

TITLE OF THE PAPER

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ABSTRACT

This paper presents an IoT-based environmental monitoring system integrated with a machine learning model deployed at the edge. The system collects real-time data on temperature, humidity, air quality, and particulate matter, enabling local anomaly detection without cloud dependency.

PROBLEM STATEMENT	OBJECTIVE
Existing monitoring systems depend on cloud processing, causing high latency and failure in low-connectivity areas. An edge-intelligent, real-time alerting solution is needed.	Design a low-latency environmental monitoring system using IoT sensors and TensorFlow Lite for real-time anomaly detection and alerting at the edge.

METHODOLOGY

- Step 1:** Sensor data collection using DHT22, MQ135, and BME680 modules connected to Raspberry Pi 4.
- Step 2:** Data preprocessing and feature extraction locally on the edge device.
- Step 3:** TensorFlow Lite model trained on historical data classifies air quality levels.
- Step 4:** Alerts sent via MQTT to a Node-RED dashboard in under 15 ms.

RESULTS

Metric	Value	Metric	Value
Model Accuracy	94.7%	Avg. Latency	12 ms
F1 Score	91.3%	Cloud Data Reduction	78%

CONCLUSION	FUTURE SCOPE
The system achieves 94.7% accuracy with 12 ms latency, reducing cloud dependency by 78%. It is cost-effective, scalable, and suitable for smart city deployments.	Integration of federated learning for privacy-preserving updates, expansion to industrial monitoring, and development of a citizen-facing mobile alert application.

KEYWORDS

IoT Machine Learning Edge Computing Environmental Monitoring TensorFlow Lite Raspberry Pi Anomaly Detection

REFERENCES