International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Dynamic Traffic Density Routing for Vanets Using Cooperating UAVS

B S Aparna [1], Mr. R. Karthikeyan [2]

[1]UG Scholar, Department of Computer Technology, Sri Krishna Adithya College of Arts and Science, Coimbatore.
[2] Assistant Professor, Department of Computer Technology, Sri Krishna Adithya College of Arts and Science, Coimbatore.

ABSTRACT

This study introduces the DAVN, which efficiently combines the communication and networking technologies of drones and connected vehicles to provide ubiquitous connections for automobiles. In particular, we first provide a thorough architecture for the DAVN and describe some of its potential services. Drones can enhance vehicle-to-vehicle connection, infrastructure coverage, network information collection capability, and network interworking efficiency by collaborating with vehicles and infrastructures. In this system, we explore how UAVs in ad hoc mode might work with VANET on the ground to facilitate routing and increase the reliability of data delivery by bridging connection gaps when necessary. The effectiveness of vehicle networks can be greatly improved using the suggested DAVN design, according to simulation studies.

KEYWORDS – VANET, DAVN, Routing, Communication, UAV.

1. INTRODUCTION

Intelligent Transportation Systems (ITS) are a group of cutting-edge technologies that are anticipated to make a variety of services for managing and securing traffic on roads possible. Vehicular Ad hoc Networks (VANETs) are anticipated to have a significant impact on increasing road safety and making commuting more enjoyable as an integral component of ITS. VANETs depend on inter-vehicular communication (IVC) to create an effective information exchange between cars, roadside

equipment (RSU), and sometimes nearby pedestrians. ITS may provide a variety of services without relying on permanent communication infrastructures thanks to VANET routing protocols, which enable vehicles to organise themselves into mobile communication networks.

Each of these entities has the ability to act as a relay to facilitate data packet forwarding and routing in VANETs. These relays, however, are restricted to specific regions and occasionally are unable to send data between cars. Unmanned aerial vehicles (UAVs) that fly over cities have considerably expanded in number during the past few years. UAVs are anticipated to be used for a variety of purposes in the near future. We won't have to wait long for the necessity to group UAVs in an ad hoc network of flying vehicles speaking with one another and sharing data because they are equipped with communication and navigational accessories.In this work, we examine the potential for heterogeneous communications between an ad hoc network of flying UAVs and preexisting VANETs. The goal of this research is to use UAVs to re-establish communication linkages when they are broken down by barriers. Here, UAVs are used for both data packet delivery and re-linking broken road segments.

2. EXISTING SYSTEM

For vehicle-to-infrastructure (V2I) communications in VANETs based on fixed infrastructure-RSUs, connection analysis (propagation speed and time) and delay probability distribution have been proposed in numerous articles. For example, Abdrabou and Zhuang provided a probabilistic model for the delivery delay of packets from a vehicle to an RSU. The greatest distance between infrastructure-RSUs that stochastically restricts vehicle-to-RSU packet delivery delay to a specific upper bound is obtained using their model, which is based on effective bandwidth theory and the effective capacity notion. Additionally, an earlier proposal used a mathematical framework for distributing the delivery delay of vehicle-to-RSU packets depending on the spacing between fixed RSUs that are evenly spaced out throughout the road. They did not, however, include in their model the wireless communication coverage of the RSU.

3. DRAWBACKS

- The infrastructure drones act as gateways to the Internet and the infrastructure of other systems, such as the intelligent transportation system (ITS), while the cars relay their real-time data and Internet requests to the drones.

- However, it is challenging to achieve VANETs with complete connectivity by filling in all gaps in the roadway in terms of infrastructure expense (number of drones).
- Contrarily, using fewer drones results in long vehicle-to-drone delays since packets must be carried farther, especially in VANETs with low vehicular density. This is so that the vehicles can carry and go on via these openings until they reach the next drone..

4. PROPOSED SYSTEM

The Drone Assisted Vehicular Networks (DAVN) architecture that we suggest is comprehensive. In DAVN, drones are connected with traditional VN to enhance vehicle connectivity, increase infrastructure coverage, make network data collection easier, and provide vehicles more access to resources. Based on the DAVN architecture, drones can be used to deliver several enhanced VN applications, including ubiquitous Internet connectivity, dynamic transportation surveillance, and seamless hand-off across infrastructures or networks. In order to have a comprehensive understanding of the connected segments and enhance routing, we propose UVAR (UAV-Assisted VANET Routing Protocol), a revolutionary routing protocol that works in conjunction with existing UAVs in the sky. The UVAR protocol accounts for the actual distribution of vehicles in the chosen road segments to avoid the drawbacks of earlier efforts, which not only results in correct calculations of vehicle connection but also removes the current calculation-distorting challenges. UAVs are also utilised in UVAR to calculate connectivity thanks to their comprehensive view of the overflew road segments. Despite employing the same methodology as in for forwarding data packets on the ground, UVAR fully utilises UAVs because the obstacle problem is no longer an issue.

5. FEATURES

- The closed-form representation of the vehicle-to-drone packet delivery delay probability distribution provides a design tool that may establish the maximum separation distance between two nearby drones while satisfying a probabilistic requirement of vehicle-to-drone packet delivery delay.
- It can be used to optimize drone placement and determine the smallest number of drones needed to cover a two-way major road.

6. MODULE

A) VEHICLE

On board units (OBUs) are incorporated in DAVN vehicles to allow for communication with other network components. The OBUs facilitate vehicle-to-vehicle communication and offer a variety of connections to various types of networks. Vehicles in the DAVN also feature a data processing module (DPM) to handle the interworking and data exchanges among heterogeneous networks because heterogeneity has become an unstoppable trend for Vehicle Network (VN).

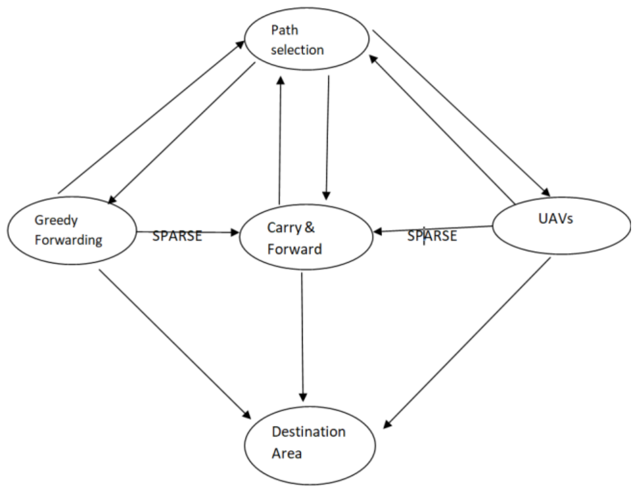
B) INFRASTRUCTURE

Cellular base stations (BSs) and roadside units (RSUs) are both classified as infrastructures in the DAVN. Infrastructures can use DSRC or the cellular band to immediately transmit data to vehicles and drones within their coverage area. However, drone relays for V2I communications are used outside of coverage or in coverage gaps where reliable data delivery cannot be ensured. A group of remote radio access nodes (RRAN) are formed by drones in DAVN, which is similar to the idea of a remote radio head (RRH). Each infrastructure sends out a few RRAN drones to hover over the gaps in its coverage. Vehicles in the vicinity of coverage gaps communicate directly with RRAN drones, which subsequently transmit V2I data to infrastructures via dedicated drone-to-infrastructure (D2I) lines.

C) DRONE

Relaying node (RN) drones and RRAN drones are the two types of drones taken into account by DAVN. Drones used for RN can be thought of as flying vehicular nodes when they operate on DSRC or the wider spectrum band for VN. They access infrastructures similarly to automobiles and relay data for vehicle-to-vehicle communications. Additionally, a swarm of RN drones can create a network of drones to give cars another entry point. RRAN drones can be dynamically allocated to the necessary positions to support V2I data transfers by acting as remote radio access points. RRAN drones are used to improve V2I connectivity for coverage gaps and to increase capacity for designated zones. Both varieties of drones have sensors for gathering network data.

7. SYSTEM BLOCK DIAGRAM



8. CONCLUSION

In order to effectively increase system performance, we have devised a comprehensive DAVN architecture to combine drones with terrestrial vehicular networks. The difficulties and unresolved research problems in DAVN have been discussed. It has been established that DAVN is effective. In this research, we suggested a routing system to achieve a low vehicle-to-drone packet delivery latency by enhancing VANET connections with infrastructure drones. The probability distribution of the vehicle-to-drone packet delivery delay on a two-way roadway was proposed in this work as a closed-form formula.

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