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(57) Abstract :  
 The present invention proposes an AI-driven Reconfigurable Intelligent Surface (RIS) framework for interference mitigation and adaptive beamforming in sixth-generation (6G) wireless communication networks. RIS devices, composed of programmable metasurfaces, are capable of dynamically altering electromagnetic wave propagation by adjusting phase, amplitude, and polarization of incident signals. Unlike conventional infrastructure that relies on active and power-intensive solutions, RIS offers a low-energy, cost-effective, and scalable approach to shaping the wireless environment. The invention integrates artificial intelligence algorithms with RIS control mechanisms, enabling real-time optimization of reflection patterns to mitigate interference, enhance signal-to-interference-plus-noise ratio (SINR), and extend network coverage in line-of-sight (LoS) and non-line-of-sight (NLoS) scenarios. Through reinforcement learning and distributed optimization, RIS units autonomously adapt to user mobility, channel variations, and service demands, ensuring low-latency and ultra-reliable connections. The framework employs a hierarchical architecture, with local RIS controllers performing autonomous decisions while the 6G core coordinates global objectives. The system ensures energy efficiency by using lightweight AI models and minimizing unnecessary reconfigurations. Furthermore, the framework incorporates secure control protocols, anomaly detection, and privacy-preserving learning, making it resilient against malicious reconfiguration and cyber threats. Applications span healthcare, transportation, smart cities, industrial IoT, defense, and financial systems, where reliable, interference-free, and real-time communication is critical. By transforming the wireless environment into a programmable and intelligent asset, this invention establishes a future-proof solution that enhances spectral efficiency, scalability, and sustainability in 6G networks.

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