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Analysing Vehicular Congestion Scenario in Kuala Lumpur Using Open Traffic

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ABSTRACT

Traffic congestion on the roads is mainly the result of overcrowding and this phenomenon happens when a great number of vehicles storm the road, resulting in the disruption of the smooth traffic flow. This greatly affects the daily routines of the people. Not to mention the time that is wasted while a person feels stranded in such situation and it results in the loss of productivity, also deteriorates the societal behavior to a certain extent and have adverse effects on the economy. The natural calamities add to the miseries. It becomes very difficult to manage the traffic flow in situations when there are flash floods or other accidents. Therefore the trend of the traffic seems very unpredictable. The real-time information and the past data are deemed as the significant inputs for the predictive analysis. Modern day researchers perform the predictive analysis using the simulations as it does not seems to have any accurate and exact predictive model, mainly because of the higher complexity and the perplexing situation the researchers face while performing the analysis. Open Traffic seems to be a viable option, as it is an open source and can be linked with the Open Street. This research targets to study and understand the Open Traffic platform. In this regard the real-time traffic flow pattern in Kuala Lumpur area was successfully been extracted and the analysis was performed using Open Traffic. It was observed and deduced from the results that Kuala Lumpur faces congestion on every major avenue, junction or intersection it mostly owes to the offices and the economic and commercial centers during the peak hours. Some avenues experience the congestion problem due to the tourism.

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1. INTRODUCTION

The most visible and frequently highlighted problem of a city is its traffic congestion, and it is well known that high levels of congestion create significant impact on local and national GDP. There is a huge impact on environment and the society due to the problems related to transportation. It has a serious toll on the quality of life and urban productivity. Some of these impacts include congestion, energy consumption, air pollution, uncontrolled motorization, mobility of urban poor, disabled and senior citizen and traffic safety.

The congestion is perhaps the most visible manifestation of the series of failures in the planning of urban transportation and it also has quite a significant cost. For example, INRIX reported, that the combined annual cost of gridlock to UK, France, Germany and US is expected to rise to $293.1 billion by 2030, which is an obvious increase of 50% from 2013 [1]. Considering this entire period, the combined cost caused by

congestion for the related economies is estimated to be a staggering $4.4 trillion [1]. The U.S experiences a greatest overall economic impact, where the estimated cumulative cost of traffic congestion will be $2.8 trillion by 2030-which is the same that was paid as taxes by the Americans a year before. However the UK (at 66%) and London (at 71%) will see the greatest annual rise in the cost of congestion by 2030, mainly due to the rapid urbanization experience by the region. At the individual level, traffic congestion cost drives $1,740 last year on average across the four countries. If unchecked, this number is expected to grow more than 60% to $2,902 annually by 2030 [1].

Besides the huge amount of energy consumed by the transportation industry, the motor vehicles contribute more towards the air pollution phenomenon. When focused on city centers, the concerned agencies revealed that, the city centers are responsible for 90 to 95 percent of the carbon monoxide, due the huge amount of traffic experienced by these areas. In addition to this, the traces of 80 to 90 percent of nitrogen oxides and hydrocarbons, and a large portion of the particulates, pose a major threat to human health and natural resources. Lead emissions from the combustion of leaded gasoline also cause an estimated 80 to 90 percent of lead in ambient air. Owing to this issue many developed countries have started the practice of reducing the gasoline level from the fuel, but in most of the developing countries, a certain old trait is yet being followed. These emissions have an alarming global as well as a local impact: The transportation sector is the most rapidly growing source of greenhouse gas emissions that is, emissions of chemicals that have the potential to contribute to global warming. Narrowing CO2 emission from transport sector in Southeast Asia, Malaysia is second largest per capita greenhouse gas emitter among the group of ASEAN countries [8]. Although, Malaysia shares only 0.3% of global GHG emission the major concern lies in the ever increasing trend of GHG emission. Most of this owes to congestion scenario.

Fuel subsidies, induction of some policies which artificially lower the prices of the fuel, are estimated to costs a hefty amount on the government and major economies around the globe, a rough estimate of 500 billion dollars was given by the experts [3]. Besides adding the surplus costs, fuel subsidies induces several other problems which bring in various negative impacts on the economy some of these include encouraging wasteful energy consumption, creating fiscal burdens on developing country budgets, disproportionately benefiting wealthy households, and increasing health and environmental costs of fuels.

Various efforts have been done in order to mitigate this issue. Different suggestions have been given which leads to a number of approaches. At different places sensors and actuators are installed to collect the data. Besides this, cameras are also used to find the real time traffic flow

During the emergency situation, the behavior of traffic always deviates from the norm and it tends to change drastically in other situation. This behavior results in the disruption of the traffic flow. Thus, creates complications for the concerned disaster management authorities, to carry out the relief operations effectively. Traffic congestion is considered as a menace which is unavoidable during festive season and also during phenomenon such as, accidents, floods and etc [2].

Using the real-time data to perform the analysis and deduction seems quite an uphill task as the traffic deviates from the norm drastically. The nature of the traffic flow in Kuala Lumpur follows the same trend. Therefore, a solution should be suggested in order to cope with the problem. Therefore, it has been the motivation in the research to study and to collect the real-time traffic behavior and analyzing it with the help of Open Traffic software.

The organization of the paper consists of 5 sections. Section 1 presents the introduction of the work. A detailed preface of the problem was discussed in the section. Section 2 presents the literature review related to the platform. Firstly, a review of traffic monitoring and traffic analysis from other researchers is described. In section 3, an overview of the Open Traffic system is given. In section 4, the result and the discussion based on the data collected from the Open Traffic system. Section 5 concludes the research findings.

2. RELATED WORKS

The conducted research takes account of different aspects considered by other researchers. In the following sub sections, previous works related to this work are reviewed.

2.1. A Glimpse at the Open Traffic Platform

There are several challenges being faced by the agencies all arounf the world which are concerned with the issue of traffic management. Some of these challenges are but not limited to, the congestion and the scarce resources. There is a need to monitor the real time traffic flow, bearing in mind that there are no effective tools available to monitor real-time traffic flow, to collect and analyze historical travel time data. Owing to these challenges, Cebu City Government had come up with an open source platform which collects, visulaizes and analyzes the traffic data speed. The data was derived from taxi driver’s phone. This project

won Philippines National E-Governance Competition on 2013 [4]. The team then went on to collaborate with an ASEAN famous taxi-hailing app called "Grab Taxi", which generates GPS data and with Conveyal who is an open source transport software development consultant to further improve the initial development. The "World Bank Big Data Challenge Innovation Grant" was also won by them. The project started in January and successfully completed on June 2015 which was around six months [4].

2.2. Architecture of the Open Traffic Platform

The components of Open Traffic software are shown in Figure 1. Traffic Engine, Traffic Data Pool, Open Street Map (OSM-linked) Traffic Data Set and Real-time Routing API are considered as the back bone of the architecture.

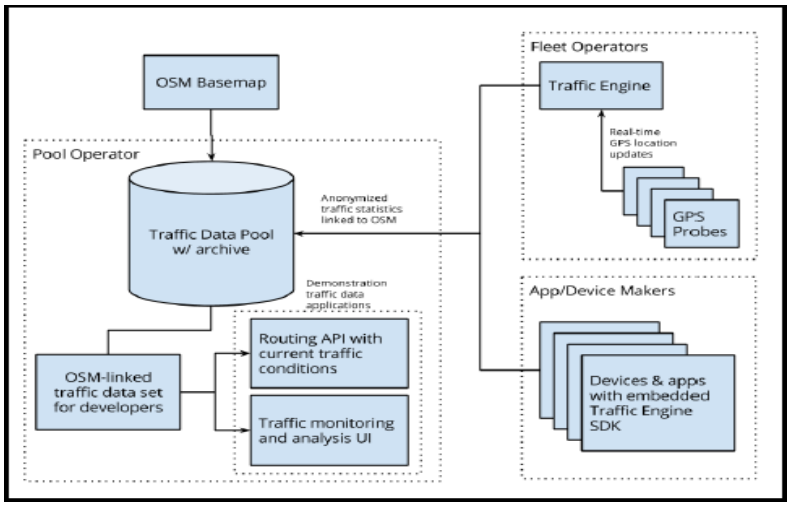

Figure 1. Components of Open Traffic Software

2.3. Traffic Engine

The translation of the vehicle location, to the OSM linked speed estimates, is done by the Traffic Engine. Traffic Engine is located inside a fleet operator. The main role of the Traffic Engine is the conversion of real time GPS location information to an insightable traffic statistics. This block guarantees the surety that the fetched data, from the data provider's network, is entirely anonymous. On the other side of the picture, the Traffic Engine Software Development Kit (SDK) may also be embedded onto the applications that are user friendly. This thing paves the way for direct calculation and by such means the traffic information is shared among the user's [5]-[6].

3. OVERVIEW OF THE OPEN TRAFFIC SYSTEM

The implementation of the proposed system requires several open source software. Firstly, Java and Maven will be installed, following with the Traffic Engine software and Open Traffic application. The work also involves downloading the Open Street Map of Kuala Lumpur the configuration file will be edited and the Traffic Engine app will be used to extract the real-time data to be analyzed at later stages of the implementation.

3.1. Top-level View

A comprehensive approach taken for the traffic data collection is shown in Figure 2. The work is initiated by installing Maven which is a well-known to build Java related projects [7]. After this step, Java JDK version 1.8 is installed, following with the installation of the Traffic Engine and OSM respectively. This was followed by the editing of the configuration file for Traffic Engine Application and then re-run it. Finally, the traffic speeds can be extract in CSV file and analyze the data.

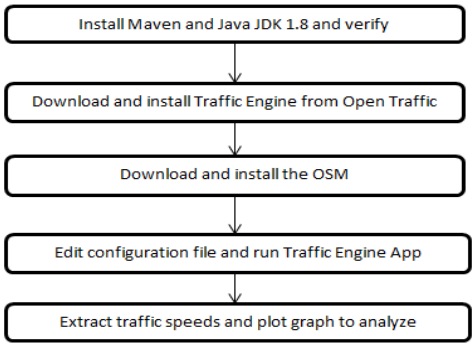

Figure 2. Comprehensive Flow Chart to Collect Traffic Flow Data

3.2. Loading of the GPS Data onto the Map

The Map of Malaysia can be accessed and can be downloaded from the Geofabrik's server. This server provides maps for OSM projects, which are updated. The map in pdf is downloaded from http://download.geofabrik.de/asia/malaysia-singapore-brunei.html. Since the scope of this work is to take consideration of Kuala Lumpur only, so the map of KL was downloaded from this link https://mapzen.com/data/metroextracts/metro/kuala-lumpur_malaysia/ as shown in Figure 3. The format of the map downloaded in raw OSM data as pdf format.

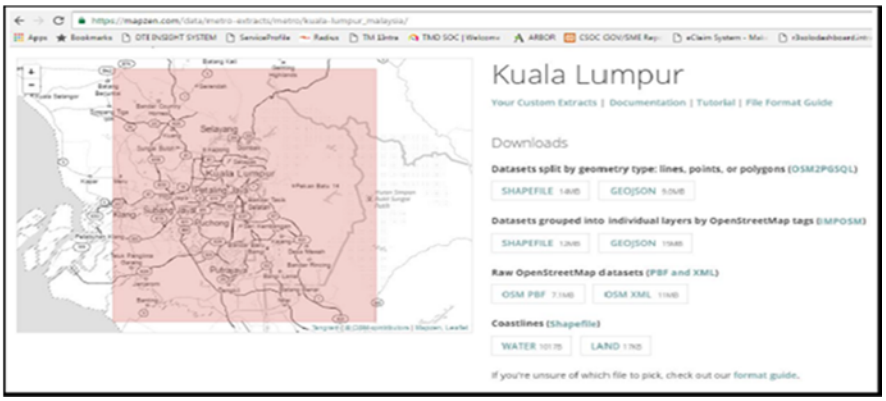

Figure 3. Map Extraction from Mapzen

3.3. Loading of the GPS Data onto the Traffic Engine

The loading of the GPS data to the Traffic Engine is depicted in Figure 4. The steps are mentioned:
(i) csvloader.jar file downloaded from https://github.com/opentraffic/csv-loader site.
(ii) the file named "Kuala_Lumpur.csv" is in the same folder as of " jar file".
(iii) at terminal, get the csvloader folder.

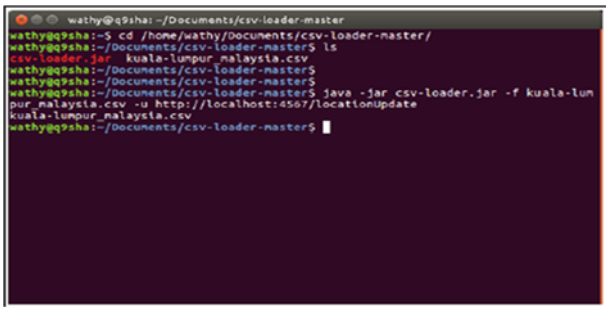

Figure 4. Screenshot of Loading CSV file

The congregated spots in Figure 5 shows the points of interest (POI) which were loaded from CSV file in Traffic Engine. Since the loading of the data, the number of the traffic statistics that were counted along the process are displayed by the "Data Loader Status Bar". It will keep on updating as long as the Traffic Engine App remains connected with the server.

Figure 5. Screenshot of KL Area with POI

At the end, after the extraction of data from the GPS and extracting the traffic speed in CSV format the platform is ready to collect the data and the interface looked like as shown in Figure 6.

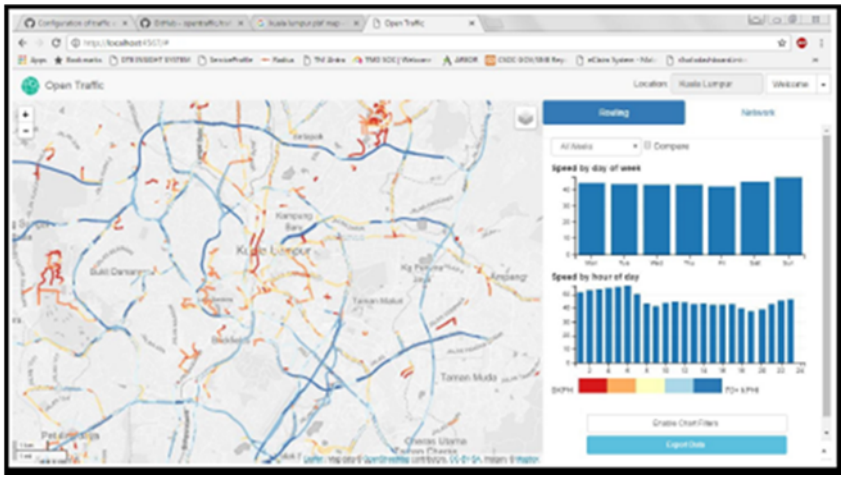

Figure 6. Screenshot of Open Traffic Platform

4. RESULTS AND DISCUSSIONS

4.1. Traffic Analysis for Kuala Lumpur

Approximately two million data samples, which were related with the speed metric, were extracted from the Open Traffic software. The average traffic speed for whole Kuala Lumpur was depicted using the bar graphs as shown in Figure 7. The traffic data as shown in Figure 7 is an average for all major areas in Kuala Lumpur. The districts include, Bukit Bintang, Wangsa Maju, Batu, Kepong, Titiwangsa, Setiawangsa Segambut, Lembah Pantai, Seputeh, Bandar Tun Razak and Cheras. Figure 8 shows comprehensively, that the average traffic speed is more than expected during weekdays and a bit calm during weekends.

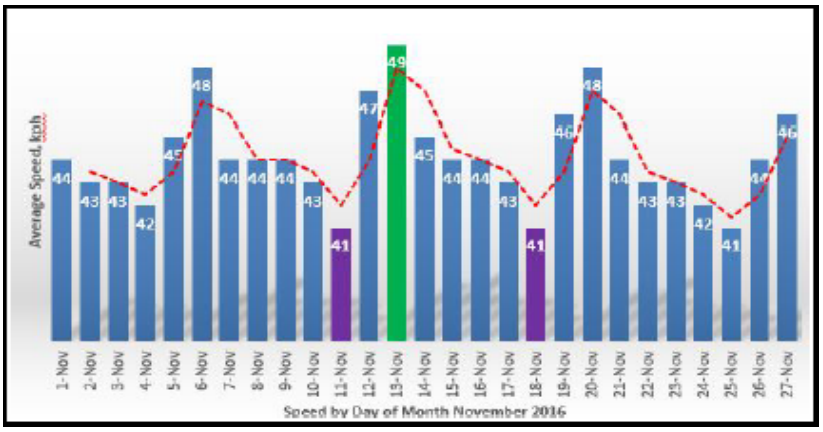

Figure 7. Traffic Analysis For whole Kuala Lumpur area in Nov 2016

It is observed that on Saturdays and Sundays, the average speed falls between 44-49 km/h for November. On 11th November and 18th November, the speed is the minimum. This deduces that the speed is the slowest on Fridays as the Muslims offer the prayers in large numbers and in congregation. The other main reason for the low speed is that the majority of the people are going to their hometown after the day has been called. Besides this people also go for shopping with their family. This altogether results in a congestion scenario. However, the trend is the quite opposite in the weekends where most of the people are resting and the weekends almost experience no activity as compared to the weekdays. It is observed that the traffic is heavy on weekdays because most of the businesses are operated during that time.

4.2. Traffic Analysis of Major Towns

Some major towns of Kuala Laumpur were taken into consideration for the analysing the traffic behaviour spanning a week. These towns were Sentul, Pudu, Kampung baru, Seksyen 10, Bangsar, China Town and the Starhill. A slow trait was experienced at the towns od Bangsar, Chinatown and Starhill as depicted in Figure 9. The average traffic speed varies between 26-34kph. Most of this slow speed owes to the strategic location of the Bangsar, which is connected to Petaling Jaya by means of the Federal Highway. It also connected to the New Pantai Expressway and the Sprint Expressway. Besides this, Maybank tower, Bangsar village and some automotive showrooms are also situaued in the vicinity of Bangsar. This all factors contributes and make Bangsar a hotspot of activities. Chinatown on the other hand is a very famous tourist's attraction because it is surrounded by hotels and it is thronged by the hawkers espcially at night. This place alternatively is also known as Petaling Street which attracts the visitors. On the otherside, Starhill has luxury shopping malls such as Pavilion, Sungei Wang Plaza and Times Square. Moderate traffic speeda are observed for Sentul, Kampung Baru and Seksyen 10. This is because these places have shopping complexes and business areas in their vicinity.

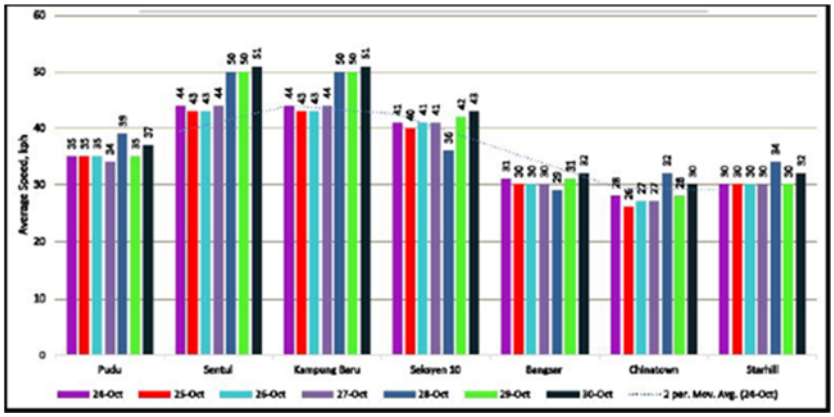

Figure 8. Traffic Analysis for Major Town in 4th Week of October 2016

The above mentioned spots experiences congestion most of the times when the public activities are at their peak.

4.3. Traffic Analysis per Hour Basis

An hourly data collection approach was taken at an important location i.e. Masjid India. Figure 9 shows the analysis made on hourly basis at Masjid India road on 24th October 2016. Heavy traffic flow was observed after 9.00 am until midnight.

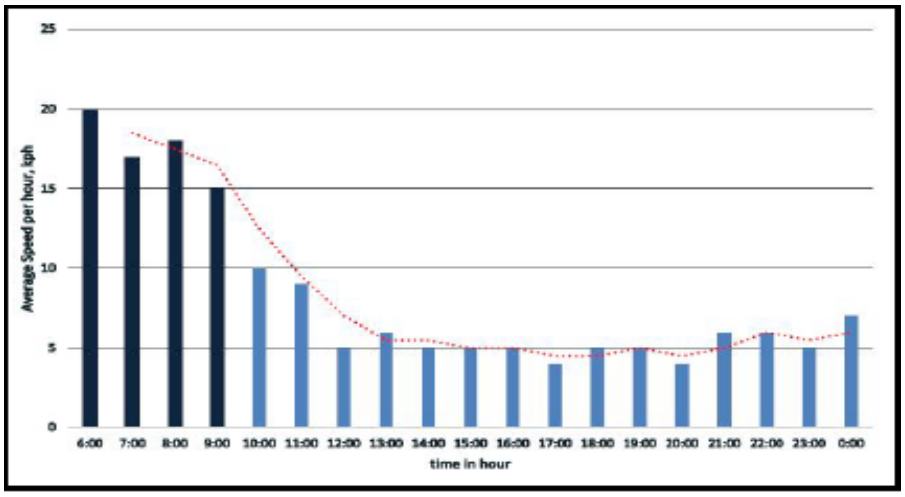

Figure 9. Traffic Analysis on Hourly Basis at Masjid India Road on 24th October 2016

5. CONCLUSION

In this work average Traffic Speed was observed at selected locations of the major areas of Kuala Lumpur area for the whole month of November (from 1st to 30th) and the last week of October 2016. The traffic speeds and arrival time were observed by the help of Open Traffic software. The work signifies the importance of Open Traffic platform. It also focusses at the process of collecting the real time traffic flow data and then analyzing it. Based on the results obtained, the congestion scenario occurs the most during the weekdays compared to weekends. It was depicted that the Open Traffic is helpful in analyzing and understanding the real time vehicular traffic flow for the given area. Therefore, it is recommended that Open Traffic can be used for traffic analysis in the future works. Besides this, the data can be used for the prediction of the vehicular traffic behavior and also, the data can also be used by the private or the public sector for the traffic management.

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