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An Effective Way of Dynamic Routing for Flying Ad HOC Networks

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Abstract:

Mobile Ad-Hoc Network is a self configurable network. It will establish a network in on demand manner especially for battlefield communications. In such applications, intergroup communication is crucial to the team collaboration. To address this weakness, in this paper a new class of ad-hoc network called Flying Ad-Hoc Networks (FANETs) is introduced. A distributed client tracking solution to deal with the dynamic routing nature of client mobility, and present techniques for dynamic topology adaptation in accordance with the mobility pattern of the clients is proposed. The proposed system is two different routing algorithms for ad hoc networks: Optimized Link-State Routing (OLSR), and Predictive-OLSR (P-OLSR). The latter is an OLSR extension that is designed for FANETs. It takes advantage of the GPS information available on board.The simulation results indicate that FANET is robust against network partitioning and capable of providing high relay throughput for the clients. Depending on the high mobility of FANET nodes, the topology changes more frequently than the network topology of a typical MANET or even VANET. Multi-UAV systems may include different types of sensors, and each sensor may require different data delivery strategies.

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I. INTRODUCTION

FANETs (Flying Ad-hoc Networks) is a group of Unmanned Air Vehicle (UAVs) communicating with each other with no need to access point, but at least one of them must be connected to a ground base or satellite . UAVs work without human help, like autopilot. This is because cheaper and small wireless communicating devices, the in recent years, many research fields from academia and industry make attention on FANETs. Now, FANETs are used in various applications such as military and civil applications, such as managing wildfire and disaster monitoring. As each type of network has its own specification and using the protocol depends on this specification, it is important to use a reliable protocol for this kind of networks and check their performance using simulation. Two factors affect protocol simulation: the first one is mobility model, and the second one is the communicating traffic pattern, among others.

FANET can be viewed as a special form of MANET and VANET. Mobility degree of FANET nodes is much higher than the mobility degree of MANET or VANET nodes. While typical MANET and VANET nodes are walking men and cars respectively, FANET nodes fly in the sky. Depending on the high mobility of FANET nodes, the topology changes more frequently than the network topology of a typical

MANET or even VANET. Depending on the high mobility of FANET nodes, the topology changes more frequently than the network topology of a typical MANET or even VANET. FANET also needs peer-to-peer connections for coordination and collaboration of UAVs. Besides, most of the time, it also collects data from the environment and relays to the command control centre, as in wireless sensor networks. Consequently, FANET must support peer-to-peer communication and converge cast traffic at the same time. Typical distances between FANET nodes are much longer than in the MANETs and VANETs. In order to establish communication links between UAVs, the communication range must also be longer than in the MANETs and VANETs. This phenomenon accordingly affects the radio links, hardware circuits and physical layer behaviour. Multi-UAV systems may include different types of sensors, and each sensor may require different data delivery strategies.

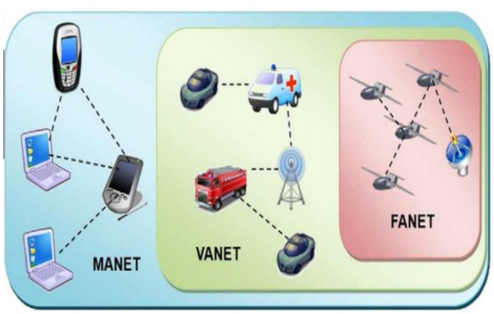

Fig 1. MANET, VANET, FANET

II. FLYING AD HOC NETWORKS ROUTING

This new Flying ad-hoc network to support such a dynamically changing mesh topology. Flying ad hoc networks (FANETs) composed of small unmanned aerial vehicles (UAVs) are flexible, inexpensive and fast to deploy.In this system that each flying node is fully charged in the initial location and has enough power to update its location and forward data for mobile clients. Flying nodes can be classified into Intra group routers and Intergroup routers. Therefore each flying mesh node is fully charged in the initial location and has enough power to update its location and forward data for flying mobile client. Also proposed autonomous wireless mesh network, deal with the dynamic routing.

III. IMPLEMENTATION DETAILS

DSR IMPLEMENTATION

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.

Dynamic source routing protocol (DSR) is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence. The basic approach of this protocol (and all other on-demand routing protocols) during the route construction phase is to establish a route by flooding Route-Request packets in the network. The destination node, on receiving a Route-Request packet, responds by sending a Route-Reply packet back to the source, which carries the route traversed by the Route-Request packet received.

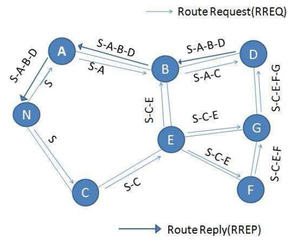

Fig 2. DSR Process

IV. PROPOSED SYSTEM

Flying ad hoc networks (FANETs) composed of small unmanned aerial vehicles (UAVs) are flexible, inexpensive and fast to deploy.In this system that each flying node is fully charged in the initial location and has enough power to update its location and forward data for mobile clients.

Here the advantages are: To achieve better overall end-to-end delay. Cost of the network should be less. Able to efficiently utilize all free routers to track UAV.

MODULE 1:. Network Topology
MODULE 2. Mobility Models
MODULE 3. Beacon sharing
MODULE 4. Dynamic Routing

1. Network Topology

Topology formation is an important issue in a flying adhoc network. Performance parameters such as energy consumption, network lifetime, data delivery delay, sensor field coverage depend on the network topology. Flying adhoc network mainly used for monitoring the events such as disaster tactical in military surveillance. In order to the higher mobility, degree, topology changed frequently. The communication between UAVs has also broken frequently; because the higher speed, or if the UAV is out of the range because location changing occurs rapidly. At each UAV connection failure, update processing is needed. Wireless Mesh Network (WMN) is a mesh network implemented over a wireless network system. It is a point-to-point-to-point, or peer-topeer, system. A node can send and receive messages, and also functions as a router and relay messages for its neighbors. Through the relaying process, a packet of wireless data will find its way to its destination, passing through intermediate nodes with reliable communication links.

2. Mobility Models

In node mobility, the degree is larger than MANET and VANET. The UAV has a speed of 30-460 km/h, and this speed causes the communication problem between UAVs. In many mobility models, the flight plan is predetermined and at each step there is a change, recalculation for the map take place. Other models are using random speed and directions for the UAVs. The mobility of a network depends on two basic parts, nodes location and velocity change in a time.

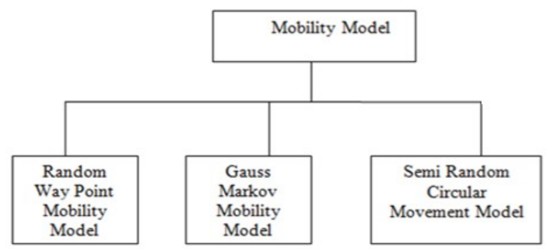

Fig 3. Mobility Model

a) Random Way Point Mobility Model

The time pause between the changes in node direction and speed are included in Random Way Point Mobility Model. UAVs in this Model move in random locations in a specific area, it is free in their movements within the simulation are independently from any other UAVs in the region.

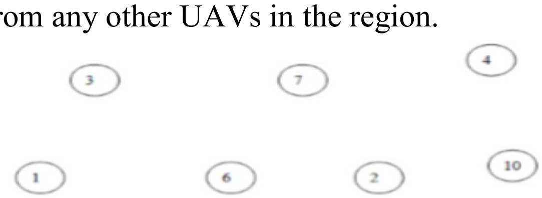

Fig 4. Random Way Point Mobility Model

b) Gauss-Markov Mobility Model

GMM model uses one tuning parameter to vary the degree of randomness in the mobility pattern. In GMM model, each node is initially set to a specific speed and direction, and then at each period of time, the movement will update the direction and the speed for the UAVs.

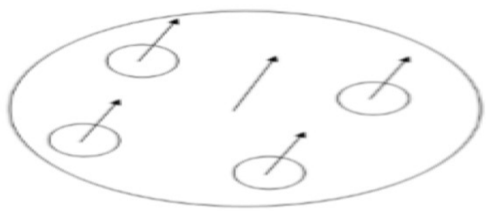

Fig 5. Gauss-Markov Mobility Model

c) Semi-Random Circular Movement Model

This model is developed for the UAVs which their moves are in curving manner. This technique is used to simulate UAVs to capture some information about some regions by rotating around the area specified.

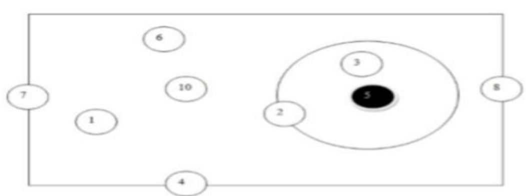

Fig 6.Semi-Random Circular Movement Model

3. Beacon sharing

In a multi-hop network, links are usually established and maintained proactively by the use of one-hop beacons which are exchanged between neighbouring nodes periodically. Beacons are broadcast in order to conserve bandwidth, as no acknowledge messages are expected from the receivers of these beacons. Thus, the link status of every link on which a beacon is received can be effectively obtained through beacon transmissions. In addition, it is possible to protect the beacon using the RTS/CTS signalling of the MAC layer.

In our proposed work, the Router need to track the mobile client and need to provide the continuous connectivity with less number of Router usage using beacon sharing. To use less number of Routers, routers need to share the client info message to each other.

When node n_i receives a CLIENT INFO packet from its previous node s, it can use the neighbor list in the CLIENT INFO packet to estimate how many its neighbors have not been covered by the CLIENT INFO packet from s. If node n_i has more neighbors uncovered by the CLIENT INFO packet from$s$, which means that if node ni rebroadcasts the CLIENT INFO packet, the CLIENT INFO packet can reach more additional neighbor nodes.

4. Dynamic Routing

The nodes inside the network move around randomly and have no restriction on their distance from other nodes. As a result of this random movement, the whole topology is changing in an unpredictable manner, which gives rise to both directional as well as unidirectional links between the nodes. In a large area mission and multi-UAV operations, dynamic routing can occur. Therefore, robust algorithms with dynamic routing are make better communication with source to destination. The mobile nodes in FANET form on-the-fly communication backbone, which changes dynamically and arbitrarily over a period of time. There might be cases where a link between nodes might be in a transient state from unidirectional mode to bidirectional mode. Dynamic Source Routing is a reactive approach of routing in ad-hoc networks in which sending nodes recover the routes whenever they need to send data to the receiver nodes. In FANETs, the mobility is very high between the nodes; hence the possibility of route breakage between any two nodes is really high. Hence the packet is lost. Now, to minimize the packet loss, the route is maintained. In the process of data transfer, when the data is transferred from one node to the next an acknowledgement is sent back to the sender node .The frequency of such transitions and the time interval for a node to stay in such a state will be functions of the offered traffic, terrain, mobility pattern, and energy availability.

V. SYSTEM ARCHITECTURE

Fig 7. System Architecture

A battlefield environment, however would be more hostile; where the enemy could attempt to disable the flying mesh nodes. Such a topic is beyond the scope of this proposed system although replacement mobile mesh nodes could be launched as needed to maintain the desired communication coverage; in which case, the airborne network would reorganize itself to integrate the new mesh nodes. As a group of clients moves from place to place, the area they occupy may change over time. Our goal is to dynamically allocate a finite number of mesh nodes to cover as many mobile clients as possible, while maintaining the connectivity between the groups of clients. Even though describe the operation of AMMNET using the group mobility model, AMMNET can actually support a more general mobility model, where clients might move independently. In an extreme case, each client can be thought of as a group that contains only one user, and the design of AMMNET can still be applied to support connectivity for those independent clients. To support such a dynamically changing mesh topology.

VI. FANET DESIGN CHARACTERISTICS

FANET can be defined as a new form of MANET in which the nodes are UAVs. According to this definition, single UAV systems cannot form a FANET, which is valid only for multi-UAV systems. On the other hand, not all multi UAV systems form a FANET. The UAV communication must be realized by the help of an ad hoc network between UAVs. Therefore, if the communication between UAVs fully relies on UAV-to-infrastructure links, it cannot be classified as a FANET. For example, aerial robot team is a collaborative and autonomous multi-UAV system, and generally, its network architecture is ad hoc. In this sense, ad hoc based aerial robot teams can also be viewed as a FANET design. However, aerial robot team studies mostly concentrate on the collaborative coordination of multi-UAV systems, not on the network structures, algorithms or protocols.

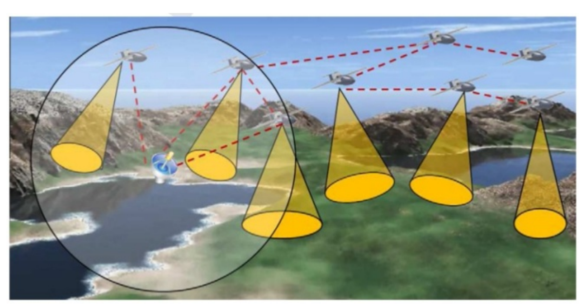

Fig 8: A FANET scenario to extend the scalability of multi- UAV systems

Topology change Depending on the higher mobility degree, FANET topology also changes more frequently than MANET and VANET topology. In addition to the mobility of FANET nodes, UAV platform failures also affect the network topology. When a UAV fails, the links that the UAV has been involved in also fail, and it results in a topology update. As in the UAV failures, UAV injections also conclude a topology update. Another factor that affects the FANET topology is the link outages. Because of the UAV movements and variations of FANET node distances, link quality changes very rapidly, and it also causes link outages and topology changes

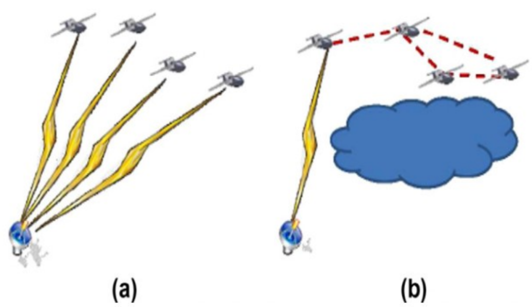

Fig 9. A FANET applicatiom scenario for reliable multi-UAV communication network.

FANET ROUTING PROTOCOLS

FANET routing protocols are categorized into four main classes;

• Static protocols have fixed routing tables there is no need to refresh these tables.

• Proactive protocols, or table driven protocols, have routing tables that are periodically refreshed.

• Reactive protocols, or on-demand protocols, dynamically discover paths for messages on demand.

• Hybrid protocols are a combination of proactive and reactive protocols

VII. NS 2 SIMULATION

Network Simulator (Version 2), widely known as NS2, is simply an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviors.

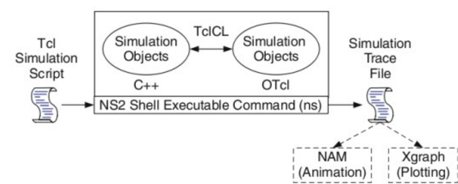

Fig 10. Basic NS2 architecture

NS PROGRAMMING STRUCTURES:

1. Create the event scheduler
2. Turn on tracing
3. Create network topology
4. Create transport connections
5. Generate traffic

VIII. CONCLUSION

In a FANET, one of the objectives of the movement is to maximize region coverage. One of the basic services provided by a wireless detector network is monitoring the specified region. We addressed the problem of dynamic routing in mobile client partitioning by applying the mobile target detection technique in mobile Fly devices name as UAV based Seamless Connectivity Solution.The proposed a enhanced solution for our basic FANET model to avoid the Fly Rob failure. The proposed system extra-mobile fly's for failure recovery unit. Here successfully tested our proposed system with NS2.

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