# TSVCC:Tracking Service in Vehicular networks based on Cloud Computing Platform as a Service

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**Abstract**

*Recently many Tracking system proposed in VANET as an applications to do specific function such as anti theft car systems ,vehicles monitoring systems,fleet management ,this type of applications depend on real-time vehicles' location ,we call it Location-Based Applications(LBA) or Location-Based Services(LBS) .*

*From the VCC top view point, this paper propose platform location tracking system for support built many LBAs in VCC environment. Authors propose optimized VCC architecture for improve bandwidth utilizationand decrease number of location update message.via handling impact increase number of LBAs in a single vehicle*

*The performance of the proposed system is evaluated on the basis of percentage of bandwidth consume and number of packets send to server vs number of LBAs.*

**Keywords:** Vehicular Network; Vehicular Cloud Computing, Location Based Application.

## 1. Introduction

Recently Vehicular networking has become a unusual research area due to : (a) its specific applications such as efficient traffic management, road safety and infotainment[1].(b)Vehicles are considered as computers on wheels due to they are carrying more resources On Board Unite(OBU) such as communication systems ,storage and sensors[2].in Fig.1, OBU has many components consider as a resources on a vehicle,many researches proposed to develop ITS solutions.

Concept of Vehicular Cloud Computing (VCC) is solution shifted from Mobile Cloud Computing (MCC) for best utilities of a vehicular

network resources.The VCC is a new technology that has an unusual impact on traffic management, road safety and other application by on-demand using vehicular resources, such as computing, storage and internet for decision making and support customers by new services and applications [3][4].

Location-based applications (LBS/LBA) have seen fast growth in the last decade due to pervasive adoption of GPS enabled mobile devices, Location-Based-Application (LBA) /Location-Based-Service (LBS) is type of vehicular cloud computing services and applications depends on real-time vehicles location, LBA dose tracking vehicles location and maintaining an accurate up-to-date view of the entire network. Each a vehicle update its real-time location Abscissas "GPS" periodically to server, but this scheme have some challenges, storage, bandwidth overhead and server overhead. This called Location Update Problem (LUP) .

Many researches proposed Location update problem solutions, main goal was minimizing number location update message required between vehicles and servers if you want know more about location update problem and methods to solve it read [5], real-time vehicle's location is a cornerstone in several proposed LBS in vehicular cloud computing such as Pic on wheel as a service, Vehicle Witnesses as a Service [6], Video capture, Tracking systems, and traffic analysis.

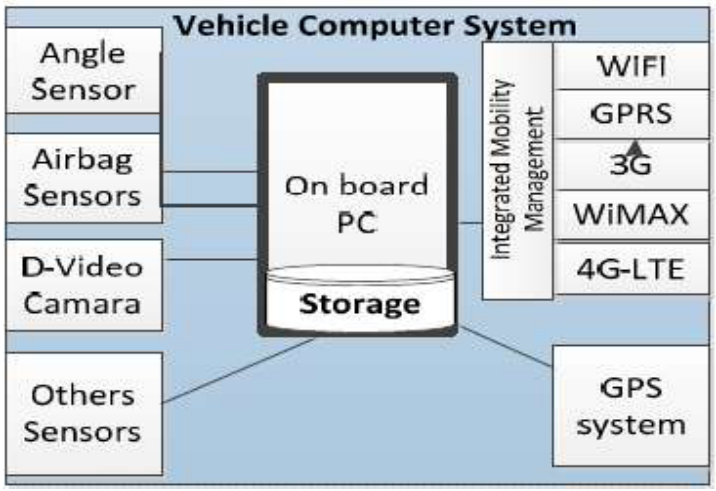


**Fig. 1 On-Board Unit (OBU)**

Note that in VCC environment what if single vehicle has more than one LBA? normally the LUP will be doubled by number of LBAs

installed on a single vehicle. Vehicular cloud computing LBAs needs a scalable and efficient tracking real time vehicles' location not just as an application also as a platform make others build LBS. In this paper, we propose a Tracking Service in vehicular Networks based on Cloud Computing(TSVCC).TSVCC platform is tracking real-time vehicles' location as a service in VCC environment it supports development many Location based applications, TSVCC improves bandwidth consume and number of location update message.via handling impact increase number of LBAs in a single vehicle

The remainder of this paper is organized as follows. In Section 2, related works are surveyed and we have discussed the problem formulation. The proposed solutionis introduced in Section 3. Section 4 presents the results and evaluation of the proposed schemes. Section 5 presents the conclusions and future work. Section 6 is reference.

## 2. Related work

In [3], authors presented state-of- art survey of vehicular cloud computing, they classified of a VCC's applications and services, they designed VCC architecture which we can use it as a VCC reference model, they showed open issues and challenges in VCC.

In [5] it is proposed a query-aware location update framework for Mobile Clients. For decrease number location update message send to location server. All the mobile clients must aware of query. In this scheme assume that mobile clients and the location server have a local copy of the same road network database .the focused was how mobile clients send little number of the location update message to location server to reduce bandwidth consume and server overhead, it take in account each a single vehicle has a single LBA, In fact, the VCC maybe a single vehicle has more LBA.

In [7] a Service-Oriented Security Framework for Vehicular Cloud Computing is proposed to support applications security in VCC environment, the author's idea based on this work from a different issue we deal with real-time vehicle locations

[11] Proposed a new vehicular cloud service. It is on demand utility of the available resource of vehicles to capture image and send it to

customer, after several year in future will see this service consider as a software application, pics-on-wheel service has some challenges how system can know where and when vehicles shots image, so that author proposed solution, each vehicle sending location update message periodically to location server. This scheme causesextra bandwidth consume and cause network congestion [5].

**Problem formulation**

Recently VCC open area to produce new kind of services that help human to get better and easy life on this world location based applications in VCC is faced with location update problem , many researchers provide solution to location update problem which take in account each a single vehicle contain a single LBA but this not enough in real-life. Note that, in current smart phone system is single phone has many LBAs .VCC has been shifted from MCC, So In real life a single vehicle may be contain more than one of LBA on the same vehicle . So the traffic in vehicular networksoverhead can be unmanageable when thousands of vehicles must update their Locations within short time. It is proposed to develop efficient Tracking Service in Vehicular networks based on Cloud Computing Platform as a Service for support every LBAs in vehicular networks and handle impact increase number of LBAs on a single vehicle.It should has the following features:

- Less Overhead Bandwidth
- Less number of location update massages
- Efficient Support LBAs

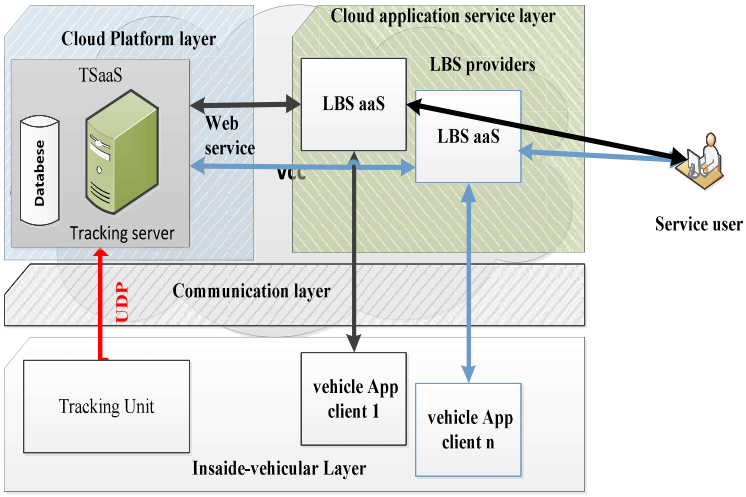


**Fig. 2.TSVCC System Architecture**

## 3. Proposed Tracking Service in Vehicular Cloud Computing (Platform as a Service)

In this section the proposed system is presented in four subsections. The first subsection presentssystem architecture of the proposed system. The second subsection describes real-time vehicle location process. The third subsection describes details of the location update .The last subsection describes Location server sharing (platform tracking system)

### 3.1. Proposed System Architecture

Proposed system architecture, as illustrated in Fig. 2, consists of six of components, namely, the Tracking unit, the tracking servers, the database server, the Vehicle app client, the LBSaaS server and the service user.

**Tracking Unit**: it is the software components that run on the OBU of the vehicle. It computes the current location of the vehicle (GPS Coordination) [8]. Then, it periodically sends the location to the tracking Server and another information such as vehicle status, speed, and temperature

**Tracking Server**: It is component that do two main functions. First, it receives the locationupdated messages fromvehicle's tracking unit and then it save this information in the data base server. Second, it provides a set of web services to be used and consumed by LBSaaS providers.

**Database Server**: This server is used to store the vehicle location and information in order to be easy to store large information and retrieve it easily.

**Vehicle app client**: It the application installed in vehicle. For each LBSaaS application server has application client .this client runs aninstructions that is sent by server application such as images capture, video capture, or any other request then it send response to application server. The single vehicle can have many app clients. In the previous system, the application client also periodically send the vehicle location to its app server location. In Proposed system we remove this function from app-client's responsibilities and assign it to tracking unit. Then, we proposed one location server for all applications server. This share the location server with all application servers that works on the same platform using service oriented architecture.

**LBSaaS**: This is an application server. It is a service that are produced to the user base on real-time vehicle location in VCC environment such pic on wheel, traffic analysis, tracking systems, and witness as a service.

**Service user**: It is the user. It is consumed utility of LBS- aaS provider services on demand model, this user may be inside vehicle or anywhere connected to internet.

### 3.2 Real-time Vehicle Location.

The location calculation in the modern vehicle is one of the basic function due to the availably of many location support techniques such as GPS. In Proposed research we used GPS because the availability of a satellite based global position system (GPS) enhances the accuracy of position of vehicle inhigh dynamic environment (PMB-648 GPS receiver accuracy is 2 meters) [8].The vehicle identification number (VIN) is used as a unique Id for the vehicle. The VIN is used for

distinguished each a vehicle from other in the database system. The tracking unit should be installed in the Vehicle. It can be implemented as a part of the vehicle operating system. It has the IP address and port number of the location server.The tracking unit computes the current location using GPS. Then, it add the VIN to location and it send the message to location server using UDP protocol. The UDP protocol is used because it is connectionless and need less time to send message to server.

The tracking unit can support more than one location server through multicast address

**Algorithm Real-time Vehicle Location**

*Begin*

*While(tracking unit switch On)*

*initialization// check software update , get parametrats*

*Var VIN=Get Vehicle serial number*

*While(true)*

*Var POS=Get Current location // by GPS*

*Send current location to servers(VIN,POS) // by udp protocol*

*End while*

*End while*

*End*

### 3.3 Location update

Location server receives location updatemessage from tracking unit of vehicle. The message contains VIN and location. Every vehicle should send location update message periodically to location server.The location server should check the message validity using DTD.In figure **3** we present an example of a DTD for the location update message validation[9], it add this message elements to the database server. The follow algorithm describe the location update steps.

**Algorithm location update**

*Begin*

*While (true)*

*VarInComeL =Receive Location update message*

*IF InComeL is valide=true then*

*Add new record in database server*

*End if*

*End while*

*End*

```
<!—Location Update Message  DTD file-- >
<!ELEMENTLocation_Message (timestamp,
Vehicle_Info+,Location_Info+, Velocity)>
<!ELEMENTUTC_DateTime (#PCDATA)>
<!ELEMENTVehicle_Info (VIN)>
<!ELEMENTVIN (#PCDATA)>
<!ELEMENTLocation_Info (Lati,Long)>
<!ELEMENTLatitude  (#PCDATA)>
<!ATTLISTLatitude  Indicator (S | N ) >
<!ELEMENTLongitude (#PCDATA)>
<!ATTLISTLongitude Indicator (E | W ) >
<!ELEMENTVelocity (#PCDATA)>
```

**Fig. 3 DTD schema to validate Location Update**

### 3.4 Location server sharing (platform tracking system)

The system use web server to handle web services requests from LBSaaSproviders.There are many web services can be provided to be used by application developers to develop applications that depend on real time vehicle location.Another part of the system is an application works as UDP server handles message update from tracking unit of vehicle.The web services provided by tracking server convert between location information and VIN and vice versa.  The following algorithm show web service request handling.

**Algorithm  Tracking web service**

*Begin*

*Var request =Receive lbs provider request*

*Convert lbs provider request to suitable SQL query*

*Run SQL query on database*

*Convert result to lbs provider  response*

*Send Response to lbs provider*

*End*

## 4. Results and Evaluation

In this section, the proposed system is evaluated through studying the relationship between the number of app client and bandwidth or in terms of communication overhead (bandwidth consume) [10] and number of location update message should be send to the location server of Proposed optimized VCC which contain TSVCC platform as a service. The followed figers show results of quantativly evaluation to impact increase number LBAs vs single vehicle bandwidth consume and Location update message

The Size_LUMis minimum necessary size of location update message for carry Vehicle's information such aslocation(GPS data), VIN and speed.one UDP packet can carry one location update message.[11]

The NLBA is number of LBA's installed on single vehicle

Then, one position update operation for one vehicle costsUDP Packet's =NLBA* Size_LUM.So, one position update operation for one vehicle costs bandwidth =NLBA * Size_LUM /available bandwidth of vehicle.

Figure 4 show impact increase number LBAs in single vehicle on bandwidth consume ,note that in previous system when number LBA increase ,the bandwidth consume increase but in Proposed system stop impact increase number of LBA on a single vehicle.

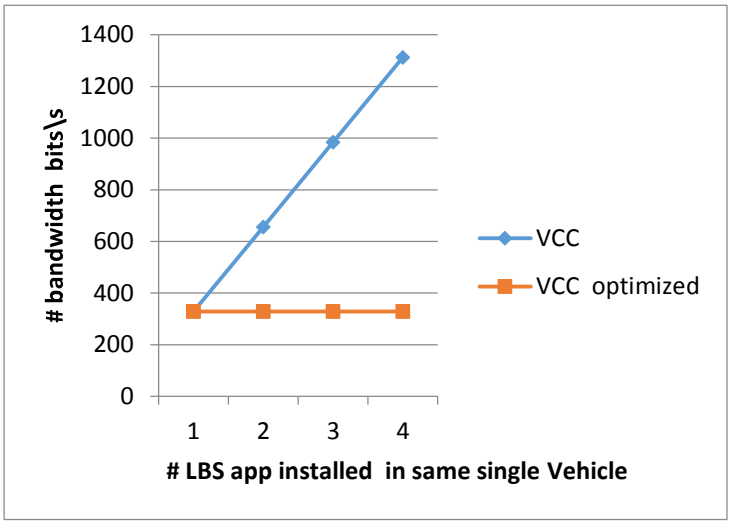


**Fig. 4 app client vs bandwidth consume**

Figure 5 show the impact increase number LBAs in single vehicle on number of necessary location update massage ,note that in previous system when number LBA increase ,the of necessary location update massage increase but in Proposed system stop impact increase number LBA on single vehicle.

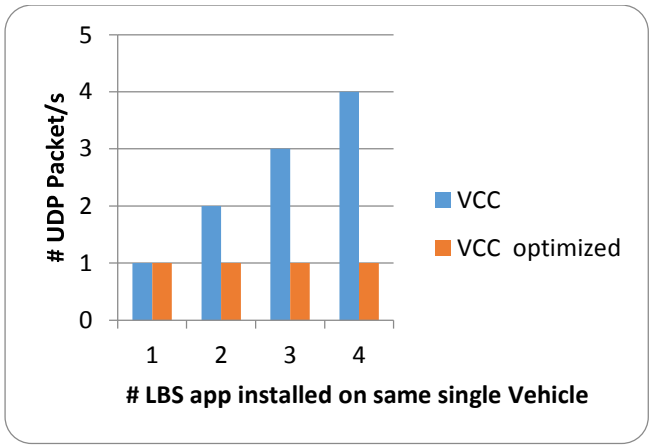


**Fig.5 app client vs location update message**

## 5. Conclusions and Future Work

In this paper, a novel enhancement to VCC architecture is proposed. The proposed scheme supports development real-time vehicle location applications in the intelligent transport system. The contributions of this paper are that it to solve the problem ofhuge bandwidth consume required by previous model. It addefficiently SOA architecture to previous VCC at platform layer .It open future work in many issues such as add Identification service to platform ,Optimize security and privacy Open area to researchers to add new function for VCC platform and can create new applications in future

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