Bi-Usage Energy Efficient Techniques (BUEET) for Energizing the Vehicle and Broadcasting the Information in Highway Scenario

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ABSTRACT- The proposed technique BUEET is introduced mainly for two major reasons such as (*i*) RSU broadcast the emergency messages and the energy status to the vehicles without any interruption. It helps to shake hands with the neighboring node for energy sharing and (*ii*) RSU boost up the energy efficiency level with the help of energy sharing by the adjacent vehicles. Most of the self-organizing protocols in wireless sensor networks considers only initial energy consumption phase and neglects the maintenance phase of topology. The vehicles are cooperatively interacted to form a reliable network structure. RSU's are placed in the roadway infrastructure and On-Board Units (OBU's) are placed in the vehicles, then the communication takes place with the help of these devices. Therefore, this provides the clear roadmap structure by receiving the information from various sources of vehicles. If the information received from the RSU is not relevant to the vehicles then it automatically transmits the information to the adjacent vehicles travelling in the highway. The adjacent vehicle checks the information and transmits to another vehicle if it is relevant. Therefore, the proposed method considers two parameters such as packet transmission and energy efficiency on NS3 simulation. Packet transmission among the vehicles plays a vital role in the proposed technique and the nodes without any route breaks and the loss of connection leads to a strong network. Energy efficiency is analyzed and compared with other existing schemes; in result it is proved that BUEET's energy efficient is higher in all the nodes. It helps to communicate among the nodes without energy loss. When the energy among the nodes in the network is high, then the performance of the nodes also good. The maximum number of Hop's helps to transmit the information without any delay.

Keywords: Road Side Unit, Hotspots, Packet Transmission, Energy Booth.

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1. INTRODUCTION

A particular variety of Wireless Ad-hoc Network (WANET) called Vehicular Ad-hoc Network disseminates the idea of altering vehicular movements in a systematic manner. Here, automobiles and Road Side Units (RSU) are the communication units, exchanging information about domestic appliances and applications for improving traffic flow while moving. Unexpected accidents that happen on the road every day entail significant car damage as well as grave risks to people's lives. In general, roadside stations and automobiles are referred to as static nodes and mobility nodes, respectively, in vehicular networks. In the context of VANET, which is a subset of Wireless Sensor Networks (WSNs), energy-efficient routing is a crucial feature. WSNs are designed to gather data and direct it towards the cluster head and the base station.

Intelligent Transportation Systems (ITS) are being fostered from one side of the planet to the other, with the principal objective of further developing traffic security. Vehicular correspondences are one of the main innovations in this exploration field, since they might possibly decrease the quantity of street mishaps by communicating status messages containing data about traffic perils and the condition of every vehicle, *e.g.*, its position, course and speed. A harmed individual gets legitimate consideration from the Emergency Medical System (EMS), is connected with the likelihood of death and injury.

2. LITERATURE SURVEY

A two-level edge computing was proposed for automated driving services [5] for vehicular communication. The vehicle with rechargeable batteries which can be charged by electricity from a charging station or in home using charging batteries. If energy level of car gets low, then car can be charged in energy booth found nearby. Arriving vehicles use the Internet infrastructure from a road segment where an energy-constrained RSU with restricted literacy is stationed. A one-dimensional, fixed-length roadway segment with homogeneous, uninterrupted light vehicular traffic is the hallmark of the VEHICULAR TRAFFIC MODEL, a discrete-time free-flow traffic model [1].

VANETs are sub-classification of Ad hoc systems where nodes are moving vehicles. Vehicle correspondence is intended to give street security by keeping away from impacts on the street, appropriation of street data and map data and diversion of travelers. Sub-regions have been created throughout the whole monitoring region. Depending on the priority of a particular region, the decision to transmit sensed data from that region is made [2].

The Architecture of the VANET trading off of numerous individual things like insightful vehicles i.e., vehicle fitted with handsets and on-board application, RSU, brought together administration framework, correspondence joins and so on. A VANET is varied from MANET in the perspective that the vehicles don't move haphazardly as in MANETs, rather in VANET the moving vehicles keep a few rules and pathways, for example, streets or thruway. The design can be separated into three modules to be specific Mobile unit domain, Infrastructure domain, and Management domain [10].

Many IDSs have been created especially to satisfy the needs of SCADA systems. However, they differ in terms of the modelling techniques utilized to create the detection model as well as the chosen information source. A SCADA data-driven IDS has the potential to change the safe monitoring of our everyday infrastructures and industrial processes, according to significant of this study [6]. Numerous Network Intrusion Detection Systems are installed all throughout a huge network. The logs and alarm data are shared amongst these distributed IDS. A Distributed Intrusion Detection System (DIDS) is referred as a configuration of several IDS in which the administrator configures the type and amount of information shared among the distributed IDS, and adjustments may be necessary from time to time [4].

The traffic anomaly detection module is used by the planning recognition module to gather data statistics and assess by going after the knowledge base. The usual operation of the block chain network is not impacted when a single communication network node or a few network nodes experience an interruption [7]. IDS based on protocol features have better performance in this area than the detection method relies on traditional features of IDS because it doesn't need to detect the packet payload against the specific encryption algorithm.

Any navigation system must typically have the following components: source and destination addresses, route maps, a graphical user interface, an audiovisual display, and a power source [3]. Geographical protocols use four forwarding strategies for inter-vehicle communication. Each node transmits the packet to the farthest neighbour who is close to the destination in the greedy method. The discriminator completes the Nash equilibrium between generator G and discriminator D, establishing the classification model required by intrusion detection, and then realizes the accurate classification of training samples through continuous iteration [8].

It is required to update the detection model to recognize new intrusion behaviours due to the advent of new intrusion tactics. n. The model is built using an initial set of data and a variety of random distributions to create numerous initial base classifiers, which are then used to forecast fresh data streams, remove false positives and missing data, and label the data [9].

The requirement for big data to be accessed more rapidly, significantly, and locally is expanding with the rise of linked cars and the development of cutting-edge automotive applications. The varied forms, high volume, and real-time processing demands of the ITS data may be identified. Simple data processing, integration, and analytics tools do not meet the needs of the complex data processing tasks of ITS [5].

Communication between vehicles in these specially appointed systems is of two sorts—Vehicle to Vehicle (V2V) correspondence and Vehicle to Infrastructure (V2I) correspondence. V2V includes correspondence among the moving vehicles for example vehicles go about as source, goal, and switch in correspondence process. For vehicle-to-vehicle correspondence, Dedicated Short Range Communication (DSRC) is required [11]. In VANET, common life alongside property security is unquestionably protected scarcely when both security and transportation are guaranteed [12]. It is approved that the design of the security framework goes about as a defensive make preparation for generally speaking perils by featuring the desperation and complicacy in settling the stress of VANET by the framework. It is projected that forthcoming smart cars would have caching capabilities, especially those that include On-Board Units (OBUs).

Therefore, it is advised to preserve downloaded items in caches for a short period of time to avoid making repeated queries. In fact, the prevailing trend of vehicle users is to visit several zones in their journey. Sometimes, they send requests for diverse contents from different entities, e.g., BS, RSU, Access Points, and others [13]. The Software Defined Vehicular Network (SDVN) platform offers complete security and privacy utilizing energy-efficient proactive and reactive techniques.

RGA authentication is intended as a lightweight, low-cost authentication technique for proactive security [14].

Currently, the majority of studies are focused on designing and improving routing protocol algorithms; however, there is little introduction to the specifics of simulation implementation. Additionally, the simulation tools and techniques employed by researchers varies greatly. Algorithm verification requires simulation implementation, which is frequently challenging and time-consuming [15]. A Simple and Efficient Adaptive Data dissemination (SEAD) protocol was proposed here a beaconless strategy was adopted for measuring vehicles' density. Each vehicle is able to dynamically define an appropriate probability of rebroadcast to mitigate the broadcast storm problem.

Efficiency is manifested by reducing excessive retransmitted messages and hence promoting the network capacity and the transmission delay [16]. By adopting optimised clustering approaches, it is necessary to awaken the fewest possible sensor nodes in order to use less network energy while still providing quality of service. A MAC/NET Upgraded Genetic Algorithm - Cross Layer Approach (MNUG-CLA) was proposed [18] to address the network's shortcomings, based on the MAC layer and network layer. To find the optimum next hop for the dynamically changing network, an updated neighbour identification method is created at the network layer. Giraffe kicking optimisation (GKO) uses the kicking motion of a mother giraffe to activate the fewest number of sensor nodes while maintaining a balance between exploration and extraction. It also helps to increase the speed of the network and network lifespan [17]. Enhanced Distance and Residual energy-based Congestion Aware Ant Colony Optimization (EDR-CAACO) for VANETs was proposed [19]. Based on the link's fitness values, the roulette wheel here chooses the quickest route. Based on the pheromone level of the link, the fitness value is calculated. The distance, residuals, and traffic density of the vehicles are used by the suggested model's improved Ant Colony Optimization (ACO) to calculate pheromones levels. Energy efficient quasi-congested shortest possible path was provided with high fitness values.

The objective of the proposed model is to overcome the message redundancy and considers only the relevant information that required for the vehicle node. This helps in energy saving process. The majority of the algorithms mentioned previously place a greater emphasis on path length and residual energy than they do on the effects of other energy data management, such as average energy, lower threshold energy, longevity of the network, and task scheduling overheads, which could lead to an imbalance in the network's overall energy attenuation.

3. VANET SECURITY REQUIREMENTS

In Vehicular Ad Hoc Networks, the packets holds the fundamental data and its basic information and the packets must reach the drivers without any changes of adding information. Likewise, the request of the drivers might to be perceived the traffic condition suitably. VANET should satisfy the security necessities

1) **Authentication:** It gives an assurance of information to the customer. It plays a major role which defines the fact of VANET from beginning to end.

2) **Integrity**: It guarantee that the data from the sender and customer are same. The customer or beneficiary uses a same methodology as utilized as sender side to another side.

3) **Non-Repudiation**: It stops the intruders from refusing the disturbances from the attackers.

4) **Availability**: It has some reasons to continue the communication constantly. It gives more speedy reply from the Ad Hoc Systems.

5) **Confidentiality**: Driver's safety should be restricted. In packet communication requires classification.

4. ARCHITECTURAL FLOW OF THE PROPOSED WORK

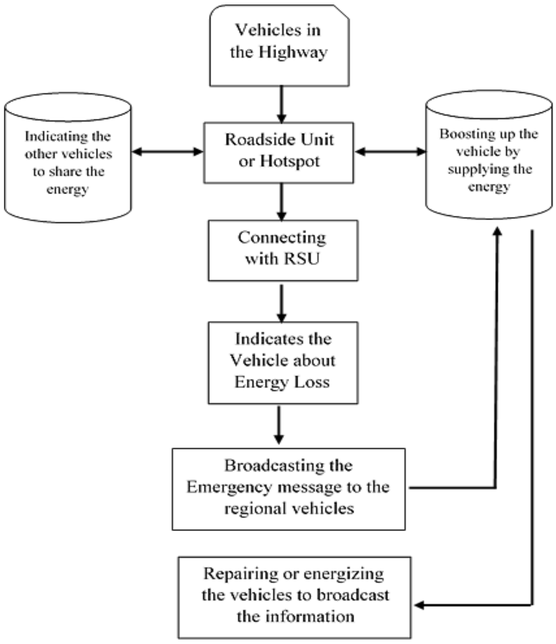

Figure 1: Architectural flow of BUEET

The architectural flow work of proposed BUEET is shown in *figure 1*.

5. PROPOSED WORK

In VANETs, however, the broadcast is typically used to disseminate traffic-related information (e.g., temporary re-route course, accident alert, development cautioning) inside a specific territory. While these may not be as time-basic as mentioning a highway, a traffic message should persevere in a system for a more drawn-out timeframe (e.g., a couple of hours up to a couple of days). Along these lines, the Road Side Unit (RSU) or Energy Booth that broadcasts traffic data as well as the communication message to keep it alive for whatever length of time that required.

These days' individuals need web offices while moving. One great answer to this situation is the execution of roadside hotspots. This framework comprises of roadside passageways and the vehicles out and about are additionally go about as transmitters.

At whatever point a vehicle comes into the scope of a roadside passage or a vehicle's range it will gain admittance to the web.

For our easy understanding the set of vehicles can be diverse into regional categories. Among 9 vehicles, it can be divided into 3 sectional regions. Each region contains a Roadside Hotspot to energize and to aware the vehicles condition. While the vehicles moving form source point to Destination point, some vehicles may lose the energy level. The energy level might decrease due to heavy traffic, collision and unexpected issues. But the vehicle has to know the condition and the entire map of the journey to reach the Destiny point.

INBROCAST is a proposed technique to find the best forwarder node. The best forwarder node helps to communicate or transmits the data packets to more number of receivers in an intelligent way. Consider the dissemination of messages along a linear highway. The RSU periodically broadcasts messages to vehicles located in its vicinity.

Begin :
Initializing the parameters
$V_i \leftarrow$ P packet from R_i
If $V_i \leftarrow$ P first then
Separate $N_j, l_{ai}, l_{oi}, T_i, l_{aj}, l_{oj}, T_j$;
$D_{ij} \leftarrow$Compute distance($l_{ai}, l_{oi}, l_{aj}, l_{oj}$);
$S_j \leftarrow D_{ij}/T_{ij}$;
If S_j maximum of speed in Nj then
Flag Set 'True';
Else
Flag Set 'False';
Broadcast 'P' again;
Return;
End if;
Else
Delete P;
Return;
End if;

In order to deliver the data to many vehicles in a cost- effective way and without installing additional infrastructure, vehicles on the highway can be elected as a Relay Node to support message propagation. If nodes were elected to forward the received packets, in a manner that is not properly coordinated, a substantial number of packets may be discarded, leading to low packet delivery ratio and low throughput. RSU or the Roadside hotspot helps to communicate the awareness message to the vehicles losing the energy level. It will indicate the vehicle though GPS about the level of the energy. So automatically the vehicles would get the alert message or warning message about the energy level while moving in the Highway scenario. If the nearby vehicles are ready to share the energy to the vehicles losing the energy, then it will share the energy to safeguard the data loss until it reached the RSU. If the vehicles adjacent to the weak vehicle is not ready to the share the energy, then it will be warned and automatically forced to stop in the next power station *i.e.*, RSU. So, installing RSU in a regular distance is mandatory to energize and to aware the vehicles energy level in a proper interval.

On the basis of their energy consumption rate for their last set of transmission, vehicles with higher remaining energy are chosen. Choosing high energy vehicles is important for ensuring improved communication between them. The total network is set with a cut-off point for energy-intensive vehicle selection, which prevents energy-efficient nodes from routing. The variance between the current energy level E_P and the prior energy level P_E, which is given in *equation 1*, is used to determine the energy consumed rate (E_{Spent}), which is used to identify high remaining energy vehicles.

$$E_{Spent} = \left(\frac{E_P - P_E}{T_{current}}\right) \tag{1}$$

6. ALGORITHM – BI-USAGE ENERGY EFFICIENT TECHNIQUE (BUEET)

Input:{V1,V2,V3,V4,V5,V6,V7,V8,V9} Vehicles
Output: Finding Distance of the vehicles within the region and energizing the weaker vehicle in the Roadside Energy Booth

RSU or Energy Booth Roadside Unit for Energizing and for Communication
Step 1: Vehicles Send Hi Message to the adjacent nodes
Step 2: While receiving the 'hi' messages from the adjacent vehicles, each vehicles is interconnected. Then the vehicles travelling in the region is in the safe journey
Step 3: The 'hi' messages helps to interconnect all the vehicles V1, V2, V9 always.
Step 4: The region is fully controlled by the RSU or Hotspot installed in the Road side.
Step 5: It often connected with the vehicles of the region.
Step 6: If the vehicles is losing the energy then RSU automatically send a broadcasting messages to the neighboring vehicles and to the corresponding vehicle.
Step 7: The adjacent vehicles receives the emergency message from the RSU and shake hands with the needy vehicles.
Step 8: If the adjacent vehicle is ready to share its energy then it shares the energy needed for the weaker one. That helps the vehicles to reach the next RSU for energize.
Step 9: It reaches the next RSU with the help of the adjacent vehicles energy.
Step 10: RSU or Hotspot then boost up the vehicles and proceeds the same

Procedure compute distance(lat1,lon1,lat2,lon2)
{
R →6378.137; // Radius of the earth in Kilometers dLt→ (lt2-lt1) X 3.14/180;
dLn→ (ln2-ln1)X3.14/180;
b→
sin(dLt/2)xsin(dLt/2)+cos(lt1/180)xcos(lt2/180)xsin(dLn/2)xs in(dLn/2);
c→2X tan2 (sqrt(b),sqrt(1-b)); d→RxC
return
d x 1000; // returns distance in meters
}
Let Nj →Vehicles in the Range Vi →Vehicle i
lai →Vehicles Latitude i loi →Vehicle Longitude i laj → Vehicles Latitude j loj → Vehicle Longitude j
Dij →Distance between vehicle Vi and Vj Ri →RSU
Sj →Speed of Vj
i→Relay node; J represents receiver.

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7. SIMULATION ANALYSIS

In this work INBROCAST technique is proposed, a new data dissemination protocol for Vehicular systems (VANETs) to work in parkway situations with various activity conditions, utilizing the vehicle-to-vehicle correspondence innovation. In this protocol, the messages retransmission has a tendency to be finished by vehicles situated inside the inclination zone. The performance of the proposed protocol was evaluated using the tool called NS-3 simulator tool.

A gateway that has connectivity to the global web allows users to either download or upload content while they are on the move. RSUs and OBUs have been placed in different topographical zones to send and receive data to the centralized management system for vehicle to infrastructural communications. The simulation is continued until all the packets are delivered or dropped due to Time to Live (TTL) expiration. The simulation constraints and values are given in the *table 1*.

Table 1: Constraints and its Values

S.No	Constraints	Values
1.	Number of vehicles	200
2.	Average velocity of vehicles	15-30 miles/h
3.	Wireless communication range	300m
4.	packet interval	10sec

A data dissemination protocol for Vehicular systems (VANETs) named BUEET is proposed here to work in parkway situations with various activity conditions, utilizing the vehicle-to-vehicle correspondence innovation. In this protocol, the messages retransmission has a tendency to be finished by vehicles situated inside the inclination zone, with that we augment the (coverage) information scattering inside the zone of enthusiasm with ease and low deferral.

Table 2: Comparison of Packet transmission techniques

Algorithm	1st Hop	2nd Hop	3rd Hop	4th Hop	5th Hop	6th Hop
FLOODING	(1000, 20)	(1200, 25)	(1400, 35)	(1600, 40)	(1800, 45)	(2000, 60)
DV CAST	(1000, 30)	(1200, 35)	(1400, 45)	(1600, 55)	(1800, 60)	(2000, 69)
SEAD	(1000, 35)	(1200, 45)	(1400, 55)	(1600, 60)	(1800, 72)	(2000, 88)
BUEET	(1000, 40)	(1200, 50)	(1400, 60)	(1600, 70)	(1800, 80)	(2000, 100)

Flooding technique, DV CAST technique, SEAD technique and the proposed algorithm BUEET can be compared and analysed in NS3 simulation tool. When comparing with the existing algorithm, BUEET performs well and the transmission rate is very high. BUEET has high performance with 6 hops of performance checking. The below table clearly explains the number of Hop's and the Energy Efficiency level in a better way. During 1st Hop to 6th Hop the values and the nodes transmission is varied. Packet transmission is quite high in the BUEET technique pave way to a better performance of packet transmission.

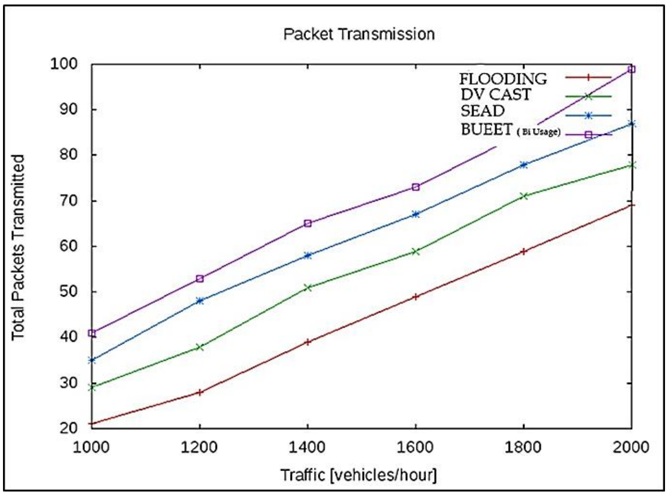

Figure 2: Packet Transmission among the vehicles

The *figure 2* describes the packets transmission ratio in the highway scenario. The transmission of the packets between the vehicles is maximum in our BUEET and is shown in table 2. This helps to broadcast the information or messages in a proper way. Connecting with the nodes with the help BUEET helps to transmit in a successful manner. Without any disturbances the nodes can easily interconnected itself.

The nodes transmission among the network without any break helps to transmit the information without out any disturbances. BUEET procedure sends the information very fast comparing with the other existing techniques.

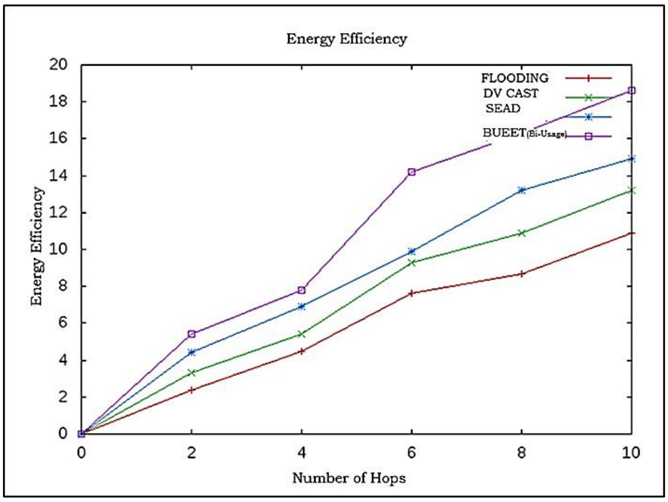

Figure 3: Energy Efficiency among the vehicles

Figure 3 exhibits the number of hops in the respective region. A source vehicle transmits the information to the next corresponding vehicle through another vehicle will be count as a single hop. Similarly, the hop count will be considered between the vehicles. In *figure 3* the hop consideration will be high when compared with flooding technique. The maximum number of hops helps to transmit the information in an easier way without any delay. While the connection among the nodes is proper then automatically the energy efficiency also good and this is described in *table 3*.

Table 3: Comparison of Energy Efficient techniques

Algorithm	1st Hop	2nd Hop	3rd Hop	4th Hop	5th Hop	6th Hop
Flooding	(0,0)	(2,2)	(4,4)	(6,6)	(8,7)	(10,9)
DV CAST	(0,0)	(2,3)	(4,5)	(6,7)	(8,9)	(10,11)
SEAD	(0,0)	(2,4)	(4,6)	(6,8)	(8,11)	(10,13)
BUEET	(0,0)	(2,5)	(4,7)	(6,13)	(8,15)	(10,18)

Energy efficiency is the major contribution in the proposed work. All the nodes in the network will need more energy and the efficiency to transmit the information in various aspects. In BUEET technique helps to connect the vehicles without any break and keeps the node busy among the network. It helps to transmit the information in a dynamic manner. The energy efficiency among the nodes will be high due to the proper and smooth connection between them. *Table 4* provides the advantages of proposed BUEET over existing algorithms

Table 4: Advantages of proposed scheme over existing algorithms

S.No	Existing Algorithms	Proposed Technique
1.	Two Level Edged Computing for Vehicular Communication [5]	The Proposed Technique is not only two edged computing Communication, it's a multilevel edged communicating techniques
2.	One Dimensional, fixed Length roadway segment with homogeneous , uninterrupted light vehicular traffic [1]	Multifaceted and Multi-Dimensional with Heterogeneous un interrupted Vehicular Setup.
	Depending on the Priority region [2]	Priority with Pro Active authentic Security
4.	Common life alongside property security [12]	Challenging and time Consuming
5.	Algorithm verification requires simulation implementation [15]	Bi Usage Energy Efficient Techniques is implemented using NS3 Simulation methods

8. CONCLUSION

The proposed technique helps to broadcast the emergency messages to the regional vehicles and energize the weaker vehicle. The adjacent vehicle travelling along the roadside shares the energy to the weaker one and helps to reach the next RSU. It helps to avoid the loss of node and the information. The energy level of the vehicle will be always monitored by the RSU with the help of GPS. The frequent status of the regional vehicle will be known by the highway vehicles. Bi- Usage of energy efficiency will be done through this BUEET algorithm. The vehicle could approach an OBU for the inquiry response if communication between vehicles breaks down and the query-initiating vehicle goes outside the range of that specific roadside unit's wavelength. By locating OBUs in various parts of the network architecture, the service access delay can be decreased. The proposed system has lowered energy consumption by 18.2% and packet transmission rate by 28%, respectively, according to an evaluation of its performance and comparison with the conventional scheme. For future works, it is planned to introduce some improvements in the store carry-forward mechanism to reach 100% of coverage. Additionally, while accounting for its networking complexity, the network coding paradigm may be used to further reduce the consumption of network resources.

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