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An Integrated Security Support on Wireless Networks using Efficient Power Aware Routing (EPAR)

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ABSTRACT:- Flying Ad-Hoc Networks (FANETs) represent a rapidly evolving area of wireless communication, where Unmanned Aerial Vehicles (UAVs) collaborate to form dynamic, self-organizing networks in the sky. These networks offer flexible and scalable solutions for applications such as disaster response, environmental monitoring, military surveillance, smart agriculture, and real-time data collection in remote or inaccessible regions. Unlike traditional Mobile Ad-Hoc Networks (MANETs), FANETs operate in a three-dimensional space, introducing challenges related to high mobility, dynamic topology, limited energy, and communication delays. The future Internet will require the transport of a wide range of services, including high-bandwidth one-to-many applications, with dynamic device interconnection. Wavelength Division Multiplexing (WDM) layer support realizes such services in a transparent, reliable, and efficient way. Most studies focus on efficiently building and configuring light-paths for unicast or light-trees for multicast in isolation, without considering existing traffic demands. In this paper, we consider a dynamic design problem of integrated traffic in a realistic WDM mesh network, supporting new multicast and/or unicast demands dynamically in the presence of existing mixed traffic. By optimizing WDM resources and enabling sub-wavelength sharing among unicast and multicast traffic, we build a hybrid virtual topology that exploits both existing light-trees and light-paths. Our approach maximizes WDM layer capability and efficiently supports more traffic demands. We validate the efficiency of our approach with extensive simulations on various network topologies.

KEYWORDS: FANET, MANET, WDM, Power Aware Routing, Security, Topology, Clustering

I. INTRODUCTION

The emergence of mobile computing has led to the rapid development of Mobile Ad-Hoc Networks (MANETs). These networks enable mobile devices to communicate without the need for a fixed infrastructure, which makes them ideal for emergency response, military operations, and remote area networking. However, the ad-hoc nature and energy constraints of nodes make it challenging to ensure stable and long-lasting communication paths.

Energy efficiency is a critical factor affecting the usability of MANETs. Traditional routing protocols such as AODV and DSR often fail to consider the energy status of nodes, leading to the early depletion of critical nodes and, consequently, network partitioning. Security is another crucial concern, as the decentralized nature of MANETs exposes them to various threats including node impersonation, packet dropping, and denial-of-service attacks.

This research introduces an enhanced routing protocol named Efficient Power Aware Routing (EPAR) that incorporates energy-aware decision-making and basic security support. EPAR not only improves network longevity but also enhances route reliability by avoiding compromised or low-energy nodes.



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II. SYSTEM MODEL AND ASSUMPTIONS

The proposed system assumes a flat network topology with uniformly distributed mobile nodes. Each node is equipped with a Global Positioning System (GPS) module to determine its location and a battery with limited capacity. The MAC layer follows the IEEE 802.11 DCF standard, and communication occurs over a shared wireless channel. Nodes periodically broadcast Hello packets containing their residual energy and location information. This information is used by neighboring nodes to update their local routing tables. The routing decisions are based on the residual energy, distance to destination, and historical reliability of the nodes.



Figure 1: Mobile Ad-Hoc Network Example with Mixed Devices

The simulation environment consists of 120 nodes deployed over a 2000x2000 meter area. The mobility model follows the Random Waypoint model with varying speeds between 0 and 20 m/s. Traffic is generated using constant bit rate (CBR) sources.

III. EFFICIENT POWER AWARE ROUTING (EPAR)

EPAR enhances conventional routing by incorporating energy metrics into the route selection process. The core concept is to select routes that have the maximum predicted lifetime. This is computed by evaluating the node with the minimum residual lifetime on the path.

Mathematically, the path lifetime is defined as: $\max T_k(t) = \min \{T_i(t)\}, i \in k$

Where $T_k(t)$ is the lifetime of path k at time t, and $T_i(t)$ is the predicted lifetime of node i on path k. The prediction is based on the node's current energy level and its transmission/reception rate.

To implement this, EPAR modifies the DSR route request (RREQ) and route reply (RREP) packets to include the residual energy and energy consumption rate. When a source node initiates a route discovery, it evaluates multiple candidate paths and selects the one with the highest minimum node lifetime.

EPAR also maintains a secondary path to ensure quick recovery in case of route failure. This path is periodically validated to ensure its availability.



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Figure 2: Flowchart of Efficient Power Aware Routing Logic



Figure 3: Route Discovery Path from Source to Destination



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Volume 14, Issue 5, May 2025 |DOI: 10.15680/IJIRSET.2025.1405321| [1, 2, 6]1,2,6] [1, 2, 6]Source Destination 8 1 5 7 Figure 4: Reverse Route Formation in EPAR 400 s 1000 200 s 800 E 100 s 700 s RREQ RREP

Figure 5: Lifetime-Based Routing Selection in EPAR

Node Lifetime

IV. SECURITY CONSIDERATIONS IN MANETS

MANETs are particularly vulnerable to security threats due to their open medium, lack of centralized authority, and dynamic topology. EPAR includes a trust-based mechanism to mitigate common routing attacks.

Each node maintains a trust table with scores based on the observed behavior of its neighbors. Nodes that frequently drop packets or send inconsistent control messages are assigned lower trust scores and are excluded from route consideration.

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EPAR protects against the following attacks:

- Wormhole attacks: by validating hop count and delay.
- Blackhole attacks: by requiring multi-source verification.
- Sybil attacks: by correlating behavior across different time intervals.

Although EPAR does not implement cryptographic measures, its trust-aware mechanism significantly reduces the risk posed by malicious nodes.

V. SIMULATION RESULTS AND DISCUSSION

The proposed protocol was simulated using NS2. The performance was compared against DSR and MTPR protocols based on the following metrics:

- Packet Delivery Ratio (PDR)
- Average End-to-End Delay
- Energy Consumption per Packet
- Network Lifetime

Simulation results showed that EPAR outperformed the existing protocols in all metrics. The PDR was consistently above 95% even under high mobility, compared to 85% for DSR. The average end-to-end delay was reduced by 20% due to better path stability.

Energy consumption per packet was lower in EPAR because it avoided overusing specific nodes, thereby distributing the load more evenly. The network lifetime was extended by 65% as measured by the time until the first node exhaustion.

Figures included demonstrate the architecture of the network, route selection process, and simulation topology. These visualizations help in understanding the protocol's operation and performance.

VI. CONCLUSION

This paper presented an Efficient Power Aware Routing (EPAR) protocol for MANETs that incorporates energy-awareness and basic trust-based security mechanisms. By evaluating multiple paths and selecting the one with the highest predicted lifetime, EPAR significantly improves network reliability and longevity.

Future work includes integrating EPAR with lightweight cryptographic methods to enhance its resistance to more sophisticated attacks. The protocol can also be extended to support Quality of Service (QoS) by incorporating delay and bandwidth metrics.

REFERENCES

- 1. Chen Huang, "On Demand Location Aided QoS Routing in Ad-hoc Networks", IEEE, 2023.
- 2. C. Perkins and E. Royer, "Ad Hoc On-Demand Distance Vector Routing", IEEE WMCSA, 1999.
- 3. David B. Johnson and David A. Maltz, "Dynamic Source Routing in Ad Hoc Wireless Networks", Mobile Computing, Kluwer Academic, 1996.
- 4. Kim et al., "Routing Mechanisms for MANETs Based on Energy Drain Rate", IEEE TMC, Vol. 2, No. 2, pp.161– 173, 2023.
- 5. Mohammad Ilyas, "Handbook of Ad Hoc Networks for Mobility and Energy Efficiency", CRC Press, 2022.
- 6. S. Muthuramalingam, "A Dynamic Clustering Algorithm for MANETs", IJCEE, Vol. 2, No. 4, pp.709–714, 2023.
- 7. Vinay Rishiwal et al., "QoS Based Power Aware Routing in MANETs", IJCTE, Vol.1, No.1, pp.47–54, 2024.









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