IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Volume-5, Issue-6 E-ISSN: 2347-2693

A Study on Social Internet of Vehicles

Jamsheera M[1*] and Riyadh M[2]

[1]Dept. of Computer Science, APJ Abdul kalam Technological University, Kerala, India
[2] Dept. of Computer Science, Calicut University, Kerala, India

Corresponding Author: getjamsheerarahman18@gmail.com

Available online at: www.ijcseonline.org

Received: 10/May/2017, Revised: 22/May/2017, Accepted: 17/Jun/2017, Published: 30/Jun/2017

Abstract—One of the main vision of Internet of Things (IoT) is to equip real-life physical objects with computing and communication power so that they can interact with each other for the social good. As one key members of IoT, Internet of Vehicles (IoV) has seen steep advancement in communication technologies. Here, a vehicle can easily exchange safe, efficient, infotainment, and comfort-related information with other vehicles and infrastructures using vehicular ad hoc networks (VANETs). We introduce a cloud-based VANETs theme to propose cyber-physical architecture for the Social IoV (SIoV). SIoV is a vehicular example of the Social IoT (SIoT), where vehicles are the key social members in the machine-to-machine vehicular social networks. We have identified the social structures of SIoV components, their relationships, and the interaction types that manage the overall system . Also we have defined the tNote message, that describes how vehicles can share transport related safe, efficient and comfort notes to the cloud and other infrastructure following the Dedicated Short Range Communication (DSRC) standard.

Keywords- *Social Network Of Vehicles, Internet Of Things, Internet Of Vehicles, Vehicular Adhoc Network*

I. INTRODUCTION

The growing advancements in the field of information technology have made smart cities to be a thing of near future. In a smart city, where every object would have embedded processors and capability to communicate with each other wired or wireless connections [3].This intelligent object provides a safe and better environment to users through increased interoperability and interconnections , which also termed as Internet of things (IoT) [5]. Within the objectives of IoT, vehicle is a key entity for safe and convenient travel that leads to Internet of Vehicles (IoV). Almost every major cities cause heavy traffic during peak hours due to the dramatic increase in the number of vehicles and a small road maintenance task or an accident causes huge traffic jam and further accidents. Our method is based on Social Internet of Things where things are the social entities rather than their owners, which align with the vision of smart things. Smart thing refers to vehicle-vehicle, home-home, home-multimedia devices. SIoV is a cyber-physical application on top of physical vehicular network of WAVE(IEEE 802.11p) communication model. Every physical entity has its own twin corresponding virtual entity where operation flows from physical-to-cyber or vice versa while objects are in cyber/physical peer-to-peer like OBU-OBU, RSU-RSU, HBU-HBU connections. In tNote, [2] it is an architecture for SIoV as well as an infrastructure to retain sensory data from VANETs. Also it is a platform to support real-time safe, efficient, and infotainment application for vehicular users. The tNote system can also be described using the acronyms already described in the VANETs model such as On-Board Unit (OBU) and Road Side Unit (RSU). OBUs with RSUs form an ad-hoc network and transmit safe and non-safe message with each other. tNote is an virtual overlay application on the top of physical vehicular network of WAVE (IEEE 802.11p) communication model. In the tNote social graph, every vehicle represent a node and any relationships between two vehicles are represented using a link representing the DSRC message exchange. Every vehicle belongs to a household and there is a Home Base Unit (HBU) to which all the vehicles and household devices are connected to form the Internet of Vehicles (IoV)[1]

The following sections comprises of a brief description of the two methods. Followed by the detailed explanation of the comparison results between the SIoV concept and tNote: a network of vehicle under IoT. Finally the paper is concluded.

II. MATERIAL AND METHOD

This survey focuses on the following two schemes:

The first paper deals with an approach to safe and convenient travel that leads to Internet of Vehicles (IoV) and it would provide a better environment through increased interconnection and interoperability. This strategy introduces SIoV, SIoV is a vehicular example of the Social IoT (SIoT), where vehicles are the key social members in the machine-to-machine vehicular social networks. Also we have identified the social structures of SIoV components, their relationships, and the interaction types [1].

1. SIoV : SIoV is a network of vehicles that is highly dynamic and nodes join or leave extremely fast. Connection links are based on travel route, similar configurations, similar owner interests etc. These interaction occur mostly within anonymous neighbours since the identity of vehicle and the vehicle owner is hidden.

SIoV is an overlay network on top of the physical vehicular network and mostly used as a knowledge base of vehicle usage and experience.

The second paper describes tNote using the acronyms already established in VANETs such as OBU (On-Board Unit) and RSU (Road Side Unit). tNote consists of both dynamic nodes (OBU) and static (RSU and HBU) nodes. The tNote system consist of six components they are tNote message, On Board Unit (OBU), Road Side Unit (RSU), Home Base Unit (HBU), tNote cloud, and user interface. These components maintains a social interaction between users and vehicle.

2. tNote Messages : tNote is a metadata which consist of user for user details (e.g. mental state, physiological state), message from OBU (e.g. Basic safety message), vehicle for vehicle details (e.g. identity, physical attribute). The structure is made up of an automotive ontology, SAE J2735 Dedicated Short Range Communication (DSRC) message set, and ITISEventType of Advanced Traveller Information System (ATIS) schema [2].

III. RESULT AND DISCUSSION

I. SIoV

SIoV works by offering safe and efficient travel to the vehicle users and the offline data ensures smart behaviour of the vehicles or big data analysis for the transport authorities.

Fig 1: Social web portal view of the SIoV.

A. Stage 1 : message generation

A service advertisement goes through the control channel of VANETs and once a service channel is selected for data communication between the provider and consumer vehicle, then the data exchange starts through the service channel. Hence, the established OBU-OBU communication and DER encoding can handle tNote OBU-OBU social graph handover to the RSU. Since XML based organization helps in post-processing, RSU can convert the social graphs to an XML format before transferring to the cloud[1].

B. Stage 2: Cyber-Physical SIoV Infrastructure

Cyber-physical SIoV system has two layers of implementation the first layer is a mock setup for the physical components of VANETs OBUs, RSU, and cloud respectively by android tablets, laptop computer and desktop computer . We simulate multilane, same direction and opposite direction vehicular traffic here in the setup. Second, a java based connectivity platform for the Things, which can be used as an IoV simulator or as middleware for vehicular communications [1].

C. Stage 3: IoV Simulator

The SIoV simulator has SUMO (simulation of urban mobility) vehicle traces, road network file (created from the open street map) and customizable communication properties as inputs. The messages are then stored in the vehicles, shared with the platoons and finally transferred to the cloud. All messages are stored in the MySQL database. Data analysis based on data count, message type can be applied on the MySQL database [1].

2. tNote

This paper describes a tNote system structure where it as a compelling use case of Internet of Things. A tNote is a metadata that consist of several information about vehicles and their users. It has some important components with their interaction and interrelations . It also describes a kind of interaction message with safe, efficient and infotainment application which adopts DSRC standards.

tNote infrastructure has the following social relationship and interactions. Here we discuss relation type of the network structure and then social interaction among the component [2].

1) Network structure and Relation types: Network structure consist of both dynamic nodes (OBU) and static nodes (RSU and HBU) nodes. The social relationship are like POR (parental object relationship) that is relationship between vehicle and its manufacturer. CLOR (co-location object relationship) and CWOR (co-work object relationship) were applied to tNote OBU-OBU communication where object works to achieve a goal placed in geo-neighbouring locations. OOR (owner object relationship) that represent OBU-HBU relation and a SOR (social object relationship) with OBU-HBU when vehicle owner shares protected information with users. A GOR (guardian object relationship) also defined for communication between OBU-RSU.

2) Interaction types: OBU-OBU (when one vehicle with GPS comes in contact a virtual link of type CLOR-CWOR is created between the vehicles in contact). OBU-RSU (when RSU gets OBU-OBU data with interaction message then a GOR transaction is completed). RSU-RSU (CLOR-CWOR relationship is created with a virtual link in tNote).OBU-HBU (vehicle placed at his residence create a OOR relation with

home HBU). HBU-HBU (each HBU in its geographical constraint of SIoV map is connected to another HBU through internet).

A. Stage 1: tNote message generation

To build the tNote message we have used OSS Nokalva ASN.1 studio and mocked the tNote VANET system infrastructure. Using this for any value instance of tNote, the corresponding hexadecimal data dump has been analysed. Then we have done the data size comparison of byte type encoding formats at different level of friend population size for safety type messages. It is find that friends population depth increases the size of tNote also increases. The number of friends at any time depends on the speed and communication range of OBU. VANET service channel (SCH) bandwidth availability must be considered by OBU settings for acceptable level of friend size and depth[2].

B. Stage 2: video comfort message size comparison

Here we will describe the comparative data size of various X.690 encoding formats for tNote video comfort messages. We compare the data size of video comfort messages with or without the social information (e.g. like,viewcount,dislike) for metadata based video sharing application build on tNote. Here we see that PER type encoding ensures the smallest data size and XML representations XER-CXER encodings result in the largest data size. BER-DER-CER are preferable for their Type-Length-Value (TL-V) type structure over data heavy XML representations XER-CXER. XML representations are not suitable for tNote friends related messages for heavy size and VANET bandwidth limitation.

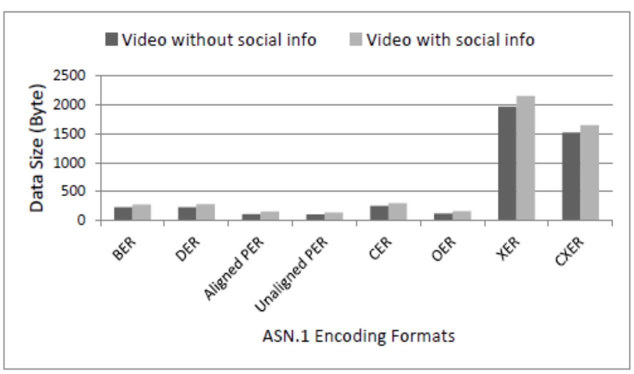

Fig 2: Video comfort message size comparison for different ASN.1 data encoding types.

The DER is recommended for VANET type communication so the data size DER encoding from tNote message generation and from message size comparison friends population and friends social information can be supported using VANET communication infrastructure. Overall analysis shows that tNote system is viable for SIoV [2].

C. Stage 3: tNote system infrastructure

The tNote system infrastructure is created by using a mock setup. To connect the wireless and wired network interface to windows 7 we used software bridging method. Then the safe messages from OBU tablets are tunnelled through the TCP data socket to the tNote cloud. Web interface for social user is created using JSP and the underline database is build using MySQL[2].

IV. CONCLUSIONS

The first section of the paper relies on Social Internet of Vehicles as a compelling usecase of Internet of Things. Here things become social entity rather than their owners, which aligns very well with the vision of smart things. Then we describe a tNote, also as a compelling usecase of Internet of Things.The tNote defines how the communication message structure is developed, their components, interrelations, interaction and shows it is viable for SIoV very well.This application offers a safe and efficient travel to the vehicle users, data analysis for transport authorities and other smart behaviours. This report enlightens the strategy of emerging Social Internet of vehicle (SIoV) where vehicles become smart things and establish connection with other smart things.

REFERENCES

[1]. Kazi Mazudul Alam, Mukesh Saini, and Abdulmotaleb el Saddik, “Toward Social Internet of Vehicles: Concept, Architecture, and Applications,” IEEE Access (volume 3), Apr 27. **2015**, pp. 343-357

[2]. K.M. Alam, M. Saini, and A. EI Saddik, tNote: A Social Network of Vehicles under Internet of Things,” in Internet of Vehicles – Technologies and Services, Springer-Verlag, 2014,pp. 738-745.

[3]. M. Al-Hader, N.Ahmad and A.R. Sharif, “ Smart City Components Architecture,” in Proc. Int. Conf. Comput. Intell.,Modelling simulation, sep. 2009, pp. 93-97.

[4]. K.M. Alam, M. Saini, D.T. Ahmed, and A.EI Saddik, “ VeDi: A Vehicular Crowd-sourced Video Social Network for VANETs,” in Proc. IEEE 39th conf. Local comput.Netw(LCN), SEP. 2014, pp. 738-745.

[5]. S. Haller, “The things in the Internet of Things”, in Proc. Internet Things conf. 2010, pp. 1-3.

Authors Profile

Mrs. Jamsheera M pursued Bachelor of Engineering in Computer Science from Anna University Chennai, India in 2015 and is currently pursuing Master of Technology from Kerala Technological University. She has published few papers in important conferences. Her main research work focuses on Networking.

Mr. Riyadh M pursued Bachelor of Technlogy and Master of Technology from Calicut University. He is currently working as Assistant Professor in Department of Computer Science, Royal College Of Engineering and Technology since 7 years. He has published many papers and has attended conferences including IEEE and it’s also available online. His main research work focuses on network security.

