An Angle-based Geographic Routing Protocol with Adaptive Information Diffusion for Multi-UUV Networks

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***Abstract*—With the development of Underwater Acoustic Sensor Networks (UASNs), Unmanned Underwater Vehicles (UUVs) have become essential tools for underwater exploration. The collaboration of multiple unmanned underwater vehicles enables larger-scale missions, which require addressing the inter-vehicle communication challenges. UUVs exhibit high mobility and are energy-constrained, resulting in highly dynamic network topologies. Moreover, such networks cannot afford high-overhead topology maintenance methods. To tackle the issues of high mobility, energy constraints, and unstable links in multi-UUV underwater mobile swarm networks, this paper proposes a geographic routing protocol named APID(Routing Protocol with Adaptive Position Information Diffusion and Angle-based Forwarding). The protocol introduces an adaptive beacon interval mechanism, a self-decision location information diffusion strategy, a forwarder selection method based on confidence and forwarding angle, and a packet buffering mechanism. These features effectively enhance routing stability and energy efficiency in dynamic environments. Simulation results show that compared to GPSR, Improved GPSR, and OLSR, the proposed protocol improves the packet delivery rate by 24.23% and reduces the average energy consumption by 18.89%.**

***Keyword*—Geographic routing protocol, UASNs, Multi-UUV, Angle-based forwarding, Adaptive information diffusion**

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