PRESIDENCY UNIVERSITY

Itgalpura, Rajanukunte, Bengaluru - 560064

School of Engineering

A Project Report on

“Water quality analysis using Arduino”

Submitted in partial fulfillment of the requirement for the course

Innovative Project - Arduino using embedded C (**CSE 1002**)

Submitted by
Group: **IPC 204**

Student Name	Roll No
KHUSHI S M	20211CSD0045
RAKSHIHTA N K	20211CDV0016
ANVITA V SAJEEVAN	20211CSG0007
SNEHA R	20211CSE0223
VIJAYEENDRA N	20211CBD0021
KIRAN N	20211ECE0293

Under the supervision of

Guide name: Mrs. Manasa R
Designation: Assistant Professor
Department: Electronics and Communication Engineering

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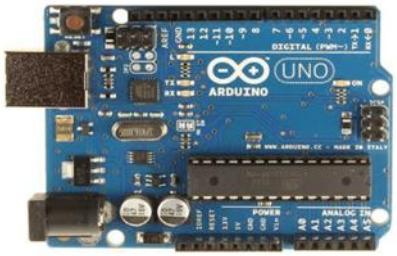
Abstract :

Water pollution is one of the biggest threats for the green globalization. Water pollution affects human health by causing waterborne diseases. To prevent the water pollution, necessary steps are to be taken. First step is to estimate the water parameters like pH, turbidity, conductivity etc., a s the variations in the values of these parameters are detected by chemical tester laboratory test, where the testing equipment's are stationary and samples are provided to testing equipment's. Thus, it is a manual system with tedious process and is very time consuming. In order to minimize the time and to make the system automated, the testing equipment's can be placed in the river water and detection of pollution can be made remotely. To ensure the safe supply of drinking water, the quality should be monitored in real time, for that purpose Arduino based water quality monitoring has been proposed. In this project report, the design of Arduino based water quality monitoring system that monitors the quality of water in real time is presented.

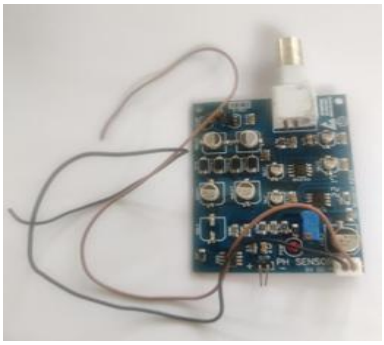
In this project, the main parameters that define water quality are monitored and observed. All the measured parameters are compared with the threshold value that define the purity. Once the parameters are measured, they are sent to authority in the form of alert messages.

Hardware, Software and tools used:

- **Arduino UNO:** The Arduino Uno is an **open-source microcontroller board** based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.



- **pH sensor:** The pH sensor measures the level of pH in the water sample by measuring the activity of hydrogen ions in water and determine if the water sample is acidic or basic. The ideal pH of drinking water lies between 6.5 and 8.5. If the given water sample has pH lesser/greater than this threshold value, the output will be sent in the form of messages, alerts to the user.

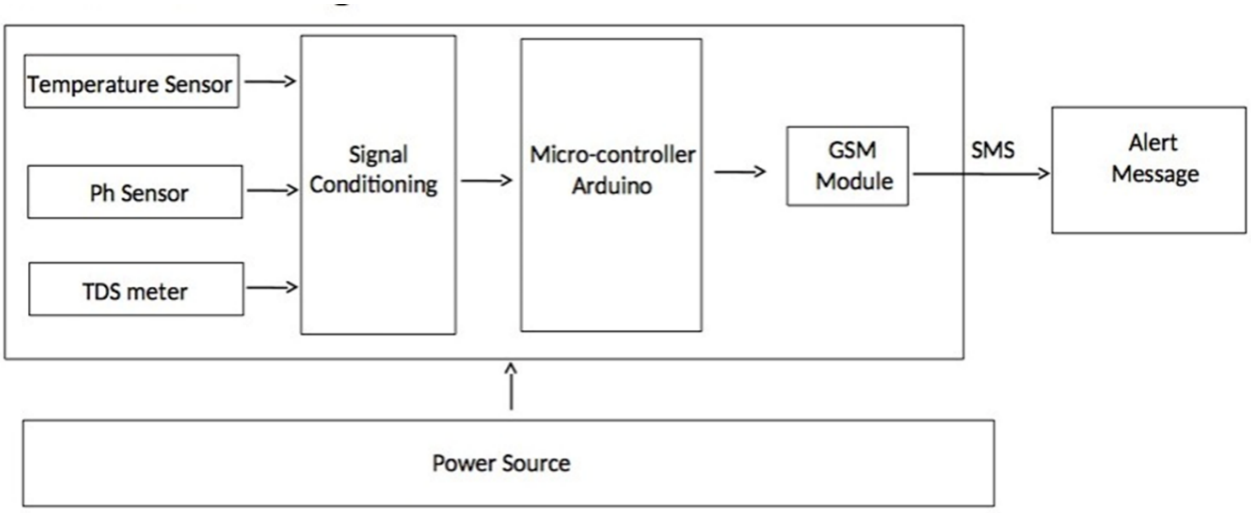


- **Breadboard:** A Breadboard is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits.

- **Temperature sensor:** A temperature instrument is a device, that is typically an resistance temperature

indicator or a thermocouple, which gathers the data on temperature on a specific source and translates data into human comprehensible form for a device. Temperature instruments were used in added applications like HV and AC system ecological controls, food dispensation, medical platform, chemical handling and automotive under the food monitoring and controlling systems.

Block diagram & Description:



The development of a simple prototype system fit for water quality monitoring needs to be comprised of the following components:
1. Multiple sensors to collect relevant data from the environment.
2.A central microcontroller loaded with a computer program to read analogue data and convert them to digital output.
3.A portable laptop with relevant software to read the digital data and present the data in an understandable format on a screen, as well as to provide power to the microcontroller

Sensors were chosen based on ease of use, measurability (of parameters), portability, as well as being economical and cost-effective as a strict budget must be adhered to. Programming was done with an Integrated Development Environment (IDE) based in Java with the programming language C. With the IDE, program sketches can be made, compiled, debugged, and uploaded to the Arduino microcontroller board to be executed.

Analog pH sensor is designed to measure the pH value of a solution and show the acidity or alkalinity of the substance. It is commonly used in various applications such as agriculture, wastewater treatment, industries, environmental monitoring, etc. The module has an on-board voltage regulator chip which supports the wide voltage supply of 3.3-5.5V DC, which is compatible with 5V and 3.3V of any control board like Arduino. The output signal is being filtered by hardware low jitter.

Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature sensor is -55 to +125 °C. This temperature sensor is digital type which gives accurate reading.

The data from these sensors undergo a process called signal conditioning where the input signal or analog signal is converted to digital signal which is easily understood by the microcontroller, here the microcontroller used is Arduino UNO. The microcontroller receives the data from the sensors, processes it and transfers it to the GSM Module. GSM module acts as an communication device which sends and receives alerts, messages to the user whenever there is any change in pH, Temperature of the given water sample above or below the threshold value and sends the information to the user. The power source is required for the operation of the system.

There is basically two parts included, the first one is hardware and second one is software. The hardware part has sensors which help to measure the real time values, another one is Arduino UNO which processes the data from the sensors and provides corresponding output.

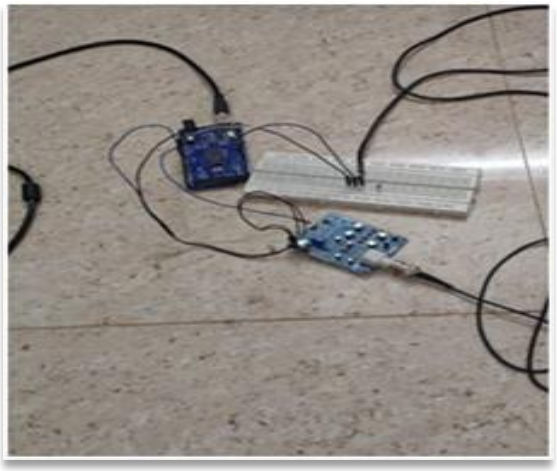
This system makes use of two sensors (pH and temperature), processing module Arduino, and two data transmission modules Arduino and GSM. The three sensors capture the data in the form of analog signals. The ADC converts these signals into the digital format. These digital signals are sent to the Arduino via a GSM module. The microcontroller will process the digital information, analyze it, and further communication is done by the GSM module, which sends an SMS with the water quality parameters onto the smart phone/PC, which also displayed on the LCD of the Arduino. Arduino accepts and processes the data collected from the sensors to the Web page via GSM module. This is carried out with the help of coding. The code is written in C-programming and using the Arduino software to simulate the code.

A GSM modem is specialized type of modem which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone. A new version of now SMS is available that supports the ability to use Android phones as GSM modem devices for both sending and receiving SMS and MMS messages.

The task of monitoring can be done by using less trained individuals. The installation of the system can be done easily when it is near the target area. To ensure the portability of the device, a self-mode, small size Arduino microcontroller is used.

Results (Model's image):

Monitoring of PH, and Temperature of Water makes use of water recognition sensor with exclusive advantage. The sensors controls the proposed system that can display water quality robotically, and it is low in price, less difficulty monitoring system is proposed and does not require any external people for monitoring. The experimental system can be upgraded by including algorithms for irregularity discoveries in water quality.



The experimental setup for water quality monitoring system using Arduino Uno is shown in the Figure. Whenever the sensed parameter values exceed the threshold, message is sent to authorized person. The thresholds set for IR, pH, conductivity and temperature are 1V, 7, 3V and 40 degrees Celsius respectively. The Fig 3 shows the SMS containing alert message and parameter value. Based on the parameters sensed by different sensors, an alert message will be received by the authorized person and accordingly they take necessary action to prevent or control pollution level.

The capability of water quality monitoring system can be enhanced to obtain more efficient reliable results. The number of parameters to be sensed can be increased by the addition of multiple sensors to measure dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), ammonia nitrogen, nitrate, nitrite, phosphate. The system can be further upgraded using wireless sensor networks. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value. Work can be carried on to include controlling the supply of water.

Challenges faced:

- The sensors used in the project are quite expensive and were difficult to obtain for the project.
- The coding involved are difficult to comprehend for beginners in this field.
- Time management and balance between academics and the innovation project is crucial for the implementation of the project.
- In the initial stage of the process, teamwork and communication reduced the chances of an effective and successful project.

Conclusion:

Real time system for water quality measurement based on GSM is presented in this report. The system is incredibly versatile and economical. It is a system that measures numerous parameters pertaining to the water and send them to the monitoring center. The system can monitor water automatically and it is low in cost and doesn't need individuals on duty. It is flexible because simply by replacing the sensors and making changes in the computer code, the system can be used to measure some other parameters of water, that is, it can be easily manipulated according to the user's requirement. The system is reliable and easy to maintain. One can save time and cost can also be reduced by utilizing the proposed water quality monitoring system effectively.