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IoT based Dam Gate Level Monitoring and Control

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ABSTRACT: Water level management in dams is critical for ensuring the safety of downstream areas, optimizing water storage, and preventing flood hazards. Traditional dam operations often rely on manual monitoring and gate control, which can lead to delayed responses during sudden water level rises. To address this issue, this project proposes an IoT-based Dam Gate Level Monitoring and Control System using the ESP32 microcontroller, which enables both automated and remote control of the dam gate based on real-time water level data. This project demonstrates a cost-effective, real-time, and intelligent dam gate control system that enhances the safety, efficiency, and responsiveness of water management infrastructure. It leverages IoT technologies, real-time sensor data, and automated mechanical control to create a modern solution to a long-standing civil engineering challenge.

KEYWORDS: IoT-based Dam Gate Control System, Real-time Water Level Monitoring, ESP32 Microcontroller, Automated Gate Operation, Flood Hazard Mitigation.

I. INTRODUCTION

Water is one of the most critical resources on the planet, and its management is of utmost importance. Dams are a significant source of water storage, but their management can be challenging, especially with the unpredictability of weather patterns and the increasing demand for water. Traditional dam water level monitoring and water quality management systems are often costly, inefficient, and time-consuming. With the advent of the Internet of Things (IoT), it is now possible to develop cost-effective and efficient systems for monitoring and managing dams. IoT-based systems provide real-time monitoring, remote access, and data analytics capabilities, which can significantly enhance water resource management. These systems use sensors, communication devices, and cloud computing to collect and analyse data, providing insights that can be used to make informed decisions regarding water management. In this project, we present an IoT-based dam water level monitoring and control system.

Here we have a system to indicate about the water level in the dam through Blynk App and to control the dam gate/shutter with Blynk App and sometimes automatically according to the level of the water. For sensing the water levels, one ultrasonic sensor and two water floats (sensors) are used to measure and indicate the water level as high, medium and low level that is connected to the microcontroller unit. And simultaneously the dam shutter gate will be opened automatically to allow the free flow of water when the water level reaches near high flood level sensor. This information about the level of water will be sent to the monitoring unit through IoT device with Wi-Fi module.

A shutter controller is also included in this system; a servo motor is connected to the shutter and the controller will control this shutter through the driving circuit. If the water level in the dam reaches a high level, shutter will be lifted by the controller to allow water to downstream side. If the water level is low, the shutter closed. The shutter moving mechanism is designed with servo motor and is interfaced with the micro controller. Depending upon the water level of the dam, indicators and notifications will be given accordingly.

II. LITERATURE SURVEY

1. **Budida Harikranth, Linganna Banothu (Feb 2023)** : Dams play a very important role to hold and conserve water for optimal usage based on seasonal needs. Water Management plays a very important role in mitigating the current issues of water distribution and utilization. As there are lot of hazards related with the existence of the dams, it has become a necessity to develop a proper monitoring system regarding the opening of the dam gate to retain a safe water level in dams. Exploring usage of IoT for improving the safe utilization of dams,

water flow and of dam gate corrosion. This paper intends to use microcontroller for monitoring and controlling the water distribution management by usage of various sensors, control valves, automatically & proactively manage outflow during crisis by using statistical data of the environment.

2. **Ms. Sadhana Waghmode & at el (Dec 2022)** : Proposed system is an automatic dam water level; soil moisture monitors and gate opening application using IOT. The idea is to describe possibilities of IOT applications in dam monitoring and safety. Here sensors are used to sense the water level, soil moisture and flood then the dam gates are open when water level reaches the full reservoir level (FRL). The sensors are used to measure different levels and to check the water level and provides alert accordingly to the authorized user. When water level reaches to the water sensor, it is sensed and a alert is given to the authorities using software application and when it reaches the second higher level an another alert is sent on application. When it exceeds maximum water level, a red alert is given to the sensors to provide a signal to the microcontroller, so the dam gates are open automatically.

III. METHODOLOGY

This project involves the integration of various sensors and actuators with the ESP32 microcontroller to achieve automated and remote-controlled dam gate operations. Initially, two float sensors are installed at predefined positions to detect low and medium water levels. An ultrasonic sensor is placed at the top of the dam to measure the distance between the water surface and the high flood level (HFL). These sensor inputs are continuously read by the ESP32, which processes the data and categorizes the current water level. When the water nears the HFL, the microcontroller triggers a buzzer to alert nearby personnel. Upon reaching the HFL threshold, the system automatically engages the servo motor to open the dam gate using a pinion and rack gear mechanism, allowing excess water to be discharged and thus preventing potential overflow or damage.

To enhance remote accessibility and control, the ESP32 is connected to the Blynk IoT platform via Wi-Fi. This platform provides a user-friendly mobile application that allows users to monitor water levels and control the dam gate manually when the water is below HFL. The app also sends real-time notifications to alert users when the water level reaches low, medium, or high flood conditions. The methodology ensures safety, efficiency, and flexibility by combining traditional water level detection methods with modern IoT technology. Through this approach, the system offers a proactive and automated solution for dam management while still allowing for manual intervention when necessary.

IV. 3D MODEL AND WORKING

After preparation IOT Microcontroller unit the application of the IOT based Dam Gate Level Monitoring and Control had done on the small 3D Printed Dam Gate and The 3D model of the dam gate monitoring and control system serves as a physical prototype that visually represents the structural and functional aspects of the actual dam setup. It includes a scaled-down representation of the dam structure, water reservoir, gate mechanism, and the sensor placements. The gate is connected to a servo motor which operates a pinion and rack gear mechanism to simulate the vertical lifting of the gate, just like in a real-world application. The float sensors are positioned at low and medium water levels within the reservoir section, while the ultrasonic sensor is mounted above to detect high flood level conditions. When water levels are simulated (using actual water or indicative levels), the sensors trigger the ESP32 microcontroller to process the inputs and carry out corresponding actions such as activating the buzzer or opening the gate. The Blynk IoT app is used in conjunction with the model to demonstrate manual gate control and receive real-time notifications, thereby showcasing both the automatic and remote functionality of the system. This 3D model helps in testing, validating, and visually explaining the concept and working of the project before actual field implementation.

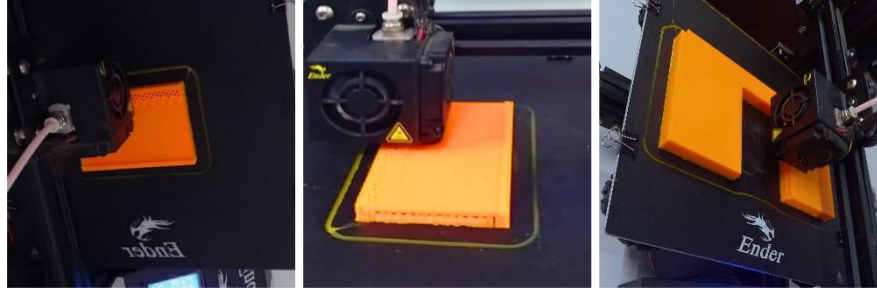


Fig. 3D Printing of Dam Gate and Dam.

V. CONCLUSION

This research presents the successful development and implementation of an IoT-based automated dam gate monitoring and control system using the ESP32 microcontroller. By integrating multiple sensor technologies float sensors for discrete level detection and an ultrasonic sensor for precise flood-level measurement, the system effectively monitors real-time water levels and executes responsive control actions. The incorporation of a servo motor-driven mechanical gate, coupled with a pinion and rack gear mechanism, enables reliable and accurate gate movement based on dynamic water conditions. Furthermore, the integration with the Blynk IoT platform offers remote monitoring, manual gate control (when safe), and instant notifications, thereby enhancing operational efficiency and safety.

The proposed system addresses critical challenges in traditional dam operations, such as delayed response and dependency on manual intervention, by offering a low-cost, scalable, and energy-efficient solution. Through automation and real-time data exchange, this smart infrastructure enhances flood preparedness and water resource management. The research demonstrates the potential for broader application in water control systems and contributes to the advancement of intelligent environmental monitoring technologies. Future work may include AI-based predictive analysis, energy harvesting for remote deployment, and real-world pilot implementations to further validate and refine the system.

REFERENCES

- [1] Pranita Vijay Kumar Kulkarni, M. S. Joshi, "IoT based water supply monitoring and controlling system," International Journal of Innovative Research in Science, Engineering and Technology".
- [2] Saranya. B, Sanju. S, Santhiya. L. P, Sandhiya. G, Palanivel. D, "Automatic Gate Control and Water Level Reservoir using GSM technology: "International Journal of Research in Electronics."
- [3] Anita, Rajesh Singh, Sushabhan Choudhury, Bhupendra Singh, "Wireless Disaster Monitoring and Management System for Dams: "International Conference on Intelligent Computing, Communication & Convergence (ICCC-2014)".
- [4] Sakthi Krishnan V, Sindhu R, Swetha A, Vivek Muthu Kumaran G, and Sri Ragavis, "Dam Gate Level Monitoring and Control Over IOT: "SSRG International Journal of Electrical and Electronics Engineering, ICRTECITA-2017, March 2017"
- [5] Sneha D. Kayte, Shweta Jamodkar, "Raspberry Pi Based Automatic Dam Monitoring and Alert System."
- [6] Patil. K. N., Kadam Tushar, Sawant Swaranjali, Amange Shreya, "IoT Based Water Level Monitoring System for Lake."



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