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# Dissolved Oxygen Monitoring Device Using Optical Sensor Based on Arduino Uno

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## INTRODUCTION

- Dissolved oxygen (DO) is critical for maintaining healthy aquatic ecosystems, as fish and other organisms rely on it for survival.
- When DO levels drop, it signals pollution, contamination, or stress in water bodies, which can quickly become dangerous for aquatic life.
- Traditional DO meters are expensive, require regular maintenance, and often provide only manual or periodic readings.
- This project introduces a cost-effective dissolved oxygen monitoring system using optical sensing and IoT technology, offering continuous real-time measurements and easy visualization through a display and cloud dashboard.



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## LITERATURE REVIEW

SL	Paper Title	Key Outcome	Author and Year
1	DOxy: A Dissolved Oxygen Monitoring System	Developed a low-cost IoT-based DO meter using optical sensing and machine learning calibration for aquaculture.	Shaghaghi et al., 2024
2	LED Optical Sensor Prototype to Determine Dissolved Oxygen Saturation in Water	Showed that blue/infrared light absorption can effectively measure DO levels.	Miura et al., 2021
3	Ratiometric Optical Fiber Dissolved Oxygen Sensor	Used fluorescence quenching principle for accurate DO detection in water samples.	Zhao et al., 2022



## LITERATURE REVIEW

SL	Paper Title	Key Outcome	Author and Year
4	Phosphorescence-Based DO Detection by Core-Shell Nanoparticles	Demonstrated room-temperature phosphorescence for sensitive DO measurement.	Yu et al., 2017
5	Optical Oxygen Sensing with Artificial Intelligence	Applied AI models to improve accuracy of optical DO sensors.	Michelucci et al., 2019
6	A Design of DO Monitoring System Based on NB-IoT	Integrated IoT with DO sensors for remote pond monitoring in aquaculture	U.S. Environmental Protection Agency 2009

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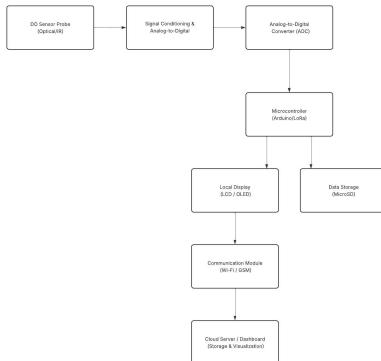
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# PROPOSED SYSTEM





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## PROPOSED SYSTEM

### Input Module:

- **DO Sensor Probe :** Detects the dissolved oxygen (DO) level of the water in mg/L (milligrams per liter).
- Sends analog signal to the microcontroller for processing.

### Processing Unit:

- **Arduino Uno Microcontroller:**
  - Reads dissolved oxygen sensor values
  - Applies calibration and compensation.
  - Controls output components and communication modules based on DO level.



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## PROPOSED SYSTEM

### Output Module:

- **LCD Display:** Shows real-time dissolved oxygen readings in mg/L.
- **Communication Module:** Transmits readings wirelessly.
- **LED:**
  - Green LED indicates sufficient oxygen level.
  - Red LED indicates turbid water.





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## SURVEY

Aspect	Traditional Methods	Proposed Arduino-Based System
Technology Used	Lab-based DO meters, chemical titration methods	Arduino Uno, dissolved oxygen sensor, LCD, LED
Detection Method	Manual water sampling and lab testing for DO levels	Real-time DO detection using electrochemical/optical sensor and voltage mapping
Features Ex-tracted	DO concentration (mg/L) measured with precise lab instruments	DO values with real-time visual (LED/LCD) and audible (buzzer) alerts
Cost and Accessibility	Expensive, requires lab infrastructure.	Low-cost, portable, easy to use in rural or field settings



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## WORKING

- The system uses an optical sensor (MAX30102 pulse oximeter) to measure dissolved oxygen (DO) in water..
- The sensor shines red/infrared light through water and measures how much light is absorbed or scattered, which changes with the DO level.
- Sensor readings are processed by a microcontroller (Arduino/LoRa Node) that converts light signals into DO concentration (mg/L) using machine learning and curve-fitting models
- If DO is within safe limits, the system records and transmits the data normally.
- If DO falls below the threshold, the system can trigger alerts or even control



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## WORKING

- Real-time DO values are shown on a web-based dashboard (graphs and charts), and data is stored for analysis.
- Communication is flexible: Wi-Fi, GSM, or LoRa depending on location, allowing remote monitoring.
- The system was tested with different water types and environments (tap water, lakes, aquaculture tanks, etc.) to verify accuracy.
- This setup provides a low-cost, automated, and user-friendly way to monitor water quality, especially in aquaculture.



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## APPLICATIONS

- **Drinking Water Testing:** Ensures safe oxygen levels in household and community water sources.
- **Agricultural Use:** Monitors irrigation water and livestock ponds for healthy growth and survival.
- **Aquaculture and Fish Farming:** Detects low oxygen levels early to prevent fish stress or death.
- **Wastewater Monitoring:** Helps check the quality of treated or discharged water.
- **Educational Projects:** Demonstrates IoT, sensors, and environmental monitoring in labs and classrooms.



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## CHALLENGES

- **Sensor Accuracy:** Readings can be affected by temperature, air bubbles, or unstable water flow.
- **Fixed Threshold Limitation:** A single DO threshold may not be suitable for all aquatic species or water types.
- **Environmental Interference:** Ambient light or bubbles in water can affect measurements
- **Limited Parameter Detection:** Focuses only on dissolved oxygen, not on other key parameters like pH, turbidity, or TDS.



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## ADVANTAGES

- **Low Cost:** Made with cheap and easily available parts.
- **Real-Time Results:** Shows dissolved oxygen level instantly.
- **Easy to Build:** Easy to set up with Arduino/LoRa-based design; can be expanded for large water bodies.
- **Clear Alerts:** Threshold-based notifications can warn users of low oxygen levels.
- **Portable:** Can be used in rural or remote areas easily.



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## FUTURE SCOPE

- **Multiple Sensors:** Integrate pH, turbidity, TDS, and temperature sensors for complete water quality analysis.
- **Wireless Monitoring:** Enhance with Wi-Fi, Bluetooth, or LoRa to send data directly to mobile apps or cloud platforms.
- **Automatic Water Treatment:** Link with aerators, pumps, or oxygen valves to automatically restore safe DO levels
- **Solar Powered Unit:** Improve portability and sustainability by running the device fully on solar energy



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## CONCLUSION

- A simple and low-cost dissolved oxygen (DO) monitoring system was developed using an optical sensor and Arduino-based setup..
- The system provides real-time DO readings and clear alerts, with data accessible locally or remotely through a web dashboard.
- It is suitable for water quality monitoring in households, agriculture, aquaculture, environmental studies, and education..
- With reliable accuracy and portability, the system is effective and practical for use in rural, remote, and industrial applications.





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# Thank You