ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 7, July 2016

Improving Reactive Greedy Reactive Routing in Flying Ad Hoc Networks

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Abstract: **One of the most important design challenge for multi-UAV (Unmanned Air Vehicle) systems is the interaction which is essential for cooperation and collaboration between the UAVs. If entire Unmanned Air Vehicle systems are directly connected to an infrastructure, such as a satellite or a ground base, the interaction among UAVs can be realized through the infrastructure. However, this infrastructure based communication architecture restricts the capabilities of the multi-UAV systems. Ad-hoc networking between UAVs can solve the problems generating from a completely infrastructure based UAV networks. The objective of this thesis contains two parts. First part, includes the enhancement in available RGR routing protocol in which one is particular to topology based protocols and applies specially to the available RGR protocol. The other enhancement is for RGR as well as geographic routing. Second part, includes the proposal of a realistic mobility model for FANETs simulation. If we assume the Packet Delivery Ratio (PDR), there is still a room for enhancement in the performance of the available RGR. As we already aware that RGR contains two operating modes (Reactive and Greedy Geographic), thus we must improve both the modes by yielding the two introduced enhancement of ours as it appears completely logical to enhance both the operation modes. On other sides, several test have been performed on RGR and a no. of routing protocol in FANETs and MANETs under an unrealistic mobility model: the Random Waypoint (RWP) mobility model. It results to many physical movements which are not possible to be done by RWP in the context of FANETs because of the aerodynamic and physical restrictions of UAV.**

I. INTRODUCTION

Unmanned Aeronautical Specially appointed Systems (UAANETs) [1] are a kind of Versatile Impromptu Systems (MANETs) [3], which are base less and self-arranging systems. The specificity of UAANETs is that they are only airborne and are framed by little and medium estimated Unmanned Elevated Vehicles (UAVs) [2] that can be conveyed for an extensive variety of regular citizen and military applications. Those applications incorporate, yet are not restricted to: protecting or looking missions in case of common fiascos, for example, tidal waves, sea tempests, tremors and so on.; the foundation and upkeep of impermanent Web or phone systems to permit

Planning steering conventions for UAANETs is exceptionally testing because of the profoundly changing system topology that follows from the high versatility of UAVs joined with their restricted transmission ranges. In MANETs, in this manner in UAANETs too, the steering conventions can be ordered into two gatherings [4]: topology-based conventions and position-based conventions. Topology-based conventions are directing conventions where the data about the connections in the system is utilized as a part of request to set up and look after courses. Among these topology-based conventions, we encourage recognize proactive (e.g. Destination Sequenced Separation Vector (DSDV) [5], Enhanced Connection State Steering Convention (OLSR) [6], and so forth.), responsive (e.g. Impromptu On-interest Separation Vector (AODV) [7], Dynamic Source Directing (DSR) [8], and so on.) and crossover (e.g. Zone Steering Convention (ZRP) [9]) conventions. In the gathering of position-based conventions, we have conventions that don't depend on connection states. Rather, just the hubs' physical area data is key. Those conventions are likewise called geographic steering conventions, and the principle one is Eager Geographic Sending (GGF) [14]. The thought is to forward the information bundle to the neighbor whose area is nearer to the destination than that of the sending hub (FN).

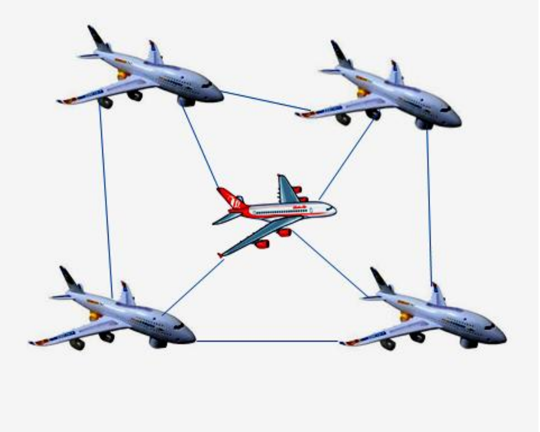

Figure 1: dimensional structure of UAANET

II. The RGR

Responsive Avaricious Receptive (RGR) [1] is a directing convention intended for UAANETs. RGR incorporates both the attributes of topology-based conventions and position-based conventions. RGR is, essentially, a blend of AODV and GGF with no recuperation technique. RGR, as its name recommends, works in 2 modes that substitute: the Receptive/AODV mode and the Voracious/GGF mode. To sum things up, in RGR, a change to the GGF mode is performed at whatever point a sending hub experiences a broken connection to the following jump in AODV mode. In the AODV mode, amid course revelation/development, freshness and length (in jumps) are the criteria for course determination. In any case, because of the elements of UAANETs, courses (chose by the previously stated criteria) are being proclaimed invalid much of the time. This course breakage recurrence can be brought down on the off chance that we ensure that the courses that are chosen are those with some level of dependability/security. Along these lines, including a dependability basis in the course choice/development procedure of RGR is a center of this work. In GGF, when the FN has no neighbor whose area is nearer to the destination than it is, the bundle is dropped and GGF is said to have fizzled. There exists in the writing a ton of recuperation techniques to address this GGF disappointment, and those procedures result in various kinds of a geographic steering convention. The procedures plan to rescue those parcels that would have generally been dropped when GGF comes up short. Notwithstanding, huge numbers of these methodologies have issues, running from high overhead, high unpredictability, and inapplicability in UAANETs. Despite the fact that we concentrate on 2D UAANETs in this exploration (generally for their relative straightforwardness), we remember that genuine UAANETs are in 3D. In this manner, each system or upgrade that we propose should be effectively extendable to 3D. Presently, some GGF disappointment recuperation techniques, for example, the planar chart based ones, are forthright not extendable to 3D, which is the reason they are esteemed inapplicable to UAANETs. All the previously stated inadequacies are the motivation behind why another recuperation procedure to handle GGF disappointment with regards to UAANETs is likewise a center of this work.

The development example of UAVs in UAANETs relies on upon the sort of utilization that they are being utilized for. Reviews displayed in [11] demonstrated that portability models significantly affect the execution of system steering conventions. In this manner, the decision of a portability model is basic. It is much more basic when we consider the physical imperatives (mechanical and streamlined) of UAVs. UAVs have a tendency to keep up the same speed and alter course by making turns with vast radii [10], which is not the situation for ground vehicles that can stand to make sudden stops, sharp turns, and so forth. In this work, we propose a portability model that catches sensible development examples of UAVs.

III. RGR PROTOCOL ENHANCEMENTS

In this segment, we talk about the three upgrades that were made to enhance the execution of RGR.

3.1 RGR with Scoped Flooding

The first RGR convention acquired RREQ flooding to the entire system amid course disclosure process from AODV, alternatively utilizing an extended ring seek method. We call this methodology blind flooding in the rest of this report. Despite the fact that the quantity of UAVs in the system is moderately little, dazzle flooding includes high convention overhead, conceivably bringing about support flood and system blockage. So as to decrease the quantity of RREQ bundles, two distinctive perused flooding systems intended for RGR are talked about beneath. The main instrument is as per the following. At the point when a course disclosure procedure is started interestingly, the source hub surges the RREQ parcels into the entire system and sits tight for the RREPs from the destination hub. At the point when the RREP bundles land at the source hub, a substantial receptive course will be set up and, meanwhile, the area data of the destination hub will be learnt by the source hub. After a brief timeframe, another course revelation procedure may should be performed for the same destination hub because of a course break brought on by the exceedingly dynamic topology of our UAANET situations. For this situation, utilizing the destination area learnt already, the source hub figures the separation to achieve the destination and incorporates this outcome in the RREQ parcel (and additionally its information of the destination's area). This new demand bundle is telecasted to every single neighboring hub. After accepting the RREQ bundle, a neighbor hub removes the separation esteem from the RREQ parcel and recalculates its own separation to achieve the destination hub. On the off chance that this new separation is not exactly the separation from the RREQ parcel, the neighbor hub ought to supplant the old worth with the new one in the RREQ bundle and rebroadcast the bundle to its neighbors. Else, this RREQ parcel will be disposed of. This procedure proceeds until the RREQ bundle achieves the destination hub, which then answers by means of a RREP, overhauling its area data all the while. The source hub will hold up to get a course answer to the perused RREQ. On the off chance that the geographic data is obsolete, this perused flooding may fizzle and the source will issue another RREQ after a predefined timeout, expanding the source-destination separation by a settled rate. In our usage, we utilized an expansion of 20% for each rehashed RREQ. The RREQ conveys a reiteration counter, permitting halfway hubs to correspondingly apply an expanded separation to the destination with every redundancy. Basically, this gives some extra "slack" in the RREQ proliferation. After a particular number of retries, say 5, the source hub will change from perused flooding to visually impaired flooding.

The second system relies on upon the realities that the source hub as well as different hubs in the system take in the destination area in RGR. At the point when course revelation is started the first run through, the source hub will set the separation to the destination to be zero and adds this to the RREQ parcel. From that point, the source hub shows the RREQ bundle to all neighbors. Each neighbor accepting the RREQ parcel first checks whether it has geographic data identified with the destination hub. At the point when a hub does not know the destination area, it rebroadcasts the RREQ bundle. Something else, the transitional hub figures its own particular separation to the destination hub and contrasts it and the separation esteem in the RREQ parcel. In the event that the separation esteem removed from the RREQ is zero, that is to say the past hub does not know the destination area, the middle of the road hub incorporates the ascertained separation into the RREQ parcel and rebroadcasts it. In the event that the separation esteem removed from RREQ is nonzero, the middle hub thinks about this separation worth to its own particular separation to the destination as above. In the event that the hub's separation is not exactly the separation esteem from the RREQ, the RREQ separation quality will be upgraded and the RREQ rebroadcasted. Something else, the middle of the road hub drops the RREQ parcel. This procedure is rehashed until the RREQ parcel achieves the destination. Expecting that no hub in the entire system knows the geographic area of the destination, this component debases to visually impaired flooding. Then again, not at all like the primary instrument, we don't as a matter of course need to depend on visually impaired flooding the first run through a course demand is issued. On the off chance that a source hub utilizes off base area data, this adaptation of perused flooding may come up short also. For this situation, the source will re-issue a RREQ with 0 separation after unsuccessfully sitting tight for a RREP.

3.2 RGR with Delayed route request

As indicated by the first RGR convention proposed in [1], if a course breaks while transmitting information bundles, a change from receptive steering to GGF will happen. The moderate hub won't erase the information bundle regardless of the fact that there is no substantial course passage. Truth be told, utilizing GGF, this information bundle can be sent to the neighbor hub which is the nearest to the destination hub. In the mean time, a RERR bundle will be created to tell the forerunner hubs that a course is broken. The antecedent hubs will retransmit the RERR bundle until the parcel follows back to the source. Right now, another course disclosure procedure will begin, if the source hub still has information bundles for the same destination.

RGR with deferred course ask for depends on GGF to enhance the execution in UAANETs. Since GGF is utilized as a fallback component, it is superfluous to send back the RERR bundle instantly when a course break happens, in light of the fact that each moderate hub in the RGR convention still can transmit .

.information parcels without having a substantial course to the destination hub. Truth be told, a past study demonstrated that for a little number of jumps, GGF has a high achievement likelihood to achieve the destination [14]. Until another receptive way is built up, a middle of the road hub can continue sending information parcels to its neighbor hub which is nearest to the destination hub. A RERR bundle will be produced and sent back to the forerunner hubs following a few moments delay. At the point when the RERR bundle achieves the source hub, another course revelation procedure will start. Deferring RERRs will possibly diminish the quantity of RREQs flooding the system (perused or indiscriminately).

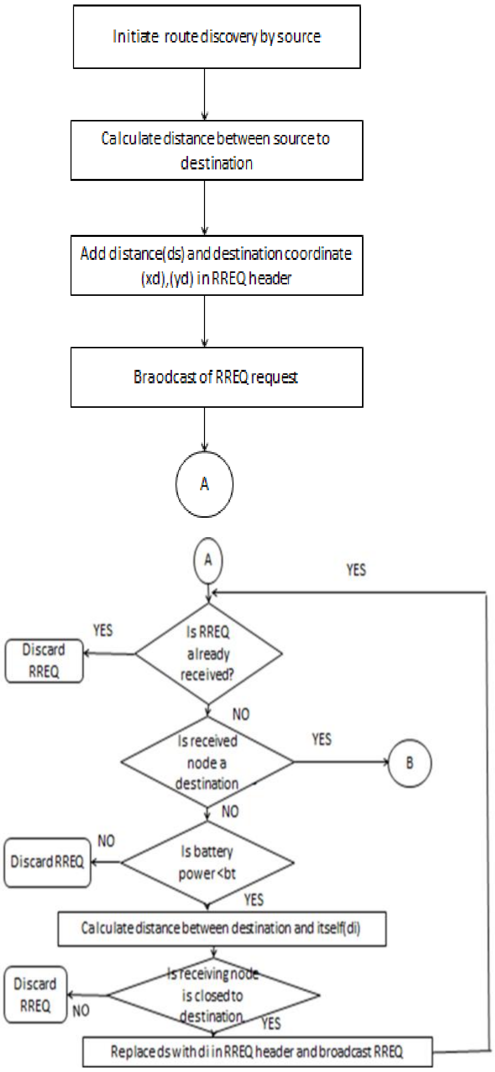

Figure 2: Proposed Algorithm

III. SIMULATION SETUP

This paper work using a simulation tool 'NS2' and 'RIVERBAD' for performing simulation. A campus network of size 1500 m x 1500 m is using for simulating varying number of mobile nodes. All the mobile nodes are spreading within this area. Each scenario takes 1200 seconds (simulation time) for running. Under each simulation we check the behaviour of RGR routing protocol with 10 m/s speed and constant (100) pause time. For examining average statistics of the delay and throughput for the RGR routing protocol of FANET, we collected DES (Global Discrete Event Statistics) on each protocol and Wireless LAN. In Table 3.1 describe the simulation parameters that are used in this simulation of the performance of RGR routing protocol over a FANET network.

Table 3.1 . Simulation Parameters

	Simulation Parameters
Examined Protocols	RGR
Number of Nodes	100, 150, 200, 250
Types of Nodes	Mobile
Simulation Area	1500*1500 meters
Simulation Time	1200 seconds
Mobility	10 m/s
Pause Time	100 seconds
Performance Parameters	Throughput, Delay
Traffic type	FTP
Mobility model used	Random waypoint
Data Type	Constant Bit Rate (CBR)
Packet Size	512 bytes

IV. RESULTS AND ANALYSIS:

There are various kinds of performance metrics for the performance evaluation of the routing protocols such as delay, network load, throughput, packet delivery ratio etc. These performance metrics are very necessary for evaluation of the routing protocols in a communication network. In this dissertation work for performance improvement of RGR routing protocol in terms of two performance metrics such as delay and throughput. The protocol need to be checked against certain parameters for their performance. If a routing protocol gives low end to end delay so this means routing protocol is efficient as compare to the protocol which gives higher end to end delay. Throughput represents the successful deliveries of packets in time. If a protocol shows the high throughput so this means it is the best and efficient protocol rather than the routing protocol which have low throughput. These parameters have great influence in the selection of an efficient routing protocol in any communication network. In the next subsections all considered performance metrics with simulation results has been described.

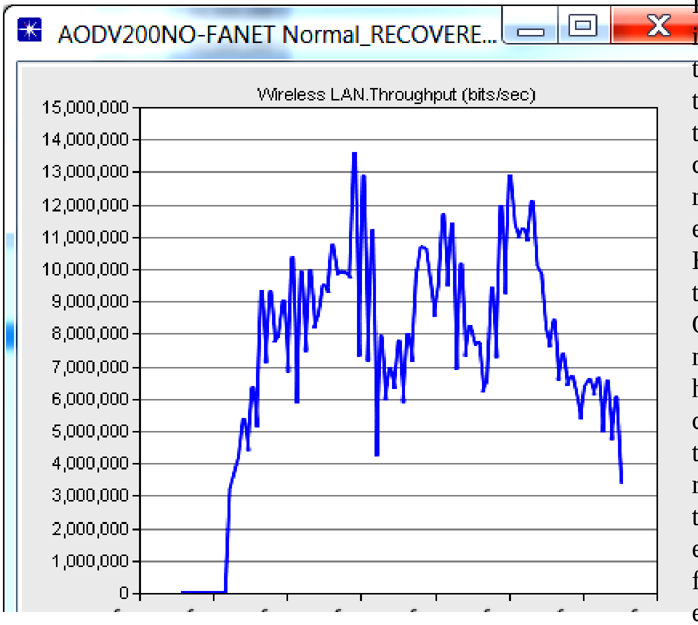

Figure 3: Throughput at 200 nodes for Normal Scenaio

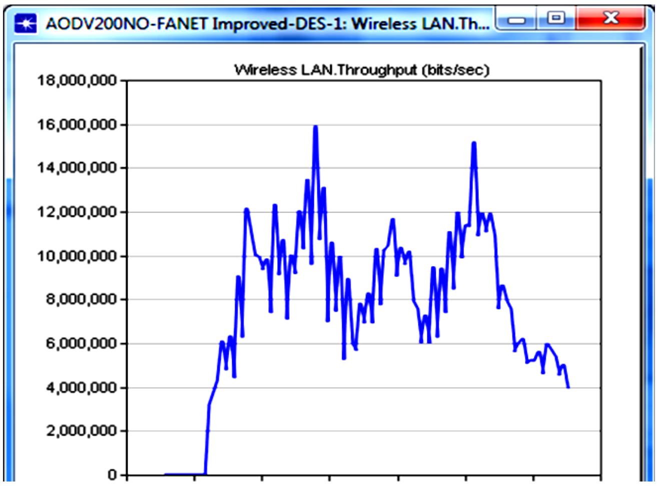

Figure 4: Throughput at 200 nodes for improved Scenaio

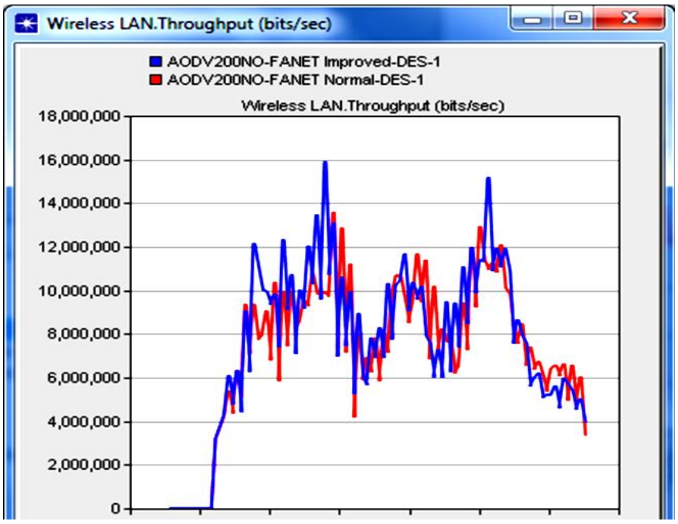

Figure 5: Throughput at 200 nodes for Normal and improved Scenaio

CONCLUSION

In this report, a no. of improvements to the RGR protocol are introduced and measured. The new protocol takes benefit of the nodes location information and velocity vector to assess the real time status of the adjacent hop node. Depending on the reactive route status, each intermediary node has the capability to decide whether to forward data packets via the reactive route or switch to GGF immediately. This change enhances PDR and decreases control message overhead. Extensive OPNET simulation studies were done to measure the relative advantages of these novel protocols.

Our simulation results explain that scoped flooding and mobility prediction results in importantly lower overhead, higher packet delivery ratio and lower end-to-end delay in comparison of the original AODV and RGR protocols. From these results, we can conclude that it is severe to examine the real time status of the adjacent hop node during the data transfer stage and both scoped flooding techniques are efficient in suppressing the RREQ control messages flooding. In the meantime, the technique of delay of RERRs efficiently decreases overhead.

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