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Efficient Resource Allocation and Computation Framework for Vehicular Multimedia Cloud Computing

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Abstract

Wireless sensor networks playing a vital role in collaboration with it contemporary technologies such as cloud computing, IoT etc. This builds a smart technology everywhere. Sensor technologies became heart to the transportation system that leads to the intelligent transportation system. Smart vehicles are integrated with a variety of sensing structures related to multimedia applications and their services related to weather, smart driving support, traffic details, road safety alerts and other electronic entertainment devices. Where as smart vehicles generates huge amount of multimedia concerned data that can be handled by high configured systems. In this way, dealing with such mixed media applications furthermore, administrations requested changes in the underlaying systems administration and figuring models. As of late, the reconciliation of vehicles with distributed computing is arisen as a difficult figuring worldview. Notwithstanding, there are sure difficulties connected with interactive media contents handling that seriously influence the exhibition of vehicular correspondence. Consequently, in this paper, we propose a productive asset designation and calculation structure for vehicular mixed media distributed computing to defeat the previously mentioned difficulties. The exhibition of the proposed conspire is assessed as far as nature of involvement, administration reaction time, and asset cost by utilizing the Cloudsim test system.

Keywords- Multimedia cloud computing, intelligent transportation system, vehicular networks, quality of experience, multimedia contents processing, response time, smart vehicle.

1. INTRODUCTION

These days auto industry in a joint effort with the scholarly world is zeroing in on independent or driver-less vehicles from one side of the planet to the other, in which the quick Internet is a essential need. These smart vehicles can take high goal pictures, record recordings, and need to

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handle numerous tangible information for their fruitful and smooth drive, and to partake in a scope of interactive media applications and administrations from ease to diversion [3] as displayed in Figure 1. Moreover, such shrewd vehicles can impart and share different sorts of data, for example, guide pictures, street wellbeing, and traffic load data for safe driving with one another through a side of the road foundation. Besides, such vehicles can likewise trade numerous other data (e.g., programmed stopping, map area, Internet access, agreeable journey control and driving, security distance and crash alerts, driver help, and dispersal of street data [1] [2]. Accordingly, generally speaking vehicles are delivering a colossal measure of basic and postpone delicate information which demanded on-time handling to guarantee on time conveyance to keep up with the nature of involvement.

Be that as it may, because of restricted stockpiling and computational capacities such a gigantic measure of interactive media related information can't be handled on the independent locally available gadgets. Moreover, discontinuous network, short radio correspondence, need of transfer speed, and high portability can make the assignment more testing.

Cloud computing (CC) is an arising registering worldview that offers quick and high velocity calculation offices as a administration to its clients without introducing any equipment [5]. Accordingly, CC is an effective answer for handling of enormous amount of information for minimal price [6]. The coordination of CC with brilliant vehicles is a compelling method for improving the availability to mixed media administrations which additionally can rouse different potential applications and examination subjects [9]. The, ordinary CC is not reasonable for such postponement touchy and basic multimedia related applications and administrations [7]. Hence, to deal with such delay-delicate and basic sight and sound applications and administrations one more sort of processing worldview is presented known as interactive media distributed computing (MCC) [8]. The MCC centres around how to give required nature of administration (QoS) to interactive media applications. Notwithstanding, media handling of vehicular information is more basic and testing as it required quick handling, and on-time reaction at diminished cost. For instance the MCC needs to process and scatter the data with respect to terrible atmospheric conditions (i.e., haze) or on the other hand some mishap occurred on the parkway and if such data

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isn't interaction and scattering to other coming vehicles on-time then there will be more mishaps and misfortune of additional lives.

We proposed a method in this paper was Dynamic priority based Efficient Resource Allocation and Computing scheme for multimedia data computations for vehicular networks at best feasible cost based on priority. The proposed scheme comprises of sub tasks and allocated resources which further contains Multimedia Cloud Computing resources such as load manager, computing cluster unit and transmission unit.

In this method vehicular multimedia processing request are received at request queue that forward them to load manager (LM) for further processing. The LM analyzes the nature of incoming requests and assigns them to the particular computing cluster (CC). The CC process the received requests and send them to the next CC or to transmission unit (TU) based on the type of requests. Finally, the TU broadcast/unicast the processed request a single or group of vehicles. The proposed scheme handles the priority or urgency of any processing request with the help of job queues.

Our main contributions of this paper are listed as below:

- We propose an efficient resource allocation scheme based on dynamic priority of multimedia request received by the job queues.
- This method comprises of load manager, computing cluster unit and transmission unit.
- We divide every multimedia job into four sub tasks and allocate them the cloud resources dynamically.
- We compared our method with single data canter resource allocation and static resource allocation with respect to the performance comparisons.
- The Cloudsim simulator is used for quality of service, service response time and resource cost.

2. RELATED WORK

This section briefs about the vehicular data processing and resource allocations methodologies especially for delay-sensitive, critical, and QoS demanding multimedia contents.

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To limit the normal offloading delay, a learning-based offloading plan for VCC is proposed in [5]. In the proposed conspire, "a versatile upper certainty bound calculation" is created in light of the multi equipped crook hypothesis which makes it versatile for time differing activity also, load space. In [6], Ashok et al. presented a heuristic conspire for offloading vehicular undertakings and their planning over the cloud. The creators thought about the proposed conspire with the on-board calculation plan and measures the execution as far as reaction time. In [7], Limbasiya et al. acquainted a plan with confirm the rightness of the gotten data from the VCC to forestall the security assaults, like adjustment, man-in-the-center, plain text, and pantomime. The accuracy of the proposed conspire is confirmed against different plans. Also, ID based signature procedure for data confirmation in the VCC is created in [8]. In the proposed plot, the signature confirmation is completed with the assistance of the pseudonymous repudiation and group confirmation procedures.

Message passing among the vehicles in the basic and crisis circumstances is certainly standing out enough to be noticed under weighty traffic situations. Accordingly, in such basic situations, it is profoundly essential to confirm the wellspring of data. Subsequently, to accomplish this objective a system called SmartVeh is presented in [9]. In the proposed conspire, an encryption method in view of traits is created to share the message safely among the vehicles. Besides, in the proposed conspire all weighty calculations, like singing testament, encryption what's more, unscrambling are re-appropriated on the cloud or RSUs. Intelligent transportation framework faces serious frequency handoff challenges when the vehicles speed getting over the 300 km/h speed limit. In this manner, in such rapid situations, vehicles can't perform trade of data or then again information calculations among one another. Subsequently, there is a need of planning a proficient cloud-based answer for handle such basic situations. In this way, to handle such a high speed handoff issues, an original structure called SVCC-HSR is presented in [3].

3. PROPOSED METHOD

The proposed plot is involving on a three-layer distributed computing engineering, in which some different methods are additionally acquainted with tackle the other significant difficulties, like quick encryption-decoding, confirmation, multi-way transmissions, identifier planning, what's more, bundle pressure. Vehicular specially appointed organizations can incredibly work on their capacity, calculation and detecting skills by embracing the distributed computing arrangements.

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Hence, a VCC based model is recommended in [3] to work on the vehicular computational and correspondence administrations.

The proposed model additionally tended to different administrations issues like asset the executives, security, protection, and information collection. Vigneri et al. recommended that the vehicles could be utilized as versatile reserves to fulfill the rising need of Internet contents furthermore, decreasing the over-burden on the cell framework in [2].

In the proposed conspire, clients can associate with the close by vehicle for the connected items briefly and afterward the association is moved towards the cell framework after the expiry of the predefined course of events.

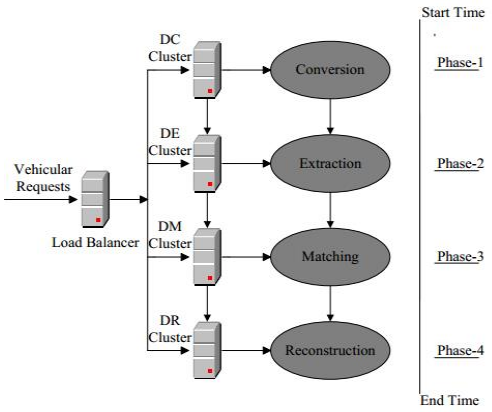

Fig.1. Task Level Parallel Processing Procedure

In [33], the creators center the underutilization of locally available computational assets and their productive portion according to the idea of the applications. Consequently, they proposed a plan for the VCC to proficiently using the installed computational assets.

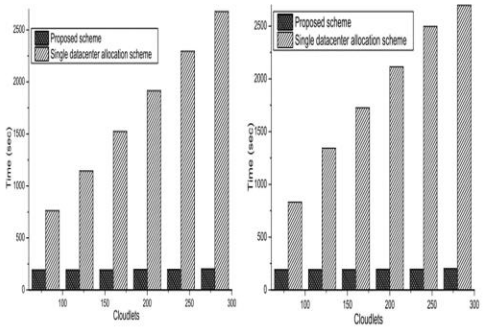

Fig.2. Proposed vs single data centre scheme for settings

In the proposed conspire, the vehicular-assignments are partitioned mostly into three

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classifications for computational purposes and to lessen the reaction time for additional basic undertakings they are being figured by means of an installed accessible assets, the less basic and more computational-weighty assignments are offloaded to the VCC and all the more weighty and least significant assignments are being offloaded on the cloud. In [4], the creators proposed that the disconnected or left vehicles can be utilized as a mean of capacity for the moving or dynamic vehicles information. In any case, to diminish the reaction time for getting to the applicable information or data a proficient and quick scheduler is required. Subsequently, they proposed a scheduler called TSP-HVC for the VCC.

Algorithm: Priority-based Task Scheduling and Processing Procedure

Input : Global channel set N
Output: Sorted Set of available channel K
1 Initialize request queue with RQ ← null
2 Assign collection time Ct with initial value αt;
Ct ← αt
3 Collect requests from vehicles till the expiry of αt
4 LM analyzes the RQ to estimate the total workload N
5 for ni ← 1 to N do
6 /* Sort ni based on priority value */
7 LM assigns computing resource χαt to each computing cluster CC based on the value of total workload N
8 DCC ← χαt
9 DEC ← χαt
10 DMC ← χαt
11 DRC ← χαt
12 for I ← 1 to N do
13 /* LM sends multimedia task I into the priority queue PQ of its appropriate CC */
14 for J ← 1 to N do
15 /* CC processes the multimedia task J */
16 if J wants further processing step then
17 Add J into the P Q of next CC
18 else
19 Add J into the P T Q of T U
20 for K ← 1 to P T
Q do
21 /* T U transmits processed multimedia task K to its intended vehicle(s) */

In this part, we talk about the proposed DP-ERACOM conspire for vehicular mixed media

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distributed computing (VMCC).The DP-ERACOM has three principal parts: 1) VMCC engineering, 2) asset designation for VMCC and 3) VMCC lining model.

4. VMCC ARCHITECTURE

In this subsection, we examine the proposed VMCC engineering for handling vehicular media related assignments, such as picture or video examination. We have partitioned the entire media handling structure into four stages: 1) change, 2) extraction, 3) coordinating, and 4) recreation as displayed in Figure 3. This order is like the introduced in [8]. Be that as it may, in the DP-ERACOM these four calculation stages are performed independently by four devoted figuring groups instead of a solitary registering bunch. Accordingly, all together to limit the processing cost, registering assets to each processing group are relegated progressively agreeing to the need or burden data. Besides, in the proposed VMCC engineering each devoted processing group (DCC) contains single need line for putting away tasks to keep up with the need of the vehicular sight and sound assignments. Moreover, to accomplish higher registering execution these four DCC's perform execution of vehicular sight and sound undertakings in helpful way as displayed.

MVCC Job Queues Model

This subsection present the portrayal of the gig lines utilized in MVCC design and their working. Generally speaking, there are three distinct kinds of occupation lines: 1) solicitation's line, in which all vehicles present their media errands that should be handled by the media cloud, 2) registering or work lines, those store the vehicular media errands for cloud handling, what's more, 3) transmission line that store and hold handled errands prior to sending to the destination(s).

5. DYNAMIC RESOURCE ALLOCATION FOR THE VMCC

The primary goals of the proposed dynamic asset assignment conspire are; 1) productive handling, 2) on-time conveyance, and 3) limiting the processing cost. In the proposed dynamic asset portion conspire cloud has four devoted media groups where virtual machines are introduced that are answerable for handling of mixed media vehicular assignments. Figuring assets to each DCC is designated powerfully in light of the vehicular media demands load that is assessed by the LM. For instance assuming vehicular solicitations are more than the apportioned assets then additional registering assets are distributed to DCCs, comparatively on the off chance that the assessed load is less than the generally allotted registering assets then, at that point, processing assets are

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eliminated. Consequently, in view of vehicular burden assessment the figuring assets are occasionally refreshed to limit the figuring cost and to give better QoS to moving vehicles.

Algorithm (Priority-based Task Scheduling and Processing Procedure): From lines 1-4, the underlying tasks and examinations were done upon the appearance of ongoing and sight and sound errands from different vehicular clients in the time length, αt. From lines 5-7, all got sight and sound solicitations are dissected and arranged as need non-precautionary in light of their need values. In this paper, the lower worth of need show the higher need of undertaking for handling. From lines 8-12, every one of the four figuring bunches are allocated the assets for work handling. The figuring assets to every CC is appointed in light of the examinations of beginning responsibility got in time αt. Hence, for next time the sum of figuring assets will differs in view of the got responsibility. This is finished to use the registering assets proficiently and meeting the mixed media errands postpone cutoff times. From lines 13-15, the LM allots the every interactive media task to its proper CC and spot to the assignment into its work line for additional handling. From lines 16-22, the CC cycles the interactive media errands and spot them into the gig line of further figuring unit or transmission unit in view of the assignment handling nature.

For instance, assuming the errand is completely handled then, at that point, it will be shipped off the gig line of transmission unit for transmission to the planned vehicular user(s) or send it into to the gig line of next CC in the event that its handling isn't finished however. At last, from lines 23-25, the handled sight and sound undertakings are sent towards their expected vehicular user(s) all the while to try not to any further line delay and to fulfill the postpone time constraint of sight and sound undertakings for accomplishing better nature of involvement (QoS).

6. PERFORMANCE ANALYSIS

In this segment, first we present our trial settings then, examine the plans for execution assessment and assessment models. At long last, we examine our re-enactment results.

We assess and contrast the proposed conspire and the pattern single group and static asset allotment plans. Every one of the four stages connected with picture handling are being performed by a solitary group in the standard single bunch conspire. Nonetheless, in the static asset distribution

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conspire, assets to each DCC are distributed at start-up with no intermittent updation of figuring assets. We led correlations in view of the accompanying boundaries:

Nature of Experience: The QoS is estimated as far as start to finish or SRT time, that is a period estimated from vehicle media demand start stage till vehicle accepts its required reaction. In our paper the QoS is straightforwardly corresponding to the worth of SRT. For instance on the off chance that a specific vehicle get its expected reaction in-time then it experience better QoS. In any case, in the event that a specific vehicle don't get the required reaction in-time then, at that point, its experience low QoS.

Processing Cost: For any cloud administration give, giving the ideal QoS at diminished coast is dependably a difficult task. In this paper, the processing cost is straightforwardly corresponding to the quantity of figuring assets, for example, the no. Of virtual machines allotted for calculation of a specific media task. Subsequently, the more no. of inactive assets the more will figure cost.

7. SIMULATION RESULTS

In this segment, we present the re-enactment after effects of the proposed plot contrasted and the static distribution, and pattern single group designation plans. Figure 2 present the exhibition assessment consequences of the proposed conspire with static asset designation conspire under different recreation settings (i.e., setting 1, setting 3). Figure 1 presents SRT under signs setting 1 of virtual machines in the media server in which VM has handling speed 2100 MIPS, 2 Central processors, and 4 GBs of RAM. It is obvious from the figure that the proposed plot perform better compared to the static asset distribution conspire with regards to SRT. In static asset designation plot, the assets are allotted once toward the start of recreation. Under the less no. of cloudlets the static plan performs better. In any case, as the no. of cloudlets increments the SRT likewise increment which thusly lessen the QoS at recipient vehicle. As in the proposed plot the assets are progressively refreshed by the heap data.

Subsequently, the proposed plot performs better considerably under all the more no. of undertakings and it gives player and ensured QoS at the getting vehicle. Essentially, the figures show that the proposed conspire performs hitter under other recreation settings. Figure 2 addresses

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recreation after-effect of the proposed plot with static asset portion plot as far as number of sum registering assets (i.e., number of Virtual Machines (VMs)) expected for calculation. Figure shows that with the expansion in number of cloudlets the quantity of VMs likewise increment. This is on the grounds that of keeping a reliable QoS to vehicles and giving on-time reactions.

Figure 1 present the re-enactment results for the SRT of the proposed conspire with pattern single bunch or data center based asset portion plot under different arrangement settings given in Table 2. It is obvious from the Figure 2 that the proposed plot beat the single bunch based registering plan. The proposed plot gives the base calculation time and thusly, upholds the reliable QoS for vehicles. Notwithstanding, it very well may be obviously seen that the SRT increment as the cloudlets increment in single bunch based registering plan. This occurs as just the single bunch is answerable for playing out each of the four picture related undertakings. While, in the proposed plot, a picture handling task in isolated into four sub-errands those are additionally appointed to the four committed figuring groups, in like manner. Consequently, the proposed conspire performs hitter than the benchmark single bunch processing plan as far as the SRT.

8. CONCLUSION

In intelligent transportation frameworks, vehicles are prepared with different sensors, cameras, and other savvy gadgets that delivers a tremendous measure of media related contents for handling which can't be performed by the ready independent registering gadgets because of their restricted stockpiling, battery powers, and calculation limits. Along these lines, coordination of vehicles with interactive media cloud computing (MCC) is exceptionally expected as it give a strong processing device that offers the quick and productive calculation of vehicles mixed media applications and administrations. In this paper, we proposed a unique need based proficient asset designation and processing engineering for vehicles to address the difficulties of quick reaction time, reliable nature of involvement, and least figuring cost. In our proposed conspire, sight and sound errands are isolated into four sub-undertakings and doled out to fitting committed figuring group for handling. Need non-pre-planned line is utilized to guarantee the on-time reaction conveyance to various vehicular interactive media errands with different scopes.

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