

The Simulation on Vehicular Traffic Congestion Using Discrete Event Simulation (DES): A Case Study

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Abstract— The bottleneck networks of the vehicular traffic flow required the clear understanding and the insights of congestion factors, determines the time and location of traffic breakdown. The congestion propagates through the network caused by the numbers of vehicles continuously growing. There have been lots of research studies to resolve the issues. Simulation and modelling to the related issues seem significance to the operational research specifically the traffic flow dynamic for the design, analysis and the management. Hence, this work focused on a simulation model for the vehicular traffic flow in order to reduce the traffic congestion for a smooth and low-density traffic flow system. Three scenarios from a traffic flow system based on queuing environment which is current traffic flow system as S1, the newly proposed models as S2 and S3 have been suggested to improve the traffic flow of the intersection. The method of comparing the performance of simulation results and difficulties, alternative road, the predictive strategy as decision support model with the potential alternative road has been identified with developing traffic flow simulation using Discrete Event Simulation (DES). DES is as the well-known traditional approach to catering the problems regarding the queuing system and run simulation models on the different traffic scenarios for bottleneck analysis. The lower values for the cumulative average all the parameters indicated the traffic congestion is decreased and to avoid the traffic jam. The experimental results and statistical analysis showed that the proposed simulation model S2 and S3 for vehicular traffic flow is better than the current traffic flow system S1. It can be summarized that model 3 (S3) can be applied to the new vehicular traffic flow system with the better simulation results has been produced from the experimental simulations.

Keywords— Traffic flow; discrete event simulation; traffic congestion; vehicular traffic flow; simulation model

I. INTRODUCTION

Nowadays, most of the cities all over the world share at least one common problem, traffic flow that is causing congestion due to the numbers of vehicles continuously growing [1]. It is portrayed by slower speeds, longer excursion times, and expanded vehicular queueing. The main reason why traffic congestion occurs is due to the increasing number of vehicles, poor road management, and poor practices of the car pool. Thus, the major causes due to the

increment on the number of vehicles because of road capacity. The major issue is traffic congestion in which a decisive problem is happening on roads that full of vehicles and buses caused the traffic busy. The traffic congestion occurs during the peak hours because of a lot of vehicles on the road at this time (usually in the morning and evening which is the working or office hour).

Therefore, the research question is how to build an efficient traffic flow system with simulation model in order to reduce congestion in real scenario? Discrete Event Simulation (DES) found as a suitable technique to simulate this problem. In order to have an improved model, Arena Simulation Tool has been used to simulate the traffic flow problems as described above. The model corresponds to a system that depends on a series of sequential condition where the state of the system for each event changes in discrete time [2].

Thus, a simulation model is able to create visual demonstration for future scenarios attractively [1]. The experimental data has been analysed to validate and verify the proposed solution in order to reduce traffic congestion. Therefore, this paper focuses on improving the traffic congestion by investigating the potential alternative routes as a new proposed vehicular traffic systems This may lead in decreasing the traffic congestion so that, the flow of the traffic are very smooth. Several measurable objectives should be accomplished with a specific end goal to fulfil the motivation behind this exploration which is to identify the potential alternative road. The second aim is to have an improved traffic flow simulation model using DES. This paper also focused on the analysis of simulation models for the different scenarios of the vehicular traffic flow systems.

The outlines of this paper as follows. The first section is the introduction of research study. Section 2 describes the related works from the previous researcher including the techniques for the simulation model, the methodology of this study consists of the project scope and the traffic flow simulation model. Section 3 describes background of research work and focused on the case studies and three different scenarios; three scenarios is compared with respect to the characteristics. The next section discussed about the finding; experiment and result. The elements of analysis and discussion have been discussed in section 5. This paper ends