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DEVELOPMENT OF A MICROSCOPIC TRAFFIC SIMULATION MODEL FOR GALLE ROAD, COLOMBO

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ABSTRACT - This research attempts to build a microscopic traffic simulation model for a 17km road section in the Galle Road corridor in Colombo, Sri Lanka. The simulation was developed by utilizing existing traffic counts collected at multiple intersections. The developed model is validated with actual hourly traffic speeds on the corridor. This simulation platform can be used to evaluate different traffic management interventions.

Keywords: SUMO; Traffic Flow Modelling; Real-world traffic scenario

1. INTRODUCTION

Simulation-based methods help analyze the traffic problems in urban areas as they allow the possibility of making a more detailed analysis of the issue and suggesting solutions for quicker and accurate decision-making. Such simulations will help evaluate the overall impact of a selected traffic management intervention. It is a tedious exercise to build up a realistic microscopic traffic simulation scenario from scratch as data collection, data conversion, and application into a simulation model require a significant amount of time and effort. However, once those initial steps are completed, further research can be done on top of that model with little preparation [1]. The applications of such simulation models are multifold. To name a few examples, they have been used for emissions modelling and estimation [2] [3] [4], applications in fuel-saving [5], mobility simulation during big events [1], congestion root cause identification [6]. To develop these microscopic simulation models, an accurate traffic demand representation method is essential. These data can be available in many forms, such as sensor data [1] [3] [4] [6], Origin-Destination matrices [7] [8] [9], traffic counts that are already available [5], and demographic data-based activity generation [10].

In the Sri Lankan context, the attempts made to develop large scale (city level, corridors that include multiple junctions) microscopic traffic simulations based on actual demand data are limited. This research attempts to develop a microscopic traffic simulation base model using SUMO [11] for the Galle Road corridor in Sri Lanka with the intention of testing out different traffic intervention strategies.

2. MATERIALS AND METHODS

Figure 1 illustrates the overview model development process using SUMO. A section of the Galle Road corridor from Cross Junction (Moratuwa) to Kollupitiya Junction (17 km in length) was considered as the case network. The network consists of 9 major signalized intersections. The simulation duration was set to 14,400 seconds (6.00 a.m. to 10.00 a.m.). The demand is represented based on the hourly traffic counts extracted from the ComTrans report [12]. The demand data were fed into the simulation in the form of a 'Turn Count' file as shown in Figure 1. The vehicle types used for the simulation are cars, motorcycles, vans, three-wheelers, goods vehicles, multi-axle vehicles, and busses. The entire simulation building process is automated using built-in Python scripts with SUMO and some custom Python scripts. The period from 6.00 a.m. to 7.00 a.m. is considered as the simulation warmup period.

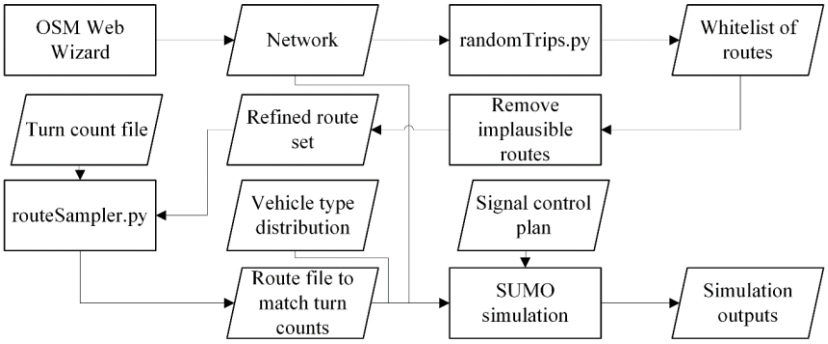

Figure 2. Workflow of creating SUMO simulation

The model is calibrated to match the simulated hourly average speeds with the actual hourly speeds measured in the same corridor [13]. A summary of some of the useful parameters used in the model building process is given in Table 1.

Table 2. Summary of the model parameters

Sub Model / Parameter	Value	Description
Car-Following Model	Krauss	Default car-following model of SUMO
Sigma	0.38 (calibrated value)	Governs the driver imperfection
Lane Change Model	SL2015 with 'lateral-resolution' value of 1.6 meters	Allows multiple vehicles to move parallelly on a lane
Simulation step length	1 second	Default value of SUMO

3. RESULTS AND DISCUSSION

GEH statistics were used for the comparison of the observed and modelled hourly flows. GEH < 5 was achieved for all the flows (100%) for the entire simulation period, meaning that the flows are consistent with each other. Figure 2(a) shows the traffic flows at one of the intersections of the model. The hourly average speed of the model is shown in Figure 2(b) and it can be seen that the simulated speeds agree with the observed speeds.

4. CONCLUSION

A microscopic traffic simulation model was developed and validated for the Galle Road corridor from Cross Junction (Moratuwa) to Kollupitiya junction. In future research, it is planned to evaluate different traffic management measures (e.g., bus priority) using this base simulation.

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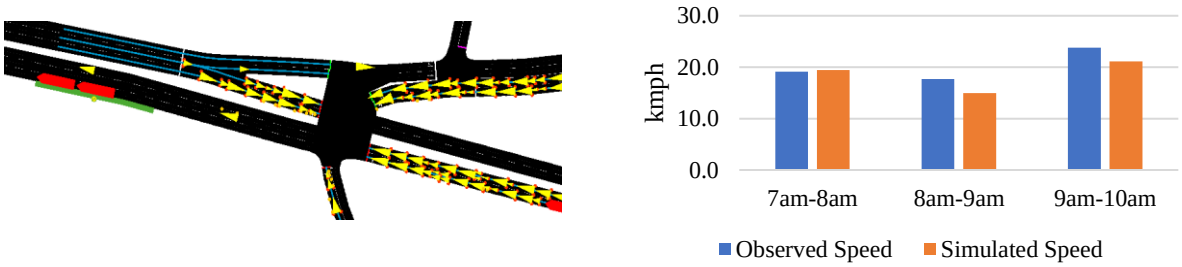

Figure 2. (a) A section of simulated traffic flows with SUMO, (b) Comparison of hourly speeds (Observed vs. Simulated)

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