An Effective Framework to Enhance Intelligent Transport Systems using Cloud Computing

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***Abstract*-Mobile ad hoc networks are employed in different fields which include rescue missions, battlefields and recently in inter- vehicular networks, known as Vehicular Ad Hoc Networks (VANETs). There has been lot of research works done on the use of VANETs in traffic safety in road networks. Efforts are done to achieve these objectives but many drawbacks have been recorded such as an expensive cost of the service in which the user is required to buy the service and its resources (software, infrastructure and/or platform). A framework of ad hoc cloud network architecture and incorporating the concepts of intelligent transport systems mechanical devices and systems using cloud computing is discussed.**

Keywords: Cloud Computing, Vehicular Cloud, Ad Hoc network, Wireless Network, VANET.

I.INTRODUCTION

The term vehicular ad-hoc network is regarded as a method of mobile ad-hoc network designed on the fly between groups of cars connected or communicated by wireless devices. VANET allows communication among vehicles in the close proximity, also between moving vehicles and fixed vehicles too and with equipment, described as roadside equipment. Providing safety from road mishaps and comfortable journey for passengers and other road users is the ultimate motive of VANETs. A distinct electronic device is fixed into every automobile which provides mobile ad-hoc network connectivity for the travellers. This network operates lacks basic infrastructure and server communication. Vehicles with a VANET device becomes a node in the Ad-Hoc network which can receive and reply in communication. These vehicles would become the first vehicles to converse with each other for safety tenacities. The concentration to mobile ad-hoc network is because of VANETs but the information may diverge. Instead of travelling at arbitrary, vehicles travel in a systematized order .The communications with the roadside units can similarly be considered legitimately perfectly. But vehicles are circumscribed in their series of motion, for example, the vehicle being restrained to follow a paved highway. This network may pose safety concerns (for example, one cannot make phone calls when driving). Navigation systems and GPS are employed here, since these components are combined with traffic intelligences in order to deliver the optimal route to process and to travel. Wireless vehicular communications is the important technology aimed at raising the road protection, transport efficiency and also providing internet access to the move vehicles for wireless ubiquitous connectivity. Depending upon the small and intermediate range communications like WIFI and for long-range communication, networking in vehicles will empower a wide range of traffic applications, information sharing applications as well as other requests and connecting communication to and from vehicles. Since the circumscribed node movement is involved, it is a possible statement that the VANET will be maintained by approximate services and can offer admittance to immobile networks. The secure infrastructure is employed at dangerous locations like dangerous roads, service stations, dangerous intersections or places well-known for bad weather conditions. VANET enables communication between vehicles. A system for detecting terrorist activities can be built using VANET. Police cars are provided with threat – detect sensors (e.g., for sensing or detecting threats such as explosives chemicals, radiation, etc.) can communicate and work together to counterbalance the situation. By using VANETCLOUD, vehicles are transferred as “Computers on the Wheels” or “Networks on the Wheel” (i.e.) vehicles helped or influenced by computers. Communications between vehicles are “ad-hoc" in nature. Vehicular communication is of two types: - (i) Vehicle to Vehicle (V2V) Interaction (ii) Vehicle to Infrastructure Interaction. By using vehicle to vehicle communication, vehicles can communicate between each other if there is some danger on roads, thus making travelling an accident free zone. In vehicle to vehicle communication uses multi-hop/multi cast technique and it uses naive broadcasting and intelligent broadcasting. In vehicle infrastructure, communication between the roadside units and vehicles allowing drivers to follow rules and regulation. VANET requires that a traffic and network simulator should be used to perform this test. Cloud services are obtained from data centres which are distributed throughout the world. Virtual resources are provided to clients through internet in cloud computing such as Gmail, provided by Google. The rapid growth in cloud computing has led to numerous advantages but at

the same time it possess lack of security concerns which has been a major challenge. There is a increasing group of large-scale scientific applications which are loosely-coupled in nature comprises many minor jobs/tasks with much shorter durations and also encompass huge amount of data where these applications comprise those from data analytics, bioinformatics, data mining, astronomy, astrophysics, and MPI ensembles [1]. Cloud computing suffers from security issues like securing confidential data, cloud storage and examining the utilization of cloud by the cloud computing vendors and key questions arises like how safe is data in cloud ? .Besides, cloud computing has numerous advantages like scalable and dynamic. Cloud computing is independent computing and varies from utility computing and grid computing. Technologies involved in cloud are developing as well as evolving such as, Service Oriented Computing. Cloud computing environment is still lacking security features and large scale utilization and convention, which would rationalize the perception of cloud and there are no extensively established descriptions. The cloud computing is divided into three forms [2],

Public: In a public cloud, the infrastructure and service are provided off-site over the internet. A public cloud accommodates storage services and application to the users over the internet.

Private: Private cloud is deployed for a single organisation or by a third party externally. They consists high advanced security fault tolerant solutions. The private cloud is mainly employed for single organization. Associating with other cloud models, private clouds provides power as a service within a virtualised environment employing the features of cloud computing resource. The private cloud can be used by a single organisation providing that organisation which guarantees privacy and control. From technical aspect, the underlying mechanisms are hard to define. The advantages of private clouds are more control, higher security and privacy, cost and efficiency.

Hybrid: It comprises both private and public cloud services with multiple providers.

Cloud computing has been increasing its facilities to data-intensive computing on distributed platforms such as MapReduce [3] and Hadoop. Cloud-distributed platforms, virtualization takes place on the physical machines, and hence a virtual cluster is formed due to large collection of virtual machines. Data-intensive tools works on virtual group unlike the old-fashioned physical cluster. Such a virtual cluster provides adjustable environment, which can move up and down according to the changes in computation demands from different users.

II. COMPONENTS IN VANET

The basic components in VANET are communication, onboard control unit (OBCU) and Road Side control Unit (RSCU):

Communication: - Wireless Access in Vehicular Environment (WAVE): IEEE 1609.2 Standard.11p and it supports wireless access in vehicular environment (WAVE) Wireless Access in Vehicular.

On-Board Control Unit (OBCU):- This component which is positioned in the vehicle handles and processes the data composed from numerous sensors placed inside the vehicles which provides the situation of the vehicles and communicates with outside network.

Road Side Control Unit (RSCU):- It is a device consisting of infrastructures for effective interaction between the cars and the road side units such as sharing information between them. The wireless components are placed on the vehicles for example, passenger cars which track the identical route for their transportation acting as nodes. These vehicles conceal the part of the city including time and space, which can be systematized into a multihop wireless ad hoc network backbone which delivers network access and common communication services during the course of the city. In order to enhance the ad hoc network routing scalability and to grant internet connectivity for several base stations are located throughout the city in which nodes can communicate over multi-hop paths.

III.VEHICULAR AD HOC NETWORK AND CLOUD COMPUTING

This topic deals with intelligent transport system which means safe and secure transportation and it allows permits flow traffic and employs GPS and DGPS equipped devices [6].The several kinds of technologies which are used are:-

1). Wireless communications
2). Inter- Vehicle Communications
3). Road-side to vehicle communication
4). Computational technologies
5). Floating car data
6). Floating cellular data
7). Sensing technologies
8). Inductive loop detection
9). Video vehicle detection
10). Bluetooth Detection

However ad hoc network wirelesses LAN, cellular technology for intelligent transport system – all work same in VANET, where routing is the most significant part. VANET can use V2V as well as V2I interactions for progressive notification of traffic proceedings. For

backing the traffic-related communications, Federal Communications Commission (FCC) of US ensures reserved 75 MHz of spectrum in the 5.850 to 5.925 GHz band and assigned by the FCC for devoted short-range communications. Cloud computing commenced after the understanding of the detail that businesses discover it beneficial to hire out the infrastructure and even the desirable software to track their applications. One vital improvement of cloud computing is its scalable admission to computing resources. With cloud computing developers need not deploy their service in terms of large capital servers for internet applications and services. Using magnificent advantages of cloud, the impression of VANETClOUD comes into light.

In VANET, cloud computing can be employed as a Network as a Service (NaaS) or Storage as a Service (SaaS). In NaaS, the car with internet can provide its additional capacity to the other cars in the VANET when needed. For SaaS, the vehicles with sufficient storage capacity share storage with other vehicles which need storage capacity.

IV.PROPOSED FRAMEWORK

Initially, a survey is done to study the technologies and the methodologies involved in accessing the data stored in cloud which is uploaded by the vehicular node (user) or the management agent. An idea of incorporating Vehicular Ad-hoc Networks (VANETs) with the Cloud Computing known as VANET-CLOUD design. This VANETCLOUD concept will encourage in implementing the Intelligent Transport System (ITS) concepts in Cloud Computing to foretell the traffic situation, weather conditions and most importantly to perform safety warnings to vehicles by using some authentication mechanism. To assess the feasibility of the proposed scheme, this study is compared to several research challenges involved in VANETs and Cloud Computing. And hopefully this proposal will be the solution useful in accessing the remote data which will be useful to forecast the route map or network congestion at the time of travelling from one place to other. The vehicles on which wireless device are attached, in the city as the important component of the network which are movable nodes. The stationary component of the network infrastructure are trivial number of base station nodes and because of the multihop routing competence of the ad hoc network mobile nodes, positioning of the fixed base station nodes is eased, thus forming a classified, multitier organization. The network mobile nodes route packets between personal mobile nodes inside the ad hoc network, and also between personal mobile nodes and the internet, through a trivial group of secure base stations. If there is no base station in adjacent, there is no problem since in ad hoc network structure all the nodes generate a network by hopping the signal to the nearest base stations. Furthermore, over VANET, each vehicle can connect with the other vehicle through V2V network. So, with the ad hoc network produced within the traffic can be measured. Each time a car will originate into a close proximity inside a assured area which can create congestion in the road, by V2V the car will direct message to the other car and generate sufficient room in the road so that when the green signal turns on every car can travel securely without creating a massive traffic jam due to congestion. A car which is moving front repeatedly directs a communication message for maintaining a distance to the rear vehicle and sending a caution message in case of violation which provides a help hand for traffic administration to regulate and reduce accidents as well as recognize the errors for compelling legal activities. The interaction between vehicles is swapped through DSRC standard. As each car has internet connections, the wireless sensors associated to the cars for calculating fuel convention, road data, GPS information, CO_2 emission etc. information are routinely directed to cloud measured by the traffic police. Now, if any car produces too much CO_2 or violates traffic law, all the information will be routinely uploaded to the cloud controlled by traffic department and they can track the car by analysing the IP address of the car or registration or chassis number uploaded into cloud. Every car is equipped with a wireless device for ad hoc network architecture. If a large traffic jam occurs, a huge number of cars with internet access and computational infrastructure facility get stuck.

We propose a system established on vehicular ad hoc networks and does not require fixed infrastructure at each intersection. In addition, the system can also operate without traffic lights at the intersection. This system is expected to help with the hidden car problem or the blind spot problem since cars notify each other about their presence. The following advantages are achieved:-

1). collision avoidance
2). safety warnings in vehicles
3). real-time traffic congestion
4). routing information
5). media and content sharing
6). Threat- detector sensors

V.ARCHITECTURE DESIGN

The V2V vehicles form groups depending upon distinct road segmentation. Every group is ordered node in cloud and single group pass to direct all data to other vehicles in each group and also to neighbouring group passers. The group header will examine inside in a country for any base station is found for transmitting information to cloud. In certain disastrous situations damage to the mobile communication infrastructure is possible, at this time the VANETCLOUD becomes a decision support and act as a replacement for the infrastructure. In this architecture, the

key issues such as security and privacy, road safety message, Storage as a service, Network as a Service are discussed. But there a number of possible areas remaining to be explored, such as context based routing ,security and privacy data sharing ,unstable communication links, physical location of attackers inside the same cloud servers. A brand new research is needed to create VANETCLOUD vehicle reference models, architectures and protocols

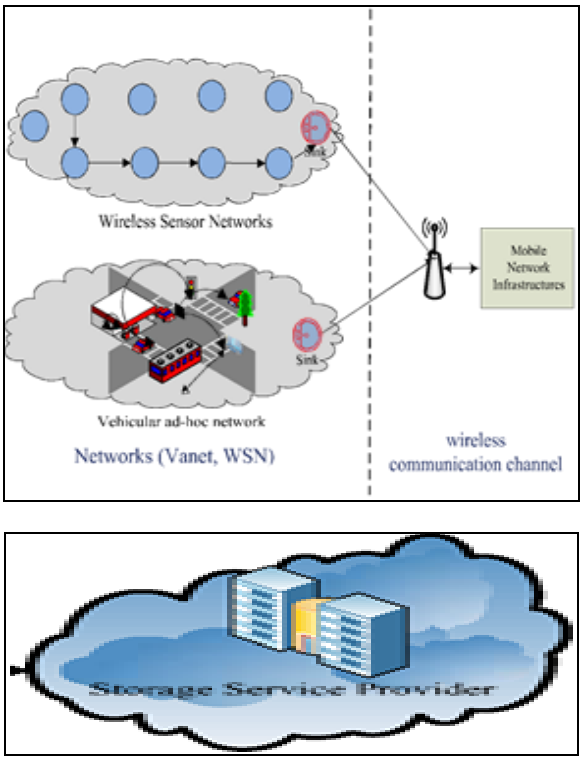

Figure 1: VANETCLOUD ARCHITECTURE

As shown in figure 1, vehicle cloud architecture consists of IaaS- infrastructure as service, PaaS-Platform as service and SaaS- software as service to work the cloud environment and STaaS- storage as service, NaaS- network a service. VANET can deliver drivers with improved announcements of traffic events, the drivers can get the message instantaneously or even if the driver is busy in that moment the notifications will be protected into the cloud from where the drivers can develop them whenever they want, and traffic department. We work on the assumption of a completely infrastructure-less system that minimizes waiting time at a road intersection, and controlling traffic lights to provide absolute priority for emergency vehicles, and relative priority for all other vehicles, based on sitting capacity. VANETCLOUD leads to enhancement of safety, security and economic value of the society. VANETCLOUD can establish an enormous ad-hoc federation in guiding many types of hazard situations. In certain disastrous situations damage to the mobile communication infrastructure is possible, at this time the VANETCLOUD becomes a decision support and act as a replacement for the infrastructure.

NETWORK AS A SERVICE (NaaS):-
Though cars have net connections, most cars have no network as service. As a solution for this, cars with internet access can give this facility of internet access for other cars on the move. Important resources can be shared on the road by giving from other drivers.

STORAGE AS A SERVICE (STaaS):-
Approximately vehicles have large amount of on-board storage while the other cars may require additional storage. Therefore vehicles with additional storage will provide STaaS. There is certain obstacle for renting car storage as a backup. This can be overcome by COPYING-BASED STORAGE in which a car leaves the place; the copy of the file can be used.

SAFETY AND WARNING ROAD MESSAGES: -
An embedded-threat detect sensor placed in vehicle acting as a sensor node and forming wireless. Vehicles will receive road messages such as mishaps and conditions on road, speed breakers, holes, and indiscipline drivers.

SECURITY IN VEHICLE NETWORKS AND CLOUD COMPUTING: -
Here the security is divided into three layers namely,
1).Security of VANET
2).Security of wireless networks
3).Security of Cloud computing

Providing security and privacy are the important and challenging tasks especially in wireless networks.

VI.METHODOLOGY AND SCOPE

The VANETCLOUD combines multiple networking technologies like WIFI 1609, IEEE 8020.11P, WIMAX IEEE 802.16, WAVE IEEE, BLUETOOTH, IRA and ZIGBEE. Vehicle ad-hoc networks are likely to device wireless technologies like the short range communication cellular satellite and wimax. These can be observed as module of the intelligent system.

Festag [5] successfully designed and built an experimental platform to conduct research on co-operative drive intelligent transport systems. They developed a vehicle that could work as an automated vehicle. This allows experiments in single vehicle lane tracking and multiple vehicle collision advance systems. Here the vehicles broadcast their ongoing paths locations and velocity. Making use of the cutting edge technological advancements for innovative and effective traffic hazard detection and monitoring systems, we can implement the mobile ad-hoc networks for street and high-way communications.

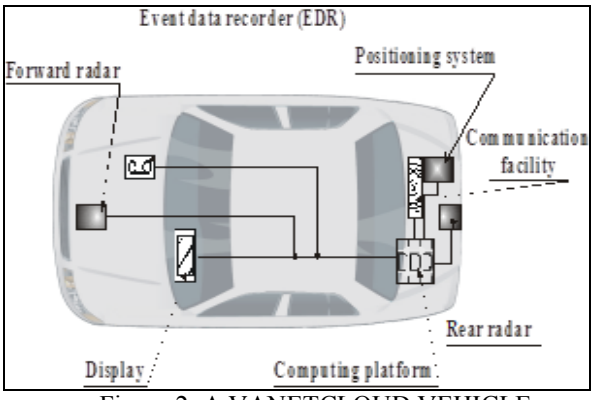

Figure 2: A VANETCLOUD VEHICLE

Vanet emphasize emergency alerts, co-operative driving, traffic status reports, collision avoidance and the physical data centre unit is in charge of process the data computation and storage. But the virtual aggregated of vehicles resources generates the datacentre cloud including the RSU combined services. The VANET vehicle, as shown in figure 2, consists of positioning system communication facility rear radar, front radar, display, event data recorder and a computing platform.

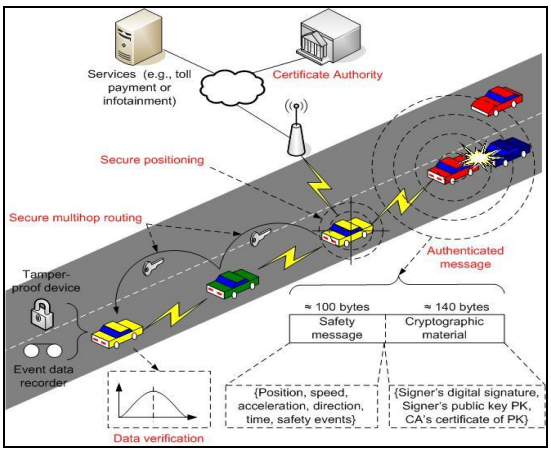

Figure 3: VANETCLOUD IMPLEMENTATION

Areas of interest include, but are not limited to:

- Simulation frameworks
- Field operational testing
- Networking to reduce energy consumption
- Wireless in-car networks
- System that reduce driver distraction
- Communication related to electrical vehicle charging and Security and privacy issues and protection mechanisms.

As shown in figure 3, a VANETCLOUD vehicle is a new hybrid technology encompasses the combination of various networks like mobile ad-hoc networks, wireless sensors networks, ad-hoc networks and also cloud computing for better services such as control car paths as well as car movements and managing navigation system to provide short and safe routes for travelling. The current Interactive and Eco move projects within the European safety framework, several US programs derived from the connected Vehicles projects and Japanese smartway and advanced safety Vehicles programs are some petty examples of ongoing project in vehicle cloud computing .Ad-hoc networking is also present in a very active field of standardization activities around the world. VANETCLOUD arises from the convergence of implanted vehicle resource , sensing and cloud computing as well as recent advances in network mobility The on board vehicles resources like the internet connectivity , storage and computing power can be rented or shared with various customers over the internet like the cloud services.

VII.CONCLUSION

VANET requires that a traffic and network simulator should be used to perform this test. Cloud services are obtained from data centers which are distributed throughout the world. Virtual resources are provided to clients through internet in cloud computing such as Gmail, provided by Google. The rapid growth in cloud computing has led to numerous advantages but at the same time it possess lack of security concerns which has been a major challenge. VANET enables communication between vehicles. A system for detecting terrorist activities can be built using VANET. Police cars are provided with threat – detect sensors (e.g., for sensing or detecting threats such as explosives chemicals, radiation, etc.) can communicate and work together to counterbalance the situation. VANETCLOUD leads to enhancement of safety, security and economic value of the society. VANETCLOUD can establish an enormous ad-hoc federation in guiding many types of hazard situations. In certain disastrous situations damage to the mobile communication infrastructure is possible, at this time the VANETCLOUD becomes a decision support and act as a replacement for the infrastructure. In this architecture, the key issues such as security and privacy, road safety message, Storage as a service, Network as a Service are discussed. But there a number of possible areas remaining to be explored, such as context based routing ,security and privacy data sharing ,unstable communication links, physical location of attackers inside the same cloud servers. A brand new research is needed to create VANETCLOUD vehicle reference models, architectures and protocols. Therefore a collaborative effort is needed among the auto-industries, researchers and the government to implement VANETCLOUD.

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