SAT SUBMISSION - V

Team No.: 09 **Date of submission: 03/ 12/ 2022**

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Paper Title with citation:

Vishal Kumar, Shailendra Mishra, Narottam Chand, Faculty of Department of Computer Science (BTKIT-Dwaeahat, NIT-Hamirpur), India "**Applications of VANETs: Present & Future**" proceedings of 2013 5th Communications and Network: 12-15, under Scientific Research copyright.

Motivation for selection of the paper:

In this paper, we wanted to answer a very fundamental question- *What information do the VANET via V2V or V2I transmit? And what are the applications and possibilities of using VANET?* This paper is from the Communications and Network journal. It addresses some of the details of VANET applications and can light clarity to arrive at the answer to the question.

Summary:

As an introduction part, the author has shown some statistics i.e., Due to road accidents direct/indirectly, around 43000 deaths/year, 2.7 million people injuries/year and $230 billion social cost as per NHTSA record. The implication is that the increasing vehicle count day-by-day requires some intelligence to reduce the possibility of accidents. VANET adds this ability to vehicles. The vehicular safety consortium and vehicle infrastructure initiative, along with giant vehicle manufacturing companies, are setting in research and development of applications and productive insights from the usage of VANETs – use of mobile ad-hoc networks by on-board unit (OBU) in a vehicle from network established by roadside unit (RSU) without any other infrastructure.

This paper detailed the categories of various possible applications of vehicular networks and their implications in the real world. The applications would tell us the kind of data/information that would be communicated between vehicle OBU, and infrastructure RSU via V2V, V2I networks. Some of the approved standards for vehicular communication are DSRC (Dedicated short range communication) and IEEE 802.11p WAVE (wireless access for vehicular environment) for physical and MAC layer. WAVE process allocates DSRC spectrum band of 5.9Ghz with BW of 75Mhz. The main objective of design is low connection setup delay, fast network recognition and differentiation of applications for normal and emergency use. To address the emergency communications, and alerting message transmission, and trans-received between fast-moving vehicles. The cellular system goal is different as it is soft-real time system service but DSRC-based VANET at emergency has to serve hard-deadline. In section 2, various characteristics of VANET has explained i.e., Highly dynamic topology, robust to frequent disconnect network, mobility modelling and prediction, Communication environment, Hard-delay constrain, OBU interaction, and power consumption. In section 3 description of various applications using VANET is detailed. The author has categorised applications into Safety oriented (i.e., Real-time traffic, cooperative collision warning, traffic vigilance etc), commercial oriented (i.e., remote vehicle diagnostics, multi-media access, digital map data service), convenience applications (mainly deals in traffic management with the motto to enhance traffic flow efficacy covering route diversion information, Electronic toll collection, parking management), lastly Productive applications which encompasses tasks related to environment benefit (fuel consumption, gas emission quality). In this section, the author has briefed some of the applications. Very interesting applications which I found were, one from Real-time traffic management: RSU serve as the repository to monitor the vehicle count and vehicles OBU can use this info priori in find the efficient route and thereby increase traffic flow. Other application is post-crash notification- sending post-accident info to nearby police and emergency team. Traffic vigilance system, which is automates the vigilance and fining. Remote diagnostics application- where vehicle company can monitor, diagnosis remotely to assist clients post sale. In the next section, the author has detailed future of VANETs. Some of the noteworthy are the current adaptation of VANET applications by various departments, NHAI-highway authority India planning to replace manual toll collection to complete ETC electronic tolling collection system, which would use RFID tag in vehicle's OBU and tag reader in RSU at plaza. Australian police in NSW and Victoria have come up with laser camera system installed in RSU servicing traffic

vigilance. The future of VANETs is secure undoubted. The challenge would be the transition of phase from manual to automated traffic management system and its commercial adaptations by market.

My conclusion – The author has described the architecture, standards & protocol of vehicular ad-hoc networks, followed by the classification of various categories of applications it could be employed for. These applications are implement using the VANET platform, thus answering the question that we were searching answer. Further, author has also emphasised on the kind of cyber challenges that would be involved in such platform.

Plan of selection of paper for next week:

Picked up papers-

Marc TorrentMoreno et al., "**Broadcast Reception Rates and Effects of Priority Access in 802.11 Based Vehicular Ad Hoc Networks**" Proc. Conference on Radio communications, University of Karlsruhe.

James Bernsen, D. Manivannan, "**RIVER: A reliable inter-vehicular routing protocol for vehicular ad hoc networks**" Computer Networks 56 (2012).

Shashank K. Gupta et al., "**A 5G-Based Vehicular Network Architecture to Enhance Road Safety Applications**" Proc. 2021 IEEE 94th Vehicular Technology Conference (VTC2021-Fall).

T. Imielinski and J. C. Navas, "**GPS-Based Geographic Addressing, Routing and Resource Discovery**" Commun. ACM, vol. 42, no. 4, Apr. 1999.

Mudalige, Priyantha. "**Connected autonomous driving: Electric networked vehicle (EN-V) technology.**" In 18th ITS World Congress. 2011.

P. Mac , Z. Becvar, "**Mobile Edge Computing: A Survey on Architecture and Computation Offloading**," IEEE Communication Survey&Tutorial, Vol. 19 Issue 3, pp. 1628-1656, March 2017.