CONTRIBUTION OF VANET IN SAFE TRANSPORTATION

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ABSTRACT:

Transportation is base of the progress of any country in this era. The economy of any country fully depends on the transportation through road, water, air or on rail. All kinds of business or commerce related with transportation directly or indirectly. Mostly it is related with road transportation. But in developing countries like India there are various challenges as road accidents as well as traffic jam. VANET technology is a good technology that can help to prevent road accidents. VANET can also be used to avoid those ways which have heavy traffic jam. In this we can create two kinds of securities. One of them is security in vehicles & second security on road. We can use a cheapest technology in the vehicle which can indicate the driver about wrong way or the possibility of accidents. A base station can be set up on highways or roads which give an alert message to a vehicle about traffic jam on that.

Explaining topics
(a) Present system in India to avoid accidents and traffic jam
(b) Present or Latest system used in different countries of the world to avoid accidents and traffic jam.
(c) Challenges in India to implement latest traffic security.

Keywords: VANET-: Vehicular Adhoc network. MANET-: Mobile Adhoc Network, RVC-Roadside-to-Vehicle Communication

[1] INTRODUCTION:

The road transport industry in India has emerged as the dominant part of the transport system. However, the industry is finding it increasingly difficult to meet emerging requirements. This may be partly due to the inadequacies of the road network, which if expanded and upgraded could go a long way in promoting efficient vehicle operations. Part of the problem also lies in the inability of service organizations, especially in the public sector, to deliver services efficiently. With the industry having suffered from a near absence of technological improvements in the design and manufacture of vehicles, there is urgent need to effect these changes immediately.
Transport industry is a big industry. Indian economy fully depends on it. There are some challenges for this.

1.1. **INADEQUACY OF THE ROAD NETWORK:**

Despite the fact that plan allocations to the roads have been low relative to other components of the transport system, the total road length increased from nearly 4 lakh km in 1950–51 to nearly 22 lakh km, in recent times, accounting for more than a five-fold increase in the road length. At the same time, the surfaced road length to total road length went up from 38% to nearly 46%. All this is apparently remarkable although in terms of the road accessibility indices and quality of roads, India lags behind advanced countries. For example, India has a road length of 2.4 km per thousand persons and about 60 km per sq km of land which are respectively one-tenth and one-third of similar indices for developed countries. About 35% of the villages are without a road link. A significant part of the road network has been in existence for several decades and was primarily built to serve the needs of animal-drawn traffic. Because of congestion and poor road conditions, the annual avoidable vehicle operating and fuel costs are estimated to be Rs 15,000 crores$^5$.

A World Bank Study on road deterioration in developing countries$^{10}$ found that road maintenance is a very cost-effective option since the rate of return on investment on maintenance is supposed to be as high as 50%. Thus, it becomes important to review even the present policy of expansion of the network at the cost of maintenance of existing roads. The importance of having a proper road maintenance programme can be gauged from the fact that nearly 90% of freight on National and State Highways is carried by two-axle trucks, which are generally overloaded and cause significantly more damage than vehicles with more axles which have a better load distribution. Thus, our country requires more expenditure than other countries because of the particular composition of its commercial vehicular fleet.

1.2. **PERFORMANCE OF PUBLIC SECTOR ROAD TRANSPORT CORPORATIONS**

Public sector participation in passenger road transport services in India commenced with the passing of the Road Transport Corporations Act, 1950. At present, there are 71 State Transport Undertakings in the country comprising 21 Corporations registered under the Road Transport Corporations Act (1950), 31 Companies registered under the Companies Act, 1956 (this number may be different in Tamil Nadu now), 8 Departmental Undertakings and 11 Municipal Undertakings. As on 31 March 1995, there were around 1,11,200 buses in the public sector with a total investment of over Rs 6,000 crores and formed 27% of the country’s bus population. These Corporations earned total revenue of Rs 8,385 crores in 1995–96, showing an operating loss of about Rs 610 crores. The financial return on capital invested (net profit or loss/capital invested) was (−) 9.25%. According to a study by the Planning Commission$^{11}$, there has been a perceptible improvement in the rate of return during the last five years though the return is still negative.

In Britain, a combination of privatization and deregulation has softened the effects of subsidy cuts on users. In developing countries like Sri Lanka, Chile, etc. privatization and deregulation have generated large service expansion with little or no fare increases even when public subsidies have been reduced if not withdrawn. At the present moment, the preferable policy approach would be to enhance competition between public and private operators through
deregulation rather than de-nationalization that can come at a later stage depending on the outcome of this experiment

1.3. THE ROADS GOODS TRANSPORT INDUSTRY IN INDIA

Road freight operations in India have almost been always in the hands of numerous private operators. In the four decades since independence, the number of trucks rose from around 80,000 to an impressive figure of more than 15 lakhs in recent years. In the past ten years alone, the figure has doubled.

The principal legislation regulating the industry is the Motor Vehicles Act of 1939 that was amended comprehensively in 1988. The amended Act, by its various provisions, appears to recognize the potential of the industry as an essential ingredient of the social and economic infrastructure (for long endorsed by different Committees) rather than support the earlier predominant view that the industry only needed to be supervised and controlled. Though such a perspective provides for a more liberal policy framework and at the same time a strengthened regulatory mechanism, the implementation needs to be qualitatively different.

For instance, while the purpose of the permit system is essentially to restrict numbers, it is quite possible to achieve this objective by emphasizing the qualitative aspect of the provision. These relate mainly to the responsibilities to be fulfilled by the operators. On a broader level, issues relating to the problem of

Growth of Indian road network (km)

<table>
<thead>
<tr>
<th>Category</th>
<th>1951</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressways</td>
<td>18,811</td>
<td>34,600</td>
</tr>
<tr>
<td>National highways</td>
<td>60,000</td>
<td>135,000</td>
</tr>
<tr>
<td>State highways</td>
<td>316,000</td>
<td>1,035,000</td>
</tr>
<tr>
<td>Other roads</td>
<td>400,000</td>
<td>2,100,000</td>
</tr>
<tr>
<td>Total</td>
<td>400,000</td>
<td>2,100,000</td>
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</tbody>
</table>


1.4. TECHNOLOGY AND ROAD TRANSPORT DEVELOPMENT

It has been well established that road user costs are significantly influenced by the pavement quality. This brings into focus the desirability of optimizing pavement investment in the overall interest of minimizing total transport costs in the long run. Small et al. emphasize the need for optimal investments in road durability, which would produce thicker pavements and would result in substantial benefits in the long run. It is in this context that the role of rigid pavement technology based on different types of cement concrete becomes significant. The changing relative price structure of bitumen and cement and the total road cost concept which considers construction costs and maintenance costs over the design life tend to render cement
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Concrete roads viable. However, the inherent structural characteristics of such roads require that they are built to proper structural standards and appropriate maintenance standards are used. They have good scope for use on four laning of National Highways and on Expressways.

The compulsion for a technological change in the automobile industry in India became necessary only when the market became more competitive in the early eighties. Until this time, the different strategies mainly related to modernization, scale, production process, etc. which did not affect costs and thereby had no effect in market shares of different firms. Thus, there was a delay in the introduction of new and more efficient technologies although individual manufacturers updated their product lines from time to time through limited research and development efforts. Some of the technological improvements that have resulted from foreign collaborative ventures/indigenous efforts in recent times include fuel-efficient, weight-effective, high-performance engines, modern aero-dynamic cabs, improved suspension systems, etc. To increase the payload capacity of the vehicles so that fuel consumption per tonne-km is reduced, the use of multi-axle vehicles and tractor-trailers need to be introduced in a significant way. This would bring about a change in the composition of the commercial vehicular population that consists mainly of two-axle vehicles.

[2] FIVE COUNTRIES WITH THE BEST PUBLIC TRANSPORTATION SYSTEMS

In terms of countries with the best quality of infrastructure, the United States has consistently been ranked somewhere between roughly 15th and 25th for many years. The most recent World Economic Forum ranking puts the United States at number 16. You can tell by our commutes. When you compare the United States and Europe, the United States has the third worst average commute time at just under 50 minutes. We're barely beating Romania and Hungary. The Interstate Highway System the United States initiated in 1956 was referred to as the "greatest public works project in history." When it came about, President Eisenhower said it was "essential to the national interest," as safe and efficient roads would be crucial if there was ever an attack by a foreign nation. Since then, many nations around the world have ramped up infrastructure programs while the United States has mostly slowed down. As of 2013, the United States has the second largest highway system, after being outdone by China.

There are different modern transportation system applied in the following countries

- **Hong Kong SAR**

Hong Kong SAR is the city of Hong Kong and the surrounding areas. It ranks second in the world in infrastructure, including third for airport infrastructure and third for railways, according to the World Economic Forum. In the 1990s, Hong Kong literally took apart nearby mountains to build a new airport off the coast. The previous airport was becoming overcrowded and had no room to grow, so the city developers decided to create an island in a place that was previously just ocean water. The city has also created numerous, new subway and high-speed railways in the past couple decades. The city's largest public transportation company, MTR, recently announced it will be investing $7 billion to replace 78 trains that have been running for over 35 years. Being a place that is filled with technology companies, Hong Kong has the fastest Internet in the world. It's a quickly growing town, and the infrastructure is quickly growing with it. That being said, some budget concerns and labor shortages have slowed it down a bit
Singapore

Singapore is a wealthy city-state. It was recently said to be the place where people become millionaires the quickest, with it only taking them around 10 years. It's number five for overall infrastructure and number one in airport infrastructure. The city-state has high quality public transportation, flight availability, and minimal traffic compared to other places its size. A bullet train is being developed that will take Singapore residents to Malaysia's capital city, Kuala Lumpur. The train should be finished by 2020, and it will go about 220 mph. Singapore is also focusing on train transportation within its limits, and it is in the process of adding 45 new trains for public transportation by 2018. Singapore is a high-tech city-state that has been on the cutting edge of many innovations. The city is on the cutting edge with infrastructure by utilizing new audiovisual technology for public safety and live navigation technology for efficient bus routes. (It was also recently in the news for investing in drone restaurant servers.

United Arab Emirates

Burj Khalifa, at over 2,700 feet tall. The United Arab Emirates is the third overall in infrastructure and second for airport infrastructure. Dubai's airport is said to be the busiest airport in the world, with nearly 70 million people passing through in 2014. Aviation will reportedly contribute over $53 billion to the country's economy by 2020. The country is considering setting up a metro line to link its major cities within the next few years, and it is constantly updating and expanding its road networks. The UAE invested over $27 billion in infrastructure between 2003 and 2010, and it is the world's sixth richest country. Many of the country's officials have said the investment in infrastructure has contributed to the country's wealth. The United Arab Emirates is a place known for building big. Dubai is the country's largest city. It holds the tallest skyscraper in the world,

Netherlands

The Netherlands is sixth in overall infrastructure and number one in port infrastructure. Most places in the Netherlands are below sea level, so the country has developed some of the world's most advanced techniques for dealing with natural water flows. It has computer-operated storm surge barriers that prevent floods when extreme weather events occur. The whole country is an array of dikes, dams, and sea walls that keep its major cities from going underwater. Bicycling is extremely popular in the Netherlands, and it has a massive amount of bicycle paths and roads that transport much of the population. A new train station in the Netherlands includes a bicycle parking garage with 5,000 parking spots and electronic signs that show how many spots are available in each row. With government assistance, a group of researchers in the Netherlands rolled out the first solar road in 2014. It was also the first country to invest in roads with glow-in-the-dark markings for safer driving.

Switzerland

Switzerland is not only in the top five for being the most competitive in infrastructure, it's the number one competitive country overall, according to the World Economic Forum. The European country is number nine for quality of roads and number two for railroads. Many Swiss roads have been ranked among the best roads to drive on in all of Europe. The Swiss Federal Railways are famous for their quality and punctuality. The small country has 9,000 trains that cover almost 2,000 miles per day. It has been found that 90 percent of Swiss train riders arrive to their destinations on time, and they make 98 percent of their train connections. The system actually has its own signature clock, and it's famous
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for its accuracy and aesthetics. The appearance of the clock was allegedly copied by Apple for the Apple Watch. The tech company ended up paying Switzerland $21 million for snatching the design.

[3] VANET

The technology which is used to move cars as joint in network to make a transportable network. Participating cars become a wireless connection or router through vanet and it allow the cars almost to connect 100 to 300 meters to each other and in order to create a wide range network, other vehicles and cars are connected to each other so the mobile internet is made. It is supposed that the first networks that will incorporate this technology are fire and police mobiles to interact with one another for security reasons. One promising application of mobile ad hoc networks is the development of vehicular ad hoc networks (VANET).

The creation of Vehicular Ad Hoc Networks (VANET) has also spawn much interest in the rest of the world, in German there is the FleetNet project and in Japan the ITS project. Vehicular ad hoc networks are also known under a number of different terms such as intervehicular communication (IVC), Dedicated Short Range Communication (DSRC) or WAVE. The goal of most of these projects is to create new network algorithms or modify the existing for use in a vehicular environment. In the future vehicular ad hoc networks will assist the drivers of vehicles and help to create safer roads by reducing the number of automobile accidents.

3.1. APPLICATIONS OF VANET

Mostly interests to MANETS belong to the VANETS but the features are different. Vehicles are likely to move in structured way. The connection with wayside equipment can similarly be indicated absolutely accurately. In the end, mostly automobiles are limited in their motion range, such as being controlled to pursue a paved way. VANET suggests unlimited advantage to companies of any size. Vehicles access of fast speed internet which will change the automobiles’ on-board system from an effective widget to necessary productivity equipment, making nearly any internet technology accessible in the car. Thus this network does pretend specific security concerns as one problem is no one can type an email during driving safely. This is not a potential limit of VANET as productivity equipment. It permits the time which has wasted for something in waiting called “dead time”, has turned into the time which is used to achieve tasks called “live time”. If a traveler downloads his email, he can transform jam traffic into a productive task and read it himself if traffic stuck. One can browse the internet when someone is waiting in car for a relative or friend. If GPS system is integrated it can give us a benefit about traffic related to reports to support the fastest way to work. Finally, it would permit for free, like Skype or Google Talk services within workers, reducing telecommunications charges.

3.2. TECHNOLOGY USED

Brilliant way to use Vehicular Networking is defined in VANET or Intelligent Vehicular Ad-Hoc Networking. Multiple ad-hoc networking technologies integrated in VANET such as, ZigBee, IRA, WiMAX IEEE, and WiFi IEEE for convenient, effective, exact, simple and plain communication within automobiles on active mobility. Useful procedures like communication of media within automobiles can be allowed as well process to follow the automotive automobiles are also favored. Security measures are defined in vehicles by VANET, flowing communication within automobiles, edutainment and telemetric. Selection of wireless technologies are required to implement in VANET as DSRC (Dedicated Short Range Communication) which is include in WiFi. Other entrant technologies of wireless are Satellite,
WiMAX, and Cellular. Vehicular Ad-hoc Networks (VANET) can be considered as device of ITS (Intelligent Transportation Systems). ITS (Intelligent Transportation Systems) has conceived vehicular networks. IVC (Inter-Vehicle Communication) permits the automobile communicate to each other at the same time RVC (Roadside-to-Vehicle Communication) allows with the stations based wayside.

The most favorable target is the more useful, efficient and safer roads will built through vehicular networks by informing to basic authorities and drivers in time in the future. Another target is to discover the advancement of vehicular ad hoc networking (VANET) wireless technologies. The purpose is to secure and to make possible commercial requests through range of communication systems and/or other networks (VANET) which goes short to medium. These technologies would support main concern for critical time secure communication and fulfill the QOS needs of other multimedia software or e-commerce mobile. Next goal to create high-presentation, extremely measurable and secured technologies of VANET shows an unusual challenge to the investigate community of wireless. Specific restrictions normally assumed in ad hoc networks are alleviated in VANET yet. Such as, VANET might assemble comparatively huge means of computational.

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3.4. CHALLENGES CREATING AD HOC NETWORKS

There are many challenges that need to be addressed when creating a vehicular ad hoc network. One of the challenges facing ad hoc networks is the topology of the network changes rapidly. Vehicles in a VANET have a high degree of mobility. The average length of time that two vehicles are in direct communication range with each other is approximately one minute. Another obstacle restricting the wide spread adoption of ad hoc networks is many of the protocols used for 802.11 are centralized and new distributed algorithms must be developed. Many of the algorithms that was acceptable for 802.11 relied on the fact that there was a centralized controller, the AP. The 802.11 standard provides a limited ad hoc mode with the independent basic service set (IBSS) configuration, but it is not sufficient for vehicular ad hoc networks. Furthermore, wireless communication is unreliable. The error rate in wireless networks is much higher than on an Ethernet. All of these issues make implementing a VANET difficult.

3.5. PURPOSE
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The purpose of VANET is to allow wireless communication between vehicles on the road including the roadside wireless sensors, enabling the transfer of information to ensure driving safety and planning for dynamic routing, allowing mobile sensing as well as providing in-car entertainment. As VANETs have unique characteristics which include dynamic topology, frequent disconnection of the networks, and varying environments for communication, the routing protocols for traditional MANET such as Ad hoc On-demand Distance Vector (AODV) (Perkins and Royer, 1999) are not directly usable for VANETs.

SECURITY IN VANET

The main component of the Adhoc part of VANET is vehicles equipped with sensors, the OBU and the Trusted Platform Module (TPM). On the other hand, the infrastructure part is comprised of the manufacturers, Trusted Third Party (TTP), legal authorities as well as service providers. In the infrastructure part, the RSU serves as a bridge between the infrastructure environment and the adhoc environment.

![VANET Components and Communication Model](image)

Figure 3. VANET Components and Communication Model

The vehicles in VANET are envisioned to be smart in the following perspectives. First, they should incorporate the basic set of sensors such as front and rear radar that receive extra information from surroundings that the human driver is unable to perceive. Secondly, positioning systems such as the Global Positioning System (GPS) are also found essential for driving assistances. Finally, a smart vehicle should also be equipped with a communication system with potentially multiple interfaces, a central computing system and an Event Recording Device (ERD) whose functioning is similar to the black box of an aircraft. There are also proposals stressing that a smart vehicle should also be equipped with Electronic License Plates or Electronic Chassis Number to better represent the identity of the vehicle and easy the verification and logging process.

VEHICULAR AD-HOC NETWORKS (VANETS) AS A SMART SOLUTION
The Vehicular Ad-Hoc Network is an emerging technology to achieve intelligent inter-vehicle communications, seamless internet connectivity resulting in improved road safety, essential alerts and accessing comforts and entertainments. The technology integrates WLAN/cellular and Ad Hoc networks to achieve the continuous connectivity. VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created.

VANETs have been used in detecting traffic density and parking management solutions in India. The aim of VANET is to provide a safety for drivers and other road users, savings space upwards of 70 percent, reduces total parking cost, environmental friendly and provides higher throughput with faster operations. VANET is a vast subject of study which is used to implement many components of ITS. VANETs are blend of both Inter-Vehicular Communication (IVC) and Road-Vehicular Communication (RVC). Communication in VANET can be facilitated in two ways: (i) Vehicle-to-Vehicle (V2V) (ii) Vehicle-to-Infrastructure (V2I). Every moving car is assumed to be a node which in turn communicates either with nearby node or other nearby fixed equipment.

Safety applications will monitor the surface of the road and approaching vehicles and feed information that could put the vehicle at risk back to the driver. The technology would allow drivers to warn other vehicles of potential dangers, while an emergency braking system will be installed to prevent accidents. The VANET provides following information in order to accompany user with traffic congestion update ahead which helps in reducing the average traffic halt time during predictable and unpredictable obstacles:

(i) To integrate the data related to position, density & distance between the node and the location of the jam
(ii) To relay this clustered information to the source node i.e. driver’s information panel

Researchers in India are working on VANET which when fully operational would allow communication among vehicles and also between vehicles and roadside equipment. Researchers say that VANET technology could alleviate road congestion and prevent accidents. Researchers at the Indian Institute of Technology (IIT) in Kharagpur plan to equip vehicles with sensors, which will be controlled by a telematics box inside the car. This box would be able to communicate with the driver and pass on the vital traffic informations such as post-crash notification technology would allow a vehicle involved in an accident to broadcast messages to vehicle in the area, as well as to the emergency services and road hazard control notification which enables cars to notify other vehicles in the area of road slides, or unpredictable terrain ahead, while the cooperative collision warning alerts drivers that they are about to
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collide. VANET will also provide drivers with the latest congested road notification feature which will detect and notify the drivers of road congestion ahead, allowing motorists to alter their course. Likewise the TOLL notification feature will enable the drivers to pass through a tolling area without stopping, while the parking availability setting helps motorists find parking spaces.

[6] CONCLUSION:

VANET is a unique technique or method by which several improvements can be done in Transportation. It can make transportation easy and convenient for the public. It can save us from accidents & heavy traffic jam. It can solve the problem of parking in developing countries like India. It can also save our highways from accidents. VANET can help us to provide best transportation in India as well as in several developing countries.

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