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AN ENHANCED CLUSTER BASED MOVEMENT MODEL USING MULTIPLE FERRIES NODES IN VANET

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Abstract

VANET (Vehicular Ad hoc Network) is advancement in ad-hoc networks to transmit messages between vehicles with the use of RSU units. VANET is both infrastructure based and infrastructure less networks. To transmit messages in infrastructure based network is easy, messages are transmitted through some base stations but transmission of messages in infrastructure based network is a challenging task. In this kind of scenarios vehicles can only transmit its messages to the other vehicles when they are in the transmission range. When the vehicles are in the high quantity then it is necessary to divide them into clusters. To transmit messages in clusters, two most popular schemes are used one is single ferry routing scheme and other one is multiple ferry routing scheme. In this paper we proposed an enhanced cluster based mechanism with the use of multiple ferry vehicles. Ferry vehicles are the vehicles which are used to transmit messages or carry message from one cluster to another cluster. Simulation results shows that proposed mechanism has higher throughput, less message delay and less overhead ratio as compared to the existing techniques.

Keywords:VANET,RSU (Roadside Units),Ferry,ONE (Opportunistic Network Environment).

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I VANET

Recently, with the development of vehicle industry and wireless communication technology, vehicular ad hoc networks are becoming one of the most promising research fields. Vehicular Ad-hoc Network (VANET) [1] is a Mobile Ad-hoc Network (MANET) that provides wireless communication among vehicles or the communication between vehicles and fixed roadside infrastructures. The main

aim of this technology is to give drivers more comfortable and more secure driving experience.

A. VANET Architecture

VANET consists of vehicles (also referred to as nodes), roadside units and trusted authority (TA) or certification authorities (CAs), whose goal is to ensure road safety and help in secure transfer of message and data [1]. Each vehicle has an on board unit (OBU), which transmits messages about the position, speed, acceleration/deceleration etc. as shown in Figure 1.

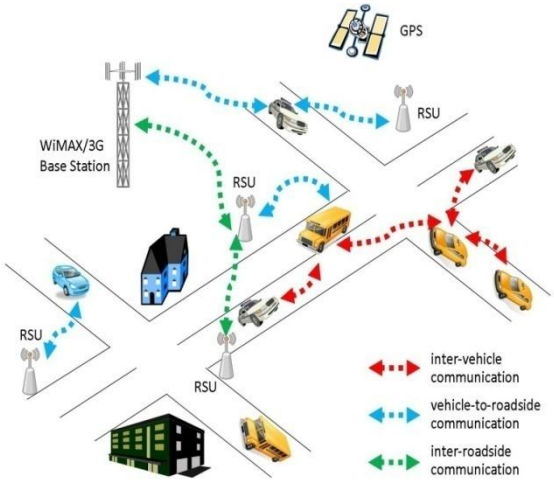

Figure 1. Architecture of VANET

B. Routing protocols

In VANET, numbers of routing protocols are available. A routing protocol is a protocol in which two communication entities exchange information, establishes a route, takes decision in forwarding, and act in maintaining the route or recovering from routing failure [2]. Two Types of routing schemes have been discussed to overcome the drawback of cluster based movement model in which a node cannot communicate with another node of another group without any

external node and the schemes are single ferry routing scheme and Hierarchal multiple ferry routing scheme.

In single ferry routing scheme [3] a network region is divided into three clusters in which the nodes are stationary and cannot be able to communicate with each other because the distance is too far. The ferry node acts globally throughout the route.

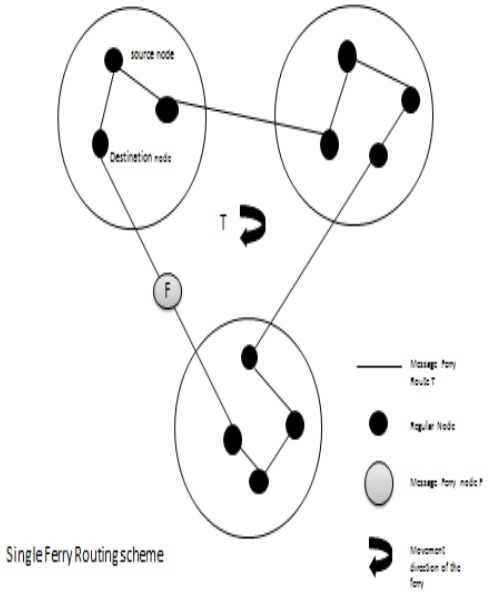

Figure 2. The Single Ferry routing scheme

But ferry node needs to communicate locally as well as globally as per the requirement of proposed work to overcome these disadvantages, a new routing scheme is proposed known as Hierarchal multiple ferries routing scheme in which nodes are distributed close to each other. In HMFRS, there are two types of message ferry one is global message ferry which delivers the message when source and destination nodes belongs to different cluster and local ferry node is there when source and destination nodes belongs to same cluster. There is a node FAP (Ferry Access point) which acts as an intermediate between local and global message ferry. HMGRS scenario is shown in figure 3:

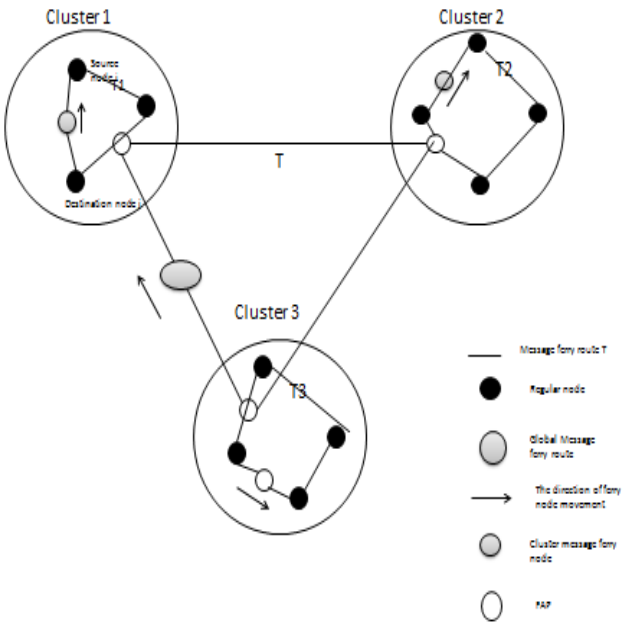

Figure 3. The hierarchal multiple ferries routing scheme

These schemes were not able to reduce drop rate, increase delivery ratio and reduce message delay, To overcome these drawback we will try to propose an enhanced cluster based movement model in which we use single ferry node that work as a local and global which reduces delay and reduce drop rate and also increases delivery ratio.

II Related Work

Bijan et al. [4], discussed pros and cons of different uni-cast routing protocols like position based routing, topology based routing, context based routing etc. which can be used for better understanding of the routing protocols and by which decides which type of future improvement can be made.

Sun et al. [5], proposed an RSU-assisted cluster head selection and backup protocol. The proposed protocol overcomes the problem of connection loss due to vehicle's high mobility, which drastically degrades the communication quality.

Shoaib et al. [6], proposed a protocol that combines features of both Geographic Routing Protocol and Topology Based Routing. The combination of this protocol provides a more convenient way to have more stable and efficient routes with lesser over heads.

Venkatesh et al. [7], provided literature review of different existing routing protocols for VANETs and classify them on the basis of their key attributes such as network architecture, applications, routing strategies, forwarding strategies, mobility models and *quality of service* metrics.

Chai et al. [8], proposed a utility based clustering algorithm for VANET which jointly considers credit history and current state of vehicles. The utility function of vehicles is formulated based on sigmoid function, the process of cluster forming is also presented, during which the vehicles with large utility are selected as CHs successively.

III Proposed Work

A. Algorithm for proposed solution:

In this section proposed mechanism has been discussed in detail. The algorithm is described in following steps:

1) Divide the network area into regions.
2) Fix the movement of nodes stationary in all clusters.
3) Choose a special stationary node called cluster head of each cluster.
4) Each cluster has its own local ferry node which is used to transfer messages from one hope to another hope in the cluster.
5) When a source node sends a message to destination and destination node is in another node at that time local ferry node takes the message from source and deliver to the cluster head of that cluster and then ferry node moves between cluster brings data from the cluster head to cluster head of destination cluster.
6) In next step local ferry node of destination cluster brings the message from cluster head to final destination nodes.

B. Data Flow Diagram

The DFD for the proposed mechanism is as follows:

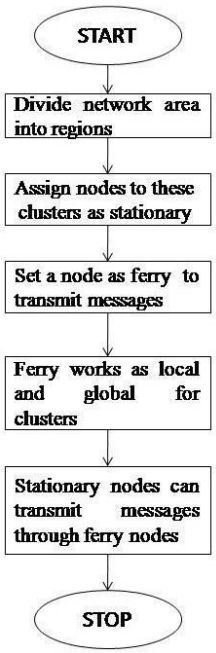

Fig. 4. DFD for transmitting messages from ferry nodes

IV Result and Analysis

A. *Simulation Parameters:* To implement proposed mechanism ONE simulator is used. ONE simulator is run on any platforms that support java. ONE is a java based simulator targeted for research in VANET.

Table 1. Simulation Parameters

Parameter Description	**Value**
Simulation Area	4500mX3400m
Simulation Time	15000s
Mobility Model	Cluster Based Movement Model
No. of Groups	9
Transmission Range	10meter

Node Speed	2m/s
Warm-up Period	1000seconds
Time To Live	[200;250;300]
Buffer Size	[5M;10M;15M]
Routing Scheme	EPIDEMIC

B. Performance Metrics used for analysis:

i) Input Parameters

1) Varying Buffer: Buffer is a temporary memory to store messages during data transmission for analysis we varied buffer space from 5MB to15MB.

2) Varying TTL: TTL stands for Time to Live. TTL is the message expiration period. For analysis we varied TTL from 200 to 300.

ii) Output Parameters:

1) *Throughput*: Number of messages delivered to the number of messages created by the source node is defined as Throughput.

2) *Average Message Delay*: The average number of messages delayed while reaching to the destination node from the source node is Average message Delay.

3) *Overhead Ratio:* This metric is used to estimate the extra number of packets needed by the routing protocol for actual delivery of the data packets.

C. Results and analysis:

This section covers results and analysis of proposed algorithm. To simulate proposed algorithm ONE Simulator is used.

i) Throughput vs. TTL: Figure 5 shows throughput of proposed work and single ferry routing scheme. TTL varies from 200 to 300.

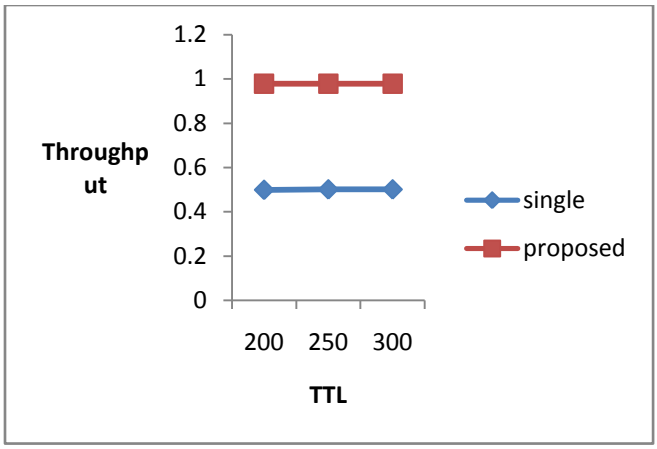

Figure 5. Throughput vs. TTL

In proposed work throughput is high as compared to single ferry routing scheme.

ii) Throughput vs. TTL: Figure 6 shows the message delay of proposed work and single ferry routing scheme.

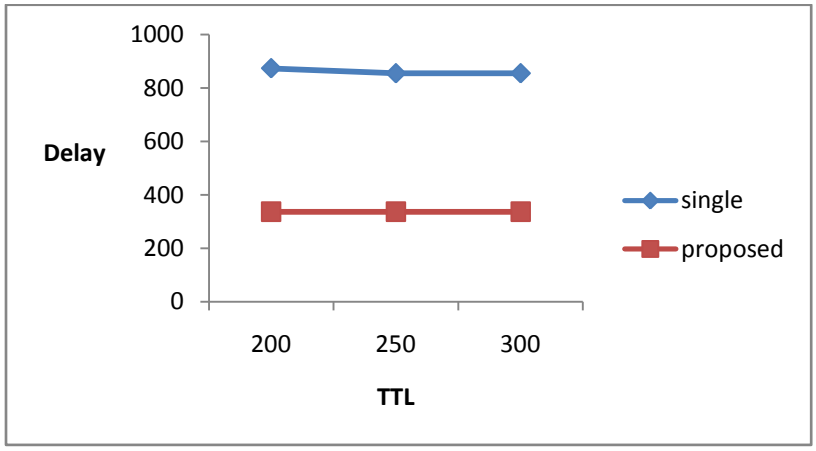

Figure 6. Message Delay vs. TTL

In proposed work message delay is low as compare to single ferry routing scheme .In single ferry routing scheme message delay is too high.

iii) Overhead Ratio vs. TTL: Figure 7 shows the overhead ratio of the proposed work and single ferry routing scheme.

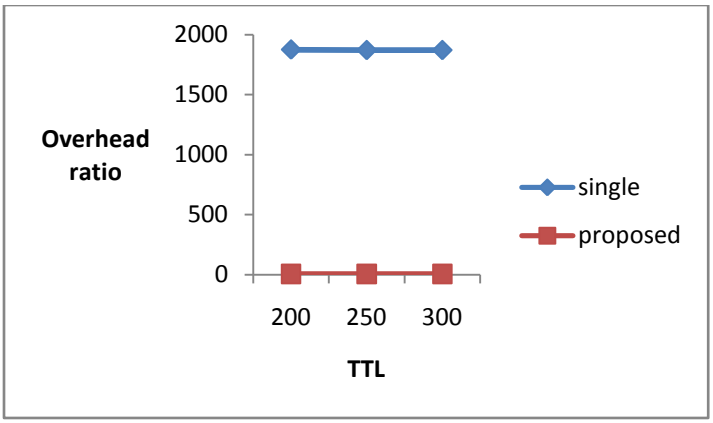

Figure 7. Overhead ratio vs. TTL

In proposed work overhead ratio is low as compared to single ferry routing scheme.

iv)Throughput Vs. Buffer: Figure 8 shows the throughput of the proposed work and single ferry routing scheme in perspective of buffer space which varies from 5M to 15M.

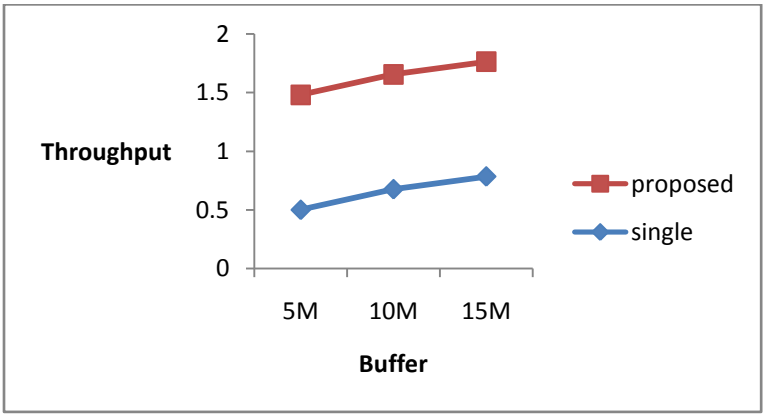

Figure 8. Throughput vs. Buffer

In proposed work throughput is high as compared to single ferry routing scheme.

v) Message Delay vs. Buffer: Figure 9 shows the Message Delay of the proposed work and single ferry routing scheme.

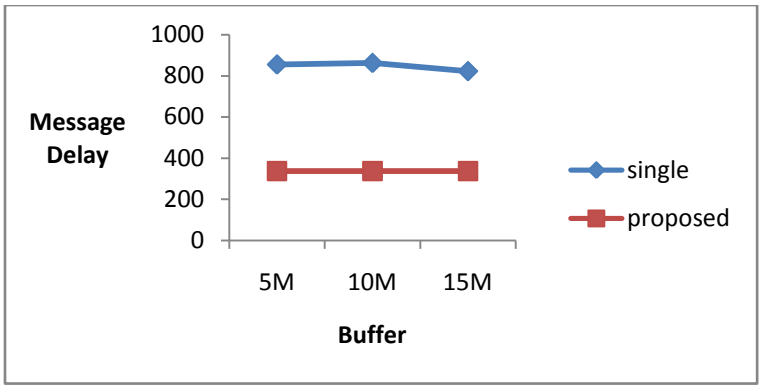

Figure 9. Message Delay v/s Buffer

Message delay is low in proposed scheme as compare to single ferry routing scheme.

vi) Overhead ratio vs. Buffer: Figure 10 depicts the overhead ratio of the proposed work and single ferry routing scheme.

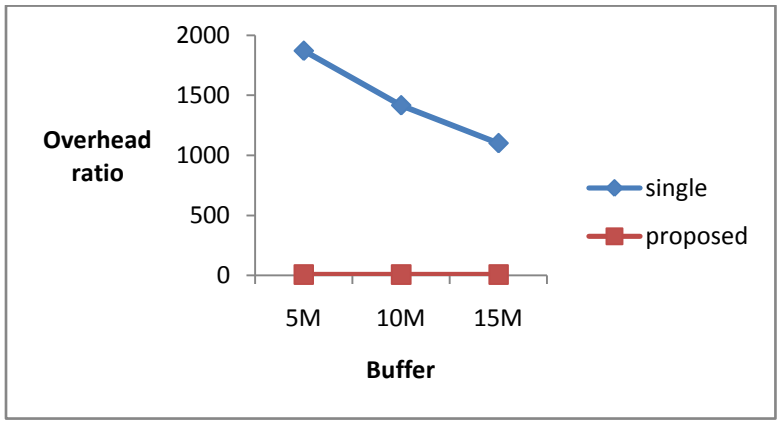

Figure 10. Overhead ratio vs. Buffer

In proposed work Overhead ratio is low as compare to existing single ferry routing scheme.

V. Conclusion

In this paper, we have enhanced a cluster based model using multiple ferry nodes in VANET in which we have compared the proposed mechanism to a routing scheme called Single Ferry Routing Scheme. One Simulator is used for the simulation results and the results shows that the proposed mechanism has high throughput, less message delay and less overhead ratio with

respect of TTL and buffer respectively. These results show that the proposed mechanism is better than the existing Techniques.

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