VEHICLE TELEMATICS SYSTEM

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***Abstract*—In contemporary road networks, mitigating the myriad of daily occurrences that pose traffic congestion and safety hazards demands innovative solutions. Vehicle Ad-hoc Networks (VANETs) hold immense potential for improving road safety and traffic efficiency. However, efficient data dissemination remains a challenge due to the broadcast storm problem and network partitions. To address these challenges, we propose a distance-based data dissemination mechanism that confines data propagation to specific regions, thereby curbing channel contention and packet transmission volume. Our approach focuses on directing data dissemination management to targeted nodes or node subsets within the network, enabling timely and appropriate responses to emergent road conditions. This paper proposes a novel approach that leverages a spatial data distribution protocol and the Epidemic algorithm within the Veins_INET framework to address these issues in urban environments. The proposed system aims to reduce end-to-end delay, minimize packet drops, and enhance driving quality.**

Keywords—VANET, Data Dissemination, Broadcast Storm, Epidemic Algorithm, Veins, SUMO, INET.

I. INTRODUCTION

The rapid advancements in technology, such as artificial intelligence, hardware speed, communication revolution, and 5G networks, have led to the development of dependable interconnected ad hoc networks for vehicles operating in road situations. These networks, known as VANETs (vehicle ad hoc networks), play a significant role in enabling intelligent transportation systems, smart city functionality, and various services, including hazard control systems and emergency handling services. In VANETs, data dissemination management must be directed towards a specific node or subset of nodes in the network to enable appropriate action in critical circumstances. The architecture of a VANET system comprises numerous distinct domains and components, with data dissemination between components categorized as vehicle-to-infrastructure (V2I), infrastructure-to-vehicle (I2V), or vehicle-to-vehicle (V2V) communication. V2I communication allows vehicles to exchange information with infrastructure components, such as traffic lights, lane markings, and streetlights, over a wireless and bidirectional communication network. The presence of RSUs (Road Side Units) plays a crucial part in VANETs, enabling moving vehicles to achieve connectivity and intercommunication, making the network more dependable and steadier. V2V communication allows vehicles to wirelessly share data about their location, heading, and speed with other nearby vehicles. This technology provides cars with a 360-degree "awareness" of other vehicles, allowing them to assess potential crash threats and alert drivers through visual, tactile, or audible alerts, thereby preventing collisions. In summary, VANETs are revolutionizing the transportation industry, making our roads safer and enabling a range of services that improve our lives.

Messages are exchanged between the vehicles in the VANET, a special application of MANET, to spread info. The directional character of the message flow is imposed by the limited road topology in VANETs. It becomes crucial that data be transmitted in the most effective methods and with the least amount of delay due to higher node speeds and unstable connectivity among the nodes.

In VANET architecture data dissemination between components is categorize as vehicle to infrastructure (V2I) or infrastructure to Vehicle (I2V) and vehicle to vehicle (V2V).

A. VEHICLE TO INFRASTRUCTURE COMMUNICATION (V2I)

Vehicle-to-infrastructure (V2I or v2i) is a communication model that enables vehicles to exchange information with the components that sustain a nation's highway system. Traffic lights, lane markings, streetlights, signs, parking meters, and overhead RFID readers and cameras are a few examples of such components. In V2I communication, data from infrastructure components can be delivered to the car over an ad hoc network and vice versa. Typically, this type of communication is wireless and bidirectional. V2I utilizes dedicated short-range communication (DSRC) frequencies, which are like those used in vehicle-to-vehicle (V2V) communication, to transfer data. The RSUs (Road Side Units), which can be compared to an AP (access point) in a wireless network play a crucial part in the VANETs system. RSUs can be used by moving vehicles to achieve connectivity and intercommunication. The network becomes more dependable and steadier when uploading and downloading data thanks to the presence of RSUs, and the bandwidth grows as a result.

B. VEHICLE TO VEHICLE COMMUNICATION (V2V)

Vehicles can wirelessly share data about their location, heading, and speed using vehicle-to-vehicle (V2V) communication. With the help of the V2V communication technology, cars can send and receive omnidirectional messages up to 10 times per second, giving them a 360-degree "awareness" of other nearby vehicles. When a possible crash threat arises, vehicles with the proper software (or safety applications) can use the messages from nearby vehicles to assess the situation. The technology can then use visual, tactile, or audible alerts, individually or in combination, to alert the drivers. These alerts give drivers the option to take action and to prevent collisions.

II. EXISTING SYSTEM AND PROBLEM STATEMENT

The Vehicular Ad hoc Network, or VANET, is an emerging form of wireless technology that makes it possible for vehicles travelling at high speeds to communicate with one another. Researchers and companies that make automobiles have taken an interest in VANETs because of their potential to reduce the number of accidents that result in fatalities by transmitting data over a network. One component of VANETs that contributes to the enhancement of both the vehicles' safety and their performance is data dissemination. In order to avoid a broadcast storm, the primary focus of the proposed system is the development of an effective data dissemination mechanism.

III. PROPOSED SYSTEM

The model proposed in this work uses Veins_INET framework to locate accident vehicle (head node) in the network. The accident vehicle represents network's head node. Data (about the accident) is then transferred to other network sub nodes. Epidemic algorithm is used in this model to distribute information. A powerful distributed computing paradigm is provided by the algorithms. Although data distribution has been extensively studied in academic journals, issues of broadcast storm and network partition are not properly addressed by the solutions that are presently available. The proposed project offers a spatial data distribution protocol for use in urban environments that is conscious of network partitions. Abbreviations and Acronyms

A. EPIDEMIC ALGORITHM

In this algorithm, each node maintains a copy of the data and periodically exchanges it with a few randomly selected neighbors. Over time, the data spreads to all nodes in the network. The basic idea behind the Epidemic algorithm is to use a store-and-forward approach, where nodes store copies of messages that they receive and forward them to other nodes as they encounter them. The algorithm assumes that nodes can communicate directly with each other if they are within a certain range, and that messages can be exchanged when nodes come within range of each other. The Epidemic algorithm works as follows:

1. When a node receives a message, it stores a copy of it in its local memory.
2. The node then broadcasts the message to all other nodes in its immediate vicinity.
3. As nodes move around and come into contact with each other, they exchange messages and update their local memory accordingly.
4. If a node receives a message that it has already seen, it discards the duplicate copy.
5. If a node encounters a destination node for a message that it has in its local memory, it forwards the message directly to the destination node.

If a node has a message that it has not been able to deliver to its destination after a certain amount of time, it broadcasts the message to all nodes in the network, in the hope that another node will eventually be able to deliver it.

B. IEEE 802.11p PROTOCOL:

The IEEE 802.11 MAC layer protocol uses a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) algorithm for medium access control, which is a widely used algorithm in wireless networks. In addition to CSMA/CA, the IEEE 802.11p protocol also includes various enhancements and adaptations for vehicular environments, such as: Short interframe spacing: In order to reduce latency and increase the reliability of communication, the IEEE 802.11p protocol uses shorter interframe spacing than traditional Wi-Fi networks. Extended channel time: The IEEE 802.11p protocol allows for longer channel occupancy times, in order to support the high mobility and rapid communication requirements of vehicular networks. Priority access: The IEEE 802.11p protocol includes provisions for priority access to the wireless medium for emergency and safety messages, which can take precedence over other types of messages. Geocast and broadcast support: The IEEE 802.11p protocol includes mechanisms for efficient geocast and broadcast communication, which are important for supporting various vehicular applications.

C. CARRIER SENSE MULTIPLE ACCESS COLLISION AVOIDANCE (CSMA/CA) ALGORITHM:

Carrier sense multiple access/collision avoidance (CSMA/CA) is a protocol for carrier transmission in 802.11 networks. It was developed to minimize the potential of a collision occurring when two or more stations send their signals over a data link layer. Carrier sensing: Before a node transmits data, it listens to the wireless channel to check if it is busy with other ongoing transmissions. If the channel is busy, the node waits until the channel becomes idle. Transmission: After the backoff time elapses, the node transmits data on the wireless channel. If the transmission is successful, the node goes back to the first step and listens to the channel again before sending the next packet. If the transmission fails due to a collision, the node doubles the contention window and repeats the backoff process again. Overall, the CSMA/CA algorithm helps to avoid collisions between multiple nodes by using carrier sensing and random backoff times before transmitting data on the wireless channel. It is a widely used algorithm in wireless networks and is an important component of the IEEE 802.11 family of protocols. The data dissemination procedure is simulated using the Veins_INET framework, as seen in the below figure 3. In order to inform the nearby nodes (sub node) within range of the collision that has happened, the accident vehicle (head node) transmits a signal.

IV. RESULTS AND DISCUSSION

FIG. Nodes Flow

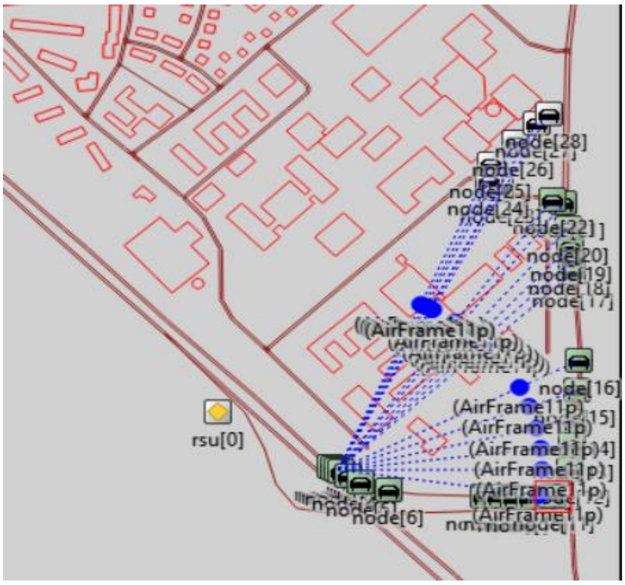

FIG. Head Node sharing data to Sub Nodes

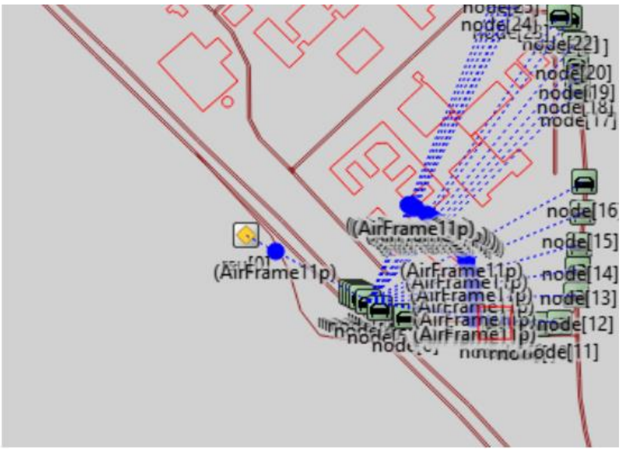

FIG. RSU sending data to all nodes

TABLE I. PARAMETERS

PARAMETER	VALUE
BEACONING RATE	6MBIT/S
BEACON SIZE	256 BYTES
MAXIMUM TRANSMISSION POWER	20MW
MINIMUM SIGNAL ATTENUATION THRESHOLD	110DBM
MAXIMUM INTERFERENCE DISTANCE	2600M
DATA TRANSMISSION DISTANCE (V 2 V)	250M
ACKNOWLEDGEMENT LENGTH	112BITS

V. CONCLUSION

Despite the fact that data dissemination has been the subject of a significant amount of research in published works, the problems of broadcast storm and network partition are not being adequately addressed by solutions that are currently available. As a solution to both of these problems, the proposed project offers a geographical data distribution protocol that is aware of network partitions and is designed for use in urban environment. This protocol eliminates the problems caused by broadcast storms and improves the ability to disseminate data throughout the various partitions of the network while reducing both latency and overhead to a minimum.

VI. FUTURE SCOPE

Future enhancements to the project could include integrating artificial intelligence algorithms and sensor technology to improve the accuracy and reliability of data dissemination and hazard detection. Moreover, the project could incorporate advanced communication technologies, such as 5G and V2X, to enable more advanced services, including autonomous driving. Ongoing research and development in this field are likely to lead to further improvements in road safety and driving quality, demonstrating the vast potential for future enhancements to this project.

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