Real-Time Water Quality Monitoring System

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***Abstract*—Nowadays water is the is the most valuable for all the human beings drinking water utilities faces challenges in real-time operation. These challenges occurred because of growing population, limited water resources, ageing infrastructure etc. Hence there is a need of better methodologies for monitoring the water quality.**
To reduce the water relateddiseases and prevent water populationWorld health Organization (WHO) has also stated thiscrisis as "the largest mass poisoning of a population in history".The main goal of this paperto build a Sensor- based Water Quality Monitoring System.

Keywords—pH, Temperature and Turbidity sensors, arduino board.

I. INTRODUCTION

Water is the primary need of all living beings and living without water is impossible. With the advancement of technology and industrialization, environmental pollutions have become a major concern. Water pollution is one of the most serious types of this environmental pollution. Our lives depend on the quality of water that we consume in different ways, from juices which are produced by the industries. Any imbalance in the quality of water would severely affect the humans' health and at the same time it would affect the ecological balance among all species. Water quality refers to the chemical, biological, radiological, and biological parameters of the water
.The essential parameters of the water quality vary based on the application of water. For example, for aquariums, it is necessary to maintain the temperature, pH level, dissolved oxygen level, turbidity, and the level of the water in a certain normal range in order to ensure the safety of the fish inside the aquarium. For the industrial and household applications, however, some parameters of the water are more essential tobe monitored frequently than the others, depending on the usage of the water.

II. MOTIVATION BEHIND THE PROJECT WORK

The traditional method for monitoring of the water quality is such that the water sample is taken and sent to the laboratory to be tested manually by analytical methods. Although by this method the chemical, physical, and biological agents of the water can be analyzed, it has several drawbacks. Firstly, it is time consuming and labor intensive. Secondly, the cost for this technique is very high due to the operation cost, labor cost and equipment cost, and it is difficult to make critical decisions in the real time.
What we need to find out in the water quality that require faster in results so that can be make possible utilization in real world application weather changes may change quality of water so we need to concentrate at a faster rate.
to overcome the drawbacks of the conventional water quality monitoring methods, sensors can be used. Sensor is an ideal detecting device which can convert non-power information to electrical signals which can easily be processed, transformed,

controlled, displayed, and transferred. Compared to the conventional water quality testing techniques, sensor based water quality testing has many advantages such as accurate, high sensitivity, good selectivity, speed, fast response, low cost etc.

III. LITERATURE REVIEW

J.Navarajan et al.[1]: This research paper focuses on Detection on water pollution and water management using smart sensors iotTo ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed.This system consists some sensors. Which measure the water quality parameter 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. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality

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NatasaMarkovic et al. [2]: this research paper focuses on Sensor Web for River Water Pollution Monitoring and Alert SystemSensor Web has provided infrastructure for collecting and processing data from distributed and heterogeneous sensors. This set of technologies has found various implementations, especially in the area of environmental monitoring. The Sensor Web architecture for crisis management, described in this paper, provides active monitoring of measuring parameters and timely responses in cases of environmental disasters. The River Water Management and Alert System built on this architecture enable access, control and management of river water pollution.

K. A. UnnikrishnaMenon et al,[3]: This research paper focuses on Wireless Sensor Network for River Water Quality Monitoring in India This paper introduces a river water quality monitoring system based on wireless sensor network which helps in continuous and remote monitoring of the water quality data in India. The wireless sensor node in the system is designed for monitoring the pH of water, which is one of the main parameters that affect the quality of water. Wireless sensor Network which aids in River Water Quality Monitoring. This paper also proposes a novel technique for the design of a water quality sensor node which can be used for monitoring the pH of water.

B. Aswinkumar et al.[4]: This research paper focuses on Detection on water pollution and water management using smart sensors iotTo ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed.This system consists some sensors. Which measure the water quality parameter 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. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time. Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time

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III. METHODOLOGY

A. EXISTING METHODS:

Existing system has a mechanisms which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. There is need to have human intervention in taking various reading of the water parameters.

The instruments or tools are used either by putting/inserting a water sensing part into water and seeing the result on small display device or by directly inserting a portable device in water and watching the output on the display. Central Water Commission (CWC) monitors water quality, by collecting samples from representative locations within the processing and distribution system.

These samples are analyzed at the well-equipped laboratories. At these laboratories, samples of raw water, filter water and treated water are taken for analysis, these analysis can be performed by human intervention which for specific period only. The disadvantage of this system is, water is not monitoring seamlessly, and it always needs a human intervention.

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B. PROPOSED METHOD:

In our proposed method, an assembled Arduino microcontroller is used as the core controller of the system. Once the code is uploaded to the microcontroller, no PC system, keyboard command, monitor is required to operate the system.

The system functions automatically and independently according to the code uploaded to the microcontroller. In this system, three sensors are used to measure the essential water parameters. As it was studied from the previous researches, the most essential water parameters needed to be monitored by the average users are water pH level, water turbidity (cloudiness) and water temperature which is a measurement of the amount of the water in a container.

Therefore, four essential water parameters which are temperature, pH level and turbidity can be measured by this proposed system. Sensors' circuits are connected to the microcontroller and the probes of the turbidity, pH, and temperature sensors placed inside the water.

A water proof temperature sensor is used to avoid any damage or electrical shock to the system and the user. An ultrasonic sensor is used to measure the level of the water in the

container. The ultrasonic sensor is connected in the system such that it will be placed on the top of the water container.
The ultrasonic sensor sends electromagnetic waves to the water surface and receives the wave back after touched the water surface. From the time taken to send and receive the wave by the ultrasonic sensor and the velocity of the electromagnetic waves, the distance which shows the water level in the container is calculated by the microcontroller.
All sensors read the water quality parameters and send the data to the microcontroller in the form of electrical signals.
The microcontroller is programmed such that is will analyze the result and compare it with the standard ranges which are predetermined in the code. If any water parameter crossed the standard limit, the alarm system will turn on.
In case of any abnormality in a water parameter detected by the microcontroller, the buzzer will buzz to indicate that the water is not proper for use. To show the sensor readings (The water parameters) on the device itself, an LCD (Liquid Crystal Display) screen is used. The LCD screen is connected to the microcontroller, and through the wired connection, it receives the sensor readings from the microcontroller and displays them accordingly.

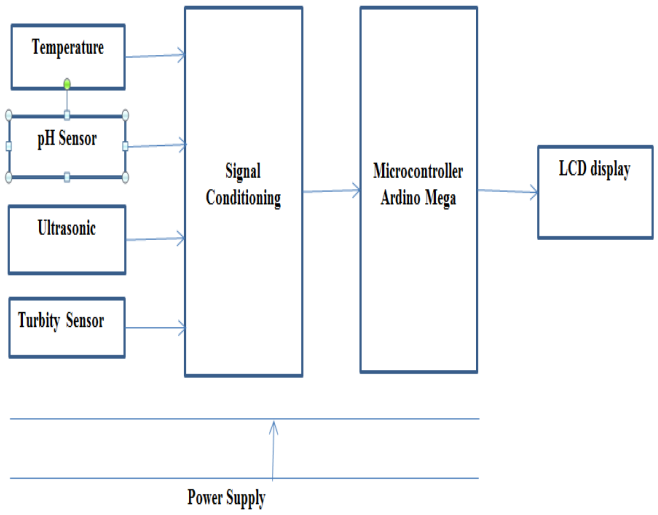

Fig 1: Block Diagram

IV. IMPLEMENTATION

- *Arduino MegaBoard.*

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Or more simply, you load on some code and it can read sensors, perform actions based on inputs from buttons, control motors, and accept shields to further expand it's capabilities. Really, you can do almost anything.
All Arduino boards have one thing in common: they are programmed through the Arduino IDE. This is the software that allows you to write and upload code. Beyond that, there can be a lot of differences. The number of inputs and outputs (how many sensors, LEDs, and buttons you can use on a single board), speed, operating voltage, and form factor are just a few of the variables. Some boards are designed to be embedded and have no programming interface (hardware) which you would need to buy separately. Some can run directly from a 3.7V battery, others need at least 5V. Check the chart on the next page to find the right Arduino for your project.

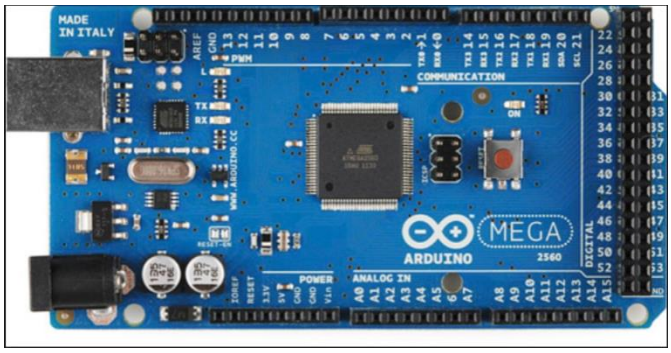

Fig 2 :Ardino mega board

- liquid-crystal display (LCD):

It is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.[1] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock.

- *The Temperature and PH sensor.*

To measure the temperature of a water tank and log it via the Arduino. The idea is to maintain the temperature of the water at 25-30C at all times. I've noticed that most applications have used a sensor such as DS18S20 or TMP35/TMP36/TMP37. but since my application requires to measure the temperature in water, I think a more suitable sensor should have a waterproof probe (or external probe).
The usual way is to contain the water inside a tank / container which can transmit heat - usually metal. To the outside of this is then bonded the temperature sensor - be that a simple bi-metallic strip thermostat, or a more complex temperature sensing transducer. Of course, this requires a metal tank, and that will radiate heat, which will be wasteful. Ideally you would want some form of waterproof probe. You haven't mentioned the amount of water you're dealing with - how big is the tank? How deep especially.There are thermocouples available in a rigid probe form - quite how waterproof these are I'm not sure, but these are never very long, so you won't be able to get it more than 6 inches or so into the water before you risk complete submersion.

- *The Turbidity Sensor*

Turbidity is an indicator often used to find the amount of suspended sediment in water. By cumbersome mechanical

sampling, it is possible to measure the concentration of suspended solids (in mg/ l) in water, but turbidity is increasingly used instead, as it is easy to use and cheaper too. It is an ecologically important parameter as the various effects of suspended solids in aquatic ecosystems are due to their light scattering properties rather than their absolute mass.

Figures and Tables

Water Samples	Readings		
	pH	Turbidity	Temperature
Water Sample 1	6.5	3.54NTU	18-20 C
Water Sample 2	4.4	3.9NTU	18-20 C
Water Sample 3	7.3	2.5 NTU	18-20 C

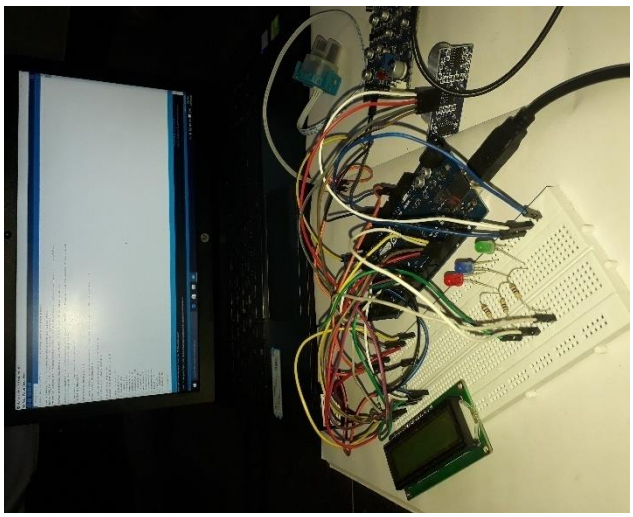

Fig 3: OVER ALL PROJECT SETUP.

V. RESULTS OF THE PROPOSED DESIGN

The system was tested under different conditions and with different qualities of water. The output of the system was successful and in accordance with the research objectives.

As mentioned, the sensor readings are obtained on an LCD screen on the device prototype itself.

If there is any abnormal conditions are found in water buzzer will get alarm sound and lcd monitor will display water ph temperature, turbidity water level in tanks.

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VI. CONCLUSION AND FUTURE SCOPE

In this work, the design and demonstration of a prototype remote, automatic, portable, real time, and low cost water quality monitoring system is described. In this system, low cost components i.e. microcontroller, LCD screen and other components are used to achieve the objectives of the proposed design with acceptable accuracy.

Compared to the previous related works, the cost of the system prototype is considerably low. Toensure the portability of the device, a self-made, small size Arduino microcontroller is used. The developed system was tested under different conditions, with solution of water with different impurities, and in different periods of time.

The results of the test for all times have been successful. We conclude that all the objectives of the proposed system have been achieved. To test more parameters of the water quality for some applications, other sensors can be included in the system. The system has wide application and it is usable and affordable by all categories of users.

VII. REFERENCES

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