**Publication Name:** Structural Health Monitoring of Dams Based on Acoustic Monitoring, Deep Neural Networks, Fuzzy Logic and a CUSUM Control Algorithm (2022)

**i) What sensor is used?**

The sensor used for monitoring in the project is the geophone. Geophones are sensors that detect and measure sound waves transmitted through the dam body, either passively (environmental) or actively (using synthetic hammers or pulses)​(sensors-22-02482-v2).

**ii) What controller is used?**

The controller used in the system is Raspberry Shake, which integrates the sensor hardware with data collection and communication capabilities. It acts as a low-cost, high-fidelity seismic monitoring system​(sensors-22-02482-v2).

**iii) What will be the IDE?**

The IDE used for developing the machine learning and deep learning algorithms in this project is Keras with TensorFlow. These frameworks were used to implement and train the deep neural networks (autoencoders) and other algorithms​(sensors-22-02482-v2).

**iv) What cloud is used?**

The document does not explicitly mention the cloud service provider used. However, given the setup, cloud services would typically be employed for data storage, processing, and analysis. In similar scenarios, providers like AWS, Google Cloud, or Azure are common choices. If this information is essential, a more detailed search might be necessary.

**v) Prepare minimum 3-questions from the reference and discuss:**

How effective is the use of geophones in detecting early-stage internal erosion in dams?

Geophones are effective in detecting acoustic signals associated with internal erosion by capturing changes in the acoustic signature of the dam. Early-stage detection is possible due to the high sensitivity of the geophones, and when combined with deep learning techniques, anomalies can be detected well before significant damage occurs.

What role does the autoencoder play in the monitoring framework?

The autoencoder is used to model the "normal" behavior of the dam's acoustic signals. When anomalies occur, the reconstruction error of the autoencoder increases, allowing the system to detect deviations from normal behavior, which can indicate potential issues like internal erosion.

How does the combination of CUSUM and fuzzy logic contribute to the accuracy of the monitoring system?

The CUSUM algorithm helps in identifying change points in the time-series data of the reconstruction errors, while fuzzy logic smoothens the scenario classification by combining the alarms from multiple CUSUM results. This combination enhances the system's accuracy in predicting the dam's structural health status, reducing false alarms and improving the reliability of the monitoring process.