SCHOLARLY PUBLICATIONS
Centers of Innovation and Research (COIR)
KIIT Deemed to be University

Journal Name: IEEE Transactions on Consumer Electronics **IF: 9.9**

Title: A Bio-Inspired, Privacy-Preserving XAI Framework via Entropy-Driven Federated Learning for Consumer Healthcare devices

Author: Othman S.B.; Chakraborty C.; Singh S.; Chakraborty C.

Details: 17th June, 2026

Abstract: The proliferation of connected consumer healthcare devices has intensified the demand for decentralized artificial intelligence (AI) that learns from sensitive patient data while preserving privacy and ensuring clinical trust. Although Federated Learning safeguards data by keeping raw records on-device, it often yields opaque global models that lack local explainability, hindering regulatory approval and clinician adoption. To bridge this gap, we propose NeuroShield-X, a privacy-preserving Explainable AI (XAI) framework grounded in Entropy-Driven Federated Learning. NeuroShield-X features a defense-in-depth architecture that synergistically integrates: (1) adaptive importance sparsification for communication efficiency, (2) a novel XAI Fidelity Regularizer (R_{XAI}) to enforce explanation consistency at the edge, and (3) an Entropy-Driven Aggregation (EDA) scheme that dynamically weights client updates based on information richness and statistical trustworthiness. Evaluated on severely non-IID biomedical datasets, CVD-Health and Diabetic Retinopathy, NeuroShield-X achieves an 18.1% improvement in XAI fidelity over state-of-the-art federated XAI baselines, reduces communication overhead by 67.1%, limits accuracy degradation under poisoning attacks to just 5.2%, and accelerates convergence by 9%. These results establish NeuroShield-X as a robust, efficient, and trustworthy foundation for deploying transparent, privacy-preserving AI in real-world consumer healthcare systems.

URL: https://ieeexplore.ieee.org/document/11569082

SCHOLARLY PUBLICATIONS
Centres of Innovation and Research (COIR)
KIIT Deemed to be University

Journal Name: IEEE Transactions on Consumer Electronics **IF: 9.9**

Title: A Lightweight Large-Model Security Framework for Consumer Electronics Based on Sentiment Analysis in Online Consumer Platforms

Author: Othman Xu P.; Zhao H.; Chakraborty C.; Guduri M.; Guo Z.; Tolba A.

Details: June, 2026

Abstract: With the widespread deployment of consumer electronics and online consumer platforms, user-generated reviews have become a key source of emotional information for consumer-facing intelligent services. Although large language models achieve strong sentiment analysis performance, their high computational cost limits practical deployment in resource-constrained consumer electronics environments requiring real-time responses and efficient resource utilization. To address this issue, this paper proposes a lightweight large-model security framework for consumer electronics based on sentiment analysis in online consumer platforms. The framework integrates the Low-Rank Adaptation (LoRA) technique into RoBERTa to construct a RoBERTa-LoRA model, enabling efficient fine-tuning with minimal additional parameters while preserving semantic representation capability. Based on this model, a lightweight framework, RoBERTaL, is developed to support real-time sentiment-aware security analysis in consumer-facing applications. Experimental results on a real-world product review dataset show that RoBERTa-LoRA achieves an accuracy of 81.2% with only 0.3M additional parameters, demonstrating improved computational efficiency, deployment feasibility, and effectiveness in mitigating AI-driven opinion manipulation in consumer electronics systems.

URL: https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=30

SCHOLARLY PUBLICATIONS
Centers of Innovation and Research (COIR)
KIIT Deemed to be University

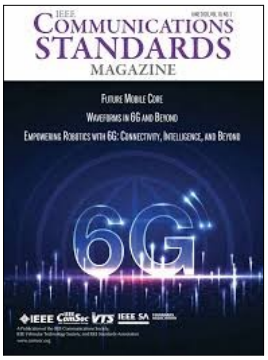
Journal Name: IEEE Communications Standards Magazine **IF: 5.1**

Title: Next Generation Wireless Networks: Edge-IoT Architecture on Healthcare Services

Author: Banerjee A.; Maity S.P.; Chakraborty C.; Guduri M.

Details: 30th June, 2026

Abstract: Sixth-generation (6G) healthcare networks are envisioned to deliver ultra-high data rates while ensuring intelligence, security, energy sustainability, and seamless edge collaboration. This article presents an Integrated Sensing and Communication (ISAC)-enabled Cognitive Radio–Reconfigurable Intelligent Surface (CR-RIS) framework for mission-critical healthcare environments. The proposed architecture integrates cooperative spectrum sensing (CSS), Primary User Emulation Attack (PUEA) detection, RIS-assisted beamforming, simultaneous wireless information and power transfer (SWIPT), friendly jamming for eavesdropping mitigation, and edge Artificial Intelligence (AI) within a structured cognitive superframe. To enable adaptive and resource constraint operation, a Deep Q-Network (DQN)-based control mechanism optimizes sensing duration, power allocation, RIS configuration, and secure transmission policies. Simulation results show that learning-driven coordination improves patient physiological data transmission (secondary user) throughput while satisfying sensing reliability, interference protection, energy causality, and secrecy outage constraints. The framework also highlights key standardization gaps in ISAC services, RIS control signaling, energy-aware Medium Access Control (MAC) protocols, and healthcare-specific security policies, providing a roadmap toward AI-native 6G healthcare systems.



URL: https://ieeexplore.ieee.org/document/11589219

SCHOLARLY PUBLICATIONS
Centers of Innovation and Research (COIR)
KIIT Deemed to be University

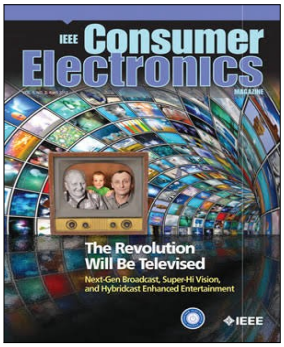
Journal Name: IEEE Consumer Electronics Magazine **IF: 5.0**

Title: Lightweight and Secure Real-Time Sensor-Text Grounding for Consumer AIoT Devices via Small Language Models

Author: Messou F.J.A.; Chen J.; Liu T.; Suresh P.; Chakraborty C.; Yu K.

Details: 26th June, 2026

Abstract: Consumer AIoT devices increasingly embed lightweight language model assistants for smart home monitoring, residential energy management, and consumer energy-awareness applications. However, these models hallucinate sensor values when asked about real-time device state because no temporal synchronization mechanism exists between sensor streams and language model context windows. This paper introduces the Temporal Grounding Pipeline (TGP), a lightweight and secure zero-dependency system that bridges the temporal gap between sensor updates (1–5 Hz) and language model inference (hundreds of milliseconds). TGP comprises four components: a novel in-process circular buffer achieving O(1) operations via Welford's online algorithm, a dual-criterion staleness detector with F1 = 0.98, a LoRA fine-tuned TinyLLaMA backbone (1.1B parameters, 4-bit quantized), and an optional causal validator. Evaluation across eight consumer AIoT datasets, spanning energy consumption and environmental sensing (commercial buildings, residential homes, household appliances, appliance-level energy, smart-home climate, smart-office occupancy, IoT air quality, and individual consumer electricity), demonstrates 81% average value grounding accuracy compared to 1–9% without grounding, 0.085 ms mean buffer latency (10.4× faster than Redis), and a total memory footprint of 1.09 GB that fits within the envelope of mainstream consumer AIoT hubs and smartphones. All computation remains on-device, ensuring secure, privacy-preserving operation without cloud dependencies.



URL: https://ieeexplore.ieee.org/document/11584922

SCHOLARLY PUBLICATIONS
Centres of Innovation and Research (COIR)
KIIT Deemed to be University

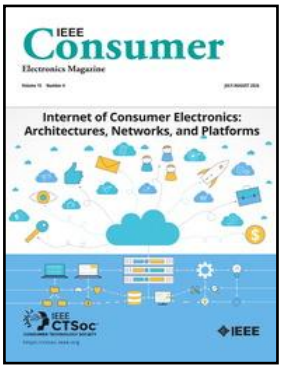
Journal Name: IEEE Consumer Electronics Magazine **IF: 5.0**

Title: Software Defined Network–Internet of Consumer Electronics for Intelligent Self-Powered Gas Sensor Monitoring

Author: Maity S.P.; Banerjee A.; Chakraborty C.; Singh S.

Details: Volume 15, Issue 4, July 2026

Abstract: Detection of harmful gases and their real-time monitoring in closed and open environments find applications such as safety in industrial settings, health monitoring, air quality tracking, etc. This article discusses the issue in the framework of an Internet of Consumer Electronics (IoCE). The model integrates Internet of Things (IoT)-based low-cost self-powered sensor deployment for gas sensing and software-defined network (SDN)-driven control, leading to SDN-IoCE. Reliable transmission of gas sensing data is essential and done through a reconfigurable intelligent surface-aided underlay cognitive radio network. Radio frequency energy harvesting is done for self-powering of sensor nodes. Two deep Q-networks are used, where the first one ensures seamless connectivity on gas sensing data transmission, while the other one performs its time-critical analysis. The proposed SDN-IoT architecture achieves 33-s- and 46-watt-lower values in delay/latency and energy consumption, respectively, over existing work.



URL: https://ieeexplore.ieee.org/document/11229933