Technology Commercialization Opportunity

Multi Meshed Tree (MMT™) Algorithm for Mobile Ad-hoc Networks (MANETs)

Technology Description

The MMT algorithm **provides a mechanism to build meshed trees in mobile ad-hoc networks (MANET)**, where the tree branches can overlap or mesh at several nodes. The amount of overlap is limited only by the degree of the nodes in terms of their communications links with their neighbors and the network attributes that can be tuned to specific applications. The algorithm further allows for the simultaneous construction of several overlapped meshed trees, to extend the coverage of the network in terms of number of MANET nodes supported. MMT offers high route redundancy, which can be very useful in MANETs with highly mobile nodes.

The MMT algorithm also **helps in the formation of clusters of meshed trees** in MANETs. Within a cluster the trees aid in providing proactive routes. For communicating between distant nodes, the solution includes a process for route discovery and maintenance at the cluster-level, thus **avoiding high amounts of message flooding, which normally take up the channel bandwidth**.
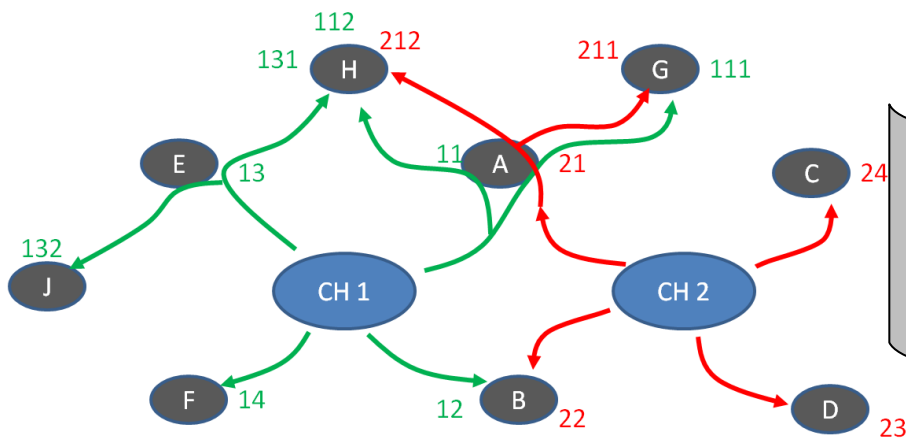
The operation of MMT depends on the concept of virtual path vectors, which are based on virtual IDs (VIDs). The VIDs can be further used by the medium access control (MAC) protocol to forward the packets along a path without the need for a different MAC address.

The MMT algorithm has been evaluated for surveillance networks of one hundred unmanned aerial vehicles (UAVs) both with directional and omni-directional antennas. The evaluation was conducted using Opnet and ns2 simulation tools. The motion trajectories for UAVs were circular/elliptical (clockwise and counter-clockwise) with speeds of 300 to 400 Kmph. The MAC protocol was a modified version of the carrier sense multiple access/collision avoidance (CSMA/CA) which works efficiently with the VIDs and is called the burst-forwarding MAC. The comparison conducted with two popular routing protocols namely OLSR (optimized link state routing) and AODV (ad hoc on-demand distance vector), show the very superior performance achieved using MMT and the modified MAC.

With omni-directional antennas, a cluster based spatial time-division multiplexing MAC that works well with MMT algorithm, was used.

The MMT algorithm was also evaluated for a MANET of *ground troops and slow moving ground vehicles*, where the node mobility was modeled as random waypoint, along with the modified CSMA/CA MAC protocol.

The MMT evaluation studies, conducted using Opnet as the simulation tool, indicate MMT's capability to work with different types of MAC protocols and demonstrate the versatility of the algorithm for different applications.

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The tree branches are grown as a sequence of VIDs. The green meshed tree and red meshed tree mesh further at nodes A and H to form multiple overlapped multi hop clusters. CH1, 2 are Cluster Heads.

Keywords: Meshed Trees, Multiple Meshed Trees, Route Robustness, Burst Forwarding MAC, Ad-hoc Networks, Wireless Networks, Self-forming Networks, UAV Communications

Technology Readiness

MMT is presently at this level of readiness:

Idea	Concept	Simulations	Prototypes	Test Bed	Commercial

The developers of MMT will work with licensees to finalize the development and move MMT towards a "commercial version."

Intellectual Property

MMT was awarded US Patent 8582500.

Target Applications and Customers

- UAV surveillance networks
- Network of airborne nodes
- MANET and mesh networks
- Sensor networks
- Rescue operations and fire fighter networks

Opportunity

RIT's Intellectual Property Management Office (IPMO) is interested in working with those parties who are qualified and interested in the commercialization of this MMT intellectual property. Arrangement types include licensing the application to existing organizations or new organizations that have expertise in the field or related fields.

Contact

Those interested in learning more about this opportunity should contact:

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