



Reconfigurable Smart Water Quality Monitoring System in IOT Environment

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Abstract:

“Water quality” is a term used here to express the suitability of water to sustain various uses or processes. Any particular use will have certain requirements for the physical, chemical or biological characteristics of water; for example limits on the concentrations of toxic substances for drinking water use, or restrictions on temperature and pH ranges for water supporting invertebrate communities. The main aim of the project is design a smart water quality monitoring system using raspberry pi zero processor and IOT. In this project temperature sensor is used to measure the temperature of the water. PH sensor measures PH of water and turbidity sensor measures the amount of light that is scattered by the suspended solids in water. If any of these parameters values exceeds the threshold value buzzer beeps. The raspberry pi zero sends these measured sensors values to the user Android phone through Wi-Fi.

Keywords:

Raspberry pi zero, Temperature sensor, Turbidity sensor, PH sensor, LCD display, Buzzer.

1. Introduction:

Water Quality Monitoring (WQM) is a **cost-effective and efficient system designed to monitor drinking water quality** which makes use

of Wi-Fi technology. The obtained data is sent to the user mobile through Wi-Fi.

The Water Quality Monitoring System will measure the following water parameters for analysis; Potential Hydrogen (pH), turbidity and Temperature using sensors. While monitoring these parameters, it is perceived that one should receive a stable set of results. Therefore a continuous series of anomalous measurements would indicate the potential introduction of a water pollutant and the user will be notified of this activity with the aid of Wi-Fi technology. When the sensor data exceeds threshold value the system active the buzzer for alert.

The Internet of things describes the network of physical objects, so known as, "things" that are embedded with sensors, software, and other technologies that is used for the purpose of connecting and exchanging data with other devices and systems over the Internet.

Hence, with the successful implementation of this monitoring approach, a water pollution early warning system can be achieved with a fully realized system utilizing multiple monitoring stations.

2. LITERATURE SURVEY:

Over the past few decades, waters in and around Fiji have gradually succumbed to a fair degree of pollution. Chemical waste and oil spills are the major, primary forms of water pollution threatening

Fiji's waterways. For example, an article published in the Fiji Times on 24 December, 2014 reported on raw sewage seeping into the Samabula River at a rate of 200 liters per second due to broken pipes [1]. Eliminating pollution altogether may seem like an unfathomable notion but limiting its effects when it does happen is certainly possible. The primary objective of this project is to devise a method to monitor water quality in an effort to aid in water pollution control in Fiji with the help of Wi-Fi technology.

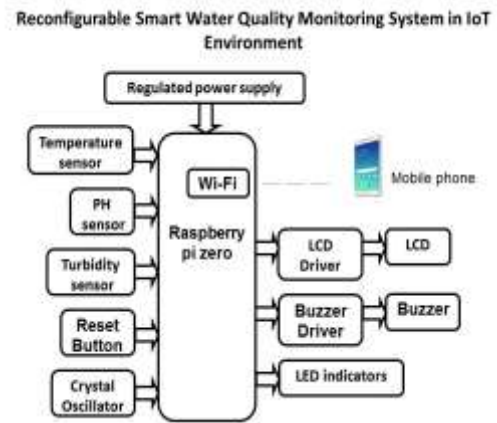
Initiatives have been taken all over the globe to develop projects based on sampling water to aid in controlling marine environments. It may not be specific to water pollution monitoring but similar concepts are involved.

Libeliums Smart Water device monitors the status of an aquarium's health in Europe [2]. It specifically monitors parameters like pH, electro conductivity, oxidation/reduction potential (ORP) and temperature. A cloud based solution is developed to help in monitoring data in real time providing a fast and effective reaction in case of rising abnormalities. A similar example to that of this project can be seen in the coastal water pollution monitoring initiative in the Gulf of Kachchh [3] with the only difference being in terms of it having a much larger scope and vastly more expensive protocols deployed to counter the effects of the industrial development.

Furthermore, locally there have been projects based around the conservation of the coral reefs. The Mamanuca Environment society's (MES) Biannual Sea Water Monitoring Program has been around for 4 years whereby tests are carried out on seawater for faecal coliform (FC) bacteria, salinity and nutrients which helps in ascertaining the health of the surrounding reefs [4].

Research indicates that projects of this nature are developed on a large scale with generous funding from reputable organizations. There is little indication of small scale and inexpensive projects that have a similar role in places like marine jetties, cities and industrial rivers to preserve aquaculture and public health. By applying a strategic, cheap and methodical technique this project hopes to achieve this in an effort to sanitize our oceans.

3. Implementation:



3.1 Block diagram of Reconfigurable Smart Water Quality Monitoring System in IoT Environment

The main controlling device of the project is Raspberry pi zero processor. Temperature sensor, PH sensor, and turbidity sensor, LCD display, Buzzer are interfaced to the Raspberry pi zero processor. These parameters values are constantly displayed on LCD. When any of these parameters values exceeds the threshold value the system active the buzzer for alerts. The raspberry pi zero sends these measured values to the user Android phone through Wi-Fi. The raspberry pi zero has SD card is a key part of the **Raspberry Pi**; it provides the initial storage for the Operating System and files. This project works using LINUX operating system and python language.

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

4.1. Raspberry pi Zero processor:

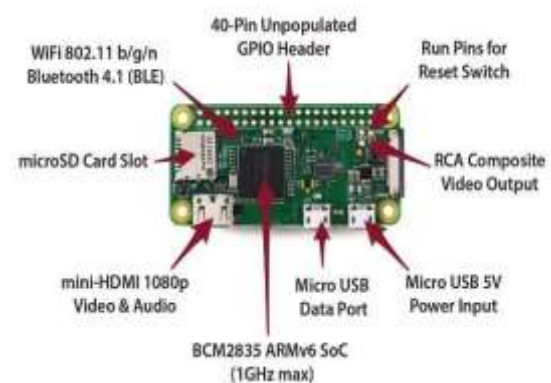


Fig: Raspberry pi zero

Raspberry Pi Zero is a super-small, hackable, and ultra-low-cost computer.

Raspberry Pi processor is programmed using embedded 'Linux'. Linux is the best-known and most-used open source operating system. As an operating system, Linux is software that sits underneath all of the other software on a computer, receiving requests from those programs and relaying these requests to the computer's hardware.

4.2. PH sensor:



Fig. PH sensor

A pH Meter is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter". The difference in electrical potential relates to the acidity or pH of the solution. The pH meter is used in many applications ranging from laboratory experimentation to quality control.

4.3 TURBIDITY SENSOR:



Fig. Turbidity sensor

Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water's **turbidity** level (and cloudiness or haziness) increases.

Features :

- Compatible with Arduino, Raspberry Pi, AVR, PIC, etc.
- Measures turbidity of water in rivers.
- Detects and verifies water quality.
- Digital and analog output;
- Able to detect particles that are suspended in water.
- Trim pot for sensitivity adjustment.
- Ideal monitoring of water turbidity in rivers, streams, lakes, water boxes, catchment and research sites, laboratories, tanks with liquids and etc.
- Comes with module and jumpers
- Operating Voltage: 5VDC.
- Current: 30mA (MAX).
- Operating temperature: -30 ° C to 80 ° C.
- Measuring Range: 0 ~ 1000 NTU

4.4. LM 35 (temperature sensor):

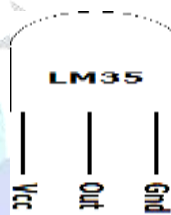


Fig. Temperature sensor

The LM35 series are precision integrated-circuit LM35 temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 sensor thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55 to $+150^\circ\text{C}$ temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only $60\ \mu\text{A}$ from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to $+150^\circ\text{C}$ temperature range, while the LM35C sensor is rated for a -40° to $+110^\circ\text{C}$ range (-10° with improved accuracy).

4.5 LCD Display:

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2. This means 16 characters per line by 2 lines respectively.

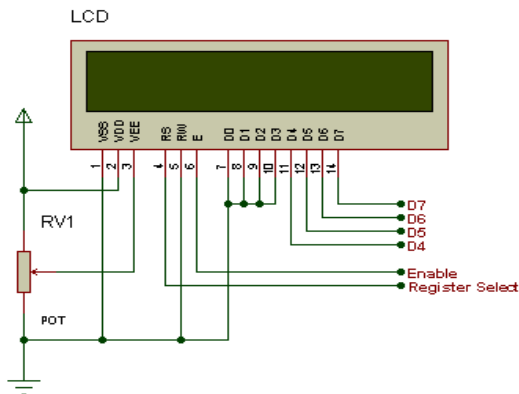


Fig : LCD display

The LCD requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used the LCD will require a total of 7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus).

4.6 BUZZER:



Fig : Buzzer

The vibrating disk in a magnetic buzzer is attracted to the pole by the magnetic field. When an oscillating signal is moved through the coil, it produces a fluctuating magnetic field which vibrates the disk at a frequency equal to that of the drive signal.

5. CONCLUSION:

The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with Arduino. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the

best working unit for “**Reconfigurable Smart Water Quality Monitoring System in IoT Environment**” has been designed perfectly. Secondly, using IOT technology for monitoring and sending sensor data and python language. And also the system able to give the audible alert in the form of buzzer. And also the system monitor the sensor data on LCD module. Thus, the project has been successfully designed and tested.

6. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future.

7. RESULTS:



Fig: 7.1 monitoring water quality parameters into the user mobile

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