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Divert A Distributed Vehicular Traffic Re-Routing System for Congestion Avoidance

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Abstract

Nowadays, choosing a node to carry the files via network is inefficient due to multiple end-users are requesting for packets at the same time. The problem is to identify the shortest path, traffic cost is high, and hackers enter the network to access the file. Whenever user requesting for packets to service provider, it has been carried out via router to provide security and effective way of transmission without any hackers. We proposed a VAN router that manages the transmission process. Once the packet enters router follows: (i) identifies the shortest path to transmit the packets, (ii) analyze the migration cost, (iii) when a hacker enters the network, the details of the hacker is send to the GPS to identify hackers location,(iv) provides the user requested packets back to the user without any modification. GPS work is to identify the hacker location in which node they are trying to access the files and that information has been sent to the user where hacker enters the network. Each packet sent by the service provider via router to end-user, the router intimates service provider with a confirmation message. Finally, VAN router provides security to the end-user by avoiding hackers to access the file and minimizes traffic cost, finds shortest path.

- Whenever user requesting for packets to service provider, it has been carried out via router to provide security and effective way of transmission without any hackers.
- VAN router provides security to the end-user by avoiding hackers to access the file and minimizes traffic cost, finds shortest path.

Key Terms: VANET – Vehicular Ad-Hoc Network, GPS – Global Positioning System .

1. Introduction

Vehicular Ad-hoc Networks (VANET) is the state of- the-art technology in the domain of transportation where vehicles communicate with each other and static Roadside Units (RSUs) via vehicle-to-vehicle (V2V) and vehicle-to infrastructure (V2I) communication to offer various applications. It includes both safety (e.g., traffic safety and efficiency) and non-safety (e.g., infotainment) applications. VANET performs a key role in the emerging smart cities and Internet-of-Things (IoT) with the aim to improve overall transportation. Figure 1 illustrates the integration of VANET in smart cities where traffic safety is achieved by connecting vehicles to each other by virtue of V2V or V2I communication. Since, applications offered to connected vehicles involve very critical information (such as steep-curve, or accident warning), a secure, attack-free and trusted network is imperative for the propagation of reliable, accurate and authentic information. In case of VANET, ensuring such network is extremely difficult due to its large-scale and open nature, making it susceptible to diverse range of attacks includingMan-in-the-middle (MITM), replay, jamming and eavesdropping attacks.

In order to address these shortcomings, trust has been proposed as a relevant technique to achieve network security. Trust is defined as the confidence of one node on the other for performing a specific action or set of actions. In VANET, it is established between two vehicles based on the messages exchanged regarding an event. Once, message is received, the evaluator node calculates trust based on numerous factors, including vehicles past interactions, vehicles reputation in the network and neighbours' recommendations about particular vehicle. However, trust between neighbouring vehicles is created for a very limited duration of time due to highly mobile and randomly distributed vehicles. Therefore, establishing, calculating, and evaluating trust on received messages based on diverse factors in such short period of time is extremely challenging.

Literature Survey

Traffic assignment is an important stage in traffic modeling. Most of the existing approaches are based on finding an approximate solution to the user equilibrium or to the system optimum, which can be computationally expensive. In this paper we use a genetic algorithm to compute an approximate solution (routes for the trips) that seeks to minimize the average travel time. To illustrate this approach, a non-trivial network is used, departing from binary route choice scenarios. Our result shows that the proposed approach is able to find low travel times, without the need of re-computing shortest paths iteratively.

One issue with traffic assignment is that even if each driver has a small set of routes to choose to go from A to B, the number of combinations of these routes (one for each driver) can be very high. The problem is not only complex due to this fact, but also because each trip affects the cost of many others since they use restricted resources (the links themselves). Section II discusses some methods that have been employed to solve this problem in an approximate way. In this paper we propose the use of a GA-based method that, although not guaranteed to find the optimum solution (from the system's point of view) for the trip assignment, has the advantage of being simple to implement and finds good solutions within minutes, without the need of recompiling shortest paths iteratively (as some of the approximate solutions do).

Thus, given a traffic network, the assignment from the point of view of the user equilibrium can be analytically stated as an optimization problem: find all flows from each OD pair s.t. only paths with minimal costs have a nonzero flow assigned to them, which corresponds to Wardrop's first principle. For a mathematical formulation of this problem, the reader is referred to Chapter 2 in, as well as to. One problem with this scheme is that it is not possible to solve the equilibrium flows algebraically, except for very simple cases (e.g., two or three links connecting a single OD pair). Thus, approximate solutions to the user equilibrium were proposed. Navigators based on real-time traffic achieve suboptimal results since, in face of congestion, they greedily shift drivers to currently light-traffic roads and caused new traffic jams. This paper presents Themis, a participatory system navigating drivers in a balanced way. By analyzing time- stamped position reports and route decisions collected from the Themis application, the Themis server estimates both the current traffic rhythm and future traffic distributions. According to the estimated travel time and popularity score computed using the learned information; Themis coordinates traffic between alternatives and proactively alleviates congestions. Themis has been implemented and its performance has been evaluated at different penetration rates based on real data. Experiments using data from 26,000 taxis demonstrate that Themis reduces both traffic congestions and average travel time

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at various penetration rates as low as 7%...

The route guidance provided by RGS can be based either on prevailing real-time traffic condition (prevailing route guidance) or predicted traffic condition (predictive route guidance), and it has been widely recognized in the transportation engineering community that when predictions are accurate, predictive information is generally expected to be more effective than prevailing information because predictive information accounts for the rapid change of traffic conditions spatially and temporally. Although a couple of anticipatory RGSs have been proposed in academia, these systems are fundamentally reactive solutions. In other words, current route guidance systems are no more than alert systems, as they provide driver's traffic information after congestion happens instead of proactively guiding drivers to prevent congestion from happening. Due to this strategic limitation of current RGS, the traffic prediction module in existing RGS has been mainly focusing on travel time prediction and the consistency of predicted travel time. Automobile congestions have an adverse effect in modern societies, causing the loss of billions of dollars and man hours every year throughout the world. In this era of global economic recession, drivers will require the necessary solutions and driving aids that facilitate the improvement of daily road transport and minimize unnecessary expenditure. In this work, we lay the groundwork for V-Radar, a query protocol for retrieving vehicular traffic information using V2V communications. The advantage of V-Radar over related works is its ability to monitor using location-dependent queries the prevailing traffic conditions in a number of road-paths from a vehicle's current location towards its final destination. We introduce its modular architecture and provide preliminary evaluation results showing significant improvements over a similar scheme.

The development of mobile devices and mobile communication has lead to a great prosperity of navigation applications. Modern drivers equipped with GPS-enabled devices not only digest the traffic information but also work as traffic information providers. Google Maps and Waze apply the location and event reports collected from Smartphone users to compute the estimated time of arrival (ETA) of the routes. Driving experiences and fuel consumptions are also shared in novel systems to help users' route choices. According to Ericsson Consumer Lab, 29% of Smartphone users in the U.S.use Google Maps or other Smartphone navigation apps during morning commute in 2011. Given the similar number of dedicated navigation devices, the penetration rate of dynamic navigation users is now considerable.

A few routing algorithms have been proposed to overcome the drawback of greedy routing. These algorithms, called cooperative routing, plan routes based on anticipated traffic volume (ATV) and corresponding predicted travel time (PTT) by assuming previously routed cars follow their suggested routes. For example, in Fig. 1, two cars may anticipate the future congestion in route 1 and take route 2 instead, even if route 2 has longer ETA based on the real- time traffic. In our prior work, we also presented a cooperative routing algorithm, EBkSP, to route traffic based on both ETA and the popularity of the candidate routes Traffic congestion causes driver frustration and costs billions of dollars annually in lost time and fuel consumption. This paper presents five traffic re-routing strategies designed to be incorporated in a cost-effective and easily deployable vehicular traffic guidance system that reduces travel time. The proposed strategies proactively compute individually tailored re-routing guidance to be pushed to vehicles when signs of congestion are observed on their route. The five proposed strategies are Dynamic Shortest Path (DSP), shortest path with repulsion, Random k- Shortest Paths, Entropy Balanced k-Shortest Paths , and Flow Balanced k- Shortest Paths . Extensive simulation results show the proposed strategies are capable of reducing the travel time as much as a state-of-the-art Dynamic Traffic Assignment (DTA) algorithm, while avoiding

DTA impractical such as lack of scalability and robustness, and high computation time. Furthermore, the variety of proposed strategies allows tuning the system to different levels of trade-off between rerouting effectiveness and computational efficiency. Also, the proposed traffic guidance system can significantly improve the traffic even if many drivers ignore the guidance or if the system adoption rate is relatively low.

This article lays the groundwork for V-Radar, a vehicular traffic information query protocol for urban environments based on V2V communication. Incontrast to other approaches in the literature that aim to obtain traffic information on singular roads, V-Radar enables the querying and acquisition of traffic information along a composite road-path, starting from a vehicle's current position towards its final destination. Specifically, V-Radar is able to query not only the initially selected road-path, but also a number of alternate paths that lead to the vehicle's destination. This allows the driver or the in-vehicle navigation system to establish a more broad and complete view of the traffic conditions that will be encountered further ahead. Such knowledge can be extremely valuable in the process of calculating a more optimal route to the destination in terms of travel time.

System Design

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having

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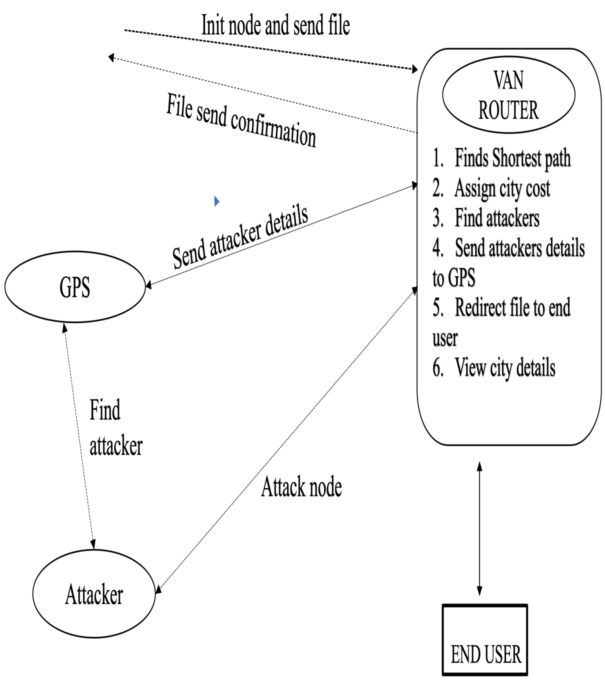
people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.



Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make

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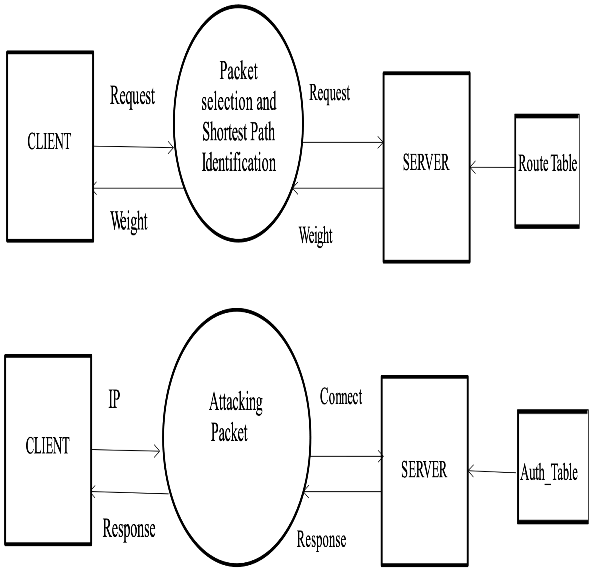
data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout .

DATA FLOW DIAGRAM LEVEL 1



A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

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Implementation

Greedy Perimeter Stateless Routing

Greedy Perimeter Stateless Routing protocol for wireless datagram networks uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbours in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility's frequent topology changes; GPSR can use local topology information to find correct new routes quickly.

The results also showed that the proposed road traffic model can be easily obtained and transmitted in real time by individual vehicles while they are travelling on streets or queuing in road cross junctions and provides a good prediction on road traffic status. The proposed model can be enhanced further by combining different histogram statistics with respect to speed, utilization, and throughput. This will be investigated in further research.

Modelling and analysis of the road traffic in a statistical way give the insight of understanding the Relationship between the higher order distribution function and the roadway navigation algorithms. Every lane has its own characteristics based on the vehicle injection behaviour over the time period, for example, some intersections will have more congestion during the office hours and some intersections will be more congested during the school timings. The congestion happening in urban areas is heterogeneous and changes over the period of time. In the proposed algorithm, this behaviour of changing patterns has been studied and taken into consideration. The traffic flow can be predicted by observing the vehicles travelling in every lane. To estimate the traffic flow of individual lanes, a density function should be derived as follows. ITS uses wireless sensor nodes that is intended for monitoring the road environment.

Dijkstra’s Shortest Path Algorithm

The *Dijkstra’s Algorithm* finds the shortest path from a source to all destinations in a directed graph (single source shortest path problem). During this process it will also determine a spanning tree for the graph Finding the shortest path in a network is a commonly encountered problem. For example you want to reach a target in the real world via the shortest path or in a computer network a network package should be efficiently routed through the network.

One of the essential properties of the road network is the time-dependency of the travel time. Computing shortest paths in a time varying spatial network is challenging since the edge (i.e., road segment) travel time changes dynamically. In this case, the computation not only considers the instantaneous travel time in one single snapshot of the traffic graph but also the relationship among the consecutive snapshots across time.

```
function Dijkstra(Graph, source):
 dist[source] ← 0
create vertex priority queue Q
for each vertex v in Graph:
if v ≠ source
  dist[v] ← INFINITY
  prev[v] ← UNDEFINED
Q.add_with_priority(v, dist[v])
while Q is not empty:
u ← Q.extract_min()
for each neighbor v of u:
alt ← dist[u] + length(u, v)
if alt < dist[v]
      dist[v] ← alt
      prev[v] ← u
 Q.decrease_priority(v, alt)
 return dist, prev
```

Demonstrated a fast greedy time dependent shortest path algorithm (SP-TAG) by using a Time Aggregated Graph (TAG) data structure instead of the time expanded graph. SP-TAG saves storage and computation cost by allowing the properties of edges and nodes to be modeled as a time series instead of replicating nodes and edges at each time unit. While algorithms such as SP-TAG provide insights into the dynamics of traffic networks, two obstacles remain besides increased computational cost.

First, it is impractical to assume the system knows the exact travel time series of every single road segment given the traffic dynamics. Second, these algorithms do not help with switching congestion from one spot to another if all the drivers are provided the same Time- dependent shortest path.

Dynamic shortest path SP is a classical rerouting strategy that assigns the selected vehicles to the path with lowest travel time. However, different from the existing systems, our system takes a proactive approach. Specifically, each time a road segment presents signs of congestion, the service obtains the set of cars whose paths intersect this road segment and computes for each car a new shortest path based on the current travel time in the road network. Therefore, the path of each car can be periodically updated on an event-driven basis.

The advantage of this strategy lays in its simplicity and consequently reasonable computational cost, where E is the number of road segments and V is the number of intersections of the road network. We expect this strategy to provide good results when the number of re- routed vehicles is low, since in this case the risk of switching congestion from one spot to another is low. Hence, locally redirecting the traffic when congestion happens should be sufficient in this case. On the other hand, when the traffic density is higher, there is an increased risk of switching the congestion from one road to another. Moreover, the re-routing frequency for a driver is likely to increase in this case, which can be annoying to drivers.

```
procedure uniform_cost_search(Graph, start, goal) is
    node ← start
    cost ← 0
    frontier ← priority queue containing node only
    explored ← empty set
    do
        if frontier is empty then
            return failure
        node ← frontier.pop()
        if node is goal then
            return solution
        explored.add(node)
        for each of node's neighbors n do
            if n is not in explored then
                frontier.add(n)
```

This is due to the fact that low mobility of vehicles provide ample amount of time for legitimate vehicles to validate trust on the sender. Moreover, network is affected when it is polluted with static attackers. These attackers have a constant attack-vector in a attack prone location, thus it is highly unlikely that vehicles receive trusted messages from legitimate vehicles in presence of the attackers. On the contrary, vehicles have the possibility to receive trusted messages in presence of mobile attackers as the attack-vector changes continuously due to their mobility. Scalability is one of the crucial requirements in VANET as the rate of entering and exiting vehicles in the network is not constant.

Modelling human factor (driver's honesty and selfishness) accurately for trust management is a challenging task in VANET. Recently, some TMs are proposed which relies on social networks for trust management. Currently, TEAM can only evaluate TMs for pure VANET and it cannot evaluate social network based TMs as it is not integrated in our framework yet. Recently, some effort is done in adopting Content-Centric Networking (CCN) and Named Data Networking (NDN) into VANET. Currently, TEAM is limited to host-based communication paradigm only, and hence, it cannot evaluate TMs which are developed purely on CCN and NDN-based VANET.

Since, applications offered to connected vehicles involve very critical information (such as steep-curve, or accident warning), a secure, attack-free and trusted network is imperative for the propagation of reliable, accurate and authentic information. In case of VANET, ensuring such network is extremely difficult due to its large-scale and open nature making it susceptible to diverse range of attacks including man-in-the-middle (MITM), replay, jamming and eavesdropping attacks.

Conclusion and Future Enhancement

The project is to identify the shortest path, traffic cost and the hackers enter the network to access the file. Whenever user requesting for packets to service provider, it has been carried out via router to provide security and effective way of transmission without any hackers. Finally, VAN router provides security to the end-user by avoiding hackers to access the file and minimizes traffic cost, finds shortest path. GPS is used to identify the location of the hacker using hacker details sent by the VAN router whenever a hacker enters into the network to access files.The results show that the proposed proposed a VAN router which helps the network to transmit data from the service provider to end-user without any hackers. GPS is used to identify the location of the hacker using hacker details sent by the VAN router whenever a hacker enters into the network to access files. This approach provides end-user a security to request and receive packet without any modification on the packet as well as avoid hackers to not access user information. Implementing the same conceptual ideas in other fields beyond share broking can be considered as future enhancement.

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