National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: IoT Based Leakage Monitoring and Detection System in Fly-Ash Slurry Pipelines
Speaker	: Shivbrat Ratha (Rollno : 621ec6001)
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Venue	: EC 303, EC Seminar Hall
Date and Time	: 11 Jul 2025 (3:30pm)
Abstract	: Leakage detection in pipelines is a critical concern in captive power plants, where undetected leaks can lead to material wastage, environmental hazards, and unexpected plant shutdowns. Traditional inspection methods are often manual, time-consuming, and incapable of providing timely alerts. This work presents an IoT-based intelligent leakage detection and monitoring system specifically designed for pipelines in captive power plants, focusing on fly ash slurry and similar industrial flows. The proposed system integrates multiple electromagnetic flow sensors positioned at strategic locations along the pipeline network to continuously measure flow rates. These sensors are interfaced with ESP32 microcontrollers and ADS1115 ADC modules to ensure accurate data acquisition. Using a SIM A7672S LTE module, the system transmits data to a cloud server in real time. A web-based dashboard displays live flow values through intuitive gauge and line charts, offering operators immediate visibility into pipeline performance. Beyond simple threshold-based alerts, the system employs a machine learning approach using a One-Class Support Vector Machine (OCSVM). The model is trained on historical data representing normal and leak conditions, leveraging statistical features such as moving averages, overlapping window means, and covariance matrices to detect anomalies. When the system identifies deviations from learned patterns, it promptly raises alerts, enabling early intervention before minor leaks escalate into major failures.Field trials conducted in an operational captive power plant demonstrated the system&rsquos capability to detect subtle leakages that might escape manual checks. Its modular IoT architecture ensures scalability, allowing integration with additional parameters like pressure and temperature for comprehensive health monitoring. The wireless design facilitates deployment in remote or difficult-to-access sections of the plant. Overall, this intelligent leakage detection system shifts maintenance from a reactive to a predictive paradigm, reducing downtime, minimizing environmental risks, and achieving substantial cost savings. Future enhancements will focus on integrating advanced deep learning models and redundant communication paths to ensure reliability even during network failures. This work underscores the potential of IoT and AI to revolutionize industrial pipeline monitoring, driving safer and more efficient plant operations.