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An enhanced Vehicular Cloud Computing framework for Multimedia data

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Abstract-
Multimedia cloud computing has seemed as a completely attractive surroundings for business international in phrases of presenting cost-powerful services with a minimum of access expenses and infrastructure necessities. The ideal Transportation structures incorporates of different styles of automobiles that are prepared with a number of sensors which provide specific capabilities like climate forecast, temperature, GPS and so forth. All those features make the power higher and easy. As a result, those automobiles produce a large amount of multimedia related information, which is essential and put off-sensitive and requires on-time processing. The standalone gadgets embedded in the cars cannot do the specified fast-processing due to their restrained computation centers. Cost minimization, high-quality of revel in, and useful resource allocation are a few more issues related to multimedia related content processing, that have arrived in latest times. The conventional cloud computing is not suitable for this essential and delay-sensitive multimedia associated facts. So a new computing paradigm called Multimedia Cloud Computing has emerged. This paper cope with one of a kind problem of multimedia cloud computing and propose green resource allocation and computing scheme to solve these issues.
Keywords: Vehicular Clouds, Multimedia, Traffic Management, Smart Driving, delay-sensitive, cluster.

1.1 **Introduction:**

Nowadays automobile industry is specializing in self-reliant or driverless motors a lot. In this, speedy net is a primary need. The vehicles can document motion pictures, capture excessive resolution picture, and technique suitable quantity of sensory data to ensure an easy and secure drive. Moreover, they can speak and proportion records like street map images, avenue safety facts and visitors load information. For that reason, these vehicles produce a large amount of crucial and put off-touchy statistics which requires on-time processing. Cloud Computing is a new computing paradigm which helps in rapid processing of records at low cost. It is miles an emerging computing paradigm that offers rapid and high-pace computation facilities without putting in any hardware. Thus, Cloud Computing is a good solution for processing huge quantity of records at low value as no additional hardware is required. Multimedia processing of vehicular data is essential and challenging as it requires fast processing and on-time reaction at reduced value. Conventional Cloud Computing is not appropriate for crucial and put off-sensitive multimedia related applications and offerings. Hence a new computing paradigm referred to as Multimedia Cloud Computing is brought. Big data refers to good sized, complex records sets which are tough to store, examine, and visualize for future moves or outcomes. These facts when stored and analyzed in the cloud can generate vital insights. Transit carrier excellent can be accessed via better understanding tour conduct the use of huge facts [1]. Vehicular Cloud Computing is a time period that refers to using cloud computing structures to provide computing capabilities in the vehicles themselves by means of collecting big statistics through offline and on line software services [2] ability to make a massive effect at the car enterprise through allowing vehicles to have greater autonomy and expanded computational energy. It could also lead to new kinds of automated driving systems which are more efficient and safer than current models. Through tapping into the cloud, motors can get right of entry to an extensive variety of services, inclusive of apps, net browsing, navigation, leisure, and lots more. Vehicular cloud computing could lead to several potential advantages. First and primary, it can enhance safety by way of lowering driving force workloads and enhancing common automobile overall performance. And another, it could reduce charges by using lowering the want for extra onboard hardware or software infrastructure. And subsequently, it is able to improve consumer revel in by permitting self-sufficient vehicles to offer extra intuitive functions and overall performance degrees than present day models. Vehicular cloud computing can help reduce the value and complexity of each sharing infrastructure and offering self-sustaining using offerings. It can assist ease congestion and enhance visitors float.

1.2 Related Work

Khasawneh et. al.[3], described an Internet of Connected Vehicles network model-based service-oriented network optimization model. The majority of traffic-related data-oriented computations were performed at cloud servers to make intelligent decisions. Heterogeneous vehicular environments may utilize handoff-centric network communication with the connection component. The network model may be utilized to deliver service-oriented smart traffic services. The model was tested to affirm several service advantages in vehicular communication environments to test several service-oriented metrics. A mathematical model was also introduced to support the heterogeneous vehicular network implementation by implementing content centric services and prioritizing network services.

Behbehani et. al, [4], describes the vehicular cloud, a processing layer operating near end users on underutilized vehicle computing resources. Fixed edge computing nodes and a vehicular cloud are used to construct a vehicular cloud architecture. Mixed integer linear programming (MLP) has been used in this paper to optimize the allocation of computing requirements in a distributed architecture to minimize power consumption. The conventional cloud requires up to 84% more power than the distributed processing architecture. It minimizes power consumption by allocating computing resources in real-time with a heuristically optimized approach that approaches that of the MILP.

Benadda et. al, [5], suggests "HAaaS," a new cloud computing service for vehicles based on BANs (body area networks), to identify, track, and manage driver fatigue as well as to offer collaboration support for driver rescue. The two main factors that contribute to deadly traffic accidents are regarded to be fatigue and malaise while driving. A driver's ongoing health can be monitored using BANs without interfering with their regular daily activities.

Jabbarpour et al. (2019) [6],presented a survey on the cloud-based network, taxonomy and conceptual hybrid architecture. Its taxonomy is focused on three major categories: cloud vehicle computing, cloud vehicles and hybrid cloud (HC). The emphasis of this paper is on applications, architectures and services in the classes of cloud based vehicle networks (CVNs). The architectures and characteristics of a comparative summary between these three groups are seen. By decomposing a high-performance system into smaller subsystems, in line with their functions. As cloud computing consists of the 3 different services (PaaS), service infrastructure (IaaS) because its common service bundle (SaaS) should be used to create cloud transport services. platforms with the compound SaaS, PaaS, and IaaS. In addition, clouds can be divided into composite, private and public clouds.

Ahmed et. al., [7], presented study on Road safety. Modern vehicles are equipped with sensors that gather data to monitor the road, ensure the safety of drivers and passengers, alert about road conditions such as risk, flood areas, congestion, temperatures, and speeds, alert about the condition of other vehicles, and evaluate the situation. A vehicle with embedded sensors, cameras, GPS units, and other technology. The victim's speed, location, and direction are sent to the vehicle, surrounding vehicles, and the vehicular cloud in case sthere is any suspicious activity on the road.

Ahmed et al.,[8], proposed and examined VCC and its services, examining the frameworks for the provision of different services through VCC. There are presented current simulators and tools needed to assess the performance of the system proposed in VANET and VCC. The processing of information is an essential feature for ITS, where online travel systems can effectively be served by means of a VC. In this work, the latest VCC paradigm is included in proposing an ITS pull-based data collection model. They demonstrated through simulation results, that low vehicle participation in a dynamic VC is sufficient to provide ITS with representative and meaningful data collection. Moreover, we illustrate the problems faced by models and facilities of IoV data collection.

Feng et al.,[9], suggest a privacy evaluation approach with unclear consideration (PAU). This algorithm focuses on determining the safety of vehicles by examining the history of the consumer in cloud V2X scenarios. PAU extends the logic of subjective insecurity to measure records in the actions of the consumer. This calculates the vehicle's real-time privacy capability on the basis of real-time contact observations on this vehicle. In order to increase the accuracy of privacy evaluations, the privacy aggregation algorithm combines the real-time of the vehicle and its offline contact. The Sybil attacks are effectively restricted using historical data collected in the cloud. Congestion detection and avoidance software can assist road conditions-based drivers with effective route planning.

H.N. Dai et. al [10], stated that the rising significance of wireless vehicular networks indeed related to the growth and acceptance of mobile wireless communications, in which through progresses in wireless channel modeling methods and the succeeding progress of complex digital transmission approaches, providing high data rate communications is possible while following the severe QoS requirements.

Zhu et. al, [11], presented the study of intelligent transportation systems (ITS) using big data analysis. However, the use of big data in VCC is missing. The authors introduced the survey by describing the history and characteristics of big data analysis as well as ITS. The architecture of big data analysis in ITS is also discussed. The authors looked at large data applications in the ITS context, such as managing rail transit, predicting traffic flow, and preventing accidents.

Goumidi et. al, [12],They done a thorough investigation into VCCs by linking a conventional VANET, a VCC seeks to advance VANETs toward autonomous driving. The researchers first described the concepts of cloud computing, VANETs, VCCs, and mobile cloud computing to introduce VCCs. Their approach includes the following services: NaaS, SaaS, CaaS, StaaS, and Coaas. New VCC applications like traffic management, disaster management, and autonomous vehicle control are described. Despite its importance in terms of security and privacy issues, big data is not considered in this approach.

Neilson et. al,[13],The authors of the paper explore several technology platforms and software architectures for transportation, along with a broad range of storage, processing, and analytical techniques, and discusses issues with Big Data analysis. This paper provides a range of suggestions for how cities may utilize Big Data in transportation to build safe and sustainable traffic systems.

Ahmed et. al, [14],presented a frameworks for using vehicle onboard resources to deliver cloud services and outlines the design problems and research issues were discussed, then the author examines mobility generators, vehicular ad hoc network simulators, and vehicular data sets as part of a detailed study of vehicular cloud computing. In this way, the paper offers a thorough overview of vehicular cloud computing and suggests potential directions for future research.

S. Singh, S. Negi, and S. K. Verma [15] proposed a scheme. This scheme replaces the road side unit with a dynamic cloud for managing overhead on the network and to maintain QoS to the users. The dynamic cloud collects and provides all required information to the vehicles in its range and forwards the information to a centralized controller, so a call is routed to the nearest police station and medical emergency response team to overcome the problem. However, the integration of VANETs with cloud computing has become a new research challenge due to scalability and reliability issues, because of the huge amounts of navigational data and safety messages along with event-location information.

Li, B et. al.,[16], proposed an architecture that took into account the servers' resource limitations and the latency tolerance of computation tasks. The primary purpose of the architecture was to efficiently utilize the idle resources in the vehicle to support all the applications and services of VCC. An architecture for vehicular cloud computing is proposed to provide seamless and efficient vehicular cloud computing services. A remote central cloud server, several edge computing servers, several SDN controllers, several RSUs, a vehicular cloud, and several vehicles are included. When vehicles travel on a highway in opposite directions, some applications in a vehicle that has a lot of computing work can be moved to vehicles with little computing work using V2V communication mode. The vehicular cloud is composed of vehicular networks and cloud computing.

Cheng et. al., [17],The author first discusses the technology used by VANETs to effectively and reliably transfer large amounts of data. The techniques using big data to analyze the features of VANETs and enhance their performance are then explored. Additionally, the author presents a case study in which machine learning techniques are used to analyze measurement data from VANETs to effectively detect unfavorable communication situations. Additionally, a case study demonstrating the utilization of urban VANET measurement data to identify NLoS (Non-Line-Of-Sight) conditions using machine learning techniques is presented.

Lai et al. [18], investigated the effects of cache under modifying channel state information where multiple nodes participate in a decode-and-forward relay mechanism. The authors also presented the selection of secondary nodes to maximize the channel gain. To evaluate the proposed system, authors derived analytical expressions while considering a system with or without cache. Further, the authors conclude that cache-based systems reduce the transmission time.

Guo et. al. [19] proposed a time-scaled caching scheme for Adaptive Bit Rate (ABR) video streaming in vehicular networks, in which caching is performed at base station (BS). This scheme manages the video quality, cache placement, and video transmission. The caching in vehicular networks is different from the traditional caching in wireless networks due to high-speed mobility.

L. N kenyereye [20] proposed scheme applies privacy to the identification of a vehicle and its data flow through a pseudonym mechanism. This scheme also ensures authorization through secret credentials and authentication through identification-based signatures. Hence, the verification of a user's information and identification of intruding vehicles are done through batch verification and a pseudonym block list, respectively. Moreover, the requirement for accessing information related to transportation has become a basic need for smart vehicles in VANETs.

Sun, Y., Guo et. al., In [21], created a learning-based task offloading framework using the multi-armed bandit (MAB) theory. In this instance, the cars offloading their responsibilities are referred to as task vehicles (TaVs), while the vehicles delivering services are referred to as service vehicles (SeVs). This framework allows vehicles to learn the potential task offloading performance of their nearby SeVs, which have an excessive amount of computing power. This framework works to minimize the average offloading delay.

Sookhak, M et. al., [22], discussed the concept of Fog Computing. Fog Vehicular Computing (FVC) is a novel approach to computerization. FVC uses the fog model, in which data processing and analytics take place close to the endpoint devices where vast amounts of data are generated, to increase the computation and storage capabilities of fog computing. However, the performance of FC can be degraded by the number of demands by patrons. An FVC architecture is proposed to counter this. There are some open issues and future directions for future research in the FVC context are also discussed

Wu et al. [23] proposed a framework. The framework uses low cost and bandwidth efficient unicast communications for handover of data between vehicles. The vehicles share their location with other vehicles through beacon messages. Before leaving a specified region, a vehicle first offloads to a new vehicle using a fuzzy logic algorithm based on through-put, stability, and bandwidth. To reduce contention at the Media Access Control (MAC) layer, a clustering mechanism is used to limit the number of senders in dense network scenarios. For the formation of the cluster, the algorithm considers channel conditions, number of neighbors heading in the same direction, and velocity of the vehicle.

Liu et al. [24] proposed a relay-selective multi-hop scheme, in which a vehicular network is integrated with cloud computing to provide media services, e.g., weather forecasting, traffic congestion reports, and road safety alarms. In this scheme, Road Side Units (RSUs) communicate through the cloud via a road-side fixed communications sources. The proposed scheme is efficient at making transportation decisions in severe weather and under controlled traffic problems.

1.3. Types of vehicular cloud

Vehicular cloud computing can be classified into two types-

Static VCC: Various groups are looking to take benefit of parking's idle computing assets by using turning motors into records storage facilities. Parking has historically been a time ingesting pastime. People have parked their motors in purchasing department shops, airports, workplaces, and hospitals. Static vehicular cloud combines computer clusters with storage sources and computational power to create information garage facilities.

Dynamic VCC: Cars on the cloud can form dynamic digital groups because of their high mobility and the rapid changes amongst networks. The cloud head, one of the motors, invitations all close by automobiles to be a part of for the formation of dynamic vehicular clouds. Trade and technique of records occur at the same time as the automobile is transferring.

1.4. Vehicular Cloud infrastructure

In VCC, vehicular resource, such as computing the storage, and the net are shared for preference-making in visitors manipulate and road safety. The belongings and services are subscribed to on name for. Cloud computing makes use of the underutilized assets of cars for a short time. These face the traditional VANET mobility and scalability problem with additional cloud computing-associated beneficial resource heterogeneity and manipulate issues. The interactions of automobiles, cars with the infra-shape and vehicular cloud with enterprise clouds are shown in Figure 1. The data series and processing at devices begin with the facts series at the device degree, along with sensors within the vehicle. Then records are sent to the neighborhood repository of the automobile for low-stage facts processing. The software programming interface circulates these data to related hardware to generate alarms or warnings consequently. Verbal exchange inside the vehicular cloud starts evolved in the car's communication tool itself that is called in-vehicle communication. The second one degree is V2V voice exchange for resource and information sharing. Vehicle-to-cloud infrastructure communication is a larger area of voice exchange for services which might be provided via cloud computing over underlying ICTs.

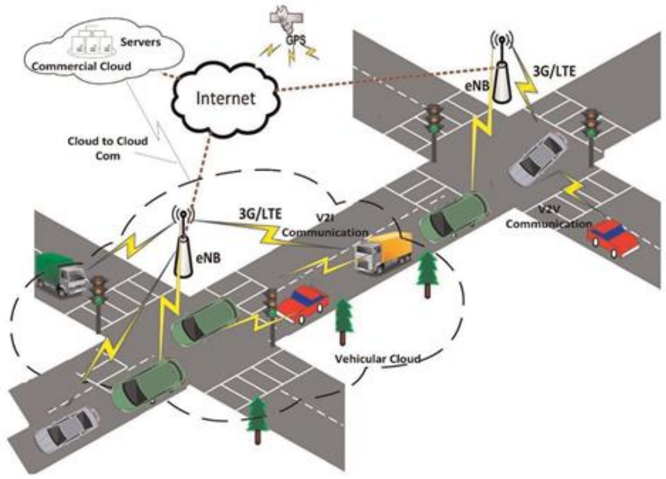

Figure1.Vehicular cloud computing

1.5. Proposed Vehicular Cloud Framework

The proposed framework is aimed is to provide the mechanisms for the storage of the information. This framework enables the heterogeneous communication between multiple devices. The proposed framework fulfill following requirements, it can manage data storage, it can allocate and share resources and can provide interoperability between different devices.

The framework undertakes this by checking the best forms of communication and interaction between vehicle networks and handling all the resources requested by the demand for services. The Proposed Cloud Framework provide following Services:

Cooperation as a provider: The framework undertakes this by way of checking the kinds of information exchange and interplay between vehicle networks as nicely offerings including road protection, site visitors manipulate, lively traffic indicators, warnings of accidents, information approximately weather or visitors situations, parking availability. This calls for organizing connectivity no longer only among vehicle however also between cars and roadside gadgets and as a result has a hybrid communiqué system for the invention and dissemination services presented via the cloud. The system can take care of conversation with denser networks with an excessive variety of vehicles.

Data as a carrier: The cloud offer offerings to pick out up records approximately no longer best site visitors conditions, however also feasible incidents that can be taking region on the road, like injuries. This service can be achieved by way of disseminating the records approximately any occasion and also sending messages that make connections with cars.

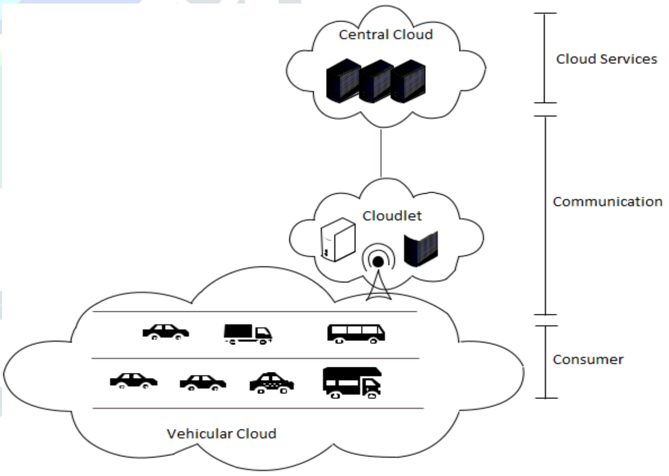

Figure2: Vehicle Cloud Framework

Figure 2 illustrates the abstraction of the cloud framework

1.Cloud service. The cloud service refers to the information middle where offerings to clients are supplied. The cloud serve consists of a traditional data center e.g., Amazon, Google or Microsoft). That is subdivided into 3 sub layers. The vital cloud includes data center that is virtualized and includes the computing infrastructure in the traditional cloud. The principal cloud is interconnected through networks and provides many features and computing services for consumers which are immediately connected to the statistics middle. This imperative cloud gives numerous sorts of software and packages that are run remotely over the net through a web browser interface or particular packages. The cloudlets are a set of devices connected to the roadside unit (RSU) to offer resource within the control of resources that are shared by way of the crucial cloud. Cloudlets can assist inside the control of resources within the vital cloud. The vehicular cellular cloud consists of a fixed of mobile computing assets and vehicles, which aren't used by traditional cloud computing. These assets are interconnected through the vehicular network

2.Communication: The cause of this sediment is to ensure that the relationship may be installed between clients positioned in the lower layer and the cloud placed inside the top layer. This residue includes numerous communication devices and networks: vehicular networks, wi-fi sensor networks and 3G/4G networks. At this layer, all the technological connections such as the physical layer, data link layer, medium access control, routing protocols, etc. This deposit must cope with a hybrid form of information exchange. It will also need to manage communication among the vehicle and roadside devices for expected statistics from the cloud.

Consumer: The consumer layer consists of give up customers which can be either human or a car that requires a cloud service. By the usage of conversation and computing gadgets such as smartphones, onboard computer systems, and GPS, consumers can set up their service requests to adjoining layers through a manager and seek useful resource mechanism.

(1) m←getNumberOfPacket()
(2) n← getNumberOfBecaons()
(3) ef←m/n
(4) if (ef>thresholdDown or (ef>thresholdUp) then
(5) return true
(6) else
(7) return false
(8) end if

Algorithm1 shows the calculation of the propagation efficiency used to decide whether to propagate a message or not. The propagation efficiency is used to control the transmissions of a given vehicle; that is, if it is below an acceptable threshold, the node broad casts the information; otherwise it does not. Periodically, the vehicle calculates the efficiency of its message delivery

Efficiency =Transmission/ Beacons

1.6 Result Analysis and Discussion

The Simulation experiment is conducted on OMNeT++ 4.6. It is a network and an event-based network simulator. Simulation uses data from OpenStreetMap.

Table 2: Simulation parameters.

Parameters	Values
Transmission power	2.4 mW
Transmission range	300 m
Bit rate	20 Mbps
Highway length	2.0 KM
Beacons time	0.5 s
Ping time	5 s
Number of runs	20
Confidence interval	95%

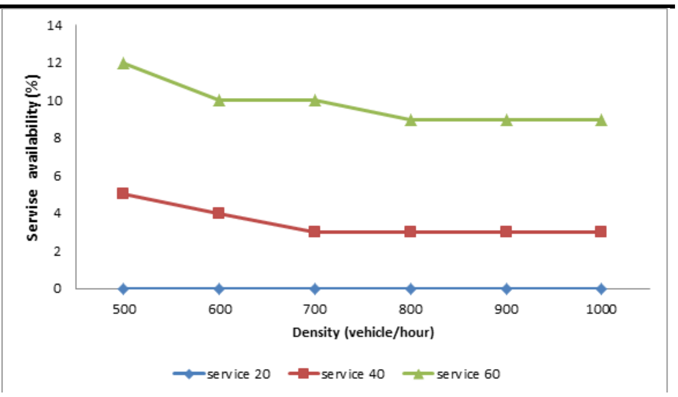

Figure 3: Service availability

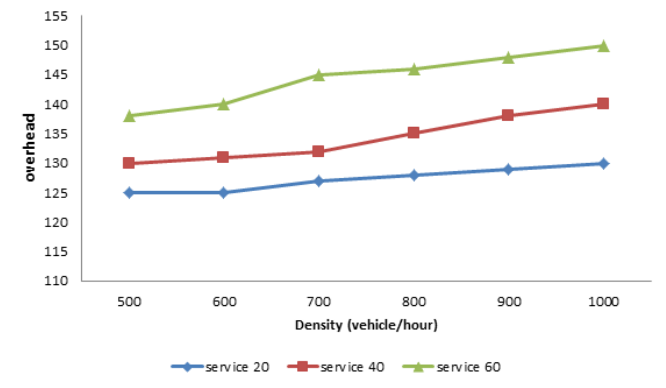

Figure 4: Overhead

Figure 3 shows the percentage of services delivered. It conveys, the protocol was able to allocate 100% of the demand for requested services. Figure 4 shows the number of generated control messages. It can be observed that an accumulation of messages occurs when the number of vehicles increases, this is due the more the vehicles on the highway, the more the pings and the vehicles will thus also receive more stink messages from the vehicles going forward. Hence, the greater the availability of resources, the larger the number of control messages.

Conclusion

In recent times automobiles are equipped with sensors, cameras and plenty of other devices to improve the clean use of automobile. A majority of these gadgets produce a large quantity multimedia associated data. The onboard standalone devices cannot perform fast processing on their personal. The vehicular communication community has acquired quite a few studies attention over the last few years. This paper makes use of Multimedia Cloud Computing in cars. It ensures rapid processing of vehicular multimedia records without installation of any hardware element. This scheme addresses the demanding situations of fast response, quality of experience and minimizing computing value. The proposed mechanisms make certain wearing out the storage of information and allowing heterogeneous verbal exchange among multiple devices while at the same time handling the mobility of automobiles and information lows. The simulation model confirmed a solid conduct in spite of the boom in automobiles or expanded use of sources. The simulation did not display a sudden variant and retained its balance. The Simulation end result shows that the proposed scheme outperforms in surprising manner and the solution proposed showed a high rate of service availability reaching approximately 85% availability within the worst case scenario. The framework is beneficial due to the fact they can help in the minimal of traffic, accidents, and incorrect converting of lanes. In future addition of additional layers and fog commuting may be used to enhance the high-quality of experience.

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