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IMPROVING ROAD ACCIDENCE MONITORING USING ROAD TRAFFIC SIMULATION IN VANET

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Abstract- Wireless communication technologies have now greatly force our daily lives. From indoor wireless LANs to outdoor cellular mobile networks, wireless technologies have benefited billions of users around the globe. VANET simulation is fundamentally different from MANETs (mobile *ad hoc* networks) simulation because in VANETs, vehicular environment imposes new issues and requirements, such as inhibited road topology, multi-path vanishing and roadside obstacles, traffic flow models, trip models, varying vehicular speed and mobility, traffic lights, traffic blockage, drivers behavior, etc. Currently, there are VANET mobility generators, network simulators, and VANET simulators. Recently, Vehicular ad hoc network (VANET) can offer various services and benefits to VANET users and thus deserves consumption effort. Intelligent Transportation Systems (ITS) are aimed at addressing critical issues like passenger safety and traffic congestion, by integrating information and communication technologies into transportation infrastructure and vehicles. In this paper, we consider that every study should chose the suitable simulator based on its requirements. VANET is expected to enhance the awareness of the traveling public by aggregating, propagating and disseminating up-to -the minute information about existing or impending traffic-related events.
Keywords- VANET, ITS, MANET, IVC, LAN, ad hoc, SUMO, VisSim.

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Introduction

Realistic simulation of Inter-Vehicle Communication (IVC) protocols is one of the main challenges in the Vehicular Ad Hoc Network (VANET) research domain. Vehicular networks are very likely to be deployed in the coming years and thus become the most relevant form of mobile ad hoc networks. In recent years, the number of motorists has been increasing drastically due to rapid urbanization. The number of automobiles has been increased on the road in the past few years. Critical traffic problems such as accidents and traffic congestion require the development of new transportation systems. Intelligent Transportation Systems (ITS) that is poised to bring about a revolutionary leap by making roadways and streets safer and the driving experience more enjoyable. VANET communications, employing a combination of Vehicle -to-Vehicle (V2V) and Vehicle-to Infrastructure (V2I) wireless communication are expected to integrate the driving experience into a ubiquitous and pervasive network that will enable novel traffic monitoring and incident detection paradigms [1]. It is widely known that, due to high-speed mobility, V2V and V2I communication links tend to be short lived. Thus, it is important to propagate traffic-related information toward a certain region of interest instead of sending to a particular vehicle; moreover, one of the best ways of propagating traffic-related advisories towards a particular region is some form of (controlled) broadcast transmission. A major setback in applying MANET protocols to VANETS is the ability to adapt to conditions such as frequent topological changes. The vehicular safety application should be thoroughly tested before it is deployed in a real world to use [2]. Simulator tool has been preferred over outdoor experiment because it simple, easy and cheap. VANET requires that a traffic and network simulator should be used together to perform this test. Many tools exist for this purpose but most of them have the problem with the proper interaction. The evaluation of VANET protocols and applications could be made through real outdoor experiments, which are time-

costly and claim for a large number of resources in order to obtain significant results. Instead, simulation is a much cheaper and easier to use method. Obviously, this leads network and application developers to use simulation in order to evaluate different simple or complicated and innovative solutions before implementing them. In turn, this stimulated the interest for the development of simulators that easily integrate the models and respond to the requirements of VANET applications. Simulators have become indispensable tools at least in the initial phases of the VANET application engineering process. Under these conditions, computer simulation has become the main tool in VANET research. However, despite the attention the field has received in the last decade, there is currently no standard simulator for vehicular communications. In this paper, we present the main solutions available for VANET simulation, along with their strengths and weaknesses [3].
When these road traffic simulators are employed in VANET simulations, traces are commonly generated offline to speed up network simulation performance, which can
Then reuse generated trace files. However, one major drawback of using offline mobility traces, both pregenerated ones and those obtained from real-world measurements is that they can only model the influence of road traffic on network traffic, but not vice versa. In order to achieve this goal, more sophisticated simulation techniques such as bidirectional coupling between a network traffic simulator and a road traffic simulator are needed.

Background

Simulators have become indispensable tools at least in the initial phases of the VANET application engineering process. Under these conditions, computer simulation has become the main tool in VANET research [3]. However, despite the attention the field has received in the last decade, there is currently no standard simulator for vehicular communications. Simulating a VANET involves two different aspects. First, there are issues related to the communication among vehicles. Network simulators, like The Network Simulator—ns-2 (2008) and Jist/SWANS (2008) cope with communication issues and focus on network protocol characteristics [4].
In the majority of VANET applications, vehicles react to messages. For instance, if a driver receives a message saying that the road ahead is congested, that driver will probably change her/his route. In order to study such reactions, an integrated simulator is needed, one in which the relationship between the vehicle mobility module and the network communication module is bidirectional.
Choffnes and Bustamante (2005) showed that the vehicular mobility (traffic) model is very important, and its integration with the wireless network model could produce more significant results. The authors have used the simulator to show that studying routing protocols for a vehicular network without an accurate vehicular traffic model is a wrong approach.
In this respect, they compared their own results with those obtained with the Random Waypoint model (Broch, 1998), which is a very inaccurate representation of a vehicular network [4]. The mobility model implemented in some simulators is not a sufficiently accurate representation of actual vehicle mobility. For example, in the model of Saha and Johnson (2004), each vehicle moves completely independent of other vehicles, with a constant speed randomly chosen. Multi-lane roads or traffic control systems are not taken into consideration. Other authors make similar simplifying assumptions and do not consider multi-lane roads or car following models. The mobility model of Choffnes and Bustamante (2005) is more complex: the motion of a vehicle is influenced by the preceding vehicle, and traffic control systems are considered. However, multi-lane roads are not taken into consideration.

Simulation Tool for VANET

There are two aspects of simulating VANET: one is the traffic simulation and other is network simulation. The traffic simulation aids in creating traces of urban mobility model; this information is fed into the network simulation. The network simulation builds topologies between the nodes and vice versa. Several approaches can be distinguished among the simulation frameworks used for VANET research [4]. The first one is to feed real vehicular traces to a network simulator. This solution has the advantage that it only needs a very simple mobility model. No computation is involved and the network simulator only needs to read from a file the geographical position of the vehicle. However, there are also some important negative aspects about real traces. First of all, such data is very rare. While some highway operators regularly gather this type of information, there are very few dedicated campaigns at the level of a city or region. A second aspect is the fact that the movement of the vehicles is pre-established and it cannot be modified by information received through vehicular communications. This makes real traces unusable for a series of scenarios, like traffic management. A number of simulations exist for VANET but none of them have been up to the mark and none of them can provide a completion solution set for simulating VANET. From the traffic simulator perspective, the traces generated once seem useless after a certain time as the dynamics of traffic change abruptly. Another problem that remains difficult to solve is the inter communication issue between the two simulators i.e. traffic and network simulator. Without a solid solution to this problem, the inter communication between the two still remains a matter of discussion.

Types of Traffic Simulator

VisSim

VisSim is a visual environment for model-based development and dynamic simulation of complex systems. It combines an intuitive graphical interface with a powerful simulation engine to accurately represent linear and nonlinear systems, and simulate their behavior in continuous time, sampled time, or a combination of both. VISSIM is the global leader on the market of commercial traffic simulators [5]. VisSim's visual interface offers a simple method for constructing and simulating large-scale complex dynamic systems; its math engine provides fast, accurate solutions for linear, nonlinear, continuous time, discrete time and time varying and hybrid system designs. The framework includes a very powerful graphical user interface which allows the user to define his own maps and scenarios. The traffic model is a car-following model that considers psychological characteristics of the drivers. A pedestrian mobility model is also included, which could be very interesting for some urban environment scenarios.

Sumo

Simulation of Urban Mobility (SUMO). It is an open source microscopic simulator, mainly developed by employees of the Institute of Transportation Systems at the German Aerospace Center. It can be used on most operating systems and the community around this project proposes many interesting extensions, like the possibility to generate real-time GPS traces from dump output [5]. The driver model in SUMO is more simplistic than the one in VISSIM and this translates in a higher simulation speed but in fewer details in the mobility model, because of its high portability and its GNU General Public License, SUMO has become the most used traffic simulator for vehicular communications.

VanetMobiSim

VanetMobiSim is an extension to CanuMobiSim , a generic user mobility simulator. VanetMobiSim is aimed at extending the vehicular mobility support of CanuMobiSim to a higher degree of realism. VanetMobiSim adds two original microscopic mobility models in order to include the management of intersections regulated by traffic signs and of roads with multiple lanes, but it is to note that the complete tool integrates all of the CanuMobiSim features, providing a very wide set of possibilities in simulating vehicular mobility. VanetMobiSim are necessary to reach a level of realism sufficient to confidently simulate VANETs mobility [6].

Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

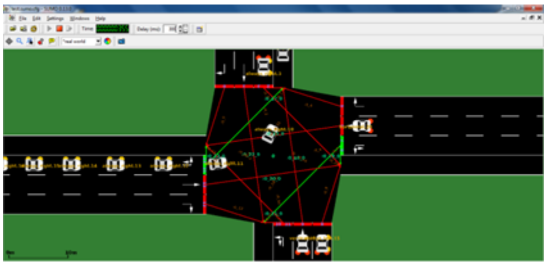

Fig. 1- VANET using traffic simulator SUMO

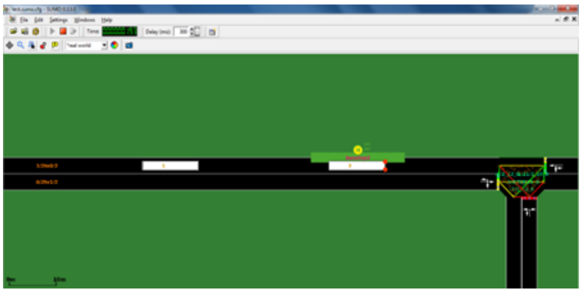

Fig. 2- VANET using traffic simulator SUMO showing bustop

System Specification

System Requirements

Software Requirements-

- Operating system : - Windows 7
- Coding Language : XML,C++
- Traffic Simulator: SUMO
- Software: Visual Studio 2010

Conclusion

VANET simulation requires that a traffic and network simulator should be jointly used with a powerful feedback between them to render the simulation results as accurate as real life. The increasing popularity and attention in VANETs has prompted researchers to develop accurate and realistic simulation tools .We first presented features of important traffic and network simulators and also certain VANET simulators. Vehicular communications are a major component of a future intelligent transportation system. Designed mainly for safety-related reasons, a vehicular network can also be used by applications with a different profile, like traffic management or passenger entertainment. Software based simulations are designed to provide an alternative to obtain the required results. VANET hits the protocol's strength due to its highly dynamic features, thus in testing a protocol suitable for VANET implementation the use of realistic mobility model should be considered.. In this paper, we make a survey of several publicly available mobility generators, network simulators, and VANET simulators. The mobility generators studied include SUMO, VisSim ,VanetMobiSim. VanetMobiSim have good software features and traffic model support. However, only VanetMobiSim provides excellent sketch support. This paper tries to assist the first stage of a study on vehicular communications by providing researchers with meaningful information regarding the crowd of existing VANET simulators.

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