

Development of Portable Air Quality Index (AQI) and Emergency Vehicles Preemption Prototype Based on Internet of Mobile Things (IoMT)

ABSTRACT

The technological advancements of the Internet of Things (IoT) in the recent past have facilitated immense progress towards mitigation of environmental pollution through smart transportation systems and solutions. In particular, communication to the commuters about the traffic ahead or occurrences of congestion has been envisioned to play a major role in outsmarting traffic through mobile applications giving rise to the emergence of the Internet of Mobile Things (IoMT). However, the existing mobile applications that serve as traffic reporting solutions still face major issues such as fixed route suggestions, longer delays during busy hours or emergencies, inefficient prompting of road accidents and heavy traffic en route to a particular destination. This research aims at providing solutions for notifying the commuters with updates on the traffic based upon the Air Quality Index (AQI) of the routes towards the destination and also about the approach of emergency vehicles. The cross-platform mobile application in this way enables the user to opt for a route with good air quality so that the more congested routes are avoided thereby mitigating the air pollution induced by road traffic. The experimental testing and validation of the proposed methodology are applied for areas belonging to Greater Kuala Lumpur. The various timings divided according to peak and non-peak hours are experimentally tested for analyzing the parameters of traffic usage and pattern through the mobile application. The outcome of the experiments has showed that when traffic flow is modelled and governed through vehicular emissions and concentrations of air pollutants, nearly 75% of the congested traffic is reduced thereby, giving rise to pollution-free environment as well as mitigation of urban heat island (UHI) effect that is formed through vehicular heat generation and difference in temperatures. On the other hand, the approach of emergency vehicles also prompts the commuters to avoid panic. CCS Concepts • Hardware → Emerging tools and methodologies. Keywords Air quality index; Air pollution; Road transportation; Internet of Things and traffic congestion.

1. INTRODUCTION In the past few decades, the population of vehicles has been on higher demand. This huge demand for vehicles results in heavy traffic congestion, accidents, pollution and costs millions of dollars for annual fuel consumption. Such drawbacks have led researchers to look for effective solutions to mitigate vehicular traffic congestion. The vehicular network environment is dynamic in nature due to the frequently changing topologies and network configurations. Though there are numerous existing Intelligent Transportation Systems (ITS) techniques comprising of Internet of Things (IoT) and Vehicular Adhoc Networks (VANETs), which enables the users to keep well-informed and well-updated about smarter ways to deal and handle utilization of transport networks, seldom do they provide guarantee for considering nonrecurring congestion as well as means for mitigation of traffic congestion induced air pollution and fuel consumption. Moreover, the long waiting hours of vehicles at signals and traffic jams leads to higher air pollution levels

and heat generated from vehicular exhausts cause Urban Heat Island (UHI) effect. The developing countries like Malaysia, still face potential drawbacks such as increased air pollution levels, due to higher vehicle usage rate resulting in adverse health hazards such as respiratory diseases and asthma. In this research, the Air Quality Index (AQI) values obtained using the deployment of real-time AQI measuring Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.