

ICRAMCS 2026

THE EIGHTH EDITION OF THE INTERNATIONAL CONFERENCE ON
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April 23-24-25, 2026 | Marrakech, Morocco



AI-Blockchain Framework for Resource-Usage Governance and Optimization: Architecture, Traceability, and an Evaluation Protocol

Communication Info

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Keywords:

- (1) Artificial intelligence
- (2) Permissioned blockchain
- (3) Data governance
- (4) Anomaly detection
- (5) Resource optimization

Abstract

Efficient resource-usage management requires integrating heterogeneous operational data (IoT signals, usage logs, and maintenance events) while ensuring trustworthy decision-making and auditability across stakeholders. We propose a computing-oriented framework that couples Artificial Intelligence (AI) with a permissioned blockchain to improve (i) operational efficiency via time-series forecasting and anomaly detection, (ii) accountability through tamper-evident logging of key events and decisions, and (iii) governance via auditable policies and access control. To preserve scalability and confidentiality, detailed records remain off-chain, while hashes and essential metadata are anchored on-chain and enforced by smart-contract rules. The architecture is modular: data collection → feature engineering → AI analytics → decision engine → blockchain anchoring/audit → governance dashboard. We define an evaluation protocol covering forecasting accuracy, anomaly detection performance, operational gains (simulated or observed), decision latency, transaction overhead, and traceability metrics (immutability, completeness, verifiability), with deployment considerations for enterprise permissioned platforms [1]–[5].

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