A Survey on Congestion Prevention in Vehicular Social Network using VANET and FoG Computing

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Abstract - *FoG-Enabled Vehicle ad hoc network (FEV) is an evolving and innovative area of study with rapid development in communicating vehicles. In various information sharing applications, several messages are exchanged, including traffic monitoring and area-specific monitoring of live weather and social aspects. It is quite difficult Where residents on the move are not compatible with vehicle velocity, orientation, and density. Congestion evasion is also quite difficult in this situation in order to prevent loss of interaction during working hours or in urgent situations. This paper introduces emergency signal broadcasting systems in (Vehicle Ad-hoc NETwork) VANET and Vehicular FoG computing which is depending on congestion avoidance situations. In a comparable sense, VANET architecture enabled by FoG is being researched that can efficiently manage the signal's congestion conditions. We introduce a scheme taxonomy that addresses congestion prevention messages. Next, to show the strengths and faults, we included a debate on comparing congestion prevention systems. We also found that FoG servers enable us to limit availability delays and congestion relative to the cloud allowed to access all applications in connection with big data repositories. We have recognized a range of accessible research problems for the reliable applicability of FoG in VANET.*

***Key Words*:, Congestion, FEV, FoG Computing, RSUs, VANET.**

1. INTRODUCTION

VANET encompasses vehicles with internet connections to share details among themselves [2], [3]. Vehicles operate as mobile devices in VANET to retrieve and distribute data in central Big data repositories, including the current status of the vehicle, travel speed, distance remaining [4]. Vehicle networks facilitate driving security, manage congestion and monitor emergency circumstances in the event of health problems, vehicle collisions, land slipping and slippery highway sections. This must also recognize the social integrity and reply to emergency circumstances which can differ from area to area. Social vehicle networks can also warn neighboring drivers in a particular area to evade more threats by retrieving information from Big data repositories about highway and area situations. Throughout this case, other vehicles can modify the path as per the target to reduce congestion. Vehicles also send an email to neighboring accumulation locations or servers to exchange information with Intelligent Transportation System (ITS) [5]. Intelligent vehicles can also automatically check street situations and risks to decrease speed and also inform the other vehicles to slow down from the accident region.

Primarily distribution of the information can be classified as one-hop and multi-hop. In one-hop, messages are only transferred to immediate neighbors [5] whereas, in multi-hop, messages are comparable to the actual street condition to transmit information to the immediate neighbors [6]. In this case, long delays must be omitted where traffic congestion can impact the efficiency of information sharing systems.

Social networks and vehicular networks are now becoming an interrelated and increasing concern. There is a need for Vehicular Social Networks (VSNs) including challenging data exchange criteria across a large number of people. Vehicular clouds are the answer to offering important data repositories for Big data. It can assist to manage and reduce improper driving and associated hazards. Furthermore, the recognition of congestion areas is also hard in social networks. The use of publicizing data in spatial and geographic sections to simulate congestion situations. Since evaluating multiple outcomes, it is reported that congestion in social networks is compatible. In quite the same way, 5G (Fifth-Generation) achieves low latency-based secure interaction. Emerging technologies faced problems in connectivity, coverage, and availability.

1.1 FoG server-based architecture

FoG computing offers data computation, storing information and connectivity between end users and cloud servers [1], [3]. It tends to decrease the latency and delays caused by obtaining storage from the cellular network. Due to mobility, vehicles need to depend on unidentified service providers that can break safety [2]. Throughout this circumstance, vehicles may behave as communication centers or agents to exchange local data rather than sending unnecessary sets of big data to cloud servers.

FoG servers can modify the information extracted from social networks and vehicular networks to forecast feasible interdependencies. This comprises both local decision-making and geo-distribution features to reduce delay. connecting via the web or the Base Station (BS). FoG server has allocation idea for load balancing and event sharing between distinct local FoG servers. Fig -1 emphasizes two modes to retrieve FoG servers, such as in the first case, it retrieves vehicles and transportation systems through Road Side Units(RSUs) and in the second case, it retrieves users and smartphones are connecting via the web or the Base Station (BS) [1]. FoG server has allocation idea for load balancing and event sharing between distinct local FoG servers.

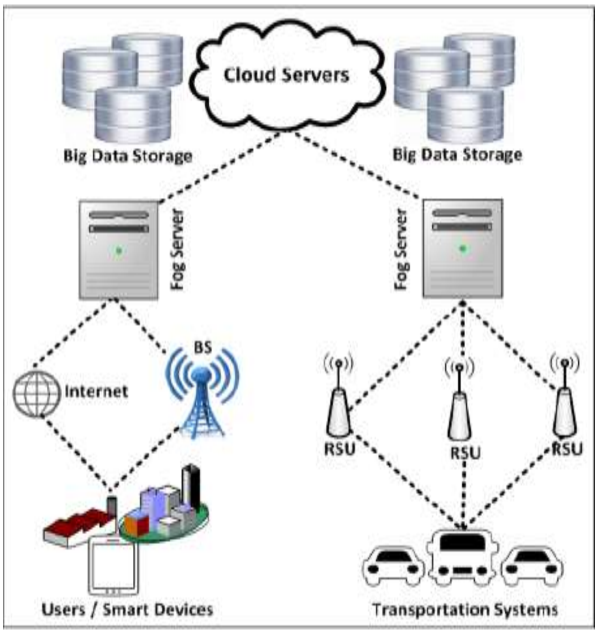

Fig -1: Architecture focused on the FoG server for transportation systems, users and smartphones using RSUs.

1.2 Existing Work and Proposed work

Emerging methods are implemented using 3G and 4G cellular networks, especially in combination with RSUs, but these are not perfectly adequate for cellular networks to offer unlimited connectivity and coverage [1]. To resolve the emerging constraints FoG computing, Software Defined Network (SDN) and 5G can support in a better way. Researchers face a wide range of difficulties in offering effective and safe alternatives to improve energy overhead, connectivity, coverage, and computation [2], [3]. VANETs are the most popular network in which vehicles have rich energy, storage, and connection capability. In addition, the topology of the network varies commonly due to rapid mobility. Researchers outlined the benefits of FoG computing in terms of improving the concept that has been used in future directions.

2. FOG ENABLED VANET ARCHITECTURE AND ITS CHALLENGES

This section discussed with FoG enabled VANET architecture and its challenges in achieving endless communication, coverage via V2V interaction.

2.1 FoG Enabled VANET architecture

FEV (FoG Enabled VANET) architecture is analyzed that handles message congestion and message disturbances triggered by excessive interaction during peak rush hour or urgent situations. With incremental improvements, VANETs have adopted a fundamental change towards cloud assistance such as VANET-based servers and vehicular cloud computing (VCC). It provides a huge quantity of data that is relevant to the collection of constraints of road conditions, health statistics of individuals or patients in vehicles, analytical teaching and training specifications depending on the social behavior and reaction of individuals on road accidents. Due to the multi-hop environment and mobility, future connectivity should be developed consistently. Throughout this scenario, mobile devices have communication delays when explicitly accessing the cloud or VCC. It is not appropriate for emergency situations and peak hours when a huge amount of vehicle users communicate with the internet. FoG enabled VANET to offers real-time and shared location position facilities.

In FEV architecture, we have considered vehicular FoG computing including smartphones and RSUs. Mobile phones can interact through Base Station(BS) to access the FoG server in order to effectively notify emergency circumstances without delay. Fig -2 illustrates that emergency situations can be notified through smartphones to BS for sharing with FoG servers that intimate the neighboring RSUs to address only vehicles passing on that area. This will support to remove the possibility of more collisions and destroys.

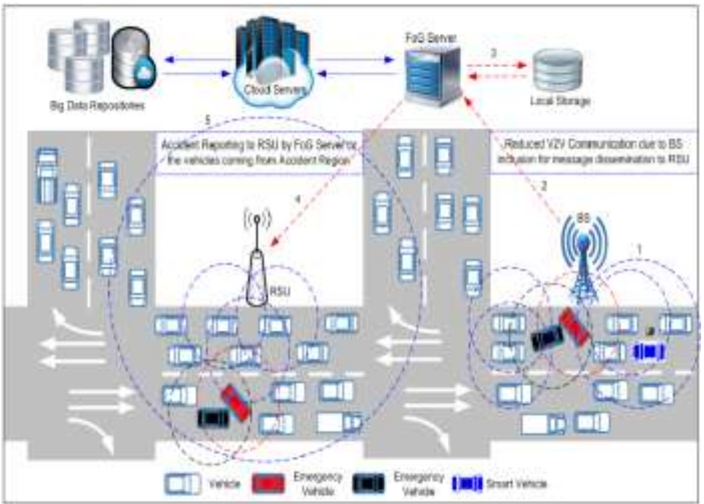

Fig -2: FEV (FoG Enabled VANET) architecture where smartphones or smart vehicles can interact with BS and RSU to report emergency activities to the FoG server.

FoG server gets location constraints exchanged by intelligent vehicles to obtain information from local storage of RSUs installed on that road in the neighboring area as represented in stage 3 as shown in Fig -2. Next, the FoG server defines path and vehicle tracks depending on prior road sections of that area [3]. Subsequently, it intimates about an emergency to RSU and preventive steps to those vehicles that are close to the emergency region as represented in stages 4 and 5.

RSU often share emails with monitoring vehicles to limit further exchanging with the next RSU. It also intimates vehicles that are usually in risk, to prevent informing about emergency situations as the incident is already detected by servers and recovery activities are launched [1]. It decreases overhead interaction and prevents congestion of messages relative to storm messages in already congested regions. Throughout this case, the Vehicle to Vehicle (V2V) interaction is quite restricted and RSU will be notified about the incident well before the vehicles from the emergency area inform to RSU. Also, it makes sure that the RSU verifies the incident, but RSU does not have to put it on hold for all such confirmations and behaves as advised by the FoG server [1]. However, in this situation, we have discussed junction-based interaction situations through the sensor nodes close to the junction can control about next-hop choice in the path of neighboring RSU during V2V interactions when both smartphones and internet choices are not accessible.

In order to implement the proposed architecture, many of the implementations are needed on the RSU, which is the key element of vehicular networks. RSU must implement the methods to receive the instructions from BS and translating the code according to enumerated value in a suitable switch case. RSU also translates instructions from the FoG server [4]. In the same way, the FoG server can also implement methods for translating the instructions sent by both RSU and BS. In this scenario, BS does not want any modifications because the existing features of sending instant messages or GPRS (General Packet Radio Service) based information messages can be transferred as per the existing setup. The RSU and FoG servers can translate and retrieve the message or information respectively.

Table -1: Real-time use case for FoG computing and their network requirements for message distribution.

Area	Application	Specification for Network Requirements
Transportation	Real-time traffic lights management, driver and vehicle safety, Reliable route estimation	Time span, enormous data, event driven and beacon messages
Smart City	Smart devices for social connection, real-time crowd identification and monitor home safety using smart locks	Huge flow of information in each domain
Forces	Secure interaction in all armies such as the Army Navy and Air Force, distributed and control task computing, house security by using smart locks	Huge confidential data, weapons tracking and safety
Healthcare	Real time health monitoring, Data storage	Time span and immense data
Tragedy management	Early warnings about tsunami arrival and earthquake detection in better time	Lack of Infrastructure, huge data

During message distribution, the movement of vehicles offers excellent message providers to convey data by creating new links consistently [4]. Due to these communication hubs, the FoG is designed rather than transmitting significant data to cloud servers. FoG server exchanges interaction services locally, which involves both local decision-making and spatial features to deliver less delay. In the same sense, we provided a set of real-time use cases in Table -1 for FoG computing enabled message distribution situations that can use FEV architecture according to the application situation.

2.2 Challenges in FoG Enabled VANET

These challenges need to be addressed in order to attain smooth traffic and road security. In smooth traffic, it requires preventing road blockage by using effective sensors. Road security standards to prevent accident rates from being informed in order to instantly protect [1]. VANET-based data allocation applications between vehicles need to concentrate on network bandwidth. Some of the challenges including such as latency, throughput, routing, safety, availability and congestion that can be strengthened using FoG computing.

3. CLASSIFICATION OF MESSAGE CONGESTION PREVENTION SYSTEMS

Congestion occurs whenever a huge number of messages are exchanged with V2V interaction to neighboring RSU or another smartphone user can identify an accident using speed and 3G data link by exchanging information to the server. Congestion prevention systems can be classified into two systems namely, static and dynamic systems. The static system utilizes fixed section positions that are not effectively applicable in VANET. Static road sections to interrupt the real condition on roads as massive sections result in failure of reliability and small section outcomes in excessive communication overhead [5]. Therefore, dynamic systems must be preferred in order to obtain information from vehicles. Dynamic systems are effective and secure to extract information in VANET rather than predetermined methods. The flexible approach can be used for many applications such as traffic light management, identification of road conditions and accident prevention. Dynamic systems are further classified into transmission control, power control, safety conservation, fragmentation and aggregation based systems as shown in Fig -3.

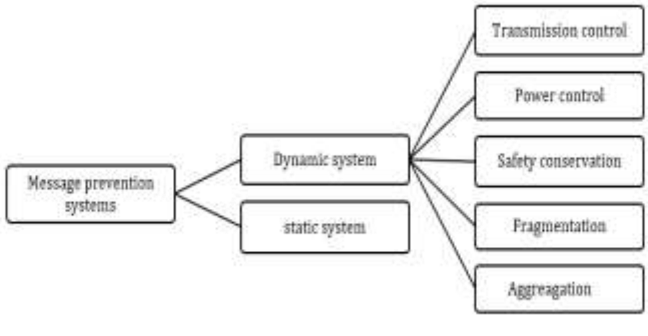

Fig -3: Classification of Message congestion prevention systems.

4. MESSAGE DISTRIBUTION METHODS

This paper involves message distribution methods and congestion prevention in VANET and FoG computing. These methods are arranged in a classification in which dynamic systems are included to handle congestion [2]. We have focused on network access, which is a key problem for allowing data distribution in V2V interaction. ITS requires to handle a few kinds of stuff like traffic management, passenger's data, and public security messages. There are 2 types of public security messages.

1. **Basic Safety Messages**: Basic safety messages are transferred for testing device connectivity. It guarantees that a specific vehicle is within the scope of an RSU or another node at the server stage. Generally, beacon messages comprise of the present location, vehicle acceleration, and path [6]. Its priority is lower than safety messages driven by an event.

2. **Safety messages are driven by event**: Safety messages driven by the event are produced during events such as to request initiation information collection, emergency notification and accident warnings These messages can either be sent through V2V interaction to RSUs.

5. CONCLUSION

FoG computing can perform a major part in vehicular networks to enhance the communication functionality for vehicles exchanging road and congestion situations. It is quite difficult when data is distributed in busy times or emergency situations when traffic can have a serious impact on smooth communications. In this paper, we surveyed message distribution systems and discussed the classification of message congestion prevention systems. It contains a set of dynamic systems that are appropriate for VANET due to flexibility assistance. We also discussed the FoG enabled architecture for VANET to prevent congestion during busy times or emergency situations. Our primary objective is to define VANETs progress towards FoG Enabled VANET (FEV) including important possibilities and challenges. We have discussed the need to present new and reliable solutions by defining the challenges for the congestion prevention problem in FoG enabled VANET.

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