

An Iot Based Self Regulating Sensors for Water Quality Monitoring

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ABSTRACT

The systematic pollution of water resources is one of the biggest hazards that humanity faces today. The main objective of the proposed system is to ensure the supply of safe drinking water by monitoring the quality of water. The system involves the design and development of water quality monitoring system along with the notification to the user about the physiochemical parameters of industrial effluents. The parameters such as pH, turbidity, flow, temperature and dissolved oxygen are used to detect the amount of impurities that comes out of the industry. The measured values from the sensors are processed by the controller. When there is a deviation of water quality parameters from the pre-defined set of standard values, an alert message will be sent through the GSM and the solenoid valve will be closed with the help of a relay. The information about the values of sensors will be updated time-to-time with the help of internet of things. Thereby, the proposed system aids in preventing harmful pollutants entering the water resources and also ensure the availability of safe drinking water to everyone.

Keywords: Arduino UNO, pH sensor, Turbidity sensor, Temperature Sensor, Dissolved Oxygen Sensor, Flow Sensor, GSM, Internet of Things.

I.INTRODUCTION

Water is one of the most indispensable factor for all living organisms so it is necessary to preserve it. Water quality is based on physical, chemical and biological significant of water. pH, temperature, turbidity, flow and dissolved oxygen are the parameters measured in water. In traditional method, water parameters are identified by collecting the samples manually and then samples will send to the laboratories for further analysis. It requires more human power. In order to overcome the traditional method, there is a need of Self Regulating sensors for water quality monitoring. The sensors are interfaced with controller. The single chip controller gets the data, then processed and analysed them. The result provides an alert where there is a deviation in the pre-defined set of

values through GSM. The sensed output of the sensors will be updated simultaneously with the help of Internet of Things.

II.PROPOSED SYSTEM

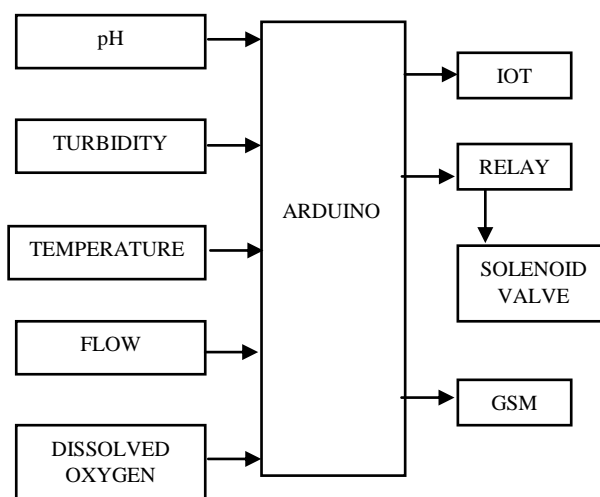


Figure 1:Block diagram of water quality monitoring

The proposed block diagram shows the Self Regulating sensors for water quality monitoring. Water quality is monitored by determining the values of water parameters like pH, flow, temperature, turbidity and dissolved oxygen. These parameters are sensed by the separate sensors. The sensors are pH sensor, flow sensor, temperature sensor, turbidity sensor and dissolved oxygen sensor. Sensor is an ideal detecting device. pH is used to measure the acidic and base level of the water. pH level of the water should be less than 11. Flow sensor is used to identify the amount of impurities has been flowing. Turbidity sensor is used to detect the thickness of impurities in water. Temperature sensor is used to indicates whether the water is hot or not. Dissolved oxygen sensor is to check the oxygen level of the water. These sensors are interfaced with Arduino. Further the Arduino is interfaced with GSM if there is any deviation in the pre-defined value the alert

message will send to the respective authority and the solenoid valve will be closed with the help of a relay. The information about the values of sensors will be updated time-to-time with the help of Internet of Things.

III. TECHNICAL DETAILS

Hardware Description

pH Sensor

pH is the measure of hydrogen ions concentration of solution. The principle of pH sensor is to measure the concentration of hydrogen ions. Solution with high concentration of hydrogen ions have a low pH whereas the solution with low concentration of hydrogen ions have a high pH. pH value ranges from 0 to 14. If the pH value is 7, the water is neutral. If the pH value is less than 7, then the water is said to be acidic while the pH value is greater than 7, then the water is said to be basic. Acids dissolved in water forming positively charged hydrogen ions (H⁺). Bases dissolved in water forming negatively charged hydrogen ions (OH⁻). pH sensor includes measuring electrodes and reference electrodes. Measuring electrode which is sensitive to the hydrogen Reference electrode provides a stable potential against which the measuring electrode can be compared ion, develops a potential (voltage) directly related to hydrogen ion concentration of the solution. The pH sensor will produce a voltage approximately 1.75V in a pH 7 buffer. The voltage will increase by about 0.25V for every pH value decreases. The voltage will decrease by about 0.25V for pH value increases.

Turbidity Sensor

Turbidity is the cloudiness or haziness of a fluid caused due to the presence of suspended particles. Turbidity is caused by particles and coloured materials in water. The turbidity level of drinking water is less than 0.1 NTU. Turbidity sensor detects water quality by measuring the turbidity level. It is able to detect suspended particles in water by measuring the light transmittance and scattering rate by which changes with the amount of total suspended solids (TSS) in water. As the TSS increases, the liquid turbidity level increases. Water with high turbidity is cloudy while the water with low turbidity is clear. Turbidity sensor can be used in measurement of water quality in rivers and streams, waste water and effluent measurements.

Dissolved Oxygen Sensor

Dissolved oxygen refers to the level of free and non-compound oxygen present in water for accessing water quality. Dissolved oxygen is too high or too low can harm aquatic life and affect the water quality. It enters into the water through air. Dissolved oxygen in water should not exceed

the level of 110%. If the concentration above this level can harmful to aquatic life. There is not enough oxygen when the water is too warm. When there are too many bacteria or aquatic animal in the area using dissolved oxygen in great amount. For the survival and growth of many aquatic organisms, the dissolved oxygen is necessary.

Temperature Sensor

Temperature sensor is a device, typically a Thermocouple or RTD, that provides for temperature measurement through an electrical signal. Temperature sensor is the process of measuring temperature levels in water. It is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. Aquatic organisms depend on the particular temperature ranges for their health. The water temperature sensor is capable of measuring temperature in the range -5 degrees Centigrade to +50 Centigrade with a resolution of 0.1 degree. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 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 does not require any external calibration or trimming to provide typical accuracy of $\pm\frac{1}{4}^{\circ}\text{C}$ at room temperature and $\pm\frac{3}{4}^{\circ}\text{C}$ over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the water 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 μA 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°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy).

Flow Sensor

The working method of hall effect sensor based water flow sensor, a turbine wheel embed with magnet is placed on a closed plastic envelope and a Hall effect sensor placed, When the water flows through the pipeline, it makes the turbine wheel to rotate and hence the magnet flux interferes the hall sensor, the rate of interference is depends on the speed of water flow, so the hall effect sensor produce pulse signal output, this pulse output can be calculated as water volume. water flow sensor has only three wires and it can be

easily interfaced between any microcontroller and Arduino board. It requires only +5V Vcc and gives pulse output, the sensor needs to be tightly fitted between water pipeline.

GSM

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. A GSM digitalize and reduce the data, then sends it through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64kbps to 120Mbps of data rates. The on board regulated power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, attending the incoming calls and internet etc., through simple AT commands.

Arduino UNO

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter. The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughput approaching 1 MIPS per MHz, allowing the system design to optimize power consumption versus processing speed.

Software Description

Arduino IDE

The open source Arduino software (IDE) makes it easy to write and upload it to the board. It runs on windows, Mac OS X and Linux. In fact the Arduino language is merely asset of C/C++ function. It provides comprehensive facilities to computer programmers for software development. This software is used to upload the sensors program to the Arduino UNO board.

IV.RESULT

The output from the sensors are given to Arduino which process the data and sends the data to the cloud through IOT module which can be viewed by the respective authority anywhere and anytime. When the value of pH, turbidity, dissolved oxygen, temperature exceeds the normal value an alert message is send to the respective authority's mobile through GSM.

V.CONCLUSION AND FUTURE WORK

The sensors are connected to the internet which collects the data for analysis. IOT is a technology that is having major impacts in many different domains. The future work of the proposed system is when the output of the sensor from the Arduino is abnormal it gives an alert message to the respective authority's mobile phone through GSM about the abnormal range of water.

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