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HIGHER PRIORITY SELECTION MESSAGE (HPSM) FOR DATA TRANSMISSION IN FLY AD HOC NETWORK

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Abstract- Flying Ad Hoc Networks (FANETs) need a set of parameters that are specific to the application. One of these parameters is energy, which must be measured regularly for as long as Flying ad hoc network exists. Most routing protocols, especially on-demand routing protocols like Dynamic Source Routing (DSR), mostly focus on finding the route with the shortest number of hop count. This leaves problems like delay and power management unsolved. In this research, we propose a novel high-priority transmission-based Energy saving Mechanism (HPSM) approach for flying ad hoc networks, which is an enhancement of the existing normal DSDV and DSR routing protocols. The UAVs are lightweight and heavyweight devices, and their use completely depends on the purpose. The UAVs are battery-powered devices, and we can use these devices for sort communication and by using multiple UAVs, transfer the data from one UAV to other UAVs. The main goal behind the development of the proposed HPSM is to reduce energy consumption and provide important information with high priority. In the proposed HPSM scheme, after route establishment, assign priority to senders based on their previous transmissions. If the UAVs have lost their energy or their energy is below then the threshold value, it means there is no need to establish the connection The performance of HPSM, DSDV, and DSR is measured by using performance matrices. The simulation is done in the NS-2 simulator, and the simulation results show that the performance of the proposed HPSM protocol is much better than that of the DSDV and DSR routing protocols. The proposed HPSM protocol enhances network performance by allowing a greater number of packets to be sent and received in the network.
Keywords: Mobile ad-hoc network, energy-aware DSR, threshold, average energy, link breakage, routing.

I. INTRODUCTION

FANETs are a type of network made up of a group of small UAVs that are connected on an as-needed basis and work together to reach high-level goals. FANETs are important because they let UAVs move around, don't have a central hub, let UAVs organize themselves, and let UAVs talk to each other when they need to. Flying Ad-Hoc Networks are a new type of ad-hoc network that is made up of UAVs or drones that can be the same or different and talk to each other, interact with each other, and work together to collect data using sensors [1,2,3]. FANETs can be used to send information quickly and easily, just like Ad-Hoc networks, in places like flood zones, earthquake-affected areas, and battlefields, and tracking the status of a mountain eruption, among other places. To improve service, each FANETs node needs to have strong hardware that can talk to a server on the ground or a satellite. FANET also has problems with how well people can communicate. FANETs are very resistant to single threats or network failures because they don't have a central infrastructure.

Also, because these networks don't need help from outside, they can be easily moved anywhere. On the one hand, these features make FANETs the best choice for a wide range of jobs, but on the other, they make networking a lot harder. Because UAVs move quickly and in unpredictable ways, the configuration of a FANET can change a lot, and a node must quickly change its routing tables to keep up.

IoT forms a cyclic phenomenon which combines the usage of sensors or UAV to create a connection and sense the user and a network to communicate with a person as it further aggregates the standards and provides a machine with augmented intelligence which helps it to analyze, behave and act according to the situation. The combination of priority based communication in air improves the performance of UAVs. The FANETs can operate either autonomously or by transmitting the flow received from land-based devices to a remote server or can also support other types of networks, for example, via cellular and satellite, if they are overloaded or unavailable [4,5,6].

The main objective of this scheme is successful data delivery at destination in minimum overhead (reduce overhead by assign priority to users or senders) because it limits the flight time of the drones, the speed of connection, and the range of the signal transmitted by them, so the challenges that need to be overcome to make FANET a reality involve primarily the search for solutions to these limitations, and in addition other factors can affect.

II. RELATED WORK

This section discusses about various existing prediction system of the link reliability and delay minimization in FANET, various researches have been conducted to design and develop technique for delay minimization but some research done in field of link reliability. In this section, various method discuses to optimize the FANET network by delay, throughput, packet delivery ratio, cost and overhead based techniques.

Chintan Kanani, Amit Sinhal [7] "Ant Colony Optimization based Modified AOMDV for Multipath Routing in MANET" This title talks about a modified ad-hoc on-demand multipath distance vector (AOMDV) for multipath routing in mobile ad-hoc networks (MANETs) using an ant colony. For this reason, Ant-AODV is used to compare with Ant-AOMDV. Both Ant-AODV and Ant-AOMDV work because the RREQ message packets are sent to a single path in Ant-AODV-based routing and to multiple paths in Ant-AOMDV-based routing. In terms of the standard ACO algorithm that ants use, RREQ message packets can be thought of as pheromones. Routing performance is expected to improve if the pheromone of the transmission path is updated regularly and the transmission path is chosen on the fly. Simulations show that the Ant-AOMDV algorithm does a better job than Ant-AODV in terms of the percentage of packets that are delivered, the normal routing load, and the number of packets that are dropped, compared to AODV and AOMDV. The main goal is to cut down on routing costs and traffic and improve performance [14, 15].

E. selvi m. s., and Shashidara[8] "an efficient routing optimization using secure reverse Multicast bellman ford ad-hoc routing using AOMDV protocol in MANET", In this title, we will talk about a new multiple-constraint QoS multicast routing optimization algorithm in MANET called SRMBAR (Secure Reverse Multicast Bellman-Ford Ad-hoc Routing). SRMBAR (Secure Reverse Multicast Bellman Ford Ad-hoc Routing) ensures a QoS guarantee by allowing reverse multicast routing on possible multiple paths between source and destination and helps reduce routing overhead through the Routing Interference Communication (RIC) framework. The proposed SRMBAR can improve the reliability of data transmission, optimize the maximum link utilization, which ensures the integrity of the data, and then reduce the amount of time used and the time it takes to send the data. Experimental results show that the reverse multicasting method is better than the existing Bellman-Ford algorithm, works well in multicast traffic engineering, and can be used to test the stability of routes in dynamic mobile networks.

Manjinder Kaur, Dr. Vinay Chopra, [9]"Implementation of Rank Based ACO approach with Load Balancing in Ad hoc Network for Multipath Routing Mechanism" Ad-hoc wireless networks are multi-hop wireless networks that can set themselves up on their own. Mobile ad hoc networks have some problems, like making a good routing protocol. The congestion network can be fixed with the multipath routing protocol and load balancing. Since they don't depend on the infrastructure, ad hoc networks are set up as needed. Ad Hoc networks are low-cost, multi-hop wireless networks that can organize themselves. We think that using multiple paths to send data at the same time can improve the performance of a network. We propose a protocol called LB-AOMDV (Load Balancing-AOMDV), which is a way to get a better load-balancing mechanism. We also apply the ant colony optimization technique to the routing problem. Finally, we use a ranked-based ACO approach, which is an extension of ACO. We call the new protocol, which has been changed, the Rank-Based Ant Colony Optimization algorithm (LB-AOMDV). The main goal of the protocol's design was to cut down on routing overhead, response time, and end-to-end delay while improving performance.

Aws Kanan, Taisir Eldos, Mohammed Al-Kahtani [10] "Mobile Ad Hoc Networks Routing Using Ant Colony Optimization" In this title, we use the ant colony evolutionary optimization method to solve the routing problem, where the guided probabilistic choice of paths can take more of these desirable qualities into account. Ant Colony Optimization (ACO), which is a biological system, is used to model a routing system. Several factors are used to study how adaptable the system [16,17].

Amanpreet Kaur, Gurpreet Singh [11] "ACO Agent Based Routing in AOMDV Environment" We are trying to add agents to AOMDV behavior in this title. So, the new protocol will take advantage of both the ant-like nature and the multipath nature of AOMDV. The modified idea is simulated, and the results are compared with AOMDV, AODV, and DSR routing protocols for a few performance parameters [18].

S. Kanimozhi Suguna , Dr.S.Uma Maheswari [12] "Comparative Analysis of Bee-Ant Colony Optimized Routing (BACOR) with Existing Routing Protocols for Scalable Mobile Ad Hoc Networks (MANETs) based on Pause Time" In this title, a new way of making an ad-hoc routing algorithm that is based on swarm intelligence is suggested. Ant colony foraging behaviour, which is a subset of swarm intelligence, is the ability of simple ants to solve complex problems by working together. Different kinds of problems, like optimization problems, can be solved with algorithms that are based on ant colony problems. The proposed algorithm is compared, and the results show that the approach could be a good way to route data in mobile ad hoc networks [19, 20].

Yuhui Deng, Lin Cui, Deng Deng Liu [13]"Ant colony-based energy control routing protocol for mobile ad hoc networks under different node mobility models" In this paper, we propose the ant colony-based energy control routing (ACECR) protocol, which uses the positive feedback nature of ant colony optimization to find the best route (ACO). In our ACECR protocol, the routing choice depends not only on the number of hops between nodes and the energy of each node but also on the average and minimum energy of the routes. Different mobility models are used to test how well our ACECR routing protocols work. We also do a lot of simulations to learn about how different mobility models move and what effect they have on routing protocols. Simulations show that ACECR does better than existing protocols at using energy in a balanced way and keeping the network running for longer [21, 22].

III. PROPOSED APPROACH

Flying ad hoc network (FANET) is a collection of flying devices with ground base station which collaboratively participate in data communication. The communication technology grown to invent the new era of network such as FANET, MANET, VANET which minimize the direct participation of human to control & decision making of system. In this research, enhance the flying ad hoc communication performance which able to impactful utilized in different application under FANET.

Flying ad hoc network is uses in military services, rescue operation, forest surveillance and drone based drug delivery system in remote areas where direct communication is not possible. In this research proposal develop the higher priority selection message (HPSM) to transfer message from source unmanned aerial vehicles (UAV's) or internet of things (IoT) to base station (BS). The HPSM system useful where the flying UAV's or IoT are limited and more of UAV's or IoT want to transfer data to base station, HPSM system assign the priority number to every UAV"s on the bases on type of data which is given in table 1. While more number of UAV's want to sent same type of data than we apply within the priority of data as first and sent data to base station (BS).

Table 1 Priority to type of data

Type (TCP or UDP)	Application layer (CBR or VBR)	Priority	Measures
TCP	VBR	High	11
TCP	CBR	Medium	10
UDP	VBR	Low	01
UDP	CBR	Lowest	00

A. Routing Strategy of HPSM

Proposed higher priority selection message (HPSM) use the base routing protocol as ad hoc on demand distance vector in multi hop environment and deploy the flying ad hoc network where UAV's or IoT device sent the data to base station (BS) through modified AODV routing. While any UAV want to send data to BS than call the AODV routing with energy approach and select the best path which contain higher energy and provide higher reliable communication to BS. After selection the route UAV send the actual data packet to BS device. In this approach while more number of UAV's want to sent data in same time to BS than apply HPSM method to select UAV's for data transmission using their priority value and assign channel to them. Proposed HPSM method is more reliable and low overhead with low energy consumption technique for data transmission in flying ad hoc network (FANET).

IV. PROPOSED ALGORITHM

In this section, we'll talk about the higher priority selection message (HPSM) algorithm, which shows how to run a protocol step by step. In a formal sense, the proposed algorithm is split into three parts: input, output, and procedure. In the input section, you define all of the variables that will be used as input values in the procedure execution section, such as UAV, base station (BS), UAV location, speed, energy, memory, radio range, etc. In the output section, describe the output values, such as the percentage of data received, the normal routing load, throughput, delay, etc. In the procedure section, describe the algorithm's step-by-step execution. In this section, the flying ad hoc network is first set up, and the source node starts the route execution on an on-demand basis. In the routing phase, the route is searched based on energy, memory, and the location of FANET, and the route from the source to the base station is found. In the last section, once the route has been set up, the source node will start sending data packets. During data transmission, each intermediate UAV will use the priority module to schedule data transmission based on the type of data, sending the highest priority data first. The HPSM gave TCP+VBR data a higher priority and UDP+CBR data a lower one. This is more useful in military service, where drone or UAV systems are used to send data to a base station (BS). Using a message called a "priority selection message," the HPSM algorithm reduces network congestion and energy use while speeding up the network and getting more data into FANET.

Algorithm: Higher priority selection message (HPSM) for FANET

Input:

F: Flying ad hoc network

UAV's: Unmanned aerial vehicle

U_i: intermediate UAV's

BS: Base Station

L_{oc}: current location of U_i

$Speed_i$: speed of U_i

Prt: priority of data (3, 2, 1, 0) where 3 is higher, 0 lower

E_n= Energy of UAV's

E_{con}= Energy consumption per second

D_{type} = (TCP, UDP, CBR, VBR)

T_x: Transmitter UAV ∈ F

R_x: Receiver BS ∈ F

M_{in}: Initial Memory Size 50 in UAV's

M_{util}: Memory Utilization

D_{drop}: Data Drop

N_{proto}: (AODV) Network Layer Protocol

Ψ: Radio Range $550m^2$

Output: Percentage of data receives, normal routing load (NRL), Throughput (Kbps), Delay [ms], data dropped.

Procedure:
Step 1: Deploy FANET (F)
Step 2: Call N_{proto} (AODV, T_x, R_x)
Step 3:
While (U_i in Ψ & U_i != Rx)
Compute in U_i Node
L_{oc} & Speed of Ui
Step 4: **If** U_i in specify direction and speed ≤ avg(speed of U_i))
E_{con}: E_{n_o} (before transmission) - E_{n_r} (after transmission)
Percentage of M_{uti_i} = (M_{uti_i}/ M_{in_i})*100
Step 5: **If** (%M_{uti_i} ≤ 80% & E_{con} ≤ avg (E_{con}) & E_n ≥ avg (E_n))
U_i select in route
U_i forward Packet to Next U_{i+1}
Step 6: **If** (U_{i+1} == R_x)
R_x Receive R_{proto}(AODV, T_x, R_x)
R_x Create reverse route & Send Ack
T_x Call Data_Send(Data, T_x, R_x)
Else
U_{i+1} goto 3
End if
Else Packet Not forward to Next hop
Call R_{proto} (AODV, T_x, R_x)
End if
Else U_i in Not the direction of BS
Stop search
End if
End While
Step 7: Data_Send(Data, T_x, R_x)
Step 8: While T_x ≥ 1 in same time
Call priority selection module
Prt retrieve data type info from al T_x
Assign prt on the bases of D_{type}
select higher priority T_x for data transmission
Use Route based on AODV
Send Data (Data, T_x, R_x)
End Procedure

V. RESULT ANALYSIS

The Network machine (Version 2), wide referred to as NS2, is just an occurrence driven simulation tool that has tested helpful in finding out the dynamic nature of communication networks. Simulation of wired, wireless further as unplanned network functions and protocols like UDP, TCP etc. may be done victimization
NS2. In general, NS2 provides users with how of specifying such network protocols and simulating their corresponding behaviors. Because of its flexibility and standard nature, NS2

has gained constant quality within the networking analysis community since its birth in 1989. Ever since, many revolutions and revisions have marked the growing maturity of the tool, because of substantial contributions from the players within the field. Among this square measure the University of Calif. and university UN agency developed the important network machine, one the inspiration that NS is predicated on. Since 1995 the Defense Advanced analysis comes Agency (DARPA) supported development of NS through the Virtual inhume Network workplace (VINT) project. Presently the National Science Foundation (NSF) has joined the ride in development. Last however not the smallest amount, the cluster of researchers and developers within the community square measure perpetually operating to stay NS2 sturdy and versatile.

A. Simulation Paramters-2

Table 2 show the simulation parameters used to create the DSDV proactive and DSR reactive routing protocols scenarios. In the evaluation, the full simulation model based on Network Simulator 2 (version 2.31) is used. The NS instructions can be used to specify the network's topology and mobility mode, as well as to configure the service provider and recipient.

Table 2: Simulation Parameter

Parameters	Value
Area of Simulation	1000m x 1000m
Antenna Type	Omni-Directional
UAVs	25, 50, 75, 100
RSUs	4
Radio Range (meters)	550
Network Type	FANET
Transferring Mode	Multi-hop
Maximum Speed (ms)	Random
Routing Protocol	HPSM, DSDV, DSR
Transport Layer	TCP , UDP
Traffic	CBR
Application Layer	FTP
Simulation Time (sec)	100
Packet Size	512 bytes

B. Percentage of Data Receives

The percentage of packets received is one of the important factors in measuring the performance of the HPSM, DSDV and DSR networks. This graph shows the comparison of packets received by the proposed HPSM, DSDV and DSR. In the case of the proposed scheme, the receiving percentage is approximately 88%, but the PDR is approximately 94%, implying a 5% (minimum) difference in PDR performance. PDR counts the packet percentage, and it is more or less dependent on the number of received packets with respect to sending packets. The better packets received mean full utilization of the UAV's battery capacity for communication. The HPSM approach reduces energy consumption and enhances the performance of networks. The detail packets receiving percentage performance statistics are also mentioned in Table 3.

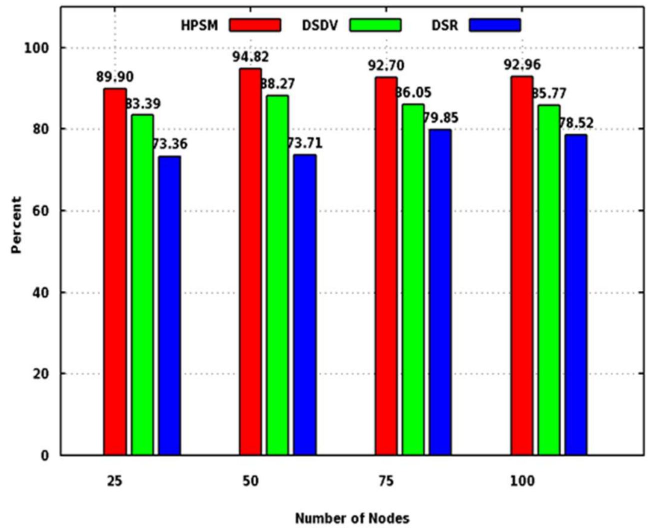

Figure 1: Data Receiving Analysis

Table 3: Percentage of Data Receives Vs Number of UAVs

Number of UAVs→	25	50	75	100
HPSM	89.9	94.82	92.7	92.96
DSDV	83.39	88.27	86.05	85.77
DSR	73.36	73.71	79.85	78.52

C. Analysis Normal Routing Load

Normal Routing Load (NRL) is the number of routing packets in a network divided by the total number of data packets that network receives. The lower NRL means that a reliable connection has been made between the sender and the receiver, but it also uses up the limited energy of UAVs. If a smaller number of routing packets are delivered in the network, it means that the energy used by UAVs because of routing packet delivery is also reasonable. This graph shows the NRL performance of DSDV, DSR and proposed HPSM schemes. Here we clearly visualized that in DSR routing overhead, 8 is showing, DSDV is 2.5, and the proposed HPSM is less than one. In HPSM, the lower number of routing packets flooding the network means that the energy consumption of nodes as compared to normal DSDV and DSR is too low. The lower overhead also shows better packet receiving and smoother communication between sender and receiver. The detailed routing load performance statistics are also mentioned in Table 4.

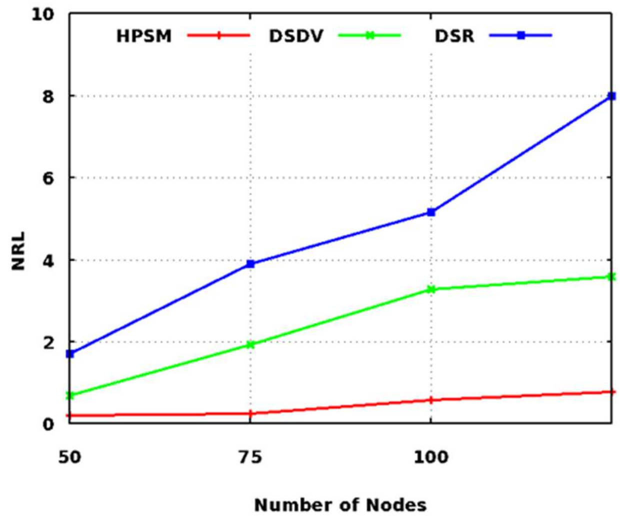

Figure 2: Analysis of Normal Routing

Table 4: NRL Vs Number of UAVs

Number of UAVs→	**25**	**50**	**75**	**100**
HPSM	0.2	0.25	0.59	0.79
DSDV	0.69	1.94	3.27	3.6
DSR	1.72	3.9	5.16	7.99

D. Throughput Analysis [Kbps]

One of the important performance metrics to measure the performance of a network is throughput analysis. Throughput is the number of packets a network sends or receives per unit of time. In this graph, the throughput is shown for the proposed HPSM, DSDV and DSR. Here, the throughput performance is 1450 kbps (maximum) in 100 node density scenarios. In the HPSM scheme, UAVs are utilizing their energy for communication and not wasting it on retransmission. This shows the lesser number of packets dropped in the network in all node density scenarios. The lowest throughput value of DSR is 250 kbps at 50 node density, the same as in DSDV (510 kbps), but in HPSM it is 1000 kbps. The difference is more than 500 with DSR and 500 with DSDV. It means the life of the network and packets receiving in the network are longer in the proposed HPSM. The detailed throughput performance statistics are also mentioned in Table 5.

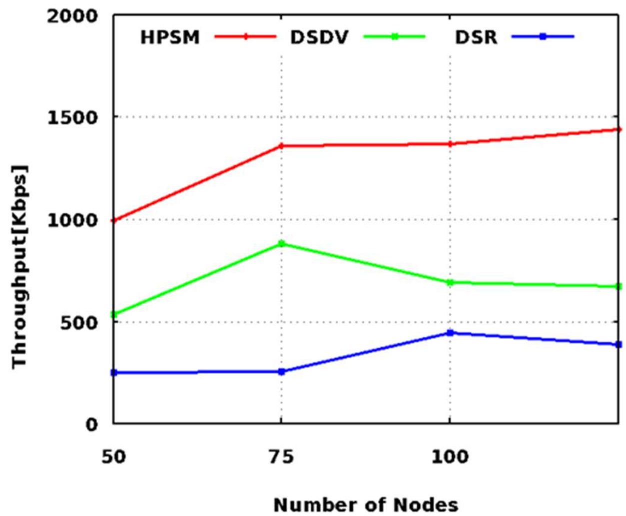

Figure 3: Throughput Analysis [Kbps]

Table 5: Throughput Vs Number of UAVs

Number of UAVs→	25	50	75	100
HPSM	996.43	1359.77	1370.03	1441.03
DSDV	536.69	881.92	690.09	675.3
DSR	250.34	257.21	444.48	386.57

E. Average Delay Analysis [ms]

There are two types of protocols working at the transport layer. One is the Transmission Control Protocol (TCP), and the next is the User Datagram Protocol (UDP). Both of the protocols have a specific role in communication. In this graph, we measure the delay performance of HPSM, DSDV, and DSR in FANET. Delay is always less desirable in networks because more delay means more overhead and dropped data packets. The performance of all the schemes is the same as evaluated in different node density scenarios (25, 50, 75, 100). The proposed HPSM has a longer delay in the 50- and 75-node densities because connection establishment takes time. This delay is noting for dropping of data. The performance in both node density scenarios is better than the other. It means that the performance of DSR routing is very poor due to increased network latency. The detailed delay performance statistics are also mentioned in Table 6.

Table 6: Delay Vs Number of UAVs

Number of UAVs→	25	50	75	100
HPSM	0.22	0.2	0.25	0.19
DSDV	0.24	0.15	0.07	0.25
DSR	2.15	2.9	1	0.96

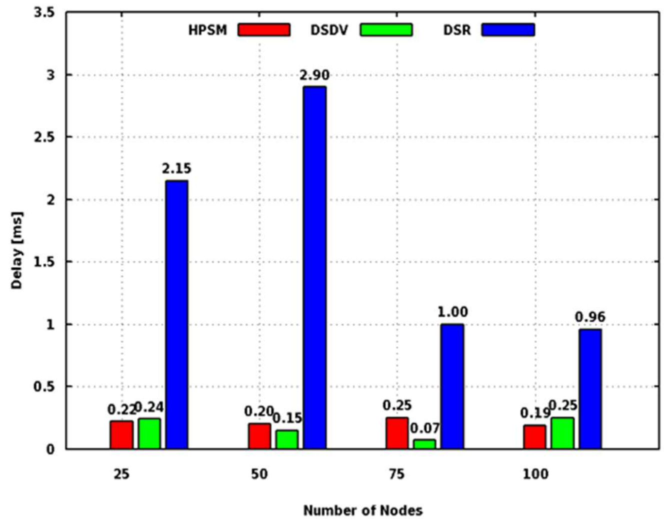

Figure 6: Delay Analysis

VI. CONCLUSION AND FUTURE WORK

UAVs must have enough energy and use less energy when communicating to keep a network's topology connected. The sending power of a mobile node is controlled for as long as the network is up and running. The idea behind this is to determine the best possible route between the source and the destination, or to find the route that has a sufficient amount of energy, which minimizes the power consumed during the transmission of packets along this route. The failure of a single UAV can significantly affect the performance of the selected route in network. Again, the performance of the network greatly depends on application specific parameters like node energy and bandwidth. The main aim of this research is to ensure that the links in the network are not broken due to the insufficient energy of mobile UAVs. In this research, the high-priority transmission-based energy saving mechanism (HPSM) is described. The priority of senders is determined by their previous transmission. The number of senders is trying to send the data by the same route or UAVs, but only those with high priority can send data in the network. Simulation results justify the advantage of using the proposed HPSM over the normal proactive DSDV and reactive DSR protocols. However, the performance exclusively depends on the energy of the UAVs in the network. On the other hand, more energy can be utilized for the transmission of the data packets. In this research work, the performance of table-driven routing protocols, namely DSDV and reactive DSR simulation results, is also mentioned. Simulation results justify that the power consumed in the transmission of data packets using the proposed HPSM is less as compared to that in the previous DSDV and DSR. The overall performance of the flying ad hoc network is improved by HPSM. The proposed HPSM approach improves the receiving packets percentage by 5%, increases throughput by 10%, and reduces delay by 10%.The overall performance of HPSM is better than the existing two routing schemes in FANET.

As an extension to future work, this idea can be verified with a wide range of flying ad hoc, on-demand multipath routing protocols such as AOMDV and TORA the performance of the proposed protocol is compared with the existing HPSM approach.

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