Seamless Handoff through Information Retrieval in VANET Using Mobile Agent

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Abstract

Nowadays, everything is moving towards the infrastructure less wireless environment to bring the smartness of the society. In this situation, it is necessary to bring the smart technologies in the ad-hoc network environment. As vehicular traffic is a foremost problem in modern cities and on highway. Huge amount of time and resources are wasted while traveling due to traffic congestion. VANET is providing comfort and safety for passengers. Moreover, various transactions like information on accident, road condition, petrol bank details, menu in the restaurant, and discount sales can be provided to the drivers and passengers. The speed and time in which the message is sent and received plays an essential part in the Intelligent Transport System (ITS). For this the VANET requires efficient and reliable methods for data communication, gathering and retrieving information for seamless handoff in VANET. In this paper we discusses the architecture of VANET consists clusters that's designed by mobile agents having instantaneous conditions of Mobile Nodes available in VANET. For efficient data communication, an attempt has been made to create a new clustering concept with the help of mobile agents among the VANET nodes. Subsequently for smooth and seamless handoff we have considered the call admission control mechanism with the help of Genetic algorithms applied over information retrieval system managed by mobile agent with the effect of shadowing for reducing the data overhead over VANET.

Key words: *VANET, Mobile Agent, CAC (Call Admission Control), Information Retrieval System, Genetic Algorithm, Handoff, Shadowing.*

1. Introduction

Vehicular Networks are a stylish, comfort and dynamic network of the Intelligent Transportation Systems (ITS) [3]. Vehicles reveal with each other via Inter-Vehicle Communication (IVC) as well as with roadside base stations. A VANET is a technology that uses moving cars as nodes in a network to create a mobile network, enables communication between moving vehicles and the road side units (RSU's) [1]. VANET is the special type of MANET, so the routing Protocols and IEEE standards used in MANET are also applied in VANET Environment [26][27]. VANET provide a communication model, vehicles are considered as VANET nodes with wireless links. Vehicles access of fast speed internet which will change the automobile's on-board system from an effective widget to necessary productivity equipment, making nearly any internet technology accessible in the car. Multiple ad-hoc networking technologies such as, ZigBee, IRA, WiMAX IEEE, and WiFi IEEE for convenient, effective, exact, simple and plain communication within automobiles on active mobility. Only a few VANET are made and dealt with the vehicular communication inside the city where enough road side units are present [4]. Next goal to create high-presentation, extremely measurable and secured technologies of VANET shows an unusual challenge like handoff to the investigate community of wireless.

Wireless network is envisioned as a convergence of different wireless access technologies that can be transformed into error-free and fast-handoff support techniques, seamless communication environments through application of context-based handovers. A hard handoff, is essentially a "break before make" connection [23], the link to the prior Base Station (BS) is terminated before or as the user is transferred to the new cell's BS, the MS is linked to no more than one BS at any given time. So when the MS moves from one BS to another BS, it becomes impossible for it to communicate with both BSs (since different frequencies are used). Handoff caused a problem of information gathering when changing their BS. Several schemes have been proposed for handoff in IEEE 802.11 networks like CAC (call admission control) for seamless handoff in VANET. Issues are how to efficiently support handoff between different routers (Vehicles), since routers in VANET are free to move to anywhere. However, in VANET handoff environment we have to consider the issue of differentiated priorities as well. That is, handoff calls have to be given more preference than new calls in the CAC process **[5]**, since users are much more sensitive to call dropping than to call blocking. The neural network and genetic algorithm tool has been used to implement and process and optimize the handoff decision metrics.

Mobile agents introduce new levels of complexity, operating within an environment that is autonomous, open

to security attacks, agent server crashes, and failure to locate resources [9]. There is significant attention within the mobile agent fault tolerance community concerning the loss of mobile agents at remote agent servers that fail by crashing [9] [10] [11] [12] [13] [14] [15]. If a user may dispatch a mobile agent to visit airlines to find the cheapest flight. The mobile agent migrates to each airline's remote agent server and dynamically updates its own internal state to reflect the cheapest price, unfortunately if agent server crashes, all information relating to the cheapest flight is lost. Some applications introduce failure dependencies with agent servers. Consequently transaction-based solutions [9] [10] [13] [14] introduce unnecessary performance overheads. Some techniques [15] modify the agent server platform to introduce fault tolerance, e.g. an agent server may replicate each mobile agent before execution a mobile agent inject a replica into stable storage upon arriving at an agent server. However, in the event of an agent server crash, the replica remains unavailable for an unknown time period. [14]. Introducing fault tolerance into the agent server platform restricts information retrieval to those enterprises that allow the modified agent server platform.

A mobile agent is a program that can migrate during execution from machine to machine in a heterogeneous network [22], it can transport its state from one environment to another, with its data intact, and be capable of performing appropriately in the new environment. Mobile agents decide when and where to move. The appeal of mobile agents is quite alluring - mobile agents roaming the Internet could search for information, find us great deals on goods and services, and interact with other agents that also roam networks (and meet in a gathering place) or remain bound to a particular machine. Significant research and development into mobile agency has been conducted in recent years, and there are many mobile agent architectures available today. During migrating to the unreliable network link, an agent can continue executing if the network link goes down with the help like Genetic algorithm and neural networks, making mobile agents particularly attractive in mobile-computing environments. The true strength of mobile agents is not that they make new distributed applications possible, but rather that they allow a wide range of distributed applications to be implemented robustly and easily within a single, general framework.

Genetic algorithms are one of the best ways to create a high quality solution. Genetic algorithms use the principles of selection and evolution to produce several solutions to a given problem. When traditional search methods fail, we employ genetic algorithm (GA) to search for the near-optimal solution [24]. Genetic algorithm helps in handoff procedure while node is changing their cluster in VANET. An effective GA representation and meaningful fitness evaluation are the keys of the success in GA applications. The appeal of GAs comes from their simplicity and elegance as robust search algorithms as well as from their power to discover good solutions rapidly for difficult high-dimensional problems. GAs is useful and efficient for large search space and no mathematical analysis is available. A genetic algorithm is an adaptive heuristic search program that applies the principles of evolution found in nature. Genetic algorithm combines selection, crossover, and mutation operators with the goal of finding the solution of best fitness to a problem. A genetic algorithm searches for the optimal solution until a specified termination criterion is met. The solution to a problem is called a chromosome. A chromosome is made up of a collection of genes which are simply the parameters to be optimized.

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The rest of the paper is organized as follows. We first describe the related work in section 2. In section 3 we proposed VANET architecture. We conclude the paper in Section 4 and section 5 defines the future scope of this paper. At last in section 5 references are given.

2. Related Work

In Paper [16]. VANET is an advanced version of Mobile ad-hoc network (MANET). Most of the MANET features can be applied in the VANET environment [25]. In VANET the vehicles move in an organized and predefined road randomly. The literature survey available on vehicular communication is very limited and most of them are the extension of the mobile ad-hoc networks. Due to this high speed of the vehicles the usual mobile ad-hoc technology IEEE802.11 is not well suited for VANET. For this reason a suitable amendment is made on the existing standard 802.11 that becomes a new vehicular technology 802.11p. Another big challenge is creating the vehicular network outside the city area. The new concept a simple highway system is taken for characterizing the VANET. The newly

proposed system takes into consideration the two scenarios: (1) Service Discovery when a vehicle moves inside the city. (2) Service Discovery when a vehicle moves outside the city. Each vehicle is equipped with a global positioning system (GPS) [25]. For the road safety, new applications are proposed for vehicular networks, i.e. car to car communication, travel and tourism information distribution and game applications. These applications need reliable communication equipment with high data rates and also a stable connectivity between the transmitter and the receiver under high reliability condition.

In paper [5], Handoff is in dispensable for connection continuity, as a mesh client moves from the range of one mesh router to that of another. In this paper, a WMN that offers above handoff function as seamless handoff WMN. While cellular networks solve the handoff problem [4], [5] using signaling embedded in their low-level protocols, there are only limited studies on efficient seamless handoff in IEEE 802.11 based WMN. This delay is too long for real-time applications, such as interactive voice over IP or video conferencing. This paper develops an MA based handoff scheme, which offers seamless and fast handoff to support VoIP and other real-time applications. The handoff and re-routing logics is done solely by the MA, and only standard MAC and IP protocols are used. To guarantee quality of service (QoS) and achieve differentiated priorities during the MA based handoff, a proportional threshold based optimal access bandwidth policy for call admission control (CAC) on the mesh router, and deploy a genetic algorithm (GA) based approximation to solve it. Simulation study shows that our proposed CAC scheme has a satisfying tradeoff between differentiated priorities and statistical access bandwidth in WMN handoff environment.
In paper [18], Information retrieval system based on Client server model has scalability and network bandwidth problems. To overcome that mobile agent based model is the suitable technology for the applications such as information retrieval system [19]. In order to get the complete benefit of mobile agent system, the system must be fault tolerant [20]. In this system, the fault tolerant technique is adapted to increase the reliability of the system by making replica. The problem can be caused (i) if MH is currently disconnected or (ii) MH is moved to some other network. This can be solved by using replica in our proposed system. Mobile host has the functionality for transferring mobile agents according to the list of servers provided a directory service and gathering results from the agents. Server receives the mobile agent and processes user's request and produces result. The client-server model though powerful, had some limitations. Mobile agents are considered a suitable technology to develop applications such as information retrieval system for mobile computing environment [29] that retrieve information from the mobile host. The creation of replica agent and the processing required for implementing fault tolerance. In client server architecture, if the connection is lost during the transaction, the user has to send his request once again to get the results. The proposed system overcomes that problem as well as the system is fault tolerant. And also, the system allows sending more user requests by the way of creating many mobile agents without affecting the performance.

3. Proposed Architecture And Mechanism

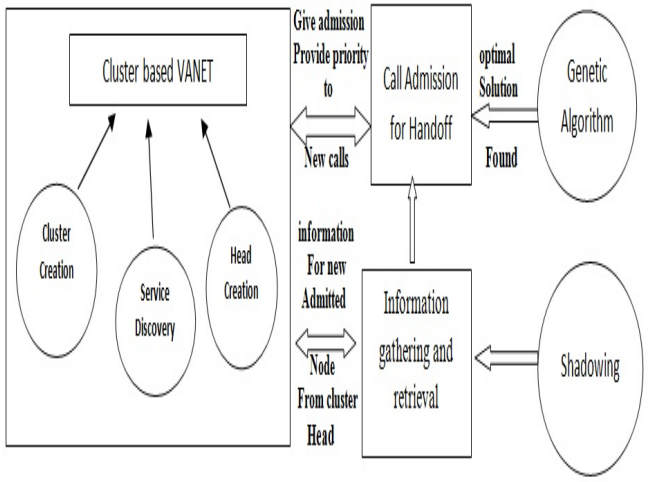

Figure 1: cluster based VANET Handoff Architecture

3.1 Working of Proposed Architecture

3.1.1 Cluster Based VANET

A simple highway system is used for the VANET [16]. Each vehicle is using a global positioning system (GPS) [17]. Clusters are created dynamically in VANET the clusters remain stationary and predefined [21]. In VANET the cluster architecture follow the following steps:

Cluster creation: In the present architecture, the VANET area has been split into a number of size clusters having cluster head and storage capability according to bandwidth, direction, velocity as per the cluster formation algorithm given. For information gathering between the cluster heads, a service announcement procedure takes place.

Cluster Head Creation: It is the process of finding the cluster head in all the created clusters. Each cluster Head has its own responsibilities and powers.

Service announcement: After creating cluster using cluster creation algorithm if any node wants to announce

any service in the network then all the cluster heads update their values according to the algorithm.

3.1.2 Call Admission Control for Low Bandwidth Handoff

According to the Service announcement the cluster head provide admission to the call. A better handoff strategy should be applied to the VANET, when node changes their cluster. A call admission (CA) mechanism is used in vehicles while changing the clusters. A genetic algorithm is used for searching optimal solution for CA on the router (vehicle), which adopts threshold structure and gives handoff calls first priority and new calls second priority [5]. We assume there are 'C_n ; clusters in VANET and a node among all the clusters wants to change the cluster the two possible case can arise (i) it is simply a vehicular node (ii) it is a Cluster head. If node is a Cluster Head then it will be accepted is it has an optimal bandwidth and Genetic algorithm decide which device needs a priority first. Then we need to find new cluster Heads in All the clusters otherwise the node is accepted.

3.1.3 Information Retrieval Mechanisms Using Mobile Agent

In order to gets the complete benefit of information gathering in VANET. A mobile agent based information retrieval system is introduced in VANET. Mobile agent migrate in the network for getting the information from the appropriate node, if node is searching for the information in all the clusters C1 to Cn retrieve information from the cluster head if Cluster head not found then find the cluster head and retrieve information after service announcement.

3.1.4 Shadowing Effects

A problem can arise while retrieving the information from cluster head in VANET, that when searching a node in cluster for information retrieval and two clusters having the information of same node then Shadowing helps in retrieving the latest information values by finding the cluster where the node is currently lies.

3.2 Mechanism for Proposed Architecture

STEP I: Cluster Creation Algorithm

```
While (Mobile Node Status is Active)
        {
          Find relative distance between Nodes;
          Find the relative velocity among nodes;
Case I:   If (velocity==th && dir==same)
          {
          //Create small size cluster;
          Bandwidth();
          Device_type();
          NoOfAvailableNodes();
          }
Case II   If (velocity==t && dir! =same)
         {
          //Create large size cluster;
          Bandwidth();
          Device_type();
          Quanity();
         }
Case III  If (velocity!=t && dir==same)
                Create Cluster();
Case IV   If (velocity!=t && dir!=same)
          {
                Create Cluster();
                get_ position( );
                Return position;
          }

get_ position(Cluster_name )
{
        While (cluster list not empty)
                If (node € C)
        // €, is belongs to;
                Return Cluster_name;
}
Bandwidth(B)
{
        If (B>=threshold)
                Return;
        Else
                Exit;
        //do not consider in cluster
        //until bandwidth not increases.
}
Device_type (ExistingDevice, DeviceType)
{
        If (ExistingDevice ==DeviceType)
                Return ExistingDevice;
        // consider it in cluster.
        Else
                Exit;
        // do not consider it in cluster until
        //Device type not matched.
}
Direction (NewDevice)
{
        If (ExistingDevice == NewDevice)
        {
```

```
                    New device will included in
                     cluster;
                // consider it in cluster.
                }
                Else
                    Exit;
                // do not consider it in cluster until
                Direction not match.
        }
        Quanity(MaxNoOfDevicesInCluster,
        ExistingNoOfDevicesInCluster)
        {
            If(MaxNoOfDevicesInCluster>=Existing
        NoOfDevicesInCluster)
            {
                AllowToJoinThisCluster
            // consider it in cluster.
            }
            Else
                DenyDeviceInThisCluster;
            // do not consider it in cluster
        }
```

STEP II: Cluster Head Creation Algorithm

```
            Cluster_Head(int y)
            For existingCluster C1 to Cn
             {
            For node Node1 to Noden
            {
                Assume Velocityth and Directionth .
            If (Velosity<=Vth  &&Direction<=Dth)
                Cluster headi = Nodei;
                Return ClusterHeadi;
            }
            }
```

service_announcement()

```
{
CASE-I
    For  ExistingCluster C1 to Cn
        For all ExixtingClusterHead ClusterHead1 to
    C,usterHeadN
        {
            Update all the values on ClusterHeadi ;
            if (NewNode found)
            {
            ClusterHeadi= values (NewNode);
            Update ClusterHeadi;
            }
        }
CASE-II
    For  ExistingCluster C1 to Cn
        For all Node Node1 to Noden
            if (Nodei announce a service)
            {
            ClusterHeadi= values (Nodei);
            Update ClusterHeadi;
            }
```

STEP II: Call Admission Control for Low Bandwidth Handoff

```
 When request arise
{
For all existing Cluster C1 to Cn
        For all node Node1 to Noden
        {
CASE-I    if (Nodei==Cluster Head)
          {
           If (optimalThresholdBandwidth found)
                AcceptNode;
                ClusterHead();
                ServiceAnnouncement();
          }
Case-II     if (Node!i =Cluster Head)
                Accept;
                ServiceAnnouncement ();

        }
```

Genetic algorithm perform the following operations for the better optimal solution

```
    {
    Create an initial population of nodes
     For Cluster C1 to Cn
          For all node Ni
           {
            If(StateOfNode Ni == ReadyForHandoff)
            NoOfNodeReadyForHandoff = Ni++;
           }
     }
    // Selection
For every Node
While (OptimalBandwidth >= BWth)
{
    {
    For (Node  j=1 to n)
        For ( NodeReadyForHandoff =1 to n)
            Node[j] = BW [NodeReadyForHandoff ]
            // crossover function.

    X[t] =BW values after insertion sort;
            // set priority, mutation;
    For (int j=1 to n)
        For (int t=1 to n)
            Node[j] =X[t];
     // termination;
```

STEP–III: Information Retrieval Mechanisms Using Mobile Agent

When node is searching the info (Node[j]) for handoff
And node[j] belongs to Cluster C_i
{
For all existing Clusters C_1 to C_n
If (ClusterHead not found)

{
ClusterHead();
ServiceAnnouncement();
}
Else
While (cluster head is active)
For all $ClusterHead_i$
RetriveInfo=$InfoNode_J$ [$ClusterHead_i$]
ServiceAnnouncement();

STEP IV: Shadowing Effects

For shadowing
While retrieving information
{
If (more than one cluster has the info [$Node_j$])
For all existing cluster C_1 to C_n
Find ();
If (C_i have info [$Node_j$])
//Retrieve information from the Current residency node;
}
Find (Ci)
{
For all existing clusters C_1 to C_n
If (C_i contains $node_j$)
Retrieve information ();
}

4. Conclusion

Moving towards the infrastructure less network, and new smart networks are developing like VANET, for better and smart data communication, a better handoff mechanism plays an important role in the handover process between the vehicular nodes during the vehicles are running on the road then mobile agent plays a important role in retrieving the information during the handoff process. For this we propose a cluster based VANET architecture which admit new node to new cluster with the help of Genetic Algorithm gives the priority to the calls and a better Quality of information retrieval is proposed which retrieve information using the shadowing of information in the clusters of VANET which helps the user to use the internet and mobile services inside their vehicles.

5. Future Scope

This system performance varies according to the bandwidth which is not defined previously, if the speed of the vehicles changes then the new cluster formation needed rapidly, heterogeneous clusters can't help in retrieving information and there should be need of defining compatibility between the cluster heads and the mechanism changes according to the change in platform.

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