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Internet of Things Based Connected Vehicles in Smart Cities: Review and Research Challenges

[1] Ankita A. Mahamune, [1] Dr. Salim Y. Amdani, [2] Vaibhav R. Pandit
[1] Dept. of Computer Science and Engg, Babasaheb Naik College of Engg, Pusad,
[2] Dept. of Electronics and Telecomm Engg, Jawaharlal Darda Inst of Engg and Tech, Yavatmal
[1] ankita.mahamune@gmail.com, [2] salimamdani@yahoo.com, [3] vaibhavpandit111@gmail.com

Abstract :- **— The Internet of Things (IoT) thinks a future in which digital and physical things or objects (e.g., smartphones, TVs, vehicles) can be connected by means of suitable information and communication technologies, to enable a range of applications and services. It is of great importance to recognize the networking problem behind developing IoT. Extensive research activities and numerous industrial initiatives have paved the way for the coming era of connected vehicles, as connected vehicles are the building blocks of emerging Internet of Vehicles (IoV).This paper explores the paradigm for vehicle-to-x connectivity (vehicle-to-sensor, vehicle-to- vehicle, vehicle-to-Internet, and vehicle-to-road infrastructure connectivities). Although there have been early stage studies in IoT based connected vehicles, some features can be added to it, to get the improved performance. Therefore, this paper addresses a complete view on wireless technologies and potential challenges providing vehicle-to-x connectivity. Hence, a literature review is presented along with the performance features that can be added to the existing IoT based Connected Vehicles solution. . This paper also proposes a generic IoT based Connected Vehicles solution that includes, - a secure object tracking, that ensures the visibility and traceability of a vehicle along the travel path to support the Internet of Vehicles (IoV), a new paradigm known as Social Internet of Things (SIoT), that can be used to set appropriate rules in the objects to select the right object, as these impact the performance of services developed on top of this social network and two algorithms that allocates available resources to the demanding vehicle services.**

Keywords: **Connected vehicles, intelligent transportation systems (ITSs), Internet of Vehicles (IoV), secure object tracking, resource allocation.**

I. INTRODUCTION

The inter-networking of physical devices like vehicles, buildings and other items that are embedded with electronics, software, sensors, actuators and network connectivity making these objects to collect and exchange data is referred to as Internet of Things (IoT). It allows objects to be sensed or controlled remotely across existing network, creating opportunities for more direct integration of the physical world into computer-based systems resulting in improved performance and benefit economically in addition to reduced human intervention. "Things," in the term IoT can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations, etc. [1].

A smart city is development vision to integrate information communication with Internet of things (IoT) in a secure fashion to manage a city's assets [2]. Nowadays in smart cities, people expect more than just vehicle quality and reliability. The next future for automotive revolution is expected by equipping automobiles with wireless communication capabilities. This paper reviews state of the art IoT techniques for vehicle connectivity, challenges in implementation and their end use in smart cities.

Connected vehicles refer to the wireless connectivity-enabled vehicles that can communicate with their internal and external environments. Extensive research activities and numerous industrial initiatives have paved the way for the coming era of connected vehicles, as connected vehicles are the building blocks of emerging Internet of

Vehicles (IoV) [3]. There are two immediate driving forces of bringing wireless connectivity to vehicles. The first one is the urgent need to improve efficiency and safety of road transportation systems. The second one is the ever-increasing mobile data demand of users on road.

The development and deployment of fully connected vehicles requires a good combination of different off-the-shelf and emerging technologies and great uncertainty remains as to the feasibility of each technology. In this paper, we addressed a complete view on wireless technologies and potential challenges providing vehicle-to-x connectivity that supports the interactions of vehicle-to-sensor on-board (V2S),

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vehicle-to-vehicle(V2V), vehicle-to-road infrastructure (V2R) and vehicle-to-Internet (V2I), as shown in Fig. 1.

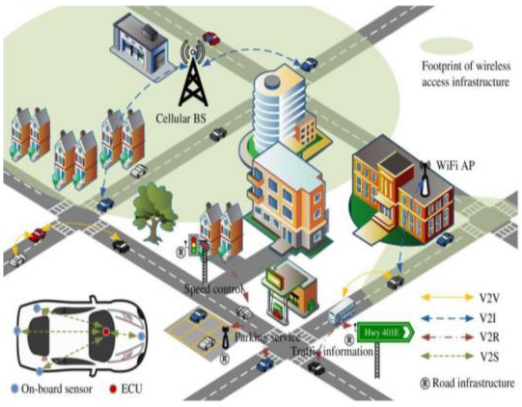

Fig.1.Overview of vehicles-to-x Connectivity

Thereafter, we proposed a generic IoT based Connected Vehicles solution that includes, -

A. A secure object tracking, that ensures the visibility and traceability of a vehicle along the travel path to support the Internet of Vehicles (IoV) which is based on radio frequency identification system for global unique identification of IoT objects,

B. A new paradigm known as Social Internet of Things (SIoT) can be used to set appropriate rules in the objects selecting the right object that provides object–object interaction (here vehicle-to-x interaction). The objects will look for others to provide composite services for the benefit of the humans, increasing the interaction complexity and this will impact the performance of services developed on top of this social networks and two algorithms (i) RAND-INIT-ALLOCATION, (ii) AVERAGE-COST-ALLOCATION that allocate available resources to the demanding vehicle services [4].

Fig. 2. Different Services, Technologies and Meanings [1]

The different possible services, technologies involved in IoT for smart city are shown in Fig.2. The remainder of the paper is organized as: Section II highlights literature review in the field of IoT in smart cities, Section III discusses various research challenges involved and Section IV underlines methodology adopted in the state of the art. Finally, conclusion is drawn in Section V.

II. LITERATURE REVIEW

There are several technologies that can be used to implement the concept of Internet of Things. Some of them are:

_ Radio Frequency Identification (RFID)
_ Near Field Communication (NFC)
_ Machine-to-Machine Communication (M2M)
_ Vehicle-to-Vehicle Communication (V2V)

A. Intra-Vehicle Connectivity / Inter-Vehicle Connectivity

Vehicle communication includes either Intra-Vehicle Connectivity or Inter-Vehicle Connectivity.

i) Intra-Vehicle Connectivity

With increasing intelligence, modern vehicles are equipped with more and more sensors, such as sensors for detecting road conditions and driver's fatigue, sensors for monitoring tire pressure and water temperature in the cooling system, and advanced sensors for autonomous control. The number of sensors is forecasted to reach as many as 200 per vehicle by 2020. Such a big quantity of sensing elements are required to report event-driven or time-driven messages to the electrical control units (ECU) and receive feedback if necessary. To do so, an intra-vehicle communication network should be carefully designed [5].

ii) Inter-Vehicle Connectivity

The vehicular ad hoc network (VANET) technology based on the approved IEEE 802.11p standard and the appendant inter -vehicle communication (IVC) has the potential to dramatically change the way transportation systems work. The fundamental idea is to change the individual behavior of each vehicle by exchanging information among traffic participants to realize a cooperative and more efficient transportation system [5]

B. A Secure Object Tracking

Biplob R. Ray in [6] proposed an object tracking protocol that ensures the visibility and traceability of an object along the travel path to support the Internet of Things (IoT).The proposed protocol

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also ensures the correctness of the travel-path while protecting the privacy of the CO, the partners, and the users.

A secure object tracking can be used in IoV to improve vehicles visibility and traceability for users along the travel path. Also security assurance of the IoT system by ensuring nonrepudiation, privacy protection for the system and users is achieved.

C. Social Internet of Things

The juncture of IoTs with SNs defines the paradigm, known as SIoT. The cluster between Internet of Things (IoT) and social networks (SNs) enables the connection of people to the ubiquitous computing universe. In this framework, the IoT provide information coming from the environment and the SN brings the glue to allow human-to-device interactions.

The adoption of the SIoT paradigm presents several advantages:

- The resulting structure of the things' social network is possible to be shaped as required to guarantee network navigability, so as to effectively perform the discovery of objects and services and to guarantee scalability as in human social networks;
- A level of trustworthiness can be established for leveraging the degree of interaction among things that are friends;
- To address IoT related issues (intrinsically related to extensive networks of interconnected objects), models designed to study social networks can be reused [7].

D. Selection of the Right Object in SIoT

In the SIoT it is very important to set appropriate rules in the objects to select the right friends as these impact the performance of services developed on top of this social network. Michele Nitti et.al. [8] proposed five heuristics, which are based on local network properties like neighborhood degree and local clustering. These heuristics are used to rank the nodes in decreasing order and choose the ones that maximize the chosen heuristic. The performance has then been analyzed in terms of global network navigability, i.e., routing is performed by assuming that each object has a view about the global social network topology. From simulations, it resulted that the approach reaching the best results is the one when objects select friends (or substitute old friends) so that on average the resulting friends have a low local neighbor degree.

III. RESEARCH CHALLENGES

They are some major problems and challenges in connected vehicles.

A. Problems:

1. There is a loss of data at unconnected huge vehicles comes between the connected vehicles, and at building intersections.
2. Because of more moving vehicles there is an occurrence of Doppler effects, shadows and multiple path fading.
3. Due to the mobility of vehicles network topology changes very fast and frequently.
4. Sometimes data transferring is disconnected because of small network range of vehicles communication, frequent change of network topology & high dynamic network topology.
5. The data link between the connected vehicles is interrupted due to obstacles.

B. Challenges:

1. Integrating the heterogeneous elements on IoT architectures in connecting vehicles is a big deal.
2. Smart devices integrating into an intelligent transportation system is another challenge.
3. The collected data from sensors should synchronize uniformly.
4. And there is need of cloud platform alternative to support the intelligent transportation system [9].

IV. CONCLUSION

In this paper, we proposed a generic IoT based Connected Vehicles Solution that includes, intra-vehicle connectivity or inter-vehicle connectivity, a secure object tracking, that ensures the visibility and traceability of a vehicle along the travel path to support the Internet of Vehicles (IoV), a new paradigm known as Social Internet of Things (SIoT), that can be used to set appropriate rules in the objects to select the right object, as these impact the performance of services developed on the top of this social network.

REFERENCES

[1] Sanjeevani Bhardwaj and Alok Kole, “Review and Study of Internet of Things: It’s the Future”, IEEE International Conference on Intelligent Control Power and Instrumentation (ICICPI), pp. 47-50, Oct. 2016.

[2] Lucy Sumi and Virender Ranga, “Sensor enabled Internet of Things for smart cities”, Fourth International Conference on Parallel, Distributed and Grid Computing (PDGC), pp. 295-300, Dec. 2016.

[3] Jinfeng Wang, Chao Li, Hao Li and Yi Wang, “Key Technologies and Development Status of Internet of Vehicles”, 9th International Conference

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International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Volume 4, Issue 4, April 2017

on Measuring Technology and Mechatronics Automation (ICMTMA), pp. 29-32, Jan 2017.

[4] Davar Pishva, "Internet of Things: Security and privacy issues and possible solution", 19th International Conference on Advanced Communication Technology (ICACT), pp. 797-808, Feb. 2017.

[5] Hassnaa Moustafa, Giovanni Pau, Fan Bai and Yan Zhang, "Guest Editorial", IEEE Internet of Things Journal, Vol.1, Issue 6, pp. 522-524, 2014

[6] Biplob R. Ray, Morshed U. Chowdhury and Jemal H. Abawajy, "Secure Object Tracking Protocol for the Internet of Things", IEEE Internet of Things Journal, Vol.3, Issue4, pp. 544-553, Aug. 2016.

[7] Mazin Yousif, "Social Networking Meets IoT", IEEE Cloud Computing, Vol. 2, Issue 6, pp. 4-5, 2015

[8] Michele Nitti and Luigi Atzori, "What the SIoT needs: A new caching system or new friendship selection mechanism?", IEEE 2nd World Forum on Internet of Things (WF-IoT), pp. 424-429, Dec. 2015.

[9] Fisnik Dalipi, Sule Yildirim Yayilgan, "Security and Privacy Considerations for IoT Application on Smart Grids: Survey and Research Challenges", IEEE 4th International Conference on Future Internet of Things and Cloud Workshops (FiCloudW), pp. 63-68, Aug. 2016.