

2012 International Workshop on Information and Electronics Engineering (IWIEE)

A Simulation Framework for Emergency Response of Highway Traffic Accident

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Abstract

The problem of road traffic accidents is now becoming a cause for concern. This paper presents a simulation framework designed to simulate an emergency response system for highway traffic accident. It is a conceptual design of a real-time emergency response system. The major modules of this simulation framework include Accident Generation, Traffic Generation and Accident Response. The key component of this simulation framework is the dispatch strategy. These include the First Called, First Served strategy, the nearest origin dispatch strategy, and the flexible dispatch strategy.

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Keywords: Highway, Traffic Accident, Emergency Response, Simulation Framework, Dispatch Strategy

1. Introduction

The problem of road traffic accidents is now becoming a cause for concern. The emergency response simulation to the traffic accidents is needed. The simulation framework for traffic accident emergency supports the evaluation of accident response time and effect. Because of traffic accidents, traffic congestion and delay are significant problems in most large urban areas or rural areas since they substantially increase the user's cost.

In this paper we present a simulation framework to simulate an emergency response system for highway traffic accident. Several emergency response vehicle dispatching strategies are used. These

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include the First Called, First Served strategy, the nearest origin dispatch strategy, and the flexible dispatch strategy.

2. Literature Review

The need for improved incident response models and the data available for developing such models are discussed in Ozbay and Kachroo[1]. Recognizing the highly stochastic nature of traffic and incident management operations, Pal and Sinha[2,3] introduce a simulation model that can be used in designing a new freeway service patrol. As well as improving the operations of existing programs, Liu and Hall[4] develop a computer program that simulates the occurrence of highway incidents, the dispatching of emergency vehicles and the traffic flow on the network. In the paper by Ozbay and Bartin[5], a simulation model is developed using Arena simulation package, and is used to model and examine the effects of various incident management strategies for the incident management operations on the Washington D.C. beltway network. Kim et al. [6] considered a dynamic truckload routing and scheduling problem with time windows operating in over-saturated conditions.

Zografos et al.[7] developed a simulation model for studying the trade-off between freeway accident delay and the size of freeway emergency response fleet, and for studying the effect of alternative dispatching strategies on the performance of the freeway emergency response fleet. Goldberg et al. [8] developed a simulation model for evaluating alternative base locations for an emergency response fleet in Tucson, Arizona. Haghani, A., H. Hu, and Q. Tian[9,10] developed an optimization model for developing flexible dispatching strategies that take advantage of available real-time travel time information, and developed a simulation model to evaluate a real-time Emergency Medical Service (EMS) vehicle response system that uses real-time travel time information and assists the emergency vehicle dispatchers in assigning response vehicles and guiding those vehicles through non-congested routes.

All these papers present simulation models dealing with emergency response. However, none of them uses dynamic traffic information links the traffic status changing, the route changing, etc. In this paper, it uses the dynamic traffic information. Moreover, dynamic shortest path are also taken into consideration.

3. Simulation Framework

An emergency response simulation provides users a powerful tool to assess current settings of an accident management or predict the effects of any changes to current accident. The simulation framework consists of three modules: Accident Generation, Traffic Generation and Accident Response Simulation.

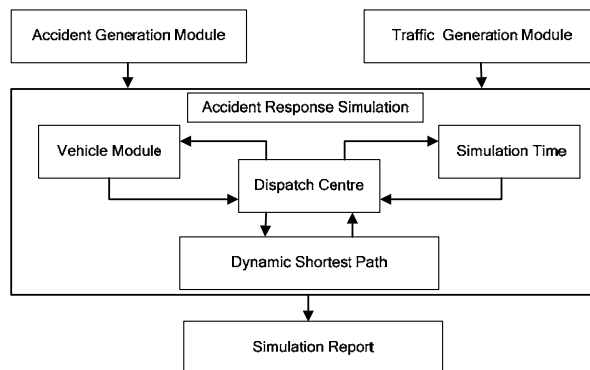


Fig.1. Simulation Framework for Highway Traffic Accident Emergency Response

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