ENHANCEMENT IN VEHICULAR ACCIDENT MONITORING AND PREVENTION USING MOBILE SENSOR DATA

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ABSTRACT

The presence of high-end Internet-connected navigation and infotainment systems is becoming a reality that will easily lead to a dramatic growth in bandwidth demand by in-vehicle mobile users. This will induce vehicular users to resort to resource-intensive applications, to the same extent as today's cellular customers. The research work considers a system where users aboard communication-enabled vehicles are interested in downloading different contents from Internet-based servers. This scenario captures many of the infotainment services that vehicular communication is envisioned to enable, including news reporting, navigation maps, and software updating, or multimedia file downloading. The project outlines the performance limits of such a vehicular content downloading system by modeling the downloading process as an optimization problem, and maximizing the overall system throughput. The research work investigates the impact of different factors, such as the roadside infrastructure deployment, the vehicle-to-vehicle relaying, and the penetration rate of the communication technology, even in presence of large instances of the problem. Results highlight the existence of two operational regimes at different penetration rates and the importance of an efficient, yet 2-hop constrained, vehicle-to-vehicle relaying.

INTRODUCTION

VANET is the technology of building a robust Ad-Hoc network between mobile vehicles and each other, besides, between mobile vehicles and roadside units. There are two types of nodes in VANETs; mobile nodes as On Board Units (OBUs) and static nodes as Road Side Units (RSUs). An OBU resembles the mobile network module and a central processing unit for on-board sensors and warning devices. The RSUs can be mounted in centralized locations such as intersections, parking lots or gas stations. They can play a significant role in many applications such as a gate to the Internet.

V2V communication in the VANETs is implemented on the intelligent transportation systems (ITS). Vehicles are enabled to communicate among themselves (vehicle-to-vehicle, V2V) and via roadside access points (vehicle-to-infrastructure, V2I). Vehicular communication is expected to provide safe and secure journey by providing the rode condition and other necessary information to the driver, and also to make travel more convenient. The integration of V2V and V2I communication is beneficial because V2I provides better service sparse networks and long distance communication, whereas V2V enables direct communication for small to medium distances/areas and at locations where roadside access points are not available.

For communication in vehicular ad hoc networks, position-based routing has emerged as a promising candidate. For Internet access, Mobile IPv6 is a widely accepted solution to provide session continuity and reach ability to the Internet for mobile nodes. While integrated solutions for usage of Mobile IPv6 in (non-vehicular) mobile ad hoc networks exist, a solution has been proposed that, built upon on a Mobile IPv6 proxy-based architecture, selects the optimal communication mode (direct in-vehicle, vehicle–vehicle, and vehicle–roadside communication) and provides dynamic switching between vehicle– vehicle and vehicle–roadside communication mode during a communication session in case that more than one communication mode is simultaneously available.

VANETS is one of the interested research areas. The main interest is in applications for traffic scenarios technology, cellular systems, sensor networks and future combat systems.

Recent research has focused on topology related problems such as range optimization, routing mechanisms, or address systems, as well as security issues like traceability or encryption. In addition, there are very specific research interests such as the effects of directional antennas for VANETs and minimal power consumption for sensor networks.

AP deployment is formulated as an optimization problem where, however, the objective is not content downloading but the dissemination of information to vehicles in the shortest possible time. The minimum number of infrastructure nodes to be deployed along a straight road segment so as to provide delay guarantees to the data traffic that vehicle has to deliver to the infrastructure, possibly with the help of relays.

A similar problem is addressed with the aim to support information dissemination. The different objectives of the above studies lead to completely different formulations, thus to results not comparable with the ones to present. The infrastructure placement strategies are proposed that maximize the amount of time a vehicle is within radio range of an AP.

An AP deployment strategy designed to favor content download through relaying in vehicular networks is introduced. The proposed optimization problem, however, aims at maximizing a metric reflecting the amount of vehicular traffic that enables V2V communication, and not the actual throughput. Moreover, such a formulation cannot capture the mutual interference among concurrent traffic transfers and content downloading and dissemination. With regard to content downloading in vehicular networks, unlike ours, focuses on the access to web search and presents a system that makes such a service highly efficient by exploiting pre-fetching.

LITERATURE SURVEY

In the paper" Understanding Traffic Dynamics in Cellular Data Networks"[1] the authors U. Paul, A.P. Subramanian, M.M. Buddhikot, and S.R. Das were stated that the he first detailed measurement analysis of network resource usage and subscriber behavior using a large-scale data set collected inside a nationwide 3G cellular data network. The data set tracks close to a million subscribers over thousands of base stations.

The analyze individual subscriber behaviors and observe a significant variation in network usage among subscribers. They characterize subscriber mobility and temporal activity patterns and identify their relation to traffic volume. They then investigate how efficiently radio resources are used by different subscribers as well as by different applications. In the paper" Alpha Coverage: Bounding the Interconnection Gap for Vehicular Internet Access", [7] the authors Z. Zheng, P. Sinha, and S. Kumar were stated that Vehicular Internet access via open WLAN access points (APs) has been demonstrated to be a feasible solution to provide opportunistic data service to moving vehicles. Using an in situ deployment, however, such a solution does not provide worst-case performance guarantees due to unpredictable intermittent connectivity.

On the other hand, a solution that tries to cover every point in an entire road network with APs (full coverage) is not very practical due to the prohibitive deployment and operational cost. They introduced a new notion of intermittent coverage for mobile users, called α-coverage, which provides worst-case guarantees on the interconnection gap while using significantly fewer APs than needed for full coverage

They proposed efficient algorithms to verify whether a given deployment provides α-coverage and approximation algorithms for determining a deployment of APs that will provide α-coverage. They compare α-coverage with opportunistic access of open WLAN APs (modeled as a random deployment) via simulations over a real-world road network and show that using the same number of APs as random deployment, α-coverage bounds the interconnection gap to a much smaller distance than that in a random deployment.

In the paper" Maximizing the Contact Opportunity for Vehicular Internet Access" [14] the authors Z. Zheng, Z. Lu, P. Sinha, and S. Kumar were stated that with increasing popularity of media enabled hand-helds, the need for high data-rate services for mobile users is evident. Large-scale Wireless LANs (WLANs) can provide such a service, but they are expensive to deploy and maintain. Open WLAN access-points (APs), on the other hand, need no new deployments, but can offer only opportunistic services with no guarantees on short term throughput.

In the paper "Vehicular Opportunistic Communication under the Microscope",[16] the authors were stated that the problem of providing vehicular Internet access using roadside 802.11 access points. They build on previous work in this area with an extensive experimental analysis of protocol operation at a level of detail not previously explored. They report on data gathered with four capture devices from nearly 50 experimental runs con-ducted with vehicles on a rural highway. The three primary contributions are: They experimentally demonstrate that, on average, current protocols only achieve 50% of the overall throughput possible in this scenario. In particular, even with a streamlined connection setup procedure that do e s not us e DHCP, high packet losses early in a vehicular connection are responsible for the los s of nearly 25% of overall throughput, 15% of the time.

METHODOLOGY

The system methodology the content downloading system so as to maximize the aggregate throughput. To this aim, we have to jointly solve two problems: 1) given a set of candidate locations and a number of APs to be activated, it identifies the deployment yielding the maximum throughput; 2) given the availability of different data transfer paradigms, possibly involving relays, we have to determine how to use them to maximize the data flow from the infrastructure to the down loaders.

Recent studies have also shown that unlike 3G, WiFi communications cannot support continuous access to vehicles. As a result, a WiFi device must proactively fetch all available data from the info-station, so that the user can browse information of interest offline. Therefore, vehicles need to download a large common content (like a tourist package) as they pass by the info-station. The second major challenge is rate scalability: the rate of data dissemination must be high and scale as the number of receivers increases. Ironically, this means as the system becomes more popular and the density of vehicles using it increases, the average amount of data that a vehicle receives from the info-station drops.

However, using broadcasts introduces its own challenges: 802.11 broadcasts are unreliable, because they do not use acknowledgments or retransmissions; they also use a static data rate, and cannot leverage dynamic rate adaptation. Both of these limit dissemination throughput The existing system generates a time-expanded graph DNTG, from a vehicular mobility trace. The aim of the DNTG is to model all possible opportunities through which data can flow from the APs to the downloader, possibly via relays. Given the mobility trace, it therefore identifies the contact events between any pair of nodes (i.e., two vehicles, or an AP and a vehicle). Each contact event is characterized by:

The quality level of the link between the two nodes. Several metrics could be considered; here, it specifically takes as link quality metric the data rate achievable at the network layer

The contact starting time, i.e., the time instant at which the link between the two nodes is established or the quality level of an already established link takes on a new value

The contact ending time, i.e., the time instant at which the link is removed, or its quality level has changed.

Roadside infrastructure i.e., access points are working at different capabilities irrespective of vehicle infrastructure are not considered

Different kind of vehicles (for example, vehicle with low quality devices receive different type of same file. Here the bandwidth consumption is more.

To capture the space and time network dynamics, and to formulate a max-flow problem whose solution provides an upper bound to the system performance are not considered.

Packets flooding occur in all nodes.

Chance of partial file transmission to vehicles farther from info-stations.

Each node may only schedule a broadcast when it receives a message for the first time.

The existing algorithm results in more broadcasts because it selects all neighbor nodes in the worst case.

Information Retrieval (IR) is a profound technique to find information that addresses the need of query. Processing of multimedia is easier and information can be retrieved efficiently. There are plenty of algorithms in hand to carry out the multimedia retrieval. Whereas retrieving geospatial information is very complex and requires additional operations to be performed. Since geospatial data contain complex details than general data such as location, direction.

Multiple concepts have proposed techniques to improve data dissemination using application-level encoding techniques such as network coding and Bit Torrent-like protocols. However, all of these systems are either designed on top of the wireless transport layer, or assume reliability through retransmissions at the wireless MAC layer. Few studies have examined the issue of vehicle density on real systems, or how well coding techniques perform in high mobility, high-loss environments.

Roadside infrastructure i.e., access points are working at different capabilities irrespective of vehicle density.

Different kind of vehicles (for example, vehicle with low quality devices receive different type of same file (text, image, etc).

Vehicle density based download scenario is applied to Access Points. Packet flooding is not occurred.

Selects only minimum neighbor nodes in the worst case (more vehicle density).

Full file transmission is possible to vehicles farther from info-stations.

OBJECTIVE

The quality level of the link between the two nodes. Several metrics could be considered; here, it specifically takes as link quality metric the data rate achievable at the network layer;

The contact starting time, i.e., the time instant at which the link between the two nodes is established or the quality level of an already established link takes on a new value;

The contact ending time, i.e., the time instant at which the link is removed, or its quality level has changed.

PROPOSED METHODOLOGY

A. Show Network

In this implementation step, a Typical Vehicular Network (with RSU Installed) is shown graphically. The panel control is used to draw the node details.

B. Add/View Access Point

In this implementation, access point unit are added and saved to ‘Access Points’ table. The access point will create and transfer information to vehicles which become relays or downloader. In this module, Access Point details are fetched from ‘Access Points’ table. The records are displayed using data grid view control.

C. Add/View Neighbor Access Point

In this module, Access Point id and Neighbor Access Point id details are added and saved to ‘Neighbor Access Points’ table. In this module, Access Points and its Neighbor Access Points details are fetched from ‘Neighbor Access Points’ table. The records are displayed using data grid view control.

D. Add/View File

In this implementation form, Access Point id is selected, file id and file path is keyed in and the details are added and saved to ‘Files’ table. The file is copied into ‘Files’ folder inside the project folder. In this module, Files details are fetched from ‘Files’ table. The records are displayed using data grid view control.

E. Add/View Vehicle

In this module, vehicle id is added and saved to ‘Vehicles’ table. The vehicle will act as relay as well as receiver. In this module, vehicle details are fetched from ‘Vehicles’ table. The records are displayed using data grid view control

F. Dynamic Network Topology Graph (DNTG)

In this module, a time-expanded graph is generated, from a vehicular mobility trace. To build the graph, we consider that on the road layout corresponding to the mobility trace there are:

A set of A candidate locations (ai, i = 1, ..., A) where APs could be placed

A set of V vehicles (vi, i = 1, ..., V) transiting over the road layout and participating in the network, and

A subset of D vehicles that wish to download data from the infrastructure.

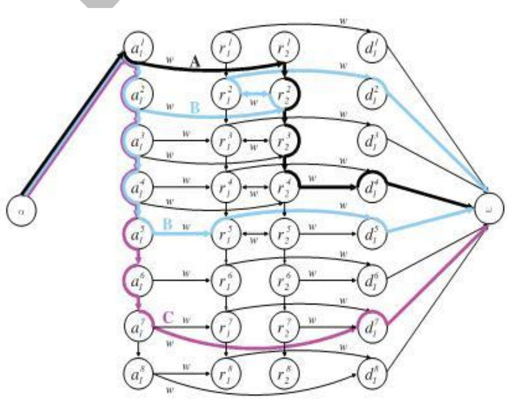

Fig.5.1 DNTG resulting from the contact events

G. The Max-Flow Problem

In this module, given the DNTG, the next step is the formulation of an optimization problem whose goal is to maximize the flow from to i.e., the total amount of downloaded data. Denoting by x the traffic flow over an edge connecting two generic vertices. The max-flow problem needs to be solved taking into account several constraints such as non-negative flow and flow conservation.

H. Vehicle Density Based Access Point Data Downloading

In this module, Vehicle density is calculated based on previous temporal changes and the new vehicle density is calculated. The access points' capabilities are adjusted so that it works more in high vehicle density environment and works less in low vehicle density environment.

CONCLUSION

The proposed system framework based on time-expanded graphs for the study of content downloading in vehicular networks. The approach allows to capture the space and time network dynamics, and to formulate a max-flow problem whose solution provides an upper bound to the system performance. Simulation results showed that the physical- and MAC-layer assumptions on which the framework relies have a minor impact, leading to a tight upper bound.

Last, the future work can validate the design and study its performance under real-complex environments. Improvements will be made based on the realistic studies before it comes to be deployed in large-scale systems.

The proposed system provides a best assistance in object tracking and merging two path sequences. The application become useful if the below enhancements are made in future.

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