A Review on Various Approaches of Video Transmission over VANET

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Abstract— VANET is filed of networking that has been widely used in intelligent transportation system. VANET is an extension of MANET that is accessible for auto driven vehicle system. Various types of messages have been transmitted over the VANET for different purposes using various routing protocols. In this paper a literature study has been done about various approaches of video message transmission over VANET. Video Messages have been transmitted to the nodes over the network using frames of the video that has been transmitted by frame to frame. Different approaches of video data transmission have been studied in this paper and brief discussion has been done about different approaches.

Key words: VANET, MANET, WLAN, GPSR, FEC and AOMDV

I. Introduction

A. VANET

Vehicular ad-hoc Network (VANET) is an application of wireless network that comprises of variable number of cars fitted with radio devices that give the ability to the driver to exchange messages smoothly over the network regardless of his position. VANET also experiences a significant point that is the supporting inter-vehicle video streaming. The commercial service has been a foreseeing trend in this kind of network, and multimedia streaming seems to be the convenient solution to a variety of predicted services. Thus, there is a blast of multimedia data consumption through a multitude of new services in our connected world. The way users perceive the quality of these services is critical. It is, therefore, necessary to relate the user perspective to the service's QoE (Quality of Experience) to the network-level QoS (Quality of Service).

B. OFDM

Orthogonal frequency division multiplexing (OFDM) is becoming the popular multi-carrier modulation technique for wireless and multimedia communication systems. Multimedia wireless services require high-bit-rate transmission over mobile radio channels. OFDM can provide large data rates with sufficient power to radio channel impairments. As OFDM has high capacity transmission , it has been applied to digital transmission system, such as digital audio broadcasting (DAB) system, digital video broadcasting TV (DVB-T) system, asymmetric digital subscriber line (ADSL), ultra-wideband (UWB) system [2], IEEE 802.11a/g Wireless Local Area Network (WLAN), IEEE 802.16 Worldwide Interoperability for Microwave Access, (Wi-Max) systems and HIPERLAN2 (High Performance Local Area Network). Its application in mobile communication is more complex especially because of the mobility of the mobile user, thus more exact symbol timing and frequency-offset control must be used to ensure that sub-carriers remain orthogonal.

C. Wireless Video Transmission

The performance of wirelessly-transmitted video [12,13] is highly dependent on the type of wireless network considered. In general, it is more challenging to transmit video over networks with multiple wireless hops. While the solutions we present here attempt to be independent of any specific wireless networking protocol, wireless network specially categorised under few points.

1) Cellular networks

When available data rates in cellular networks increase, the number of users watching or creating video on mobile phones is increasing dramatically. Current-generation cellular networks are wireless only at the first and last step leading to what is essentially a wired network with a wireless "last-mile" link. This wired backbone allows for much higher data rates than which are possible in fully wireless networks. However, the devices themselves are usually resource constrained.

2) Wireless local area network (WLAN)

Identical to cellular networks, a commercial wireless local area network or home generally relies on existing wired infrastructure for the majority of the link, and some version of the IEEE 802.11 standard to bridge the network from the fixed infrastructure to an end user. Like a cellular network, there is only a single wireless hop and the data rate is typically limited by the rate achievable on the wireless link.

3) MANET

A mobile ad-hoc network (MANET) is a self-coordinating, self-configuring infrastructure less multi-hop wireless network. The network topology along with video traffic pattern and the performance of wireless video is also influenced by the nature of the video application. Some particular application influences the tolerance to latency, distortion, and bandwidth, as well as constraints on privacy or security restrictions and format requirements. Below, we will show a number of common traffic paradigms.

D. Video Traffic Paradigms

1) Real-Time Video

Real-time video [8...10] is a video traffic pattern in which the video is being used for some real-time application slike video telephony. Because of the Real time requirement, low latency is essential. Even small delays can have a significant impact on the quality of the video. Such services can be viewed as a system that attempts to minimize the delay between the content being captured at the source and the content being displayed by the receiver.

2) Video Gaming

Video gaming applications are identical to real time video applications in which the latency of the delivered video is the primary concern. Unlike video telephony, which can be viewed as a small number of independent video streams, video gaming applications tend to be highly interactive. Such systems add additional low-latency interactive requirements to the network.

3) Video on Demand

Video on demand services transmit pre-recorded content based on the demands of the end user. Such services generally take advantage of a relatively large videos. Interactive video is essentially video on demand in which the user can interact with the playback of the video. This includes the availability of the entire video stream to deliver much higher quality video than more time-sensitive applications.

4) Interactive Video

Some mostly used commands like s vpause, fast forward, and rewind. With the huge demand for Internet video services such as Netflix and YouTube, interactive video has become the dominant source of Internet traffic in many countries.

5) Multimedia Surveillance

Video surveillance networks use video applications to oversee an area, usually to attempt to detect unauthorized or unexpected activity. When deliver real-time video content to an end user, video surveillance [11] applications may also deliver a high-quality version of the video to a storage device for later forensic requirements.

II. REVIEW OF LITERATURE

Sofiane Zaidi et al [1]"Enhanced Adaptive Sub-Packet Forward Error Correction Mechanism for Video Streaming in VANET" Video streaming over vehicular ad hoc network (VANET) provides exact information about road traffic situation, digital services requested by drivers and passengers, compared to textual messages. Rather than existing packet forward error correction (PFEC) mechanisms proposed for video streaming in VANET, which generate redundant packets for each block of original packets, EASP-FEC divides a packet into a set of original sub-packets, then it creates redundant sub-packets for each packet, to enhance the error recovery rate and video streaming quality. EASP-FEC also ignores the network congestion problem compared to sub-packet forward error correction (SPFEC) mechanism. We propose to apply EASP-FEC at the sender and relay vehicles, where the calculation process of redundant sub-packets take in consideration the traffic condition, the traffic load and the importance of video frame types (I, P, B). A set of simulations proved that EASP-FEC provides better error recovery rate than PFEC and avoids network congestion against SPFEC.

Imane Zaimi et al [2] "An Improved GPSR Protocol to Enhance the Video Quality Transmission over Vehicular Ad-hoc Networks" This work gives information on the problem of forwarding videos over vehicular ad-hoc networks (VANETs) in a time efficient manner. The same problem occours for various applications due to the highly fluent wireless networks that face different challenges to existing routing approaches. This article provides a variation of a well-known Geographic Routing protocol (GPSR),used in VANETs, introducing some multipath features consists the source node sending successive packets to more than one path of the topology since using only one path during transmission maycause reception delay due to congestion and saturation in a same path. Our proposal identified as GPRS-2P can provide a solution for delay. We observe this in urban VANETs with obstacles using a real video clips to demonstrate the feasibility of the GPSR-2P for real videos. Our experimental results show the ability of our proposal to overcome the observed problem and to improve the performance of GPSR.

Mostafa Asgharpoor Salkuyeh et al [3]"An Adaptive Multipath Geographic Routing for Video Transmission in Urban VANETs" Vehicular ad hoc networks (VANETs) make researchers know that Due to the highly dynamic nature of these networks, providing guaranteed quality-of-service (QoS), video-on-demand (VOD) sessions is a challenging problem. In this paper, a new adaptive geographic routing scheme is suggested for establishing a simplex VOD transmission in urban environments. In this pattern, rather than one route, a number of independent routes are discovered between source and destination, vehicles whose number of routes depends on the volume of the requested video and lifetime (span of time in which a route is almost fixed) for each route. A closed-form equation is derived for estimating the connectivity probability of a route, which is used to select best connected routes. Simulation results show the QoS parameters: packet loss ratio is decreased by 40.79% and freezing delay is significantly improved by 25ms compared with those of junction-based multipath source routing at the cost of 2-ms degradation in the end-to-end delay.

Roger Immichet et al [4] "Towards a QoE-driven mechanism for improved H.265 video delivery" This paper discloses the need for an adaptive video-aware and Quality of Experience (QoE)-driven mechanism to be concerned of these challenges and deliver video sequences with good quality. To this end, Forward Error Correction (FEC) techniques can be specially made to support video transmissions with QoE assurance over high-mobility and error-prone networks. The adaptive QoE-driven mechanism proposed in this paper improves the resilience of real-time video transmissions against packet losses. It depends on the combination of VANETs characteristics and High Efficiency Video Coding (HEVC) details to provide a tailored amount of redundancy, which improves both the usage of resources and the user experience. The advantages and footprint of the mechanism are marke through extensive experiments and QoE assessments, proving that the proposed mechanism outperforms non-adaptive and also adaptive competitors.

Ansam Ennaciri et al [5] "Performance Analysis of Streaming Video over Vehicular Ad-Hoc" the transmission of data in video form in Vehicular Ad-Hoc Network is a difficult task, because of the valid Quality of Service requirements of video traffic. It then becomes significant to establish specific transmission strategies to get over this problematic. Accordingly, we are looking forward in this work about the quality of service that allows the calculation of the performance of a streaming transmission especially in real time. This concept of service quality will challenge more constarints when it comes to ad-hoc networks. At the same time we are interested to the Mobility analysis in vehicular ad-hoc network and simulation of various performance factors in terms of bandwidth, loss rate, end-to-end packet delay, packet jitter and throughput of several subscriber vehicles over ad-hoc networks. Our simulation is performed using the simulator OPNET Modeler in order to control the nature of multimedia traffic in our simulations on different protocols.

Carlos Quadros et al [6] "Beacon-less video streaming management for VANETs based on QoE and link-quality" the routing decisions are performed only based on network, link, and/or node characteristics, such as link quality and vehicle's location. However, in real situations, due to different requirements and hierarchical structures of multimedia applications, these existent routing decisions are not satisfactory to select the best relay nodes and build up reliable backbones to delivery video content with reduced delay and high Quality of Experience (QoE). This paper introduces the QOe-Driven and Link quality receiver-based (QOALITE) protocol to allow live video dissemination with QoE assurance in Vehicle-to-Vehicle (V2V) scenarios. QOALITE considers video and QoE-awareness, coupled with location and link quality attributes for relay selection. Simulation results show the benefits of QOALITE when compared to existing work, while achieving multimedia transmission with QoE support and robustness in highway scenarios.

Sandeep Kaur et al [7] “Carrier Frequency Offset Estimation for OFDM Systems Using Time/Frequency-Domain Techniques”, the requirement for high-speed mobile wireless communications is rapidly growing. Orthogonal Frequency Division Multiplexing (OFDM) has chosen a key element for achieving the high data capacity and spectral efficiency requirements for wireless communication systems because it has multicarrier modulation techniques. But its main drawback is the effect of carrier frequency offset (CFO) produced by the receiver local oscillator or by Doppler shift. This frequency offset breaks the orthogonality among the subcarriers and thus causes intercarrier interference (ICI) in the OFDM symbol, which greatly derogate the overall system performance. In this paper we have studied the effects of CFO upon signal to noise ratio (SNR) for an OFDM system, and also estimate the amount of carrier frequency offset. We compare three methods to combat carrier frequency offset: Time domain CP based method, frequency domain based Moose and Classen method. The improved performance of the present scheme is approved through extensive MATLAB simulation results.

III. Approaches Used

A. GPSR

The most important advantage of GPSR during communication is that the vehicles can obtain exact movement information from on-board global positioning system receiver’s. Although GPSR encounters some disadvantages like any other protocol. Indeed, by using GPSR, the source node is brought to send the message to one neighboring node and therefore use only one road that may not be reliable. So, we can say that there is a lack of exploitation of the topology, since we do not aid from other roads that may be useful. In GPSR-2P, it examines the first two nearest neighbors of the destination instead of only one. However, since GPSR has a great interest to researchers, many studies have been proposed. We mention some of them as examples. Author position errors in greedy forwarding process, which degrade successful packet delivery rate. In the same backdrop, in the GPSR protocol by giving an analysis and simulation study to understand the impact of a GPS system error on it. Meanwhile, researchers propose an improved GPSR routing protocol that makes use of location and direction information and also link quality metrics to produce routes that improve the performance of the network.

B. GSR

Geographic Source Routing (GSR) send packets according to the forwarding path, which iare evaluated on the basis of coordinate location and placement on the road-map of the vehicles. However, this protocol fails to concern with the sparse connectivity problem when the vehicle density on road is too low.

C. Forward Error Correction

A Sub-Packet FEC (SPFEC) Mechanism is avail to improve the video streaming quality over wireless network in terms of recovery performance and jitter compared with traditional Forward Error Correction (FEC) mechanisms. SPFEC divides the video packet into n sub packets and then, it applies the FEC mechanism on these sub packets. A set of simulations proved that SPFEC outperformed Packet FEC (PFEC) in terms of video streaming quality and the transmission jitter. SPFEC could be improved by adding traffic load control in the FEC performing process to avoid network congestion. In VANET [14.....18] literature, there are some studies that applied the FEC and redundancy mechanisms for video streaming. The authors of Reactive, Density-Aware and Timely Dissemination protocol (REACT-DIS) for video streaming broadcasting in VANET network. REACT-DIS is based on the Receiver Based Forwarding (RBF) for the selection of relays vehicles.

D. Ad-hoc on-demand Multipath Distance Vector Routing protocol

The main idea of AOMDV is to estimate the multiple paths during route discovery. It is executed primary for high dynamic where link failure and route breaks occur which can be used for the route discovery. Each route discovery is associated with high overload and latency. It can be avoided by having multiple redundant paths available. In today's scenario a new route discovery is needed only when all the paths to the destination break. AOMDV is able to execute delivery of sub packets to single destination using different routes at a same time.

IV. Conclusion

VANET is a vast field that is related to vehicles composition over a simulation area. All the nodes in the network are arranged with on board unit that is useful for data communication and location tracing. Various approaches have been studied that has been used in VANET for video transmission. In this paper sub packet based FEC, GPSR and AOMDV routing protocol has been reviewed that has been used for data transmission over VANET. On the basis of study of different routing protocol we can state that FEC based routing protocol is suitable for data transmission over small scale networks and GPSR is not efficient in delay manners. Where AOMDV are outperforms due to ability of multipath routing so that if a single route get failed different routes at a same time can be used and packets through different routes to single destination can be forwarded easily.

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