Water Quality Monitoring System for Aquarium

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Abstract- **Water quality parameters such as temperature, turbidity and dissolved oxygen are most important parameters for aquatic life survival and growth, but industrial growth and water pollution affects the growth and survival of aquatic life. So it is important to maintain the quality of water. The main aim of these system is to monitor the parameters of water and according to this decide the quality of water. In this system we are using turbidity, temperature and dissolved oxygen sensor. These sensors measure the corresponding value of water parameters and all these values will be displayed on Liquid Crystal Display. The value of these parameters will be set to threshold value such that we are able to decide the quality of water.**

Index terms- **Aquarium, Turbidity, Dissolved Oxygen, Water Monitoring**

I.INTRODUCTION

Water quality testing is an important part of environmental monitoring. When water quality is poor, it affects not only aquatic life but the surrounding ecosystem as well. Water quality sustains ecological processes that support native fish population. Water properties can be physical (temperature and turbidity) and chemical (dissolved oxygen).

The system proposed in this paper is used for analysis of water parameters for aquatic animals. Water quality monitoring system measures the parameters of water like Turbidity, Temperature and Dissolved oxygen. With the help of turbidity sensor turbidity of water is measured. Turbidity is cloudiness of water. Turbidity indicates the degree at which the water losses its transparency. Turbidity should be less than 1NTU for aquatic animals. Water temperature indicates how water is hot or cold.DS18B20 temperature sensor is used for temperature measurement having range from $-〚55〛^\circ C$ to $〚125〛^\circ C$. Output of DS18B20 is in digital form. Dissolved O_2 Sensor is used for checking the dissolved O_2 level in water. All the values measured by sensor will be given to the AVR Microcontroller.

Values are displayed on Liquid Crystal Display. If the values are greater than threshold value then buzzer will activate and system will send the message to the user with the help of GSM.This system can monitor water quality automatically and it is adequate and economical.

II. LITERATURE REVIEW

Various types of systems are available to check the quality of water. Some are listed below:

Nazleeni Samiha Haron, Mohd Khuzaimi B Muhammad, Izzatdin Abdul Aziz, Mazlina Mehat have developed a water quality monitoring system for eliminating cost consuming jobs of manual monitoring. In this system the measured data of water quality monitoring sensors are collected by the data kit which gives data to the data processing unit through GSM modem. In data processing unit the data from different sensors are differentiated and it is continuously compared with the ideal parameters of the sensor value. If the water isn't meeting its quality parameter value the alert signal is there which is connected to the buzzer. This system is not reliable for long distance also it will apply to only single unit of water source [1].

Fiona Regan, Antin Lawlor and Audrey McCarthy have designed smart water quality monitoring system. In that system they made water quality smart sensors so the sensors send data wirelessly to the device which collects data from all the nodes. This data is given to the remote server through GPRS network and user can see data remotely. This system is highly scalable, faster and user friendly, but it is costly because of smart sensors. Furthermore, the size of sensors is not reliable for water tap [2].

Zulhani Rasin and Mohd Rizal Abdullah, have proposed water quality monitoring system using ZigBee based wireless sensor network. In proposing system, the sensors are connected to a single circuit which is connected to the Zigbee ZMN2405HP

module. The receiver side ZigBee is connected to the PC that shows the GUI of the network circuit. In this system the high-power ZigBee is used and it can be applied to small area network, also the base station is necessary for data storage [3].

NIEL ANDRE CLOETE, REZA MALEKIAN AND LAKSHMI NAIR have developed water quality monitoring system, with the objective of notifying the user about real time water quality parameters. The system is able to measure the physiochemical parameters of water quality, such as flow, temperature, pH, conductivity, and the oxidation reduction potential. These parameters are used to detect water contaminants. In this system microcontroller-based measuring node, which processes and analyses the data? In this design ZigBee receiver and transmitter modules are used for communication between the measuring and notification nodes. The notification node presents the reading of the sensors and outputs an audio alert when water quality parameters reach unsafe levels [4].

Bhatt J &Patoliya J focuses on real-time water quality monitoring system using IOT. This system consists of some sensors which measures the water quality parameters such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry pi using ZigBee protocol. Finally, sensors data can view on internet browser application using cloud computing [5].

Purohit A & Gokhale U have designed system consist of multiple sensors to measure the standard of water, microcontroller and GSM to send the information to the watching center at predefined time[6].

III. METHOD

Water Quality Parameters:
The first step was to determine which water quality parameters would be monitor for aquatic life, to accurately determine whether the water quality is within the specify range or not. It was determine that water parameters such as nitrates, ammonia and chlorine require frequent maintenance and calibration to sustain accurate readings over long period of time.

This would not be feasible for long-term, real time water quality monitoring system

The water parameters which are the focus of this project are Turbidity, Temperature and Dissolved oxygen. The specified ranges of parameters are layed out in Table 1

Table 1: Parameters to be monitor

Sr no.	Parameters	Unit	Quality Range
1	Turbidity	NTU	0-5
2	Temperature	°C	74-80
3	Dissolved oxygen	Mg/L	-

A. Sensors and components Used:
1. Turbidity Sensor:
Turbidity sensors measure the amount of uspended particles. Turbidity sensor is basically an optical sensor consisting of IR Transmitter and receiver. It works on the principle of refraction of wavelength between photo transistor and diode. Turbidity sensor measure the amount of light scatter by suspended solid in water. As the amount of total suspended solid in water increases, then the turbidity level of water also increases.

Fig 1: Turbidity Sensor

2) DS18B20 Temperature Sensor:
There are various temperature sensors are available but we are using DS18B20 temperature sensor because it is water proof and having good accuracy and range. The sensor works with the method of 1-Wire communication. It requires only the data pin connected to the microcontroller with a pull up resistor and the other two pins are used for power. The pull-up resistor is used to keep the line in high state when the bus is not in use. The temperature value measured by the sensor will be stored in a 2-byte register inside the sensor. This data can be read by the using the 1- wire method by sending in a

sequence of data. There are two types of commands that are to be sent to read the values, one is a ROM command and the other is function command.

Pin Configuration of DS18B20:

No	Pin Name	Description
1	Ground	Connect to the ground of the circuit
2	VCC	Powers the Sensor, can be 3.3V or 5V
3	Data	This pin gives output the temperature value which can be read using 1-wire method

Table 2: Pin description of DS18B20

Fig 2:DS18B20 Sensor

3) Dissolved Oxygen Sensor:

For aquatic species, adequate dissolved oxygen is of prime importance to their continued survival. Since dissolved oxygen levels are directly related to good water quality, the two are highly interdependent. Many factors can affect DO levels, and an understanding of these levels in order to make informed decisions concerning wastewater treatment operations, hypoxic zones, aquaculture facilities or large-scale ecosystems is essential. Dissolved oxygen refers to the level of free, non-compound oxygen present in water or other liquids. It is one of the most important parameters when assessing water quality because of its influence on the organisms living within a body of water. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality.

Fig 3: Dissolved Oxygen Sensor

4) ATMEGA8:

In this proposed system we are using Atmega8 because the sensors which are used in this system are compatible with AVR microcontroller. The Atmel ATmega8A is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs close to 1MIPS per MHz. Sensors in this proposed system are compatible with AVR. The output of Turbidity and Oxygen sensors are in analog form, AVR has inbuilt ADC for conversion so there is no need to use extra signal conditioning circuit.
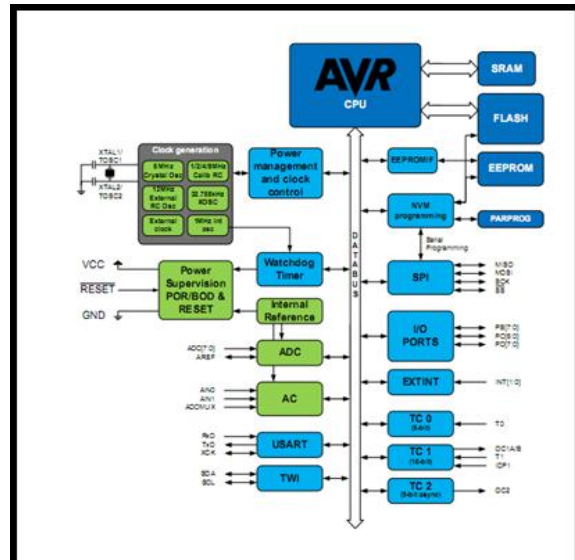

Fig 4: AVR Microcontroller

5) GSM Module: SIM 800A

SIM 800A GSM/GPRS Modem works on frequencies 850/900/1800/1900MHz. The baud rate

is configurable from 9600 through AT command. The GSM/GPRS modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM 800A GSM/GPRS Modem suitable for SMS, Voice as well as DATA transfer applicable. The power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS; attend the incoming calls, and internet through simple AT commands.

Fig 5: GSM Module

IV. PROPOSED SYSTEM

Temperature sensor: Temperature of water is measured by DS18B20 sensor. If there is more turbidity then temperature of the water will increase. With the help of temperature sensor, we are getting the values for temperature of water.

Turbidity sensor: According to the particles which are suspended in water voltage of turbidity sensor will change and we can get value of turbidity.

Dissolved oxygen sensor: Galvanic dissolved oxygen sensor is type of electrochemical sensor, dissolved oxygen diffuses from the samples across oxygen undergoes a chemical reduction reaction, which produces an electrical signal. This signal read by dissolved oxygen sensor.

Microcontroller: It is the brain of this project to control and calculate the parameter of water. For that purpose, we are using Atmega8 controller.

GSM Module: GSM module used is SIM800A to send and receive the SMS

V. WORKING OF SYSTEM

The output of Turbidity, Temperature and Dissolved oxygen sensor given to the controller. Turbidity sensor will give value according to particles suspended in water. It should be less than 1NTU. Temperature sensor used to measure temperature of water and dissolved oxygen sensor for checking the dissolved oxygen level in water. Values of each parameter will be display on LCD. Threshold value will be set for each parameter. According to that water quality will be decide. If the value of turbidity is more then the temperature of water will increase, because heat is absorbed by the suspended particles, Due to which oxygen level also reduced, because warm water holds less dissolved oxygen than cold. So the water will be harmful to aquatic life, but if all parameters are within range it will not harmful to aquatic life. If the value goes above the threshold value then buzzer connected to AVR gives an alarm indication and system will send message to user with the help of GSM.
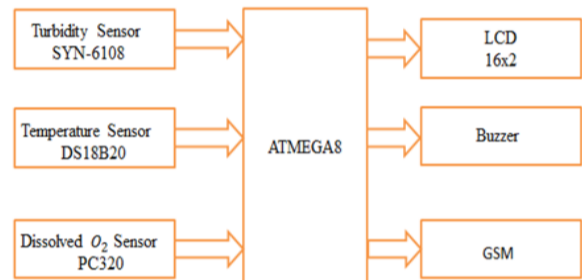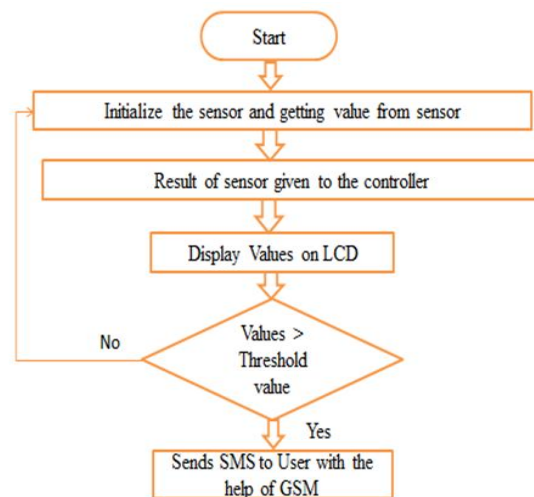

Fig 6:Block Diagram

VI. FLOW CHART

VII. CONCLUSION AND FUTURE SCOPE

With the help of this system we are able to measure Water quality parameter like turbidity, temperature and dissolved oxygen. This system is easy to maintain and it can be extended to measure water pollution as well.

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