A Review on Intelligent Techniques in Vehicular Ad-Hoc Networks

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***Abstract*—The technology has been advancing for the past few years, which resulted in technology enhanced devices equipped in many vehicles. These devices can reduce the majority of human effort in vehicular networks. The vehicles on roads are increasing day by day, which resulted in traffic congestion, air pollution due to emission of carbon dioxide, a lot of valuable time is wasted on road traffic and apart from these it causes frustration to the drivers as well as to the passengers. The construction of transportation infrastructure and various expansions does not solve the existing transportation problems. Now all countries are spending valuable time and money to explore ITS technology to solve traffic related problems. So there is a need for applying various technologies in this VANET to minimize or to overcome these problems. This paper focuses on surveying various technologies along with its application in VANET.**

***Keywords*—Vehicular ad-hoc network, v2v, intelligent techniques, rfid, intelligent transportation systems I.**

I. INTRODUCTION

The VANET is a network of vehicles which is formed without using any central base station, instead the dynamic vehicles itself will be used for establishing and providing communication facilities among the vehicles. In the Vehicular network, each vehicle can communicate with other sets of vehicles and with the road side unit (RSU) i.e., V2V communication and V2I communication [1]. Since the vehicles are mobile in nature, the network topology changes dynamically. The communications with such mobile vehicles are highly challenging due to the frequent disconnection between vehicles [2]. Intelligent Transportation System (ITS) uses continuous information which is gained from various sensors, based on this knowledge some processing will be done to optimize the required result. The development of this field is done initially in the US and later introduced in various other countries. The ITS based on Internet of Things (IoT) has been emerging for the past few years and it will continue to provide many applications in VANET [3]. The integration of IoT based technologies in VANET will provide many application oriented benefits for the traffic management system. The main application of such technologies in VANET includes non-stop electronic highway toll collection, mobile traffic police unit for law enforcement, emergency vehicle path clearance, anti-theft vehicle system, traffic rule violation monitoring, etc [4].

II. RELATED WORK

In this section, related works are discussed and presented elaborately. This literature review helps the researchers to find out various existing methodologies and areas in VANET. A detailed review that focused on video-based vehicles image capturing systems was carried out [5]. It collected various data and addressed the problems in the system and that paper presented detailed construction for video based vehicle surveillance systems, i.e., a classification based on vehicle and networked vehicular investigation is presented in the paper. It also addresses alternate methods. Another detailed review was presented, where the artificial intelligence based ITS has been categorized into six areas like clustering, controller system, location and detection, social sensing, routing and outsourced storage [6]. The importance of each is listed with methodology and presented a perspective of IoT in ITS.

III. INTELLIGENT TECHNIQUES IN VANET

Context: VANET is an extremely active wheeled system, wherever the road side units and highway vehicles deliberated as nodules to permit the wireless communication. Owing to the great active nature of VANETs, the flexibility design and the system strategies modified regularly that create it vary from the additional type of ad-hoc system. The difficulty of this investigation is a critical scheming for active routing procedure in VANETs [7].

Objective and methods: Goal of this work was to provide cluster based routing and it increases the delivery ratio, throughput and minimizes the normalized routing load. The system nodules are to decrease the expenses. Each nodule has a Node ID and it propagates information through the CH. To provide low end to end delay and minimum losses, they created routes among two bandwidths then the vitality of the optimized AODV. It provides the network with minimum complexity over an entire network.

Results and significance: Widespread executions were done in NS2 to evaluate the proficiency of the projected cluster-based routing method. The model results state that the planned method is further active and attains the better

presentation outcomes under dissimilar system circumstances as associated to even AODV routing procedures.

Drawback: For upcoming effort was done in the method toward reducing the depletion of energy through the constraint of low bandwidth for such a system.

Objective: This paper presented the model of artificial "co-drivers" as a permitting methodology for upcoming ITS [8].

Methods: The scheme of co-drivers were presented and outlined in overall human–robot communications. Numerous concepts and tools were studied, exactly those linking to appropriate emulation theory of cognition, human-like sensory-motor strategies and cognitive manners. They offered the co-driver advanced for the EU scheme co-operative as an instantiation of this notion, representing something that imitates the assumed strategies. Here due to the combination of manual tuning at higher behavioral levels and direct synthesis at the motor primitive level, a co-driver had been designed. The last scheme is thus the combination of associated human characteristics through emerging agents in numerous circumstances.

Results and significance: They presented practical consequences and illuminated the restrictions and presentation of the present execution. They investigate the influence of the co-driver methodology.

Drawback: Variety of presentation arenas, screening in what way it establishes a worldwide facilitating knowledge together for automobiles and supportive systems, and obviously groups out a database for upcoming study.

Context: An ITS currently develops an explanation for managing those difficulties. ITSs remained previously measured in industrialized nations under dissimilar developments. Though, they are infrequently recycled in most emerging nations at the cost of emerging, realizing and preserving those systems [9].

Objective: They developed a outline for two chief goals: 1) Gathering and handling traffic data from numerous kinds of foundations such as sensors, cameras, buses, GPS on cars, motorcycles, taxis, etc. or separate users via our Portable Solicitation; 2) Familiarizing numerous events in transportation research to regulate the traffic and inform users via a control center.

Methods: Firstly, they suggested extensively usage of the GPS strategies in motorbikes, which were presently prevalent in emerging motherlands, to gather the road traffic information since it is further professionally and can trail the road traffic status of all road sections. Additionally, they build a Movable Application on IoS and Android stages to gather GPS information from separate users in order to supplement the traffic dataset. Finally, we grow numerous novel procedures in dispensation and examining our road traffic data to subsidize directive and self-regulation events via a control center.

Significance: ITS is initially organized in Ho Chi Minh city in Vietnam under the support of native specialists.

Drawback: In the forthcoming years, it is valuable to grow more topography concerning the communication among operators and regulator centers in the leadership to operators for evading traffic bottlenecks or reducing travel time.

Objective: RFID-GPS combined techniques can be used to track stolen vehicles, providing a smooth way for emergency vehicles in a network [10].

Methods: RFID-GPS mechanism using AODV routing protocol is used to track stolen vehicles. The vehicle id is checked in the network using RFID and its position can be tracked using GPS. The suspected stolen vehicles ID will be communicated and detected through V2V communication in the network. Fig. 1 shows the RFID-GPS network with vehicles transmitting and receiving informations through various intermediate vehicles and other devices.

Results: Compared with other techniques its performance is good. This technique is really useful since it can identify vehicles even in tunnels.

Context: ITSs had improved conventional conveyance schemes and delivered circulation evidence to travelers [11].

Objective: To send precise and opportune measure data, a QoS-aware link rate function had been planned and castoff for information broadcast among the static sensor nodes.

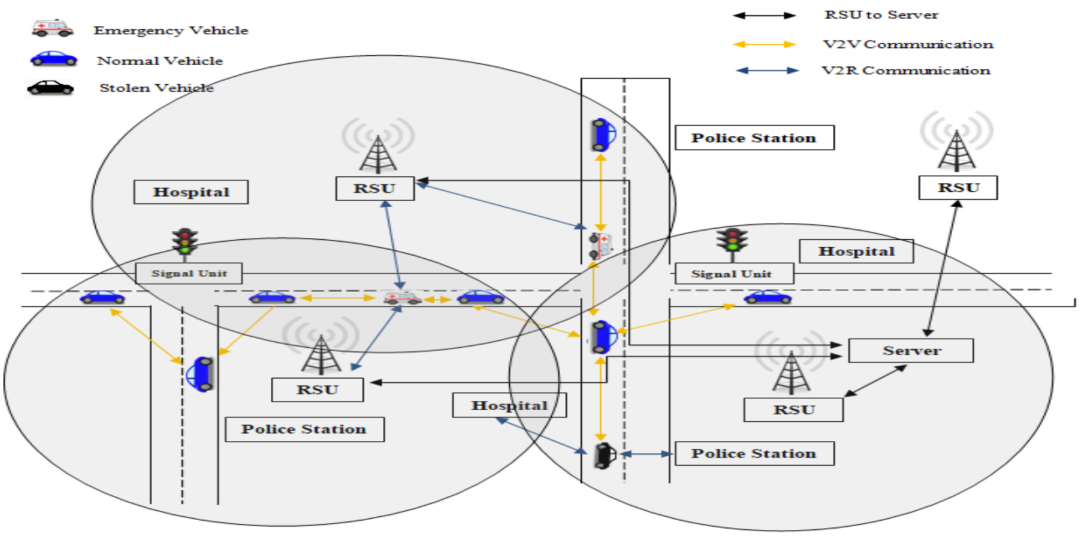

Fig 1. RFID-GPS Network formation

Methods: The planned work had two tier constructions that comprise a system of movable substances in the higher layer and a well-ordered WSN in the lowermost layer. By this method, a portion of loads on the minimum power static radar nodes could be transported to mobile objects, such as significant mobile approaches. Furthermore, the tractability of the components and the potential of data in the suitable object tier, a consistent data systematic scheme had been considered for this stage.
Results: Here, data was preceded to the together nodes, over the collection of the information being communications. The performance evaluation results indicate the effectiveness of the proposed architecture and data reporting mechanism for use in ITS applications.
Significance: Efficient of providing essential traffic data with a low computational complexity and high packet delivery ratio.
Drawback: It needs further energy.
Context: The progresses in IoT and cloud computing had delivered a talented casual to decide the experiments produced through accumulating conveyance difficulties [12].
Objective: We incline to give a single multi-covered transportation information cloud platform through manipulation of IoT and cloud computing tools.
Methods: To decide the experiments produced through increasing conveyance problems. We extant an original multi incrusted vehicular statistics cloud stage by using cloud computing and IoT technologies. We incline to suggest an entirely single multi-covered transportation information obscure platform harassment existing cloud computing and IoT technologies. Two altered data processing prototypes for the transportation data dispensation cloud service, a Naive Bayes ideal and a providing Regression model are discussed in identical manner.
Results and significance: This analysis creates influences through proposing a single processor code strategy for the transportation data within the IoT environments that has the capabilities to integrate varied devices offered inside vehicles and devices within the road structure.
Drawback: In automobile yielding technique, occasionally, certain feature difficulties were frequently concealed for a protracted time though not being known. Attributable to an insufficiency of proceedings or signs to associate several separate problems, possible disputes might not be investigated the least bit.
Context: The IoT was estimated to produce an important part in an extensive variety of request arenas. The ITS were the most talented request domains, being characteristically large-scale and collected through heterogeneous schemes [13].
Objective: To deliver sustenance for in-network combination assurances and effectual exploitation of system possessions.
Methods: Here they presented the ICSI M2M Middleware, able to associate regular Machine-to-Machine statements, while undertaking through the energetic nature of resource-constrained networks and devices. The RESTFUL edge of the ICSI M2M Middleware delivers a technique to animatedly reconfigure dispersed detecting requests. The middleware was proficient in associating M2M transmission on resource-constrained IoT schemes, while contributing a wide range of reconfiguration abilities over a RESTFUL interface. The in-network handling feature permits to diminish the amount of communications swapped in the low power network, through assistance on the power consumption and on the difficulty of system applications.
Results: Initial experimental results collected over a laboratory test bed specify that the ICSI M2M Middleware is an appropriate key for the ITS use-case of a visual sensor system of resource-constrained events.
Significance: The in-network dispensation feature documents to decrease the amount of communications exchanged in the low power system, through the benefits on the power consumption and on the complexity of network applications.
Drawback: This can lead to unnecessary destruction in case of huge source representations.

IV. INTELLIGENCE IN VANET

Machine learning and Deep learning algorithms also provides efficient decision making capabilities to this field. The various such applications includes automatic detection and penalty issued for traffic violations, speed monitoring, seat belt wearing, etc. Also it can be used to monitor and detect criminal person on the roads. Convolution neural network (CNN) is been mostly used for object detection and monitoring. For detection of accidents, driver drowsiness etc it is been very good. Recurrent neural networks (RNN) is used for resource reservations i.e., the vehicle may request different services like to find short path, to find nearest petrol station etc. With the advance in ML and DL, the VANET performance has improved a lot. Depending upon the types of application the ML techniques need to be selected. V. CONCLUSION With the help of emerging technologies in the field of intelligent transportation systems, traffic congestion problems, transportation of emergency vehicles, shortest path information etc can be addressed. A review is conducted on various intelligent techniques that have been used to track the location of vehicles, traffic optimisation methods, privacy techniques used while transferring information between vehicles to RSU and among vehicles. The construction of vehicular infrastructure is costly and it does not solve traffic related issues. This paper presented various techniques used in VANET by which intelligence can be imparted on vehicles in VANET, which makes the network smart. It addresses the merits and drawbacks of using different technologies in the field of VANTE. The emergence of IoT devices and various data analytics tools will help in optimizing traffic information at the right time. So using new technology will help to reduce the air pollution level, provide secure driving and many driver assistant tools.

REFERENCES

[1] S. Ur Rehman, M. A. Khan, T. A. Zia, L. Zheng, “Vehicular Ad-Hoc Networks (VANETs) - An Overview and Challenges”,

Journal of Wireless Networking and Communications, Vol. 3, No. 3, 2013, pp. 29-38.

[2] N. Lu, N. Cheng, N. Zhang, X. Shen, J. W. Mark, "Connected Vehicles: Solutions and Challenges", IEEE Internet of Things Journal, Vol. 1, No. 4, 2014, pp. 289-299.

[3] W. Chen, F. Guo, and F. Wang, "A Survey of Traffic Data Visualization", IEEE Transactions on Intelligent Transportation Systems, Vol. 16, no. 6, 2015, pp. 2970-2984.

[4] L. Moreira-Matias, J. Mendes-Moreira, J. F. de Sousa, and J. Gama, "Improving Mass Transit Operations by Using AVL-Based Systems: A Survey", IEEE Transactions on Intelligent Transportation Systems, Vol. 16, no. 4, 2015, pp. 1636-1653.

[5] B. Tian, B. Tran Morris, M. Tang, Y. Liu, Y. Yao, C. Gou, D. Shen and S. Tang, "Hierarchical and Networked Vehicle Surveillance in ITS: A Survey", IEEE Transactions on Intelligent Transportation Systems, Vol. 16, no. 2, 2015, pp. 557-580.

[6] V. Chand and J. Karthikeyan, "Recent Survey on Traffic Optimization in Intelligent Transportation System", Journal of Advanced Research in Dynamical & Control Systems, 15-Special Issue, 2017, pp. 89-100.

[7] R. C. Poonia, D. Bhargava, and B. S. Kumar. "CDRA: Cluster-Based Dynamic Routing Approach as a Development of the AODV in Vehicular Ad-hoc Networks" In 2015 International Conference on Signal Processing And Communication Engineering Systems (SPACES), Guntur, 2015, pp. 397-401.

[8] M. D. Lio, F. Biral, E. Bertolazzi, M. Galvani, P. Bosetti, D. Windridge, A. Saroldi and F. Tango, "Artificial Co-Drivers as a Universal Enabling Technology for Future Intelligent Vehicles and Transportation Systems", IEEE Transactions on Intelligent Transportation Systems , Vol. 16, no. 1, 2015, pp. 244-263.

[9] D. Pham, B. A. Hoang, S. N. Thanh, H. Nguyen, and V. Duong, "A Constructive Intelligent Transportation System for Urban Traffic Network in Developing Countries via GPS Data from Multiple Transportation Modes", In 2015 IEEE 18th International Conference on Intelligent Transportation Systems (ITSC), Las Palmas, 2015, pp. 1729-1734.

[10] V. Chand and J. Karthikeyan, "RFID-GPS based mechanism using aodvrp for stolen vehicle detection in VANET", Indonesian Journal of Electrical Engineering and Computer Science, Vol. 18, no. 1, 2020, pp. 396-404.

[11] M. H. Anisi, and A. H. Abdullah, "Efficient Data Reporting in Intelligent Transportation Systems", Networks and Spatial Economics 16, no. 2 (2016), pp. 623-642.

[12] K. Ashokkumar, B. Sam, R. Arshadprabhu and Britto, "Cloud Based Intelligent Transport System", Procedia Computer Science, Vol. 50, 2015, pp. 58-63.

[13] A. Azzara, M. Petracca, and P. Pagano, "The ICSI M2M Middleware for IOT-Based Intelligent Transportation Systems", In 2015 IEEE 18th International Conference on Intelligent Transportation Systems (ITSC), Las Palmas, 2015, pp. 155-160.