

**Design and Analysis of a Low-Cost Portable IoT Air Quality-Monitoring Model  
with Machine Learning**  
التعلم مع التكلفة منخفض المحمول الأشياء بائترنت الهواء جودة رقبة ام نموذج وتحليل تصميم  
الآلي

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## **ABSTRACT**

Air pollution has been a critical problem since the industrial revolution started in the mid-19<sup>th</sup> century, the world's environmental scientists and health organizations applied great and continuous effort to find a reasonable solution to this dangerous phenomenon. The root cause of air pollution are poisonous gases such as Carbon Dioxide (CO<sub>2</sub>), Nitrous Oxide (N<sub>2</sub>O), and Methane (CH<sub>4</sub>) resulted from human activities. Consequently, there will be very bad effects. Therefore, great efforts are done to find scientific-based solutions by using traditional equipment to monitor the volume of poisonous gases in the air. Yet, these equipments are large scale, expensive, complicated, and need a specialized team to operate them. In this research, the Internet of Things (IoT) has been applied to introduce a low-cost timed air pollution monitoring and forecasting model that is small, portable, stand-alone, and easy to use by low-tech individuals that can be fixed on means of transport. Therefore, it can be used as both indoor and outdoor. The model will measure the amount of Carbon Monoxide (CO), CO<sub>2</sub>, Smoke, Liquefied petroleum Gas (LPG) in Parts Per Million (PPM), the temperature and humidity in the air, and it will provide the coordinates of taken measures location, then transmits the analyzed data through the Global System for Mobile Communications (GSM), General Packet Radio Services (GPRS), Wireless Fidelity (Wi-Fi) using Transmission Control Protocol/Internet Protocol (TCP/IP), Short Message Services (SMS), and Bluetooth. Further, this research presents some of the data collected in Amman, Jordan from installing the device on local buses in collaboration with the Comprehensive Multiple Transportation Company (CMTC) in an understandable way by using Google Maps and MATLAB 21.a to provide a GEO bubble map with the collected data containing CO<sub>2</sub> levels and coordinates of taken measures with time stamps visualized in 2D geographical map with data analysis. Finally,

machine learning is applied using linear regression to predict a future reading and the logistic regression classification model to the data collected, our prediction proposed model explained 4.2% variation (Squared Correlation) of the pollution readings and a 2878 predicted records from an original 9600 records were collected and the classification proposed model accuracy was 95.59%.

**Key Words:** Air pollution, Internet of Things, Air pollution monitoring, Machine Learning, data visualization, data prediction, data classification.