A Novel Routing Based Path Planning Using RSU and OBU for Time Critical Information Sharing

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Abstract: ***Real-time traffic information can efficiently reflect the traffic condition in urban scenarios. However, how to design an efficient real-time information sharing mechanism to achieve the real-time traveling time estimation and dynamic path planning still remains a challenging problem. In this paper, we first propose an effective real-time traffic information sharing mechanism based on a distributed transportation system with RSUs, which has lower computing complexity and less redundancy. Then, considering current traffic information, we present a method to estimate the traveling time from a source to a destination in the road network, called TTE, which acts as a metric for path planning. Furthermore, we propose a real time path planning algorithm based on TTE comparison via information collection to avoid traffic congestion. We verify the complexity and redundancy of our proposed real-time information sharing mechanism via C#. Moreover, we perform extensive simulations in Vanet MobiSim to evaluate the proposed real time path planning algorithm, which uses the real world traffic scenario and urban map of Songjiang district in Shanghai. The results show that our proposed algorithm outperforms the static path planning algorithm.***

Keywords: VANET, RSU, TTE, PATH-PLANNING, Energy

1. Introduction

With the rapid increase in the number of private cars, traffic congestion has become an urgent problem to be solved. Recently, researches show that the traveling time for vehicular commuters in Beijing is twice as much to reach their destinations and traffic congestion cost ranks the highest in China. The topic of optimal path planning, which reduces the traveling time and avoids the congested road segments, has attracted many attentions from both academic researchers and traffic management organizations. The performance of path planning depends on the efficiency of information acquisition. The conventional method is to use historical data to predict the traffic flow on the road, which is easy to realize but is infeasible when a sudden congestion occurs (i.e. the traffic accident). Therefore, the emerging of vehicular ad hoc networks (VANETs) needs to deal with the issue of real-time traffic information acquisition in a mobile network environment . In VANET, an on-board unit (OBU) is equipped on the vehicle and a road-side unit (RSU) is deployed at road intersections. Vehicles share the traffic information, including position, velocity, traffic density and congestion message, with other vehicles or RSU, via vehicle to-vehicle communication (V2V) and vehicle-to-RSU communication (V2R). The data delivery of VANET realizes the issue of real-time information collection and sharing. Furthermore, there is a probability that the received real time information

becomes useless when vehicles receive it because of the vehicles' rapid mobility. Effective information sharing mechanism can reduce the sharing delay and then improve network's stability.

2. System Analysis

It becomes a major challenge problem for real-time information sharing in path planning, due to unbalanced traffic density in the road network and suddenly happened traffic accidents. To realize the real-time information sharing in transportation systems with rapid mobility vehicles, a road based using vehicular traffic (RBVT) routing via VANETs was presented in. In, an adaptive ant colony optimization in VANET was studied to realize traffic information sharing. The bidirectional roadways and traffic lights' signal operation can reduce the delay of traffic information sharing in VANETs. The emerging of VANET makes the rapid real-time traffic information sharing possible in transportation.

Drawback:

1) The existing system does not have a module which will transfer the real time information at a fast rate.
2) The existing system does not use the existing infrastructure of RSU and OBU unit
3) The existing system delays the information sending process as new method of data transformation is not available.

First, we propose a novel real-time traffic information sharing mechanism based on RSUs in an integrated distributed system architecture of VANETs, which incorporates the V2V, V2R, and R2R communications, and leads to not only rapid delivery but also lower computing complexity and redundancy. • Second, we present a method to estimate the traveling time in road traffic network. According to different road segments, the traveling time estimation includes three parts, i.e., traveling on the road segment, waiting at the intersection and bypassing the intersection. We consider the connected vehicles rate's influence on the precision of TTE. This paper gives the detailed formula of traveling time estimation (TTE), which will be used later in real time path planning. • Finally, we design a real-time path planning algorithm, which can re plan and revise the previous path according to the real-time traffic information. The algorithm can not only reduce the total traveling time from source to destination, but also avoid the sudden traffic congestion during the traveling.

Advantages

1) The given module sends the real time information about the congestion at a junction to the other vehicles.
2) The information transmitting happens fast and effortlessly using the proposed system
3) The energy utilization of the proposed system is less as compared with the existing system.
4) The proposed system uses the existing infrastructure like RSU, OBU which saves the installation of new hardware for working purpose.

3. System Design

System Architecture

The transportation network architecture is shown Fig., which contains two layers, including vehicles on the road segments, and RSU deployed at road intersections. The on- board unit (OBU) is equipped on the vehicle, aiming to realize the V2V communications with the other vehicles on the road segment and the V2R communications with RSU at road intersection. OBU records vehicle's mobile information, *i.e.* vehicle's ID, vehicle's position, real-time speed and so on. For instance, the OBU can record the vehicle's realtime speed on road segments. Once it obtains the real-time information about the following road segments from RSU via V2R communication, the vehicle can estimate the traveling time based on the real-time speed on this road segment, which is recorded by its OBU.

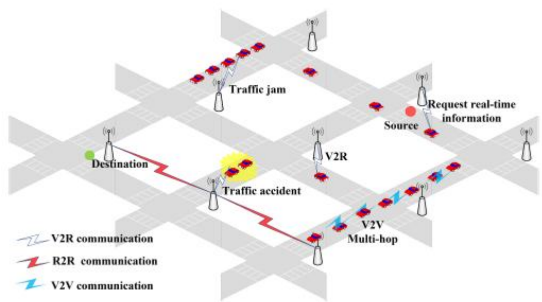
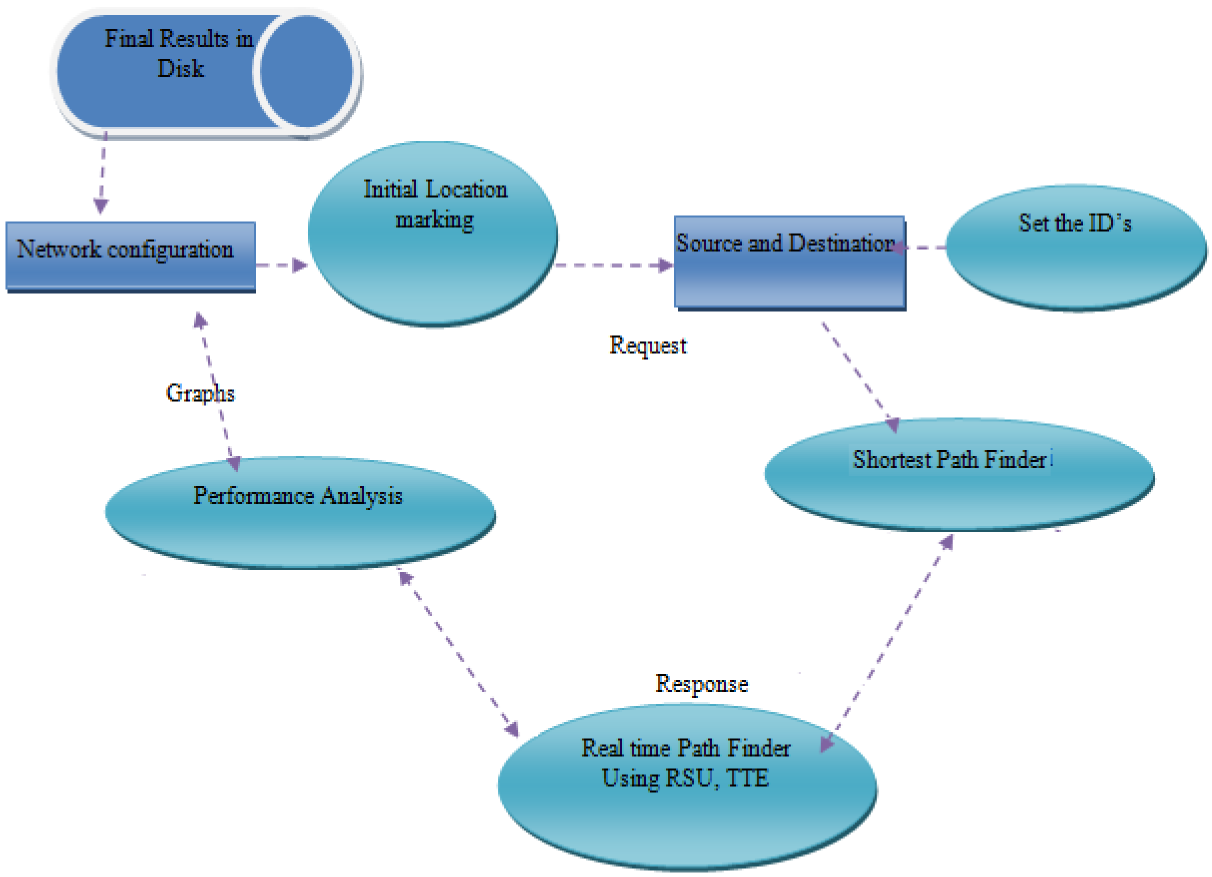


Fig. 1: Illustration of the Network architecture.

Data flow Diagram:



The above is a data flow diagram which will show how the flow of the modules happens in the system

4. Implementation

Network Configuration

In the first module we develop the Network Configuration for our proposed model. Several significant improvements are introduced in our new two-tier BUS-VANET architecture since we fully integrate BUS-VANET with traffic infrastructures. Firstly, three assumptions are made in our BUS-VANET: 1) All the vehicles, buses and RSUs are equipped with DSRC devices for communicating with each other and GPS based navigation system with a digital road map. Current information about traffic statistics is also available to them. 2) Buses and RSUs are additionally equipped with either a Wi-Fi or WiMAX communication capability. Therefore, they are truly formed a backbone of VANET. 3) The route and schedule of every bus and the location of each RSU are shared with all other vehicles.

Selection of Registration Node

In our proposed BUS-VANET, each vehicle needs to register with a nearby high-tier node for getting data delivery service. How to determine which bus or RSU should be selected for registration is an important issue if a vehicle received several beacons from different high-tier nodes. When a vehicle received an active beacon from a bus or RSU, this bus or RSU will be regarded as a candidate registration high-tier node and be put into a candidate set. If a vehicle lost connection with its currently registered bus or RSU, it needs to switch its registration to another high-tier node.

Destination Vehicle Location Identification

By integrating TCC and RSUs with buses and vehicles, we design a new scheme for identifying the destination vehicle quickly. In this subsection, we will provide more details about this TCC identification scheme including how to find the correct location of a destination and how to decrease the workload of TCC. As we mentioned, each bus or RSU keeps a registration table recording which vehicles are currently registered with them. These registration tables will be reported to the TCC periodically and TCC maintains a location table to store these collected information. The format of the location table in TCC is simulated, which records the information about each vehicle has registered on which bus or RSU.

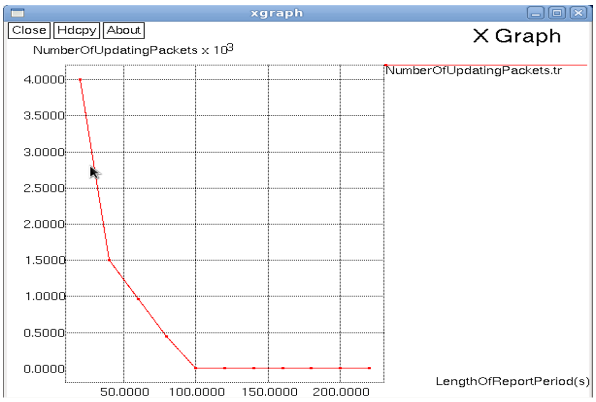
Simulation Results and Performance Evaluation

The following metrics are used in this project:

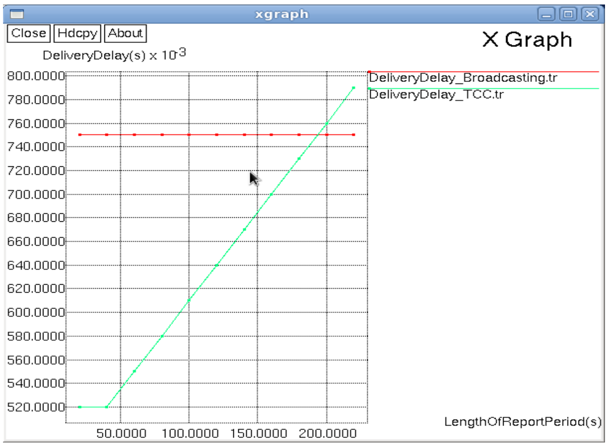
- Packet Delivery Ratio
- Average End to End Delay

Packet Delivery Ratio (PDR): The packet delivery ratio in this simulation is defined as the ratio between the number of packets sent by constant bit rate sources (CBR," application layer") and the number of received packets by the CBR sink at destination. The following equation is used to calculate the PDR.

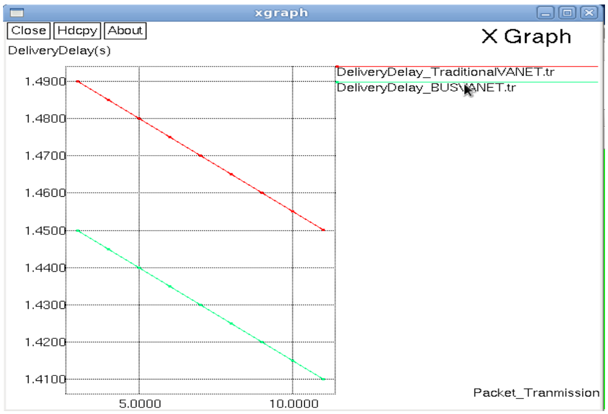
5. Impact of Result



The above graph is the number of packets it is updated in order to give the real time path planning form the source to the destination path.



The above graph is the comparison of the delay happened in checking the real time path planning with proposed and existing system, as one can see from the above graph the proposed system is far better than the existing one.



Delay rate with the energy conservation is given in above graph, the energy must be less utilized in any of the wireless sensor network, as one can see the wireless sensor network comprises of the battery operated, so utilizing the energy must be done in a systematic order so that the longitivity of the application is carried out.

6. Conclusion

The examination work endeavors to build up a versatile vitality proficient MAC convention (AEEMAC) for remote body region arrange. Low power utilization is the primary prerequisite in remote sensor arrange. The created convention depends on adjusted WiseMAC and Modified S-MAC. The proposed framework is dependable and straightforward figuring strategy and can well fit for pragmatic use in application, for example, medicinal services checking frameworks. Through this exploration work, we infer that, there are different strategies and devices for assessment of vitality proficient Macintosh convention for remote body region arrange. This examination examined different vitality proficient MAC conventions for WBAN. Amid the ebb and flow examine, a few zones have been recognized that could be additionally examined. The significant zone of quick research is the examination concerning new versatile vitality effective MAC convention, which can be more vitality effective, increment in throughput, parcel conveyance proportion and additionally increment hub life of sensor for variable movement stacks in remote body region arrange. This is accomplished utilizing versatile conflict window and dynamic obligation cycle ideas.

7. Acknowledgment

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