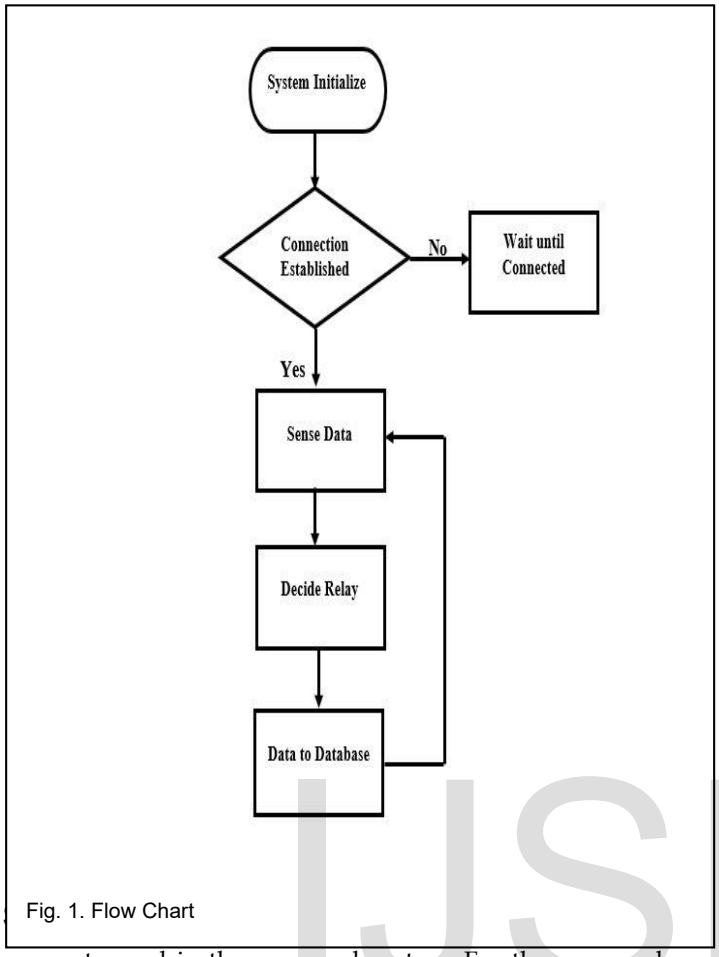


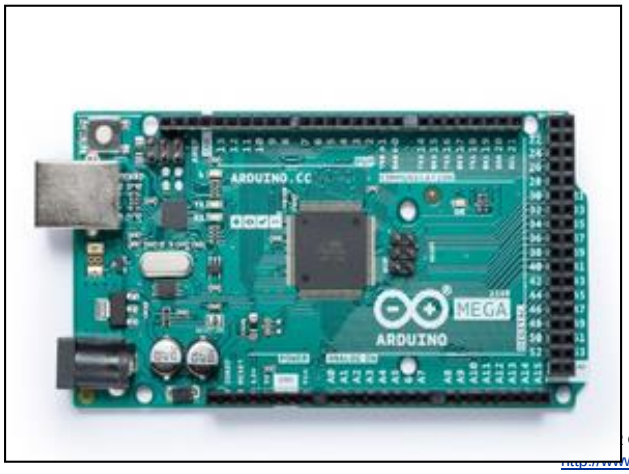

Fig. 1. Flow Chart

## 5

Components used in the proposed system: For the proposed system following hardware and software components including circuitry components, communication module, database server and sensors are used. The detail of each component is discussed below:

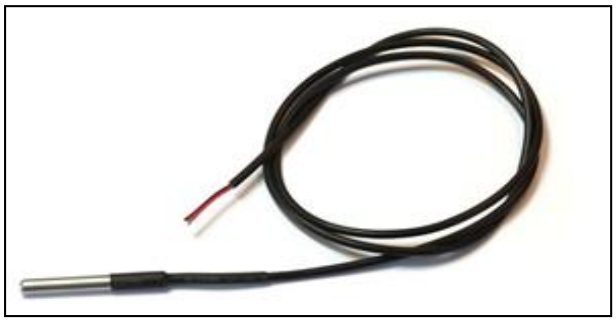
A. Arduino Mega

Arduino Mega 2560 is a most common microcontroller board. It consists of 54 digital I/O pins, 16 analog pins, 4 UARTs, a crystal oscillator with a speed of 16 MHz, the board can be powered through the USB port or the power port located on the board. The USB port is also used to program the microcontroller board by uploading a program onto it using the Arduino IDE application on a computer.




B. Water Temperature Sensor

The water temperature sensor used in this system is DS18B20. It will determine whether the water temperature is high or low. It has a range of -55 to 125 degree Celsius.

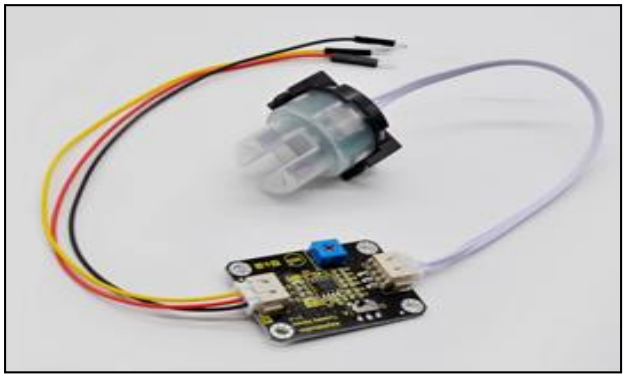


C. Temperature Sensor

The temperature sensor used in this system LM35DZ. It will determine the temperature of the area of placement. It measures the temperature between -55A°C to 150 ˆ A°C.

D. Turbidity Sensor

The turbidity sensor attached is the SEN0189. It will check the turbidity level of the water to determine whether the water is suitable for drinking purpose. Alongside the pH sensor this sensor is vital for finding out the condition of water.

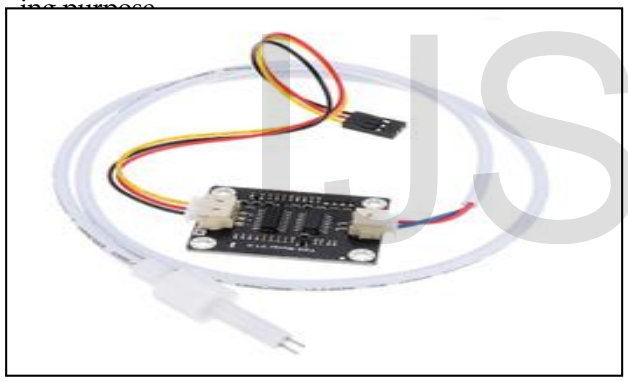


E. pH Sensor

The pH sensor operated by this system is the SEN0161 pH meter kit. It would provide suitable evaluation of the pH level of water with 7 being the optimum requirement, lower than 7 is considered more acidic and higher than 7 being more alkaline.

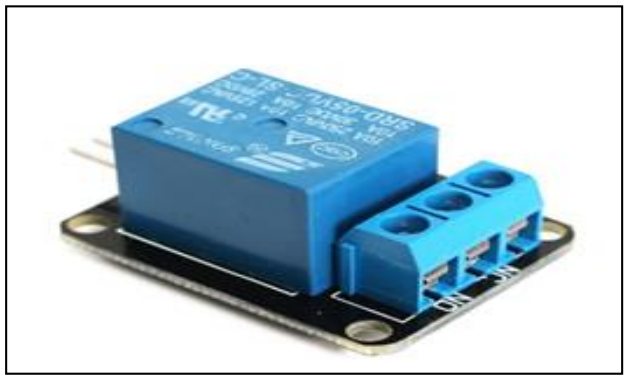
F. Electricity Conductivity Sensor

TDS sensor is used to find the hydroelectric conductivity intensity of water to determine its salinity level. High conductivity means the salinity measure is high which deduces that the water is not suitable for drinking purpose.



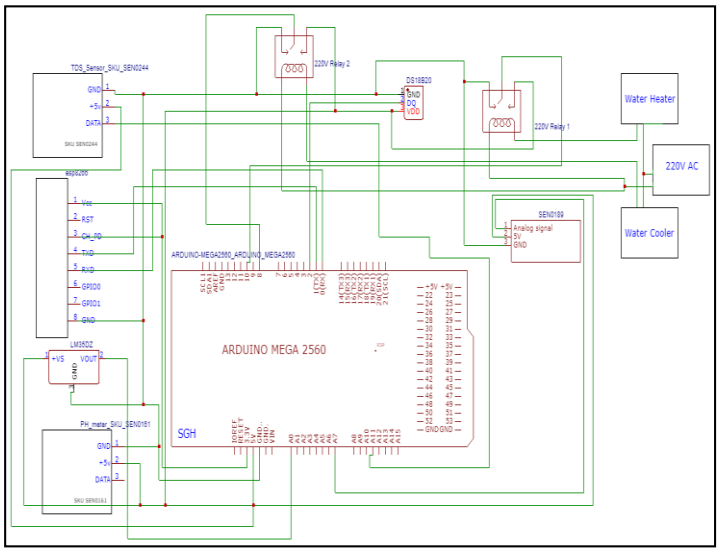
G. Relay

Relays are switches which control a certain circuit via another circuit electronically and also electromechanically.



## 6 SCHEMETIC DIAGRAM

This is the schematic diagram for the proposed system showing the connections between sensors and the microcontroller and other devices.




## 7 RESULT AND DISCUSSION

The system proposed is an efficient water quality management system along with adequate heating and cooling capacity acting with regard to the local atmosphere's temperature. The system processes the data from the sensors and then uploads it to the server, this data is then compared with predefined thresholds which when found less than or exceeding than the defined range triggers an alert and are highlighted for the user. These predefined values can however be changed to the user's preference and the temperature for cooling and heating the water can also be adjusted.

## 8 CONCLUSIONS

The data generated by the system deduces a finding which though requires human intervention will however help reduce the medical aid and assistance required for those who utilize water that is contaminated which can be detected by parameters like turbidity, pH level, salinity through a cost-efficient method. This system can be implemented in households and work places that have their water channeled from multiple sources and may have reasons to doubt the condition of water. In future, testing water for biological contaminants will allow us to implement the system in rural locations where many water sources are not treated beforehand and can be harmful.

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