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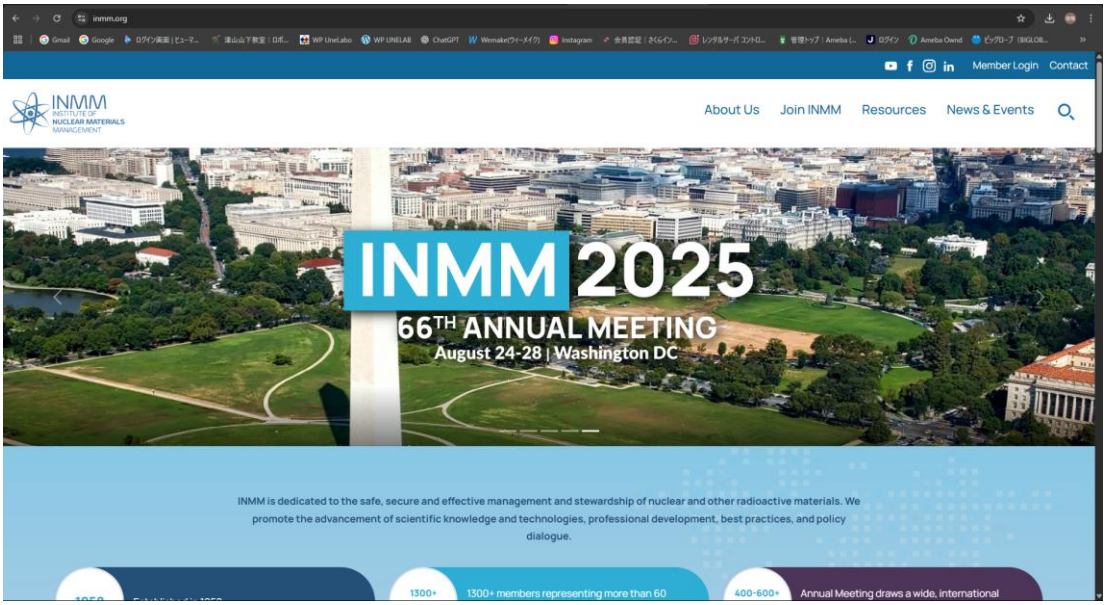

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Security and Protection

Poster Session A

(POS-28) Real-Time Anomaly Detection in Cybersecurity: Adaptive Algorithms for Power Consumption Monitoring

Monday, August 25, 2025 3:50 PM - 5:10 PM EDT Location: Capitol Ballroom

KEIKO TANAKA - Ks System
Tomoaki Tanaka - Former Graduate Student (Master's Degree), Kyushu Sangyo University
SEITO TANAKA - Brother Enterprise
TOSHITAKA UNEOKA - UNE LABO JAPAN
SHINGO KONISHI - ANA WINGS
AKEMI TAKAHASHI - AKEMI LABO JAPAN
TOMOAKI UNOSAWA - General Manager, Nagoya Sales Department, Sojitz Aerospace Corporation

General Manager, Nagoya Sales Department, Sojitz Aerospace Corporation

Submitting Author(s)

TT

TAKU TANAKA (he/him/his)

KYOTO UNIV
KYOTO, Kyoto, Japan

This study focuses on the development of an anomaly detection system for real-time power consumption monitoring using machine learning techniques. The objective is to create an adaptive detection mechanism that operates independently of the control system to ensure reliable anomaly identification in various operational environments. The prototype integrates high-precision sensors, microcontroller-based data acquisition, and real-time data processing.

The detection algorithm employs Long Short-Term Memory (LSTM) networks alongside statistical methods to recognize distinct anomaly patterns such as sudden fluctuations, sustained high consumption, and periodic irregularities. These patterns are detected through moving averages, standard deviations, and Fourier Transform analysis. Initial experimental results show a detection accuracy of 95% and response times below one second for data sampled at one-second intervals.

To improve robustness, advanced filtering methods, including Butterworth and Kaiser filters, are applied to reduce noise from high-frequency and low-frequency components in the power consumption data. Additionally, a dynamic threshold mechanism adapts to real-time data variability, enhancing the precision of anomaly detection in high-noise environments.

Further development efforts focus on optimizing accuracy through model retraining, improved preprocessing techniques, and feature extraction. Future work will test the algorithm in real-world conditions to confirm its effectiveness in detecting and mitigating abnormal power consumption patterns.

This research contributes to improving control system reliability and real-time monitoring technology, providing a foundation for more secure and efficient anomaly detection in various industrial and operational applications.