

ABSTRACT

The growth of urban areas has created a demand for reliable air pollution monitoring systems. This study proposes an air pollution prediction system based on the Internet of Things (IoT) and Machine Learning (ML), utilizing DHT22, SDS011, MQ-7, and MQ-135 sensors connected to an ESP32 microcontroller. Air pollution parameters such as PM_{2.5}, PM₁₀, CO, and CO₂ are collected every minute and transmitted to the IoT cloud platform, ThingSpeak, for analysis. A Long Short-Term Memory (LSTM) model is used to predict pollution levels one hour ahead using multivariate, multistep time series forecasting. The model is evaluated using MAE, RMSE, MAPE, and R-squared, with results showing prediction accuracies above 90% for CO and CO₂, and above 70% for PM_{2.5} and PM₁₀. The system also includes a web-based predictive dashboard for real-time data visualization. The results indicate that the integration of IoT and ML is effective in supporting smart air pollution monitoring and forecasting.

Keywords: *internet of things, machine learning, air pollution prediction, LSTM*