Industrial Science ISSN 2347-5420
Volume-1 | Issue-10 | April-2015 Available online at www.lsrj.in

INTELLIGENT TRANSPORT SYSTEM (ITS)-SURVEY

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Short Profile

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ABSTRACT:

Providing various wireless connectivity for vehicles enable the communication between vehicles and their internal and external environments. Such a connected vehicle solution is expected to be the next frontier for automotive revolution and the key to the evolution to next generation Intelligent Transportation Systems (ITS). With the dramatic increase of modern economical and technical development Intelligent Transport System today has become more and more important and essential.Mobility models play a vital role in the evaluation of Vehicular Ad Hoc Networks (VANETs). In this paper we focus on Intelligent Transportation Systems, Intra vehicle connectivity, Inter vehicle connectivity and urban mobility models.

KEYWORDS

Intelligent Transportation Systems (ITS),Vehicular Ad Hoc Networks (VANETs).

I.INTRODUCTION

Our Prime Minister's vision of building 100 smart cities is expected to change the urban landscape significantly. Even though there is no set definition for it, a smart city broadly includes a smart vehicle system which uses high end to end information & communication technologies to deliver better traffic handling conditions on the road and to reduce number of accidents which is a major problem of the India in present days.

The present need in security system is not only just moderate the effect of car crashes but also to prevent their occurrence all together & such a system called as Intelligent Transportation System (ITS).It combines advanced information technology, telecommunication technology, sensor technology, control technology and computer technology to an integral transportation management system, which is built on a larger scale.

In this paper,we focus on the wireless technologies and present an overviewof industrial and academic advances for establishing vehicle e to-x (V2X) connectivity potential challenges and identify research issues in building vehicular connectivity. This paper gives overview of the operational proficiency of traditional crossing points with stop sign model and activity lights.

II.INTELLIGENT TRANSPORTATION SYSTEM (ITS):-

The Vehicular Ad Hoc Networks (VANET) is aprogressively indispensable area in Mobile Ad Hoc Networks (MANETs) VANETs comprise vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications based on wireless local area network technologies. The intelligent transport system consists of internet vehicles communication, traffic surveillance information and real-time traffic control. Three system features can communicate with existing on-road vehicle surveillance network to form a ITS architecture. In the Figure 1, the wireless communication unit inside car (on board unit or OBU) exchange data with the roadside unit (road side unit or RSU) to get road condition and traffic information ahead of it.

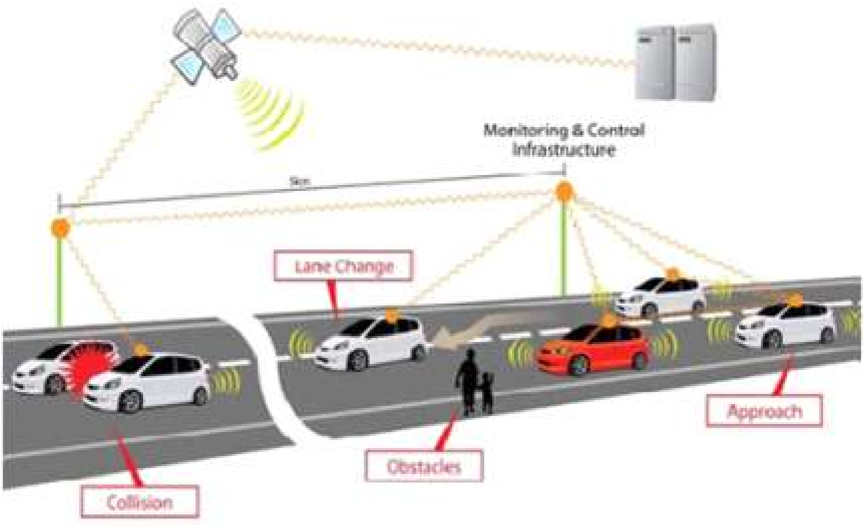

Fig. 1 -An overview of Intelligent Transport System (ITS)

These traffic congestion and road safety information can be published through service center to different RSU clusters for broadcasting. Every vehicle participate in sensing and updating latest road information. The data exchange among OBU in vehicles are through RSU or road-side assistance system, which is based on wireless networking technology Wi-Fi, zigbee, etc.

III.INTRA-VEHICLE CONNECTIVITY

A.Characteristics and Challenges

Different from generic wireless sensor networks, intra vehicle wireless sensor networks show unique characteristics:

Sensors are stationary so that the network topology does not change over time.
There is no energy constraint for sensors having wired connection to the vehicle power system.

In spite of favorable factors, deployment of intra- vehicle wireless sensor networks are still challenging: (i) the intra-vehicle communication environment is harsh due to severe scattering in a very limited space and often non line-of-sight. This is the major reason for extensive effort to characterize the intra-vehicle wireless channels (ii) data transmissions require low latency and high reliability to satisfy the stringent requirement of real-time intra-vehicle control system; (iii) interference from neighboring vehicles in densed urban scenario may not be negligible; and (iv) security is critical to protect the in-vehicle network and control system from malicious attacks. In face of these challenges, the intra-vehicle wireless sensor network has become a research focus in the area of intelligent vehicle systems, and the following wireless technologies have been investigated extensively.

B. State-of-the-art Alternatives

Bluetooth: Bluetooth is a short-range wireless technology based on the IEEE 802.15.1 standard and operating in the industrial, scientific and medical (ISM) frequency band (2.4 GHz). It allows the communication between portable devices at a data rate up to 3 Mbps, and is highly commercialized for consumer electronics. However, the Bluetooth transmission requires high power level so that it might not be viable for battery driven sensors in vehicles. Moreover, due to the poor scalability, a Bluetooth network can only support eight active devices (seven slave devices and one master device).

ZigBee: One option for enabling the V2S connectivity is through the use of ZigBee technology, which is based on the IEEE 802.15.4 standard and operates on the ISM radio spectrum (868 MHz, 915 MHz, and 2.4 GHz) [28]. As the first attempt to evaluate ZigBee performance in an in vehicle environment, research in reports the results of packet transmission experiments using ZigBee sensor nodes within a car under various scenarios (considering different sensor locations and ON/OFF status of the vehicle engine). This study demonstrates that ZigBee is a viable and promising solution for implementing an intra-vehicle wireless sensor network. ZigBee is low-cost and can provide an acceptable data rate (250 Kbps in 2.4 GHz frequency band). However, the challenge of implementing ZigBee sensors is to combat the engine noise and interference from Bluetooth devices. The performance of ZigBee intra-vehicle sensor networks is thoroughly studied in the presence of Bluetooth interference, based on a realistic channel model. Data latency of in-vehicle sensor applications is an important network design consideration. To meet the hard latency requirements derives necessary design parameters of medium access control (MAC) protocol based on a star topology.

Ultra-Wideband: Ultra-wideband (UWB) refers to radio technology that operates in the 3.1–10.6 GHz frequency band (an astonishing bandwidth of 7.5 GHz) and can support short range communications at a data rate up to 480 Mbps and at a very low energy level. UWB systems have a number of unique advantages, such as resistance to severe wireless channel fading and shadowing, high time domain resolution suitable for localization and tracking applications, low cost, and low processing complexity.

IV.INTER-VEHICLE CONNECTIVITY

It is widely believed that the advances of inter-vehicle communications will reshape the future of road transportation systems, where inter-connected vehicles are no longer information-isolated islands.

A.VANET

The advances in mobile communications and the current trends in ad hoc networks allow different deployment architectures for vehicular networks in highways, urban and rural environments to support different applications with different QoS requirements. The goal of VANET architectures is to allow the communication among nearby vehicles and between vehicles and fixed roadside equipment leading to the following three possibilities (as shown in Figure 1). Vehicle-to-Vehicle (V2V) ad hoc network: allows the direct vehicular communication without relying on a fixed infrastructure support and can be mainly employed for safety, security, and dissemination applications; Vehicle-to-Infrastructure (V2I) network: allows a vehicle to communicate with the roadside infrastructure mainly for information and data gathering applications; Hybrid architecture: combines both Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I). In this scenario, a vehicle can communicate with the roadside infrastructure either in a single hop or multi-hop fashion, depending to the distance, i.e., if it can or not access directly the roadside unit. It enables the long distance connection to Internet or to vehicles that are so far. More in detail, VANETs are characterized by high mobility, rapidly changing topology, and transient, one-time interactions. VANETS are considered as one of the most well-known technologies for improving the safety applications as well as vehicle efficiency of intelligent transportation systems. Applications for VANETs are oriented to safety issues of vehicles in order to improve the quality of transportation through time-critical safety and traffic management applications.

B.Dedicated Short Range Communication (DSRC)

DSRC is multi-channel wireless protocol used in VANET application which is based on IEEE 802.11a Physical Layer andthe IEEE 802.11 MAC Layer. This is designed to helpdrivers travel more safely and reduce the number of losses dueto road accidents. In this experiment we used IEEE 802.11 p medium access control (MAC), which uses carrier sense multiple accesses with collision avoidance. It operates over a 75MHz licensed spectrum in the 5.9 GHz band allocated by theFederal Communications Commission and supports low latency vehicle-to-vehicle (V2V) and vehicle-to infrastructure (V2I) communications. It provides wireless link between Road Side Equipment (RSE) and On board Equipment (OBE) in therange of up to 200m. Vehicle-to Vehicle (V2V) communication is good solution to extend the capability of the extant DSRC system. The motivation behind the development of DSRC ismainly the need for a more tightly controlled spectrum for maximized reliability.V2V communications can improve thequalities for both the road security service and the transportationmanagement service.

Mobility Models

A.Stop Sign Model (SSM)

In the Stop Sign Model (SSM), every street at an intersection has a stop sign. Any vehicle approaching the intersection must stop at the signal for a specified time (which is configurable). On the road, each vehicle's motion is constrained by the vehicle in front of it. That is – a vehicle moving on a road cannot move further than the vehicle that is moving in front of it, unless it is a multi-lane road and the vehicles are allowed to overtake each other. When vehicles follow each other to a stop sign, they form a per street queue at the intersection. Each vehicle waits for at least the required wait time once it gets to the head of the intersection after other vehicles ahead in the queue clear up. A vehicle crossings at the intersection is not coordinated among different directions. Although an urban layout is unlikely to have stop signs at every intersection, this model does serve as a simple first step to understanding the dynamics of mobility and its effect on routing performance

B.Probabilistic Traffic Sign Model (PTSM)

Next, we refined SSM further by replacing stop signs with traffic signals at intersections. In general, vehicles stop at red signals and drive through green signals. Although it is possible to simulate the detailed coordination of traffic lights from various directions, we did not implement it at this stage. We first wanted to understand whether such levels of detail would produce any significant impact on routing protocol performance. As an intermediate step, we developed the Probabilistic Traffic Sign Model (PTSM). PTSM approximates the operation of traffic signs by not coordinating among different directions. When a node reaches an intersection with an empty queue, it stops at the signal with a probability p and crosses the signal with a probability (1 - p). If it decides to wait, the amount of wait time is randomly chosen between 0 and w seconds. Any node that arrives later at a non-empty queue will have to wait for the remaining wait time of the previous node plus one second. The additional one second simulates the startup delay between queued cars. Whenever the signal turns green, the vehicles begin to cross the signal at intervals of one second, until the queue becomes empty. The next vehicle that arrives at the head of an empty queue again makes a decision on whether to stop with a probability p and so on. Similar to SSM, there is no coordination among vehicles crossing an intersection from different directions. This model avoids excessive stoppings, as in the case of SSM, and at the same time, approximates the behavior of traffic lights. Various research works are carried out on integrated navigation system. Sachie MASUDA et al. [5] described Vehicle-to-Vehicle Communication and Location System using Spread Spectrum Technique.

Tarik Taleb et al. [6] proposed scheme which enhances the stability of IVC and RVC communications in VANET networks. The key idea behind the proposed scheme is to group vehicles according to their moving directions.

Shie-Yuan Wang et al. [7] proposed a Radio-based CWS employing vehicle-to-infrastructure communication model.

Wen-Long et al. [8] developed a recursive model for computing end node probabilities, from which various performance measures of multi hop connectivity were defined.

Takahiro Furuyama et al. [9] proposed the PR-CSMA protocol which can carry out R2V and V2V communications on single channel. Also protocol reduces interference from V2V to R2V communications by dividing time into R2V slots,V2V slots.

Yusuke Takatori et al. [10] proposed crossing collision prevention system and has analyzed safety performance (Fully vehicle information acquiring probability: FVIAP) of it.

Marcus Obst et al. [11] described the CoVeL system which aims to reach lane-level localization accuracy for advance driver assistance system.

Mehdi Khabazian et al. [12] has been described the steady state statistical properties of the continuous communication path availability in the Vehicular Ad-Hoc Network .

Khalid Abdel Hafeez et al. [13] have given an analytical model to analyse the reliability of the IEEE 802.11p in VANET safety & warning applications which is based on relationship among vehicle density, speed & follow-on distance rule is derived.

Zhu Yongjunet al. [14] described ITS system based on the GPS and internet of things, rebuilding and upgrading the original bus information system effectively, make the urban traffic system intelligent and modern.

V.CONCLUSIONS

In this paper we focus on the present need in security system is not only just moderate the effect of car crashes but also to prevent their occurrence all together using Intelligent Transportation System (ITS),which can be used for road safety, traffic efficiency and value added services.

In this paper, we have presented an overview of the state-of-the-art wireless solutions to vehicle-to-sensor, vehicle-to-vehicle, vehicle-to-Internet, and vehicle-to-road infrastructure connectivity.

The aim is to provide innovative services relating to various modes of transportation and traffic management. These systems enable users to reach their destinations better, safer and more coordinated.

Also we have evaluated the sensitivity of mobility details on VANETs in an urban context. Though far from being the final word, our work provides a sound starting point for further understanding and development of mobility models for VANETs.

ACKNOWLEDGMENTS

I wish to thank Professor S.S. Tamboli for many of her ideas which are included in this paper, and for her continuous support. Further acknowledgements go to my colleagues in our communication Systems Laboratory.

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