

ENVIROGUARD: Machine Learning-Powered Detection of Air-Polluting Vehicles in Kenyan roads using IoT.

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Abstract

This work delves into the urgent issue of air pollution caused by unroadworthy vehicles, particularly in light of the growing concerns about climate change. In Kenya, UNEP estimates that 90% of urban air pollution in rapidly growing cities like Nairobi comes from motor vehicles. Through the application of cutting-edge IoT systems, our aim is two-fold: first, to pinpoint these vehicles and, second, to mitigate their detrimental environmental impacts. By seamlessly integrating advanced sensor technologies with real-time monitoring, our proposed solution advocates for sustainable transportation practices, ultimately leading to improved air quality and reduced greenhouse gas emissions. The system comprises of; proximity sensors (PIR sensor and NDIR sensor), ESP32 OV2640 board with built in microcontroller with a ttgo camera, WIFI module and Bluetooth module, A GSM module and a trained machine learning model. The motion sensor (PIR sensor) acts as a switch as once triggered it activates both the camera and carbon monoxide sensor (NDIR sensor) which collect data and send it to a central database. Need for implementation of machine learning is crucial based on a number of reasons: Majority of the roads in third world countries are A2 roads and congestion is the norm as there is high level emission within the small area allocated for the road. In addition, the roads are at times occupied by other parties such as pedestrians, animals crossing the roads or even

still, cyclists. Due to the challenges mentioned above, our proposal goes miles ahead by incorporating k-means clustering CNN machine learning model for image processing. This will enable differentiation between motor vehicles and non-motor vehicles. Our project is not only justified but also crucial in the face of the substantial health and environmental risks posed by air pollution. Traditional inspection methods have proven inadequate, necessitating the integration of IoT technology for a more robust approach. By utilizing IoT devices and image processing, we're enabling continuous monitoring of vehicle emissions and roadworthiness, leading to timely intervention measures.

Keywords: IOT, Machine learning, environmental monitoring systems, pollution