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Literature Review on Turbidity Sensor and Arduino for Water Quality Measurement

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ABSTRACT

Turbidity is a concept that is significant when discussing liquids since it is crucial to understanding liquid dynamics and is used to assess the cleanliness of the water. How clear or hazy a liquid is depends on the amount or degree of turbidity in it. This occurs due to the air being compressed, which is full of numerous tiny invisible particles that resemble white smoke. The light waves scatter when they travel through liquids, since these small particles are present a liquid's turbidity is directly inversely correlated with the number of free suspended particles, meaning that as the number of particles raises, so will the turbidity. So let's talk about what turbidity is and how to use an Arduino to test the turbidity of a liquid in this lesson. It is possible to connect a pH metre to an Arduino board and read the pH-value of the water to further assess the water purity. The evaluation of the degree to which suspended particles in water reduce transparency. The TSS (Total Suspended Solids) could be estimated using a measurement of turbidity. To determine the condition of the water, the Arduino turbidity sensor monitors turbidity. TSS concentration has an impact on light transmittance and scattering rates, which can be employed to find out whether there are any suspended particles in water.

Keywords: Arduino, Turbidity module, LCD.

1. INTRODUCTION

Water is a basic necessity that cannot be replaced and is utilized for a number of things, including drinking, making it essential for human survival. With these, depending on its quality, Infections and human mortality may come from water, which can either be a source of life and good health. Drinking water utilities in metropolitan areas and in order to safeguard water sources from contamination, there are additional obstacles in the way of water supply to consumer end taps, whether intentional or unintentional. Additionally, according to the global population of 3.4 million, according to the World Health Organization (WHO) pass away from water-related diseases each year, the majority of whom are children. As a result, the distribution system needs a method for checking the water quality. An indicator of how foggy the water is called as turbidity. Water with low turbidity typically has great clarity, whereas water with high turbidity typically has low clarity. Fine particles like silt, sludge, and organic matter can reduce water clarity, therefore the Arduino with turbidity sensor detects the turbidity level to determine the quality of the water. By keeping an eye on them, you can use the light transmittance and scattering rate, which vary with the concentration of TSS in the water, to find suspended particles in the water. The turbidity sensor measures the water as a result, and the findings of the measurement—water clarity, cloudiness, and dirtiness—are presented on the LCD panel.

2. LITERATURE SURVEY

Four physicochemical characteristics of water, including pH, temperature, turbidity, and electrical conductivity, can be evaluated by an Arduino-based monitoring system [1] to check for possible water pollution. The system just has the sensor-node and the sink-node. The sensor-node handles data collecting, pre-processing, wireless data transmission, data storage, data presentation on an LCD and in a ThingSpeak channel, as well as notices through SMS. While the sink-node handles sensor node data receipt, data presentation on an LCD screens and every time it is determined that the water is unsafe to drink, alert mechanisms using a buzzer are activated. A sensor device operated by a microprocessor [2] may monitor a variety of parameters, comprising the electrical conductivity of the water sample, pH, turbidity, and temperature. Getting rid of as many disparities as possible for each metric is the key goal, provides a more efficient data collection method and lowers the proportion of error, low-cost alternative device that integrates four water parameters into a single unit. The outcomes indicate the following for each parameter, the maximum percentage of errors: pH level: 2.106%, conductivity: 3.723%, temperature: 0%, and turbidity: 3.964%. In conclusion, the prototype was

successful in creating a trustworthy water quality measuring tool that is accurate and precise for use in all water quality applications.Monitoring water quality is necessary and provide online data about it, the analysis is done. Several sensors, including PH-value and turbidity sensors, are coupled to a microcontroller from the Arduino family [3] determining the water's quality. The GSM module is associated with the Arduino, additionally, the Arduino software includes embedded C. Through a microcontroller and WiFi, a remote sensor organization will send data continuously. Data is sent to the web-page connected to the microcontroller through the internet using the WiFi module. The website displays all available data on water purity and analyses it using graphs, pie charts, and tables with values. Customers can access this information through a web page application and can access it from anywhere at any time when we transfer it to the cloud. The system that continuously checks the water quality [4] with the aid of numerous sensors in order to make the process more efficient and cost-effective. We measured the pH level, conductivity, temperature, and water turbidity utilizing pH, conductivity, and sensors technology. The data collected in the sensors could be used to determine whether there are contaminants in the water. The Arduino delivered the data gathered by the various sensors to the microcontroller, who subsequently passed it to the Android app through a Wi-Fi module. To ensure that there is clean water, the monitoring system for water quality continuously assesses the impurity content of water supplies. The Smart Water Quality Monitoring (SWQM) system [5], which is Internet of Things (IoT) based, aids in the continuous measuring of water condition based on temperature, pH, electric conductivity, and turbidity qualities. Four distinct sensors are connected to an Arduino uno in order to determine the water parameters. A desktop application based on the.NET framework receives the extracted sensor data and compares it to WHO benchmark values. The suggested SWQM system can accurately assess the water properties using a rapid forest binary classifier to decide whether the test water sample is fit for human consumption or not based on the observed data.By identifying metal content and turbidity, a semi-real time system created with an Arduino [6] on the IoT is being developed as a clean water quality monitoring system. Water turbidity is being monitored by a turbidity sensor. As a metal level detector, system electrode. The Thingspeak web service will receive real-time data delivery with an average delay of 12.5secs and the WiFi ESP 8266-01 module's ability to connect to a WiFi hotspot network at a distance of up to 22 metres. Water Quality Monitoring System powered by IoT automation [7]. The various sensors are employed to keep track of the various aspects of water. A GSM module is incorporated for remote data monitoring, and Arduino is utilized throughout the system to connect the sensors. Solar energy powers the entire system. The tool can be used to check the water quality. It has the ability to continuously monitor various bodies of the water. We are demonstrating the conception and production of a cost-effective technology for continuous water monitoring. The device may also measure additional physical and chemical properties of the water. The apparatus is made up of the following modules: temperature, pH sensor, turbidity sensor, and TDS sensor. Every sensor is linked to Arduino. To transfer the signal to the GSM module, Arduino transforms it into a format that is usable by the system. The GSM Module will use an IOT platform to transfer sensed data to smart devices and the cloud. The outcome is accessible on a daily, weekly, or monthly basis. Wireless Sensor Networks (WSN) technology [8] is used in a solar PV-based system for precise water quality monitoring. A pH sensor (SKU: SEN0169), a turbidity sensor (SKU: SEN0189), and a temperature sensor (SKU: DS18B20) are the three sensors that the system hardware employs. For communication and monitoring purposes, these sensors are linked to Arduino, GSM, and LCD via liquid crystal displays (LCD). These sensors gather the necessary data (temperature, turbidity, and pH) and send it to Arduino, where it is shown on the LCD. In order to monitor the situation, measured data are sent via GSM. The system's power source is a solar panel, and a lead-acid battery gives it autonomy. Due to the lack of a grid, this enables system application in remote places. the development of a affordable system for IOT monitoring water quality in real-time [9]. In order to measure the physical and chemical properties of the water, a system made up of multiple sensors is used. The water's parameters, such as its temperature, PH, turbidity, and flow sensor, can all be measured. The core controller has the ability to process the measured values from the sensors. The Arduino model can function as a core controller. Using a WI-FI setup, the sensor data may finally be accessed online. The IoT [10] is being used for the creation and expansion of an affordable, real-time water eminence computer system. Calculating the water's characteristics, such as its temperature, pH, and turbidity. Over time, different devices are used in the centrally organized system to gather the monitored criteria. The sensor output data is transmitted to the relevant authority via the WiFi infrastructure in order to move the water quality along with further steps. The Water quality monitoring using an Arduino-based sensor system [11]. A straightforward prototype with a microcontroller and several attached sensors was used to run weekly on-site tests at various daily intervals. The system was discovered to function consistently, however it is dependent on human intervention and prone to data inconsistencies. However, the system offers a strong basis for future development projects falling under the same category, elevating the system to the degree of IoT. The IoT-based technology for

monitoring water quality [12] aims to determine the water's quality—specifically, how its pH content varies—and to communicate that information to the appropriate authorities. At the municipal water tanks and the drinking water reservoir. In order to do it, a GSM module and an Arduino board are both being used. For constant monitoring of the water parameters, we use a led display. Finally, the user receives a notice about the water's pH level. By sending sensor data to the cloud for worldwide water quality monitoring, we expand on this idea. IoT-based [13] water quality monitoring contributes to the improvement of all living creatures' health and living conditions while assisting in the fight against environmental problems. By utilizing IoT devices like NodeMCU, the system continuously analyses on water adequacy. NodeMCU's built-in Wi-Fi module is attached, enabling internet connectivity and transferring sensor data measurements to the Cloud. The prototype was created with the intention of counting the number of pollutants present in the water. The quality of water from aquatic bodies is evaluated using a variety of factors that are measured by a number of sensors. Deep learning techniques are applied to the results, which are saved in the cloud, to determine whether the water is acceptable. In the system used to monitor water quality, new technologies like IoT-based, machine learning, and cloud computing are utilized [14], which can replace the current method of quality control. This serves to protect residents of rural areas from a number of harmful conditions. Extremely high pH levels in swimming pool water can seriously affect users' eyes and skin. Since these activities must be carried out manually, the Seberang Jaya Public Swimming Pool's current method for measuring the pH of the water is ineffective for checking the water quality. The Smart Water Quality Monitoring System (SWQMS) [15] was designed and the statistical methods DOE and ANOVA were used to evaluate the variables affecting pH value and swimming pool temperature. The experiment's findings indicate that despite time of day having an impact on pool water temperature, pool volume, the pH value is unaffected by time of day or interactions between them. The crab farming water quality monitoring system [16] uses IoT-based technology to warn a farmer to maintain acceptable levels of water quality in the pond. This results in a better output of soft shell crab and a higher rate of crab survival. Our proposed system uses a wireless sensor network powered by LoRa and the lightweight Message Queuing Telemetry Transport (MQTT) protocol to send messages between tiny embedded devices, mobile devices, and sensors. In the system, sensor nodes act as publishers, whereas mobile client devices and Raspberry Pi MQTT brokers act as subscribers. The sensor nodes are constructed using compact embedded electronics, a LoRa wireless interface, and water quality sensors comprising pH, salinity, and temperature sensors. To enable anyone to view the water quality values remotely, we also built up a web-based monitoring tool with a node-red dashboard. IoT-based system [17] that can effectively send data on the level of pollutant and water quality as well as detect environmental conditions. A soil probe that detects metal, chemical, and hydrocarbon levels in the soil can be used to monitor soil contamination. Sensors for detecting pH, conductivity, dissolved oxygen, turbidity, and other parameters can also be used to assess the water quality of the rivers, ponds, etc. in the area of interest. An IoT-based system's design, development, and implementation will help the authorities take the essential steps to manage waste effectively in the impacted area. Bluetooth technology and the MCU (Micro-programmed Control Unit) [18]. The ATMega328P chip-based Arduino development board serves as the central component of this design, makes use of sensors to gauge pH-value, turbidity, conductivity, and water temperature. Through Bluetooth, the measured data is transmitted to the smartphone, where any problematic values are prompted. The test findings demonstrate that the system can accurately and quickly acquire data on water quality parameters, and that its general operation is steady, making it appropriate for numerous applications involving water quality monitoring.

SI No.	Devices Used	Space	Result/ Accuracy
[1]	Arduino, sensor node, pH, Turbidity, physico chemical parameters, sink node, Temperature, ThingSpeak, Electrical conductivity.	Testing on the drinking water	97%
[2]	Temperature sensor, conductivity sensor, turbidity sensor, analogue pH metre sensor, Arduino, LCD display.	Testing on the water samples in the glass.	98.09%
[3]	GSM and cloud storage, a microcontroller, a PH sensor, a turbidity sensor, and a wifi module.	Examination of the water samples.	99%
[4]	PH-Sensor, Turbidity Sensor, Conductivity Sensor, Arduino Uno Board, Wi-Fi Module.	Analyzing the water samples.	more accurate resulting.
[5]	Fast forest binary classifier, arduino-uno, pH, electric conductivity, and turbidity.	Testing using the water sample from the glass.	accurately resulting.

[6]	Smart phone, MCU Arduino, Bluetooth module, pH sensor, turbidity sensor, conductivity sensor, and temperature sensor.	Testing on the water sample.	Stable results.
[7]	ATMega8535 microcontroller, Turbidity Sensor, Arduino, TDS Sensor.	Testing on Drinking Water, Well Water and Citarum River Water.	97.9%.
[8]	Arduino UNO, LCD Display, GSM Module, Smart Phone, pH Sensor, Temperature Sensor, Turbidity and conductivity sensors are used.	Testing on the water samples.	accurately resulting.
[9]	Smart Phone, GSM module, A LCD, a Buck converter, a rechargeable valve-regulated lead acid battery, pH, turbidity, and temperature sensors, as well as an Arduino UNO, complete the system.	Testing on the water samples.	accurately resulting.
[10]	Temperature, pH, turbidity, flow, and WI-FI modules are all included in the Ardurino model.	Analyzing the water sample.	accurately resulting.
[11]	Arduino, Wi-Fi module, pH, temperature, and turbidity sensors are some of the sensors used.	Examination of the water sample.	accurately resulting.
[12]	Arduino, turbidity sensor, temperature sensor, pH sensor, total dissolved solids sensor.	Testing using a sample of stream water.	accurately resulting.
[13]	Arduino, GSM Module, pH sensor, LCD.	Testing on the bottle water sample.	accurately resulting.
[14]	Node MCU ESP8266, Wi-Fi Module, Soil moisture sensor, CO2, pH, Dissolved oxygen, and CO2 sensor.	Testing on the water sample.	More accurately resulting.
[15]	Wi-Fi module, Arduino, pH, temperature, and turbidity sensors.	Testing on water sample.	Stable resulting.
[16]	NodeMCU, pH Sensor, Temperature Sensor, SWQMS System, Mobile phone and personal computer.	Testing on Swimming pool water.	accurately resulting.
[17]	Embedded devices, a Raspberry Pi MQTT broker, and a LoRa wireless interface are used to monitor the quality of the water, including temperature, pH, and salinity sensors.	Testing on Soft-Shell Crab Farming water.	accurately resulting.
[18]	pH, conductivity, dissolved oxygen, turbidity, soil monitoring sensor, solar panel, Zigbee, and Wi-Fi.	Testing on Fresh water Canal and Open Well.	accurately resulting.

3. CONCLUSION

Researchers can forecast natural processes in the environment, gain knowledge from them, and identify how humans affect an ecosystem by using the Water Quality Monitoring (WQM). In addition to helping with restoration projects, these measurement efforts can guarantee that environmental regulations are being met. The WQM, which makes use of IoT technologies, must be a practical and effective system for tracking drinking water quality.

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