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Water Quality Monitoring System

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Abstract: **Water is one of the most essential resources for sustaining life, playing a vital role in human health, heavy metals, pesticides, micro plastics, and pathogens further degrade water quality, posing severe risks to human health and biodiversity. This project is based on (IoT)-based on water quality monitoring system. This system is implemented using ESP32 as the microcontroller & several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, ORP, TDS (total dissolved solid) of the water can be measured. The results of the project show that the water sources in this study satisfy the parameters of good water quality, The purpose of this research is to develop an effective IoT system for monitoring the quality of water in real time using physiochemical sensors.**

Keywords: **ADS1115, ESP32, ORP sensor, PH sensor, Temperature sensor, Turbidity sensor, Water sample.**

I. INTRODUCTION

Clean water is a world resource that is a gift of nature and important to farming, manufacturing, and the life of human beings on earth. Safely managed drinking water services are significantly less accessible in rural areas. The proposed water quality monitoring system is consisting of a microcontroller and basic sensors pure water has 7pH value, less than 7pH has acidic, more than 7pH has alkaline. The range of pH is 0-14 PH. For drinking purpose, it should be 6.5-8. 5pH.Turbidity Sensor: Measures the cloudiness or haziness (suspended particles) in water. 0–1 NTU: Ideal drinking water <5 NTU: Acceptable for general use. >50 NTU: Poor quality, high contamination temperature sensors: Measures water temperature using sensors like thermistors, RTDs, or thermocouples. 0°C to 35°C: Normal range for natural water bodies 25°C: Standard reference temperature >35°C: Can stress aquatic life ORP Sensor: Measures the ability of water to either release or gain electrons during chemical reactions. Electrode compares the potential of a solution vs a reference electrode. +300 to +500 mV: Clean, oxygen-rich water 0 to +300 mV: Low oxidizing, may indicate organic pollution <0 mV: Reducing environment, possible anaerobic or contaminated condition. High ORP = better disinfection Keeping track of water quality is a major challenge because large amounts of chemicals used in day-to-day activities and in industry ultimately make their way into water.

II. LITERATURE SURVEY

- IOT-based water quality monitoring by Wen-Tsai Sung, Fathria Nurul Fdillah, and Sung-Jung Hsiao (2021). Method used sensors with cloud storage to monitor building water.
- Smart water quality monitoring with the implementation of IoT by Megat hadif bin Mohamad, S.M.B. Abdul Rahman and Ahsana Aqilah Ahmad. Method used ESP32 reads pH, TDS, turbidity, temperature and sends data to Blynk app. In this project with help of mobile app integration we can easy monitoring anywhere. And it gives real- time alerts on phone.
- Water Quality monitoring using Embedded controller ESP32 by K. Lakshmi, K.P. Bhavya, K. Balaji, G.N. Sandhya Devi. Method used: Sensors connected to ESP32 and data will be displayed on web. It is low cost and easy to implement. It is good for home/hostel because of ESP2 with Wi-Fi.
- IOT- Based Water quality monitoring system in Philippine off – grid communities by abrajano et al. Method used pH, turbidity, temperature sensors with cloud and SMS alerts.
- Campus outdoor Air and water monitoring with LoRa WAN by Miao et al. (2022). Method used for this project they used multiple nodes placed around campus. And then data set wirelessly to central dashboard is used.

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III. METHODOLOGY

Water sample Sensors ADS1115 ESP32 Calibration and processing Parameter values display LCD +Alerts (LED /Buzzer) Water sample is collected and analysed using different sensors such as PH, TDS, turbidity, temperature and ORP. These sensors detect the respective parameter values and generate analog signals. The ADS1115 ADC module converts this analogy signal into digital form, which are then sent to the ESP32 microcontroller. The ES32 process the received data, applies calibration for accuracy, and display the parameters. Values on an OLED/LCD screen. If any value crosses the safe thresholds a buzzer is activated to alert the user.

Below sensors used in system:

Temperature sensor: temperature sensor is used to measure the temperature of water in this study. The output voltage can easily be converted to a temperature reading in degrees Celsius. This sensor can measure temperatures from −55 to 150 °C,

TDS Sensor: TDS indicates the total amount of minerals, salts, and metals dissolved in water. The TDS sensor used in this study has two separate electrodes that are inserted into the water to measure the electrical charge (EC), and the result is converted into concentration in ppm. This is possible because all dissolved solids have an EC that can flow between the electrodes. In the case of pure water containing no soluble materials, the sensor will not conduct EC and it will show a reading of 0 ppm.

pH Sensor: pH sensor is used in this study to determine the hydrogen ion concentration in water to determine its alkalinity or acidity, i.e., pH value. The pH value for a liquid is between 0 to 14

Turbidity Sensor: Turbidity sensor used in the proposed system works by sending a light beam into the water, and the amount of light reflected is used to determine the particle density in the water. The more light that is reflected, the more particles are present in the water.

IV. WORKING PRINCIPLE

The system works on the principle of sensor-based data acquisition and microcontroller processing. Each sensor produces an analog signal according to the water quality parameter it measures. These signals are converted into digital data by the ADS1115 module and processed by the ESP32 microcontroller. The ESP32 compares the reading with predefined safe or unsafe. The processed data is shown on display, and unsafe tigger the buzzer alert.

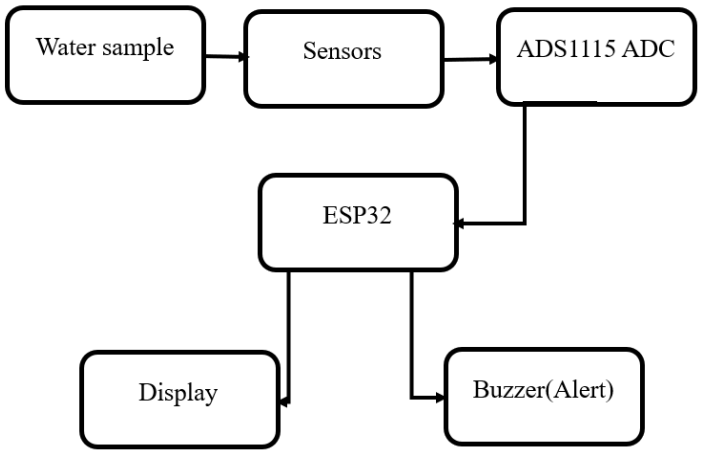

Figure 1

V. FUTURE SCOPE

This system is very much helpful for human health considering unhygienic drinking water specially at ruler area this system will gives us idea about water quality, in future we can use this system at large scale in public place, common drinking water system, school collages, offices for understanding water quality and will take necessary action accordingly.

VI. CONCLUSION

Outcomes of this project are a functional IOT- based system capable of real time measurement of pH, TDS, turbidity, temperature, and ORP. The system will display the measured values on an OLED/LCD screen and provide buzzer alerts whenever unsafe water quality is detected. This prototype will demonstrate an effective low cost and portable method for monitoring drinking. water safety and other water applications.

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