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Design and Implementation of Real Time System for Water Quality Measurement Using GSM

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Abstract: *The conventional method of measuring the water is to collect the samples manually and send it laboratory for analysis. However this method is time consuming and not efficient. Since it is not possible to take the water samples after every hour and measure its qualities. The water quality measurement system will measure the essential qualities of water in real time. The system consists of multiple sensors to measure the quality of water, microcontroller and GSM to send the data to the monitoring centre. It is a real time system which will continuously measure the quality of water and will send the measured values to the monitoring centre after every predefined time. The system is based on microcontroller 8051 and GSM.*

Keywords: *Multiple sensors; Microcontroller; GSM module; Water Quality Measurement; SMS.*

I. INTRODUCTION

Water quality is a complex term to evaluate. The quality of water depends on so many things. The parameters are each interlinked and are connected. To make it simple we have used several mainstream parameters in conjunction with each other to determine the water's quality. These include: pH, turbidity, conductivity, total dissolved solid and temperature. Since the conventional method of water quality measurement is not efficient hence there was a need to develop a system which will measure the quality of water in real time and the system needs to be efficient, accurate and low cost. The water quality measurement system makes use of multiple sensors, data acquisition module and information transmission module. Data acquisition module includes microcontroller 8051. Information transmission module includes GSM module. There are various sensors which include pH, turbidity, conductivity and temperature sensor. This system also uses ADC. The measured values are transmitted to the monitoring centre via GSM; it is also shown on LCD by the microcontroller. The system has the advantage of efficiency, accuracy and low cost.

II. SYSTEM HARDWARE ARCHITECTURE

A. Overall design of the system

As shown in the diagram the system consists of various water quality measuring sensors such as pH, turbidity, conductivity and temperature, ADC, microcontroller 8051, GSM module and LCD. The water quality measurement system uses pH, turbidity, conductivity and temperature sensor to measure the quality of water. This sensor then measures the corresponding values of the water. Since the outputs of the sensors are analog in nature and microcontroller can handle only digital signals hence there is a need of a device which converts analog signals into digital signals. The system makes use of ADC for this purpose. Since the output of the sensors which are analog in nature are given to ADC, which converts the analog signals into the corresponding digital signals. These digital signals are then given to the microcontroller 8051. Since the output of temperature sensor is digital, hence there is no need to give its output to 8051 via ADC, its output is directly given to the 8051

microcontroller. System uses GSM module for communication. GSM module makes use of serial port of the microcontroller 8051 for communication. Microcontroller sends the measured value to the monitoring centre in the form of SMS via the GSM module. Since it is a real time system hence microcontroller will send the measured values to the monitoring centre after the specific time specified in the program. With sending the data to the monitoring centre the microcontroller also displays the values of the measured quantities on the LCD. It is a real time system hence it does not require any man machine interaction for measuring the quality of water.

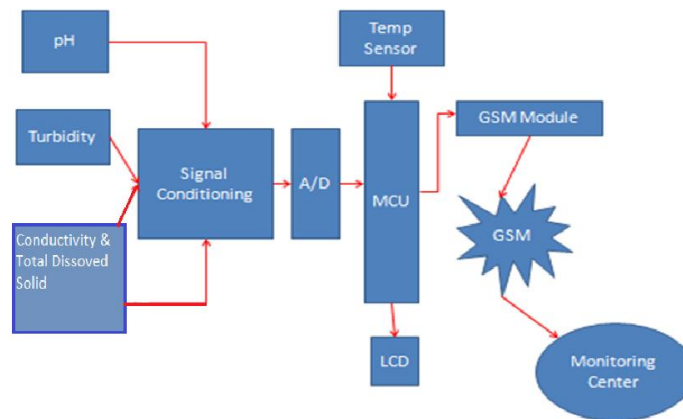


Figure 1. Block diagram of the proposed system

B. Water Quality Detection Sensors

The system uses sensors to measure five qualities of water namely pH, Turbidity, Conductivity, total dissolved solid and temperature.

- pH is a measure of the acidity or basicity of an aqueous solution. It is measured by the method of electric potential. The value of pH lies between 0 and 14.
- Turbidity is the measure of water clarity. In other words it shows to what extent the water is clear. There are suspended particles that are present in the water. These particles decrease the passage of light through the water. Turbidity sensor measures the turbidity by measuring the amount of light scattered at 90 degree.
- Conductivity defines the ability of the water to conduct electricity. As we know pure water has poor conductivity hence for water to be pure its ability to conduct electric current must be poor.
- Total dissolved solid (TDS) determines the amount of minerals and salts present in the water. Total dissolved solid in water can be determined by multiplying the conductivity by a factor and usually this factor is taken as 0.67.

$$\text{TDS} = 0.67 \times \text{Conductivity}$$

We will not use separate sensor for measuring total dissolved solid in water, we will measure conductivity and multiply it by 0.67. This all will be done by programming.

- Temperature has an important influence on water. The system uses LM35 to measure the temperature of water. LM35 is a high precision temperature sensor.

C. Microcontroller 8051

Microcontroller incorporates all the features that are found in microprocessor. Microcontrollers are usually dedicated devices embedded within an application. The 8051 is the first microcontroller of the MCS-51 family introduced by Intel Corporation at the end of 1970s.

Some features of micro-controller are:

- 8051 have 128 bytes of RAM .8051 have 128 user defined flags.
- It consists of 16 bit address bus.
- It also consists of 3 internal and two external interrupts.
- Less power usage in 8051 with respect to other micro-controller.
- It consists of 16-bit program counter and data pointer.
- It also consists of 32 general purpose registers each of 8 bits.
- ROM on 8051 is 4 Kbytes in size.
- 8051 has two 16 bit inbuilt timers/counters.
- It consists of 4 register banks.

D. Information Transmission Module

GSM stands for Global System for Mobile Communications; it is used as an information transmission module. We will use GSM SIM 300 Module for the proposed system and its figure is shown below.



Figure 3. GSM SIM 300 Module

This module can accept any GSM network operator SIM card. Advantage of using this module is that we can use RS232 port to communicate. This GSM modem is highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. GSM module uses standard AT commands. Some of the AT commands are given below:-

Command	Description
ATA	Answer an incoming call
ATD	Mobile originated call to dial a number
AT+CMGD	Delete SMS Message
AT+CSMS	Select message service
AT+CSCA	SMS service center address

Table I. Some Standard AT Commands

III. SYSTEM SOFTWARE

Microcontroller accepts the values measured by various sensors via ADC and send these values to the monitoring centre in the form of SMS via GSM module. All this are done with the help of coding. The coding is done in Embedded C and for simulation we use RIDE software.

IV. CONCLUSION

Real time system for water quality measurement using GSM is an efficient system that uses various water detection sensor and GSM network. The system is very flexible and economical. It is real time system which measures various parameters present in the water with the help of sensor and send them to the monitoring centre automatically. It does not require people on duty. It is flexible system because just by replacing the sensors and by making some changes in the software the system can be made to measure different parameters of water. The system is reliable and simple and it can be extended to measure air pollution and so on. It has widespread application.

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