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# A Study on Cost Effectiveness and Security of VANET Technologies for Future Enhancement

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**Abstract**

Intelligent Transport System (ITS) is an advanced application which provides web enabled services for traffic and transport system, which results in a safer, coordinated traffic network system. ITS is very effectively used in VANET (Vehicular Ad-hoc Network), which is a spontaneous creation of wireless network of vehicles for exchanging information between them, for improved transport and traffic management and to enable various users to be sufficiently informed about the road and make safer and smarter decisions on road by using transport networks. As the technology has to be used widely, there is a high need for a low cost VANET technology with high security and Quality of Service. To go for any further developments, a thorough analysis on the available technologies is essential to get a closer view on the current scenario. The result of this study can open doors for a better technology for future VANETs. This paper considers a few existing technologies such as CROWN, Vehicular Cloud and VANET-Cloud and a comparison on these is carried out.


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*Keywords:*VANET;ITS; CROWN;Vehicular Cloud;VANET-Cloud

## 1. Introduction

Today, as the numbers of vehicles are increasing which results in more traffic congestion and crashes and thus being one of the major issues in developing countries which are to be effectively addressed by improving the current transportation systems, by considering the necessary needs of reducing the road traffic congestion and improving road safety. At present there are different technologies available for road safety that are been implemented all over the world. For example, in USA like developed countries, they are avoiding the traffic congestion by maintaining a traffic geometry which is achieved by giving the capacity per lane as about 2,200 vehicles per hour and


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that each vehicle should maintain range of speed up to 100km/hr.The driving security and responsibility can be improved based on warning messages through GPRS or Mobile phone. There are other security measures like fixation of camera in highway for speed control and other security measures available inside the car itself, like seat belt, air bags etc.

Even though these methods make road transportation system better, they are not sufficient to improve the road traffic system to a greater extend or it is not satisfactory for the current technological world.Today there are many new and more beneficial technologies coming up like VANET [1], which is one of the technologies related to Intelligent Transport System [2].Researches on VANET are on-going.

VANET is a network of vehicles, used to exchange information, in which all the vehicles in the networks are interconnected through wireless technologies.According to the range and strength of the technology used, the capacity of vehicle in the network may vary and to achieve the data collection and processing, each vehicle is embedded with some On-board resources, including sensor, computer etc. There are mainly two types of communication possible in VANET, Vehicle to Vehicle (V2V) and Vehicle to Infrastructure communication (V2I).Each vehicle collects information around the environment using sensors and processes the information using the resources inside the vehicle and exchange the information according to the requirements. Most widely used standard in VANET is Dedicated Short Range communication (DSRC).This standard is developed to support the V2V and V2I communication and provides wide range of application including safety messages, traffic information etc. WAVE is another standard used worldwide which is developed by incorporating the DSRC with IEEE 802.11.The other wireless technologies which can be used in V2V communication include IEEE 802.15.1 (Bluetooth), IEEE 802.15.3 (Ultra-wide Band) and IEEE 802.15.4 (Zigbee), WiFi(802.11), WiMax(802.16)etc.

In VANET, the network topology is changing dynamically which creates a need for position based routing. Some of the technologies used includes, CROWN [3], Vehicular Cloud [4][5], VANET-CLOUD[6]. All these mentioned technologies use the concept of Cloud computing [7] which is one of the highly emerging research areas. Most of the industries are now migrating from its local network to cloud networkfocusing on maximizing effectiveness of data storage. Cloud is shared pool of computing resources,provided by Cloud providers, hosted on the internet so that the clients can make use of them, without installing the services on their system, via internet.

## 2. VANET Technologies

In VANET, vehicle collect the data(images, videos etc.) in its vehicular environment using sensors available in that vehicle. This data will be processed by the resources that are available inside the vehicle itself, like onboard computers, GPRS etc. After processing the collected data, appropriate message will send to the other vehicles using wireless communication. DSRC (Dedicated Short Range Communication) is used in VANET for communication. DSRC has a range of 5.9GHZ, which is similar to WiFi. The vehicle can take actions based on the messages as per the needs. The following methods add some additional capabilities to the VANET. There is a comparison on different methods to find out which one is better for better results in traffic system for future.

### *2.1. Vehicular Cloud*

Vehicular Cloud [4][5] is a cloud formed by the static resources such as on board computers, information etc., of stationary vehicles like the ones at the parking lot, traffic congestion etc. which are spending hours in such situation and wasting their resources. In such situations these vehicle can be a candidate for the cloud provider and other vehicles can make use of the resources of such vehicles. The owners of these vehicles can also rent out their excess capacity. These cloud provider vehicles can provide Storage as a Service (SaaS), Network as a Service (NaaS) and Cooperation as a Service (CaaS). The main disadvantage of this scheme is that services can be accessible to clients only when the vehicles are online i.e. driver should be present in the vehicle which is many a time difficult in