AIR AND WATER QUALITY INDEX AND ENVIRONMENT MONITORING

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College ***:*** *S.J.C. Institute Of Technology, Chikkaballapura*
Branch ***:*** *Department of Information Science and Engineering*
Guide(s) ***:*** *Dr. Susheelamma K. H*
Student (S) *: Mr. Basavaraj S. Biradar*
Ms. Deekshitha Ram
Ms. Bhavana B.

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Introduction

Environmental contamination is a widespread problem that currently plagues our planet. It is caused by various human actions that release pollutants commonly referred to as Man-made Contamination. Pollution is defined as the introduction of harmful substances into the environment which can have adverse effects on humans and other living organisms. The most prevalent forms of pollution particularly in industrial and densely populated areas are Water and Air contamination. Sadly, in India both the general public and the government are often unaware of the deteriorating quality of their surrounding water and air. This lack of awareness can lead to health issues exacerbated by the limited resources available for monitoring through Air Quality Monitoring Stations (AQMS) and water quality measurements conducted by Badan Lingkungan Hidup (BLH). However, with the utilization of modern technology such as the Internet of Things it is possible to address these problems. The Internet of Things is a novel concept that enables electronic devices and sensors to communicate through an internet connection with the aim of simplifying human life. Through the development of a Water and Air Quality Monitoring System real-time monitoring of air and water quality in the surrounding environment can be achieved. Accessible through a website or mobile application this system can help the community and government take preventive measures to combat pollution and its detrimental effects. This monitoring system comprises multiple sensor nodes that provide data on various parameters used to determine

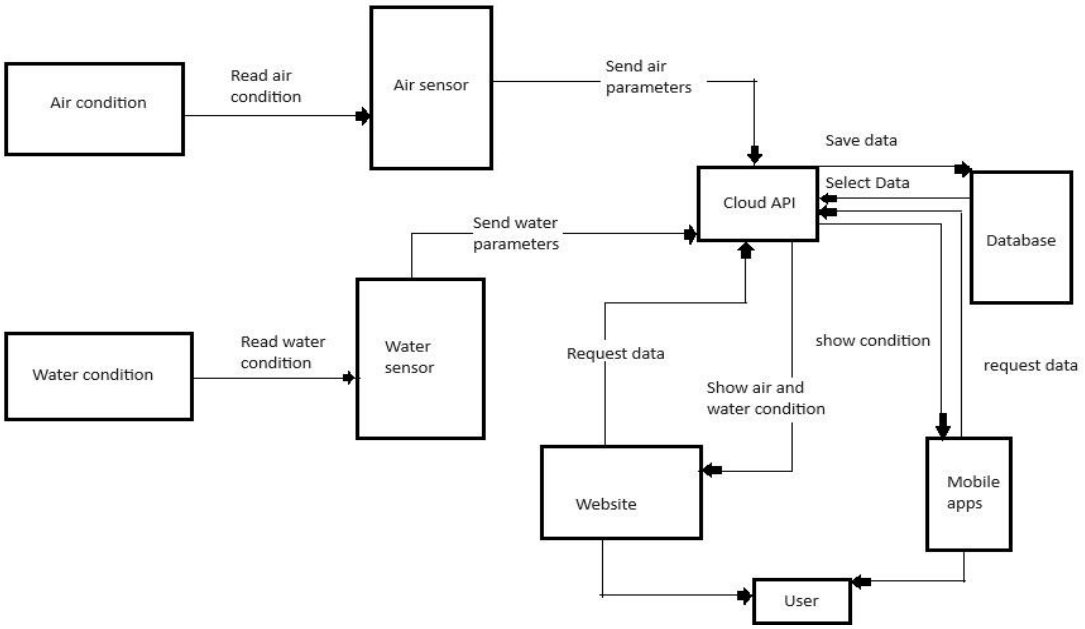
water and air quality according to relevant standards in India. The classification of air quality is based on the Index Standard Pencemar Udara (ISPU) which is a numerical value that describes the ambient air quality in a specific location and its impact on human health aesthetic value and other living organisms. Our research focuses on three primary pollutants to determine the ISPU value: Carbon Monoxide (CO) Nitrogen Dioxide (NO2) and Dust Particles (PM10). The classification of water quality in our study specifically looks into the suitability of drinking water and the necessity for Sanitary Hygiene. Drinking water is defined as processed water that meets health requirements and can be consumed directly. Meanwhile Water for Sanitary Hygiene Purposes refers to water used in daily activities that may differ in quality from drinking water. The parameters utilized to assess water quality include PH temperature turbidity and Total Dissolved Solids (TDS). To measure these parameters water quality sensor nodes are equipped with a Turbidity Sensor DS18B20 Sensor for temperature PH Sensor for acidity and TDS Sensor for dissolved solids. Additionally, air quality sensor nodes consist of a DHT11 Sensor for humidity and temperature MQ-7 Sensor for Carbon Monoxide levels MQ-135 Sensor for Nitrogen Dioxide levels and GP2Y1010AU0F Sensor for dust particles (PM10). Furthermore, this tool is equipped with an Arduino Uno microcontroller and a NEO-6M GPS sensor to determine the location of the sensor nodes. The data collected from the sensor nodes along with their location will be transmitted to the server through an internet connection accessed via ESP8266. This data will then be analyzed and presented in a comprehensible format through the website or mobile application**.**

Main Objectives of The Project

1. Build an IoT-based Water & Air Quality Monitoring System.
2. Deploy sensor nodes to gather real-time environmental data.
3. Analyse collected data to assess air quality using ISPU standards.
4. Analyse collected data to assess water quality for drinking and hygiene.
5. Utilize sensors for key air quality parameters (CO, NO2, PM10).
6. Utilize sensors for key water quality parameters (pH, temperature, turbidity, TDS).
7. Integrate GPS for location-specific data collection.
8. Transmit data securely through an internet connection.

9. Present data in a user-friendly format on a website or mobile app.
10. Empower communities and government to address pollution concerns.

METHODOLOGY



The described functioning of the system involves connecting internet-enabled devices to areas designated for monitoring water and air quality. Once the tools are stable the data collected from the sensors will be transmitted to a server for processing and storage in a database. The processed data is then sorted according to ISPU standards Water Quality Standards (Sanitation) and Drinking Water Quality Requirements. This information can be viewed in real-time on a 16X2 LCD display and a mobile application. The Air and Water Quality Monitoring System utilizes two distinct modules specifically the water module and the air module. Each module is equipped with its own set of components allowing for mobility and the ability to measure water and air quality in varying locations.

- **Water Module**

The water system is comprised of multiple sensor units tasked with gathering field data on the factors that determine the quality of both water and air in accordance with established standards in Indonesia. These sensors include a Turbidity Sensor for measuring turbidity levels a DS18B20 sensor to monitor water temperature a DHT 11 sensor to measure air temperature a PH sensor for assessing acidity levels and a TDS (Total Dissolved Solid) sensor for tracking dissolved solids. All of these

sensors are linked to an Arduino Uno microcontroller and an ESP-8266 serves as the means for connecting to the API and transmitting the data over the internet, this sensors connection and module.

- **Air Module**

The air unit consists of various components including a DHT11 Sensor for assessing humidity and temperature an MQ-7 Sensor for detecting Carbon Monoxide levels an MQ-135 Sensor for measuring Nitrogen Dioxide (NO2) levels and a GP2Y1010AU0F Dust Sensor for identifying particles (PM10). Apart from the sensor nodes each module is furnished with an Arduino Uno

microcontroller and a NEO-6M GPS sensor for marking the location. All data gathered by the sensor nodes along with their corresponding locations will be transmitted to the server through internet connectivity facilitated by ESP-8266. This sensors connection and module.

Results And Conclusion

The creation of the Water and Atmosphere Quality Tracking Solution based on the Internet of Things (IoT) marks a substantial stride towards resolving issues of ecological contamination in Indonesia. The merging of cutting-edge detectors for water and air quality parameters coupled with instantaneous data collection and automated classification algorithms establishes a strong framework for uninterrupted monitoring. The incorporation of a Geographic Information System (GIS) enhances spatial interpretation allowing for strategic interventions in areas of concern. The platform's mobile interface offers easy-to-use and accessible channels for stakeholders to remain updated on environmental conditions. By leveraging IoT technology the system guarantees efficient data transmission and centralized storage facilitating prompt responses to instances of pollution. Moreover, the alerting system adds to the system's efficacy by promptly notifying relevant authorities and users in the event of any water or air quality violation.

Description Of the Innovation in The Project

- **Enhanced Decision-Making:** Real-time and accurate data enable policymakers to make informed decisions regarding environmental

regulations and emergency responses.

- **Public Health Protection:** Continuous monitoring helps identify pollution hotspots, allowing for timely interventions to protect public health.
- I**ncreased Awareness and Engagement**: Accessible data raises public awareness about environmental issues and encourages community involvement in conservation efforts.

Sustainable Development: Better environmental monitoring supports sustainable development goals by ensuring that economic activities do not compromise environmental health.

Future Work Scope

This project lays the groundwork for a comprehensive real-time Water & Air Quality Monitoring System utilizing the power of the Internet of Things (IoT). Future advancements can expand upon this foundation to create an even more robust and informative system. One potential area of focus is the integration of additional sensors to capture a wider range of environmental data. This could include sensors for monitoring noise pollution, volatile organic compounds (VOCs), and even biological contaminants in water. Furthermore, the system's data analysis capabilities could be enhanced by incorporating machine learning algorithms to identify trends, predict pollution spikes, and even automate alerts for critical situations. The user interface of the website and mobile app could also be developed further to provide users with advanced data visualization tools and personalized health recommendations based on their location's air quality. Additionally, the system's scalability could be improved to allow for the creation of a network of interconnected sensor nodes, enabling real-time monitoring across entire cities or regions. Finally, partnerships with environmental agencies and local governments could be established to leverage the system's data for policy development and pollution mitigation initiatives. By pursuing these advancements, this project has the potential to become a powerful tool for environmental protection and public health awareness