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Editor-in-Chief

Simulation Modelling Practice and Theory

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Subject: <u>Submission of Manuscript — Simulation-Based Modelling of the Ant Roaming Algorithm (ARA) for Adaptive Security Patrols in Resource-Constrained Environments</u>

Dear Editor,

I am pleased to submit our manuscript entitled "Simulation-Based Modelling of the Ant Roaming Algorithm (ARA) for Adaptive Security Patrols in Resource-Constrained Environments" for consideration for publication in Simulation Modelling Practice and Theory. This paper introduces the Ant Roaming Algorithm (ARA), a biologically inspired simulation framework that integrates ant colony optimization principles with reinforcement learning, anomaly detection, and real-time computer vision. The framework is validated through agent-based simulation experiments on a graph representation of the University of Calabar campus, demonstrating superior patrol coverage, faster response times, and stronger compliance compared to baseline strategies. The key contributions of this work are:

i   A rigorous mathematical formalization of ARA as a simulation model.

ii   Integration of AI modules (PPO, Isolation Forest, YOLO) within the simulation framework to enhance adaptability and resilience.

iii   Empirical validation through agent-based simulation experiments, confirming ARA's superiority over random and static patrol strategies.

We believe this manuscript is well aligned with the scope of Simulation Modelling Practice and Theory, as it advances both the theoretical foundations and practical applications of simulation modelling in multi-agent systems and security contexts. The work is original, has not been published elsewhere, and is not under consideration by any other journal.

We respectfully request your consideration of this manuscript for publication. Thank you for your time and attention. We look forward to your feedback.

Sincerely,

Osahon Okoro (Corresponding Author)

On behalf of all co-authors: Obono Iwara Ofem, Ofem Ajah Ofem, Essien Eyo Essien