ABSTARCT

This paper addresses the critical need for effective water level management in dams using Internet of Things (IoT) technology. Dams play a pivotal role in water supply, flood control, and various other purposes, making it crucial to monitor and manage water levels. Traditional monitoring methods have limitations, and this paper proposes a novel approach to automate and centralize the operation of dams across the country. The system utilizes ultrasonic sensors, microcontrollers, and IoT technologies to monitor real-time water levels and securely transmit data to a central command center. This central control facilitates quick decision-making for opening or closing dam gates, automating the process, and ensuring efficient water management. The integration of IoT, big data, cloud computing, and wireless sensor networks enhances the reliability and functionality of dam safety management. The paper highlights the potential applications and advantages of this system, including improved water distribution, reduced response time during natural disasters, and efficient flood control.

1. INTRODUCTION

Dams serve as crucial reservoirs for water resources, supplying water for various purposes like agriculture, industrial use, and domestic consumption. In a country like India, where water scarcity and proper management of resources are pressing concerns, the safety and effective utilization of water from dams are paramount. This necessitates the implementation of advanced technologies such as the Internet of Things (IoT) for water level monitoring and management.

By leveraging IoT, real-time data on water levels can be collected and shared with a centralized command center, ensuring efficient decision-making regarding the operation of dam gates. The integration of IoT with cloud computing, big data, and wireless sensor networks enhances the overall functionality and reliability of dam operations.

The proposed system also emphasizes the automation of dam control, eliminating the potential for human error and ensuring equitable water distribution among various regions. Moreover, the system is designed to facilitate swift responses to natural disasters such as floods, thereby minimizing damage and improving overall safety.

By employing ultrasonic sensors, microcontrollers, and communication technologies such as LoRaWAN and Narrowband IoT (NB-IoT), the system enables real-time data transmission from remote dam sites to a central command center. This centralized approach streamlines decision-making and ensures the optimal use of water resources while minimizing wastage and enhancing overall water management efficiency.

2. LITERATURE SURVEY

S. No	Title	Methods Used	Strengths
1.	Water Level Monitoring and Management of Dams using IoT (2018)	IoT-based water level management, sensor integration, far-field communication	Centralized and automated dam operations, Real-time information sharing for better decision-making
2.	An IoT-based Dam Water Level Monitoring and Alerting System (2022)	IoT-based monitoring system, sensor networks, cloud storage	Better water management, Reduced water scarcity
3.	Dam Management and Disaster Monitoring System using IoT (2023)	IoT-based monitoring, real-time data collection, alert systems, mobile application	Efficient alert systems, Prompt actions to prevent disasters
4.	IoT Based Water Level Monitoring System for Dams (2021)	IoT-based monitoring system, far-field communication, cloud integration, decision-making algorithms	Efficient water resource management, Prevention of calamities
5.	Smart Water Level Monitoring System Using Internet of Things (IoT) (2023)	Water level monitoring, ultrasonic sensors, microcontrollers, mobile application, IoT	Effective water flow management, Remote monitoring and control

primarily focuses on the existing methods and technologies for water level monitoring and control in dams. It highlights various techniques such as the use of submersible pressure transducers for water level measurement, the role of artificial neural networks (ANNs) in river flow prediction, and the use of ultrasonic sensors and microcontrollers for water level monitoring. The paper also mentions the importance of implementing communication systems between the monitoring systems and computer models to assist in managing the complex systems of hydro power plants. It emphasizes the necessity of maintaining water levels for the efficient supply of water to the cities and the importance of monitoring and controlling water levels to prevent flooding and ensure the safety of the dams. Furthermore, it discusses the application of IoT and cloud computing in enhancing the functionality and reliability of dam operations.

3. RESEARCH METHODOLOGY

IMPLEMENTATION

A. Determining the Level of Water

In the first stage we plan on getting the data on the level of water using ultrasonic sensors. The ultrasonic sensors are interfaced with a micro controller which transfers the data to a local base station using far field/near field communication. [6] Components required: Ultrasonic sensors, Arduino.

B. Short Range Communication

In this stage we deal with transferring the data at shorter
distances i.e., at a local base station. The distance might range from few hundred meters to one or two kilometres. The short data transfer modules like Bluetooth or XBee are interfaced with the Arduino and used to transfer the data.

C. Long Range Communication

In this stage we work on transferring the data to long distances of order of several hundred kilometres. These helps us in gathering the data from all the nodes to a central base station which in turn reads the data and send the commands based on it. The technologies required to achieve this are yet to be finalized. Some types of communication which can be used for such purposes are LoRa , NB-IoT. • LoRaWAN is a Low Power Wide Area Network (LPWAN) intended to provide long range connectivity for wireless battery operated Things in a regional, national or global network. LoRaWAN meets the key requirements of Internet of Things such as secure bidirectional communication, mobility and localization services [8]. • Narrow Band IoT (NB-IoT) is a category of Low Power Wide Area Network (LPWAN) technology standard developed to enable a connection using cellular LTE bands between wide range of devices and services. NB-IoT is a narrowband radio technology designed specifically for the Internet of Things (IoT) applications. NB-IoT focuses primarily on indoor coverage, low cost, long battery life, and enabling a large number of connected devices

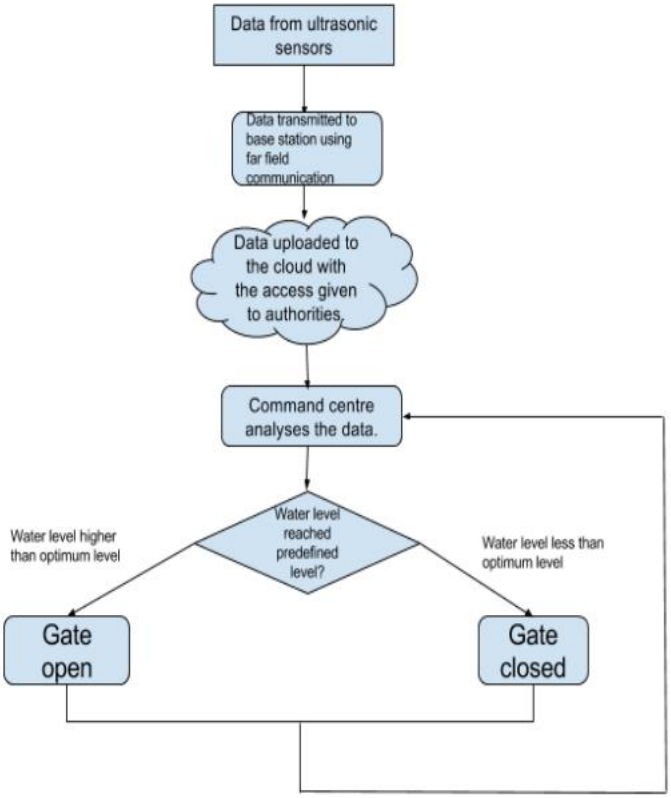

Figure 3. Flowchart of the implementation

4. PROPOSED SYSTEM

4.1. Advanced River Monitoring and Control Techniques

A project conducted along the River Nile led to the establishment of comprehensive national geo-referential databases, integrating crucial spatial layers and hydro-meteorological parameters alongside data on water usage, land cover, and soil types. Cutting-edge technologies such as automated weather stations and acoustic-based Doppler current profilers were introduced, facilitating efficient water flow measurement without the need for costly infrastructure like cableways. The deployment of Doppler current profilers on boats streamlined the data collection process, while two buoys were strategically placed on Lake Nasser in Egypt to validate satellite-based evaporation calculations. This data structure, devised collaboratively with water resource agencies, ensured seamless data exchange and facilitated the implementation of basin-wide assessment tools like the Nile DST.

In contrast, the South-East River Trust employed a traditional yet effective method known as a weir to control water levels in the River Teise. A weir, acting as a barrier across the river, effectively alters the flow characteristics, creating a pool of water behind it while allowing a steady flow over the top. Often utilized to prevent flooding and measure discharge, weirs serve as reliable tools for managing river flow and maintaining water levels, contributing to effective water resource management and flood prevention strategies.

4.2 Integrated Water Level Monitoring System with GSM Alert

In this system, an integrated monitoring setup comprising an ultrasonic sensor, PIC micro-controller, and GSM module was devised for accurate water level measurement. The ultrasonic sensor was utilized to gauge the distance between the sensor and the liquid surface. The innovation lay in the integration of the GSM module, enabling the system to send an alert to the responsible personnel through SMS when the water reached critical levels. Additionally, it automatically shut off the pump, thus preventing any potential overflow. This system facilitated convenient and timely monitoring of water levels, enhancing overall efficiency and safety

5. CONCLUSION

By emphasizing the need for real-time data collection and analysis, the paper underscores the importance of proactively identifying potential risks and implementing preventive measures.

The emphasis on the significance of reliability, including the incorporation of redundancy, fault tolerance, and robust data analysis, further strengthens the paper's argument for the importance of continuous and accurate data collection in preventing and mitigating potential disasters.

This technology is less expensive and secure to install in the dam, and this portal could provide knowledge about the impact for every dam

REFERENCES

[1] Y. Lu, B. Wu, N. Yan, H. Zeng, Y. Guo, W. Zhu, and H. Zhang, “Method for monitoring environmental flows with high spatial and temporal resolution satellite data,” Environmental monitoring and assessment, vol. 194, no. 1, pp. 1–24, 2022.

[2] J. Varghese, A. Thomas Jolly, A. Peter, B. P. Rajeev, K. S. Sajitha and D. E. George, "IoT based Disaster Monitoring and Management System for Dams (IDMMSD)," 2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT), 2019, pp. 1-5.

[3] Analyn Yumang N, Charmaine Paglinawan C, Arnold Paglinawan C, Glenn Avendano O, Jose Angelo Esteves C, et.al. (2017) Real-Time Flood Water Level Monitoring System with SMS Notification. IEEE.

[4] Daniel wu, fakhreddinekarray and Insop song,” Water level control by fuzzy logic and neural networks”, published in IEEE journal in july 2014.

[5] Ms. PranaliAnnasoBiroje, Ms. Priyanka Rajkumar Dongare, Ms. Karuna Dharmendra Kamble, Ms. Priya TatyasahebAjetrao, Mr. A. J. Chinchawade."Dam to Dam Communication to Prevent Flood using IOT", Volume 8, Issue III, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 393-399, ISSN: 2321-9653.

[6] Hamid Al-Hamadi, Ing-Ray Chen, “Trust based decision making for health IoT systems,” IEEE Internet of Things Journal, vol. 4(5), pp. 1408-1419, 2017.

[7] Darpan Anand, Munish Sabharwal, Pradeep Kumar Tiwari Omar Cheikhrouhou, and Tarek Frikha “A Disaster Management Framework Using Internet of Things-Based Interconnected Devices” Volume 2021 | Article ID 9916440 in 2021.

[8]. A. J. Varghese, A. Thomas Jolly, A. Peter, B. P. Rajeev, K. S. Sajitha and D. E. George, "IoT based Disaster Monitoring and Management System for Dams (IDMMSD)," 2021 1st International Conference on Innovations in Information and Communication Technology (ICIICT), 2021, pp. 1-5, doi: 10.1109/ICIICT1.2019.8741464.

[9] D. Selvaraj, T. P. Anish, "Outsourced Analysis of Encrypted Graphs in the Cloud with Privacy Protection," SSRG International Journal of Electrical and Electronics Engineering, vol. 10, no. 1, pp. 53-62, 2023.

[10] L. Srinivasan, D. Selvaraj, T. P. Anish, "IoT -Based Solution for Paraplegic Sufferer to Send Signals to Physician via Internet," SSRG International Journal of Electrical and Electronics Engineering, vol. 10, no. 1, pp. 41-52, 2023.