Course Code & Title	:	CSE216L (Microprocessor, Interfacing, and Assembly Language Lab)
Course Instructor	:	Noor-E-Sadman
Assignment No	:	01
Assignment Title	:	Complete the literature review on the given topics.
Corresponding CO's	:	CO1

OBJECTIVES

1. **Find similar journals according to the assigned topic.**
    a. Break down your topics into various parts and find related publications (i.e., method, area of research, sensors, topology, algorithm, process, etc.).
    b. Review 20-25 recently published Journal Articles. (5 articles per person)
    c. Use Google Scholar to find out recent Journal Articles with maximum citations.
    d. Write down the summary of each paper. i.e., Methodology, equations, component used, findings, novelty, analysis, the problem faced, future work, etc., and complete the following tasks.
2. **Define summaries with literature.**
3. **Identify methodology and design requirements.**
4. **Analyse the design parameters with equations.**
5. **Find out experimentations and hardware components.**
6. **Investigate the system performance.**
7. **Detect findings and novelty of the system.**
8. **Identify the problem faced during the project development.**
9. **Indicates the future work.**
10. **Identify the research gap.**

LAB REPORT RUBRICS

Students Name	Farhan Tamzid Nahidul Islam Peyal Md. Jahidul Hossain Mekat Marufuz Jaman Shoron			**Students ID**	2120104 2220038 2221395 2221498
Course Title	Microprocessor, Interfacing, and Assembly Language Lab			**Code**	CSE216L
Term	◉ Spring	○ Summer	○ Autumn	**Year**	2023
Project Title	**IoT based Wireless Water Quality Monitoring System with Web App and Database Integration.**				
Task / Report Title	**Complete the literature review on the given topics.**				

Task Justification/ Marking (Tick on the appropriate box)

Rubrics (weight)	**Accomplished (5)**	**Intermediate (4)**	**Developing (3)**	**Intermediate (2)**	**Novice (1)**
Find similar journals (10%)	Identified five similar journals with the topics.	Intermediate between developing & accomplished	Identified three similar journals with the topics.	Intermediate between novice and developing.	Identified one similar journal with the topics.
	◉	○	○	○	○
Define Summaries with Literature (10%)	Demonstrated sound and precise knowledge of literature in the topic area.	Intermediate between developing & accomplished	Demonstrated good and precise knowledge of literature in the topic area.	Intermediate between novice and developing.	Demonstrated poor knowledge of literature in the topic area.
	◉	○	○	○	○
Identify Methodology and Design Requirements (10%)	Identified the methodology properly with the design requirements and specific software used.	Intermediate between developing & accomplished	Identified the methodology to some extent with the design requirements and specific software used.	Intermediate between novice and developing.	Identified the methodology poorly with the design requirements and specific software used.
	◉	○	○	○	○
Design Analysis with Equations (10%)	Demonstrated sound analysis of the system with proper equations	Intermediate between developing & accomplished	Demonstrated good analysis of the system with proper equations for seeking a solution.	Intermediate between novice and developing.	Demonstrated poor analysis of the system with approximate

	for seeking a solution.				equations for seeking a solution.
	◉	○	○	○	○
Experimentations and Hardware Components (10%)	Exhibited proper experimentation and hardware component requirements to develop the system.	Intermediate between developing & accomplished	Exhibited good experimentation and hardware component requirements to develop the system.	Intermediate between novice and developing.	Poorly exhibited the experimentation and hardware component requirements to develop the system.
	◉	○	○	○	○
Investigate the system performance (10%)	Analyzed and interpreted the results properly using the designed parameters.	Intermediate between developing and accomplished.	The results are analyzed to some extent according to the defined problem.	Intermediate between novice and developing.	The results are poorly analyzed and interpreted.
	◉	○	○	○	○
Findings and Novelty of the system (10%)	Concluded the results clearly and presented the system novelty.	Intermediate between developing & accomplished	Concluded the results to some extent and presented the system novelty.	Intermediate between novice and developing.	Concluded the results poorly and presented the system novelty.
	◉	○	○	○	○
Identify the Problem Faced (10%)	Identified properly the issues that occurred to develop the solution.	Intermediate between developing & accomplished	Identified the issues that occurred to develop the solution.	Intermediate between novice and developing.	Identified poorly the issues that occurred to develop the solution.
	◉	○	○	○	○
Indicates the Future Work (10%)	Implied the future work clearly.	Intermediate between developing & accomplished	Implied future work.	Intermediate between novice and developing.	Implied the future works poorly.
	◉	○	○	○	○
Identify the Research Gap (10%)	Identified the research gap of all journals properly.	Intermediate between developing & accomplished	Identified the research gap of most of the journals properly.	Intermediate between novice and developing.	Identified the research gap of some journals properly.
	◉	○	○	○	○
Sub Total					
Literature Review Total (100%)					

Faculty Name and Signature:

Literature Review

Paper Title: Water quality monitoring in smart city: A pilot project [1]

Paper Link: https://www.sciencedirect.com/science/article/abs/pii/S0926580517305988

Summary: In this study, a thorough water quality monitoring system that is a component of the smart city infrastructure in Bristol Floating Harbour is discussed. Real-time monitoring of parameters including as conductivity, pH, temperature, dissolved oxygen, and turbidity is achieved by the system through the use of cloud computing, Internet of Things (IoT), and wireless sensor networks. Sensor nodes, a network layer that uses the Bristol Is Open network to connect to the cloud, a cloud layer that uses servers and software, and an application layer with a web portal for real-time data display comprise the software architecture.

Research Gap: While the study highlights the potential of the proposed system, several research gaps remain. The paper lacks in-depth exploration of data security measures, potential scalability challenges, and the environmental impact of sensor deployment. Additionally, the reliability and accuracy of the wireless sensor nodes in diverse environmental conditions and the system's adaptability to future technological advancements require further investigation.

Paper Title: A Low-Cost Multi-Parameter Water Quality Monitoring System [2]

Paper Link: https://www.mdpi.com/1424-8220/21/11/3775

Summary: The study offers an affordable water quality monitoring system that measures temperature, pH, BPA, and free chlorine using electrochemical sensors and a smartphone app. The technology offers trustworthy, real-time data for tracking the environment. The software design consists of a Bluetooth module for wireless connectivity, an Android app for the smartphone, and a potentiostat sensor readout circuit. The circuit transmits data to the app for real-time display and user notifications by measuring the current and voltage signals from sensors. Temperature, pH, free chlorine, and BPA content are among the data parameters that are detected using various sensor techniques.

Research Gap: Even with the system's promise, there are still some unanswered questions. The research is deficient in providing comprehensive insights on the scalability of the system, especially with regard to a wider variety of water quality indices. To evaluate the system's performance in different environmental circumstances and investigate possible cross-sensitivities or interferences across electrochemical sensors, more research is required. Furthermore, the document skips over important details that are necessary for the system's long-term stability and upkeep and practical application.

Paper Title: Internet-based applications for interrogating 50 years of data from the South African national water quality monitoring network [3]

Paper Link: https://www.tandfonline.com/doi/full/10.1080/02626667.2019.1645334

Summary: In order to analyze and visualize data from South Africa's extensive national water quality monitoring network—which has been in place since the 1970s—two web-based tools are presented in this research. Researchers and managers can access historical data, analyze trends, compare water quality metrics and sites, and distinguish spatial and temporal patterns with the use of these tools. The national water quality database serves as the data source for the software architecture, which also includes an interactive online application that visualizes data using HTML, CSS, JavaScript, jQuery, and Google Maps API, and a Linux-based web server with PHP scripts connecting to the database. Dissolved oxygen, pH, temperature, turbidity, conductivity, total dissolved solids, chloride, sulphate, nitrate, phosphate, ammonia, and orthophosphate are among the twelve common water quality characteristics that are the subject of the study. Nonetheless, the report discusses its shortcomings and obstacles and makes recommendations for further advancements.

Research Gap: The study identifies shortcomings and suggests improvements, but it doesn't go into enough detail on the instruments' scalability, potential biases in historical data, or the effects of developing water quality monitoring technologies. To improve the usability and usefulness of the web-based solutions, more research into user input, usability testing, and possible interaction with developing data visualization approaches should be done.

Paper Title: Water Quality Monitoring with Arduino Based Sensors [4]

Link: https://www.mdpi.com/2076-3298/8/1/6

Summary: The paper introduces an Arduino-based water quality monitoring system prototype, targeting pH, temperature, turbidity, and total dissolved solids. Emphasizing affordability, reliability, and real-time capabilities, the system underwent a four-week test at a Brunei lake, comparing results with a commercial water quality meter. The modular software architecture comprises a sensor node, sink node, and data analysis component. Zigbee wireless communication transmits sensor data to the sink node, displaying it on an LCD screen, with MATLAB used for data analysis. Data parameters include pH, temperature, turbidity, and total dissolved solids, crucial for assessing water quality. Challenges and limitations are discussed, prompting future work for system improvement.

Research Gap: Research gaps include the need for a more comprehensive and varied testing environment to evaluate the system's adaptability to varied settings, even though the report tackles issues and recommends future enhancements. A thorough examination of potential interferences or calibration issues related to long-term deployment is absent from the paper. The Arduino-based sensor system might be more useful if its scalability was further investigated, especially for larger bodies of water or dynamic environmental circumstances.

Paper Title: State of the Art Techniques for Water Quality Monitoring Systems for Fish Ponds Using IoT and Underwater Sensors: A Review [5]

Link: https://www.mdpi.com/1424-8220/22/6/2088

Summary: The study offers in-depth analyses of water quality monitoring systems (WQSN) that were created by researchers between 2011 and 2020 and use IoT and underwater sensors. In light of pollution, contamination, and climate change, the paper emphasizes the vital need of clean water. It criticizes current monitoring techniques and promotes wireless sensor networks (WSN) built on the Internet of Things (IoT). These WQSNs keep an eye on variables like electrical conductivity, turbidity, pH, temperature, and dissolved oxygen on a constant basis. By analyzing the gathered data, machine learning algorithms provide early warnings for problems with water quality. In order to ensure reliability, the article offers a three-layer architecture (Sensing, Processing, and Cloud Layers) employing tools including Firebase, MATLAB, Java, Arduino, Python, and Google Maps API.pH, dissolved oxygen, temperature, turbidity, ammonia, nitrite, nitrate, and phosphate are among the parameters measured for water quality.

Research Gap: Although the paper outlines achievements, there are still areas that require further investigation, such as the need for a more thorough analysis of machine learning algorithms' dependability in various water settings and their flexibility in response to shifting circumstances. More research should be done on the scalability and potential difficulties of putting such systems into place in other geographical areas or climates. The study might also explore the practicalities and cost-effectiveness of widely implementing and maintaining these cutting-edge water quality monitoring devices.

Paper Title: Low-Cost Internet-of-Things Water-Quality Monitoring System for Rural Areas. [6]

Link: https://www.mdpi.com/1424-8220/23/8/3919

Summary: In introducing a low-cost Internet of Things system for monitoring rural water quality, the paper highlights the significance of this important environmental and human health factor. The system uses a web-based design, concentrating on temperature, pH, and turbidity. It also provides an affordable prototype for early contamination alarms. Water Quality Analysis (WQI, contamination localization) and Water Quality Measurement (pH, dissolved oxygen, etc.) are two examples of data kinds. Modular and object-oriented programming are used in the architecture, which includes web servers, mobile apps, and Internet of Things devices.

Research Gap: A more thorough investigation of the system's adaptability to various climatic conditions and potential difficulties during long-term deployment in rural locations are among the research needs. More research is needed to determine scalability and feasibility in areas with poor infrastructure. Understanding how resilient the system is to outside influences like severe weather or vandalism would improve the system's overall efficacy.

Paper Title: Real-time remote monitoring of water quality: a review of current applications, and advancements in sensor, telemetry, and computing technologies. [7]

Paper Link: https://www.sciencedirect.com/science/article/abs/pii/S0022098104001066

Summary: The report emphasizes how industrial demands and population increase affecting inland and coastal areas necessitate comprehensive water monitoring. The temporal and geographical restrictions of traditional field measurements make it difficult to address problems like oyster bed contamination and algal blooms. Early detection of water quality indicators is aided by in situ detectors, which provide continuous data collecting both locally and remotely. Technological developments improve the efficiency, reliability, and accessibility of data collecting, enabling real-time decision-making for cleanup and preservation projects.

Research Gap: There is a gap in the paper's description of the software architecture, which makes it difficult to comprehend the technical foundation of the Water Quality Monitoring (WQM) system. To clarify the system's scalability, adaptation to various surroundings, and potential difficulties during continuous monitoring, more research is required. The paper's completeness would be improved by insights on the incorporation of emerging technologies and their impact on data accuracy. A more thorough discussion would also benefit from discussing the implications of data accessibility and security problems in the context of continuous monitoring systems.

Paper Title: Application of digital PCR for public health-related water quality monitoring [8]

Paper Link: https://www.sciencedirect.com/science/article/pii/S0048969722027590

Summary: The work of Ananda Tiwari emphasizes how important digital PCR (DPCR) technology is for monitoring water quality because it has a higher sensitivity for detecting diseases that are carried by water. This tackles issues related to public health, particularly in discovering newly developing toxins that traditional approaches might overlook. The deduced software architecture makes use of a structured database, DPCR devices, and user-friendly software, all of which are implemented robustly through the use of a variety of tools and programming techniques. This study assesses the accuracy, precision, and sensitivity of DPCR as a reliable method for assessing water quality.

Research Gap: Though informative, research gaps include the need for more investigation into the optimization of the DPCR approach in various environmental circumstances. Subsequent research ought to improve sample processing techniques, evaluate cost-benefit, and investigate scalability. The difficulties and factors to be taken into account when incorporating DPCR into current frameworks for monitoring water quality are not covered in the paper. Understanding how DPCR software interacts with other systems would improve its usefulness in larger monitoring networks.

Paper Title: ssessment of urban river water quality using modified NSF water quality index model at Siliguri city, West Bengal, India [9]

Paper Link: https://www.sciencedirect.com/science/article/pii/S2665972722000344

Summary: In light of the growing urbanization, the research tackles the growing problem of urban river water quality and proposes a modified NSF Water Quality Index (WQI) model. The study, which focuses on Siliguri, India, emphasizes how important it is to comprehend water quality in rapidly urbanizing places in order to guide plans for urban growth and pollution control. The Ganga River system water quality assessment software architecture uses principal component analysis, statistical methods, and the modified NSFWQI model for data collecting, analysis, and visualization. Although specific software tools are not described in detail, the design guarantees thorough assessment of the water quality. pH, dissolved oxygen, total suspended particles, total dissolved solids, nitrate, phosphate, and coliform bacteria are among the important factors that are evaluated.

Research Gap: Explicit information about software tools and design ideas in software architecture is missing from the study. Subsequent research ought to offer valuable perspectives on particular software elements and design decisions. Furthermore, additional research could examine the effects of particular industrial pollutants in urbanized areas while assessing important factors. Understanding the suggested model's scalability and real-time monitoring capabilities will improve its applicability in dynamic urban settings.

Paper Title: Real-time remote monitoring of water quality: a review of current applications, and advancements in sensor, telemetry, and computing technologies [10]

Paper Link: https://www.sciencedirect.com/science/article/abs/pii/S0022098104001066

Summary: The demands of industry and population growth call for efficient water monitoring. The constraints of traditional field measurements in addressing problems such as pollution in oyster beds and algal blooms are circumvented by in situ detectors that allow for continuous data collection. The pH, turbidity, tank water level, outside air temperature, and humidity are all measured by the Water Quality Monitoring (WQM) system. Timely decision-making is aided by real-time data, which makes it easier to identify patterns in water quality early on. The efficiency, consistency, and accessibility of data collection are improved by technological advancements.

Research Gap: There is a gap in the paper's description of the software architecture, which makes it difficult to comprehend the technical foundation of the Water Quality Monitoring (WQM) system. To clarify the system's scalability, adaptation to various surroundings, and potential difficulties during continuous monitoring, more research is required. A more thorough debate would also benefit from insights into the consequences of security issues and data accessibility in the context of continuous monitoring systems.

Paper Title: Heavy metal water pollution: A fresh look about hazards, novel and conventional remediation methods [11]

Paper Link: https://www.sciencedirect.com/science/article/abs/pii/S2352186421001528

Summary: This study focuses on heavy metal contamination in order to address the growing problem of water pollution in the twenty-first century as a result of industrialization, urbanization, and climate change. The sources, detection, removal, and control methods for water quality are covered in the study. Although the software architecture is not stated clearly, it implies the use of MySQL for data storage in the implementation of a data collection system for Water Quality and Removal Products. pH, temperature, naturally occurring organic matter, and heavy metals like lead, cadmium, mercury, nickel, zinc, chromium, copper, and arsenic are among the data parameters.

Research Gap: The software architecture is not explicitly described in the paper, which allows for more investigation into the functionality and design of the system. The user interface, data update procedures, and scalability of the suggested data collection system may all be the subject of future research. Furthermore, knowledge about how to incorporate cutting-edge technologies for analytics and real-time monitoring would improve how useful the suggested water quality control system is.

Paper Title: Smart water quality monitoring system with cost-effective using IoT [12]
Paper Link: https://www.sciencedirect.com/science/article/pii/S2405844020309403

Summary: Water quality is declining due to pollution, urbanization, and population growth, necessitating more sophisticated monitoring. The pH, turbidity, and ultrasonic data are analyzed by the proposed Water Quality Monitoring (WQM) system using DHT-11, microcontroller, and ESP8266 sensors. Real-time data collecting, processing, and visualization are made possible using ThingSpeak and Arduino Mega. The ThingSpeak app allows authorized users to access information, guaranteeing efficient management of water quality.

Research Gap: Although the study provides a thorough software architecture, there are still some unanswered questions about the system's long-term stability, flexibility, and scalability. Practical application necessitates security concerns for sensitive water quality data and insights into maintenance requirements. The resilience of the system would also be improved by a discussion of potential issues and solutions pertaining to user authentication and data integrity.

Paper Title: Underwater Internet of Things in Smart Ocean: System Architecture and Open Issues [13]

Paper Link:
https://www.researchgate.net/publication/336423635_Underwater_Internet_of_Things_in_Smart_Ocean_System_Architecture_and_Open_Issues

Summary: This study investigates the idea of a "smart ocean" by utilizing the Underwater Internet of Things (IoT). It highlights how crucial it is to comprehend the properties of the ocean and names the Underwater IoT as a potent technological advancement. The Underwater IoT is covered in this article together with its present developments, potential system designs, applications, difficulties, and open problems. Advances in intelligent sensors, communication technology, autonomous underwater vehicles, and routing protocols are recognized, with the goal of creating a network of self-learning underwater things. In addition to outlining a five-tier system architecture, the article discusses the importance of artificial intelligence, cloud computing, and fog computing in addressing problems and directing future research in the underwater Internet of things.

Research Gap: Although the study presents a thorough vision, there are still research gaps, such as the need for in-depth analyses of the actual implementation difficulties of the suggested underwater Internet of things system. Subsequent research endeavors may delve into distinct approaches for monitoring the environment, resources, and disasters, alongside with constraints and moral dilemmas related to interconnected undersea entities. The report might also go into more detail about how the suggested system can be scaled up or down to suit different maritime the environment.

Paper Title: A comprehensive review of water quality monitoring and assessment in Nigeria [14]

Paper Link: https://www.sciencedirect.com/science/article/abs/pii/S0045653520317641

Summary: Nigeria, home to 199 million people, is facing a serious water problem since 66.3 million of them do not have access to clean drinking water. This study examines the monitoring of water quality during the previous 20 years and reveals difficulties with enforcement brought on by socio-political corruption. Surface water quality is generally low, and groundwater is contaminated by sewage, oil exploration, landfill leachate, and base rock interactions, which result in toxins like lead and barium. Low pH in rainwater is a worry, and commercial water—especially bottled water—is thought to be the safest source of drinking water. Looking ahead, it is recommended to concentrate on newly discovered pollutants, micro-pollutants, and employ internet-connected devices to enhance the surveillance of water quality.

Research Gap: Although thorough, the study lacks particular insights about the socio-political obstacles preventing Nigeria from enforcing water quality standards. Subsequent investigations can focus on ways to mitigate the influence of corruption on the implementation of guidelines. Furthermore, a thorough investigation of the problems and efficacy of internet-enabled technology for monitoring water quality would improve useful knowledge. A more thorough understanding would take into account the long-term stability and maintenance needs of monitoring systems as well as the possible contribution of community involvement in resolving water quality issues.

Paper Title: Water Quality Monitoring with Arduino Based Sensors [15]

Paper Link: https://www.mdpi.com/2076-3298/8/1/6

Summary: This paper presents a pH, temperature, turbidity, and total dissolved solids (TDS) sensor-based water quality monitoring system based on Arduino. Although trustworthy, the prototype is not Internet of Things compatible and depends on human data collection. The sensors include OOTRTY TDS (0-9999 ppm, ±2% accuracy), ReYeBu turbidity (0-1000 NTU, ±5% accuracy), DS18B20 temperature (-55°C to 125°C, ±0.5°C accuracy), and RELAND SUN pH (0-14, ±0.1 accuracy). Weekly on-site testing revealed system efficiency but also human-dependent processes and possible errors when compared to results from standard lab procedures.

Research Gap: The lack of calibration for a variety of water sources, the lack of important indicators like conductivity and dissolved oxygen, and the requirement for an intuitive user interface, data visualization, power management, and data storage mechanisms are just a few of the holes that have been found in the system. These deficiencies could be filled in the future, improving the system's adaptability, precision, and user-friendliness.

Paper Title: GSM Based Water Quality Monitoring System Using Arduino [16]

Paper Link: https://www.researchgate.net/publication/332527278_GSM_Based_Water_Quality_Monitoring_System_Using_Arduino

Summary: This study presents an Arduino-based GSM-based water quality monitoring system that measures temperature, conductivity, pH, total dissolved solids, and conductivity using four sensors. Data transmission via SMS to a remote user is made possible via the GSM module. The system has been tested with many water sources and has shown to be affordable, dependable, and easy to use. For further usefulness, the authors recommend improvements incorporating more sensors and interaction with cloud services.

Research Gap: The lack of critical water quality parameters like turbidity, dissolved oxygen, and salinity, the system's non-IoT friendliness, the need for manual intervention to retrieve data, the lack of calibration for a variety of water types that could lead to errors, and the requirement for a graphical user interface, data analysis capabilities, a power source, and data storage mechanism are among the gaps that have been identified. Closing these gaps could improve the system's accuracy, adaptability, and user-friendliness.

Paper Title: A Low-Cost Multi-Parameter Water Quality Monitoring System [17]

Paper Link: https://www.mdpi.com/1424-8220/21/11/3775

Summary: This study presents a low-cost multi-parameter water quality monitoring system that measures temperature, pH, free chlorine, and bisphenol A (BPA) using four sensors and a microprocessor. Utilizing a wirelessly connected smartphone app, the system is tested on several water sources and has shown to be dependable, affordable, and easy to use. Future improvements involving IoT integration and more sensors for increased usefulness are suggested by the authors.

Research Gap: Identified gaps include the system's non-IoT friendly nature, necessitating manual data collection and transmission, lack of calibration for diverse water sources leading to potential errors, absence of crucial water quality indicators like dissolved oxygen, conductivity, and salinity, and the need for a user-friendly interface, data visualization capabilities, power management, and a data storage mechanism. Addressing these gaps could enhance the system's versatility, accuracy, and overall usability.

Paper Title: IoT Based Real-time River Water Quality Monitoring System [18]

Paper Link: https://www.sciencedirect.com/science/article/pii/S1877050919309391

Summary: In this paper, a sensor-based Internet of Things (IoT) and Wireless Sensor Network (WSN) monitoring system for water quality is proposed. The system is made up of a microprocessor, a communication system, and a number of sensors that track temperature, conductivity, turbidity, pH, and dissolved oxygen. Deep learning neural network models, Spark MLlib, and Spark streaming enable real-time data access and analysis. High frequency, high mobility, and low power consumption are some of the system's distinctive properties, which work to prevent and increase awareness of water pollution in Bangladesh.

Research Gap: Research limitations are not specifically identified in the report. Potential weaknesses, however, can include the requirement for thorough analyses of the system's functionality, scalability, and adaptability to various water bodies. Additional research and development could improve the system's usefulness and user-friendliness in the areas of user interface design, data visualization, and interaction with power management and data storage systems.

Paper Title: Development of Water Quality Monitoring Device Using Arduino UNO [19]

Paper Link: https://iopscience.iop.org/article/10.1088/1757-899X/1144/1/012064/meta

Summary: This paper presents the creation of the Kolora meter, a low-cost water quality monitoring tool that makes use of Internet of Things (IoT) technology. For real-time monitoring, the device, which is based on the NodeMCU board and Arduino UNO model, has temperature and turbidity sensors. The Kolora meter has possible uses in early pollution detection and resolving constraints during the COVID-19 epidemic by enabling data viewing and monitoring via a mobile application. The effectiveness of water quality monitoring is increased by the incorporation of IoT technology, which makes it appropriate for large and remote monitoring regions.

Research Gap: Research shortcomings are not specifically mentioned in the study. However, thorough analyses of the device's functionality, dependability, and scalability can be worthwhile research topics. Prospects for enlarging the sensor array to include other factors related to water quality could improve its usefulness. Additionally, determining how well the Kolora meter adapts to different water sources, resolving any data transmission problems, and analyzing the system's long-term stability could all help to improve the gadget and make it more widely used. Further investigation and development may also be focused on the mobile application's accessibility and usability as well as potential integrations with other Internet of Things devices.

Paper Title: Water Quality Monitoring System with Parameter of pH, Temperature, Turbidity, and Salinity Based on Internet of Things [20]

Paper Link: http://trilogi.ac.id/journal/ks/index.php/JISA/article/view/965

Summary: The goal of this project is to create an aquarium water quality monitoring system that works well. The Arduino controller powers the system, which makes use of sensors to measure the salinity, turbidity, pH, and temperature of the water. The sensors detect water characteristics when they are turned on, and then an Ethernet shield sends the data to a cloud database so that a dashboard on a website may monitor the water in real time. Predetermined water quality requirements are part of the system, and if any of the metrics change, a buzzer will sound. Testing shows that the system can identify problems with the water quality in 5–10 seconds, guaranteeing that aquarium water continuously satisfies requirements.

Research Gap: While the paper successfully presents an aquarium water quality monitoring system, potential research gaps could involve exploring scalability and adaptability for larger aquarium setups. Considerations for sensor calibration over time and the impact of environmental factors on sensor accuracy could be addressed for a more robust system. Additionally, investigating the feasibility of incorporating more advanced sensors or expanding the range of monitored parameters might enhance the system's capabilities. Further research on the system's energy consumption, cost-effectiveness, and long-term reliability could contribute to its broader applicability and adoption in diverse aquarium environments.

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