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REVIEWER'S REPORT

Manuscript No.: IJAR-58622

Title: PBAU: Lightweight Provenance Based Node Authentication for the Internet of Underwater Things

Recommendation:

Accept as it is .....

Accept after minor revision.....yes.....

Accept after major revision .....

Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality			Y	
Techn. Quality			Y	
Clarity			Y	
Significance			Y	

Reviewer's ID: JPR-Dr.Shaweta Sachdeva

Detailed Reviewer's Report

A. Major / Technical Comments (for Reviewer)

1. Novelty & Contribution:
The idea of using historical communication behavior / provenance metadata instead of key-exchange is interesting, but distinction from existing trust-based and provenance-based schemes for IoT/UWSN is not sharply established. Please add a clear comparison table of PBAU vs recent provenance-based authentication.

2. System Model Clarity:
The Thorp-absorption acoustic channel model and O(1) per-packet hash chain operation is claimed but not mathematically detailed in Section III-IV. Please provide equations for energy model and complexity analysis.

3. Baseline Selection Justification:
RBEER and EERMC are routing protocols, BEKMP is a blockchain key-management protocol. Comparing an authentication framework directly with routing protocols is misleading. Why not compare with authentication-only baselines like?[58][75][77]

4. Security Analysis Depth:
Resistance to replay, Sybil, MITM, wormhole, insider is claimed verbally. No formal security proof, game-based or AVISPA/BAN logic. At least add attack-wise reasoning with provenance forgery probability.

5. Statistical Reporting:
Good that you did 30 runs with 95% CI and Bonferroni-corrected t-tests (Fig. 11, Table

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IV). However, F(3,116) implies 4 groups. Please report effect size (Cohen's d) and exact MATLAB configuration - node count, area, mobility, acoustic range, malicious %.

6. Authentication Accuracy Interpretation:
Fig. 11(a) shows PBAU (0.912) and BEKMP (0.905) difference is not significant (p=0.09). This should be honestly discussed in abstract/conclusion, not just claimed as "marginally ahead".

7. Overhead Metric:
Communication overhead defined as "packets/round". Does this include provenance field size? Provenance chain will increase packet size - that cost is not captured. Please report bytes overhead also.

B. Minor / Presentation Comments

8. Figure Quality: Fig. 11 (a,b,c) bar charts have low resolution and CI bars are barely visible. Provide high-res with data labels.
9. Table IV: Table IV is truncated in the manuscript. Metric (ep.10) row is cut after 2nd image. Please reformat.
10. Language: Some sentences are long and repetitive, e.g., Line 360-363. Proofread for grammar.
11. Limitations: Section VI mentions limitations well - good. Expand point 2: how would channel-faithful wormholes defeat provenance? Suggest a mitigation.
12. Real Validation: All results are MATLAB simulation. Add discussion on feasibility on real acoustic modems / Aqua-Sim / sea-trial constraints.

C. Positive Comments (If you want to recommend acceptance)

13. Paper addresses a very relevant problem for resource-constrained UWSNs and proposes a lightweight alternative to heavy cryptographic exchange.
14. Experimental design is rigorous for a simulation paper - 30 independent runs, ANOVA + post-hoc tests, multiple QoS + security metrics (Delay, Throughput, Energy, Alive nodes, Detection Rate).
15. Results convincingly show PBAU achieves lowest communication overhead (~15 pkts/round vs 18-22) while maintaining ~0.91-0.92 authentication and detection rates.
16. The provenance record structure and zero node-side crypto cost concept is well-motivated for battery-constrained environments.
17. Future work is honestly stated.