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(57) Abstract :

Machine Learning-Based Energy Optimization for Solar EV Charging with Integrated Air Pollution Control in Smart Cities is the proposed invention. The proposed invention focuses on method for autonomous urban energy management that utilizes a Deep Reinforcement Learning (DRL) framework to harmonize solar energy harvesting, Electric Vehicle (EV) charging demands, and active atmospheric remediation within a smart city infrastructure. The invention features an intelligent controller that processes multi-source data including real-time air quality indices (AQI), photovoltaic (PV) generation forecasts, and stochastic EV arrival patterns to optimize the dispatch of stored energy. Unlike conventional charging stations, this system integrates an air pollution control unit as a dynamic, flexible load, allowing the DRL agent to modulate filtration intensity based on the instantaneous state-of-charge (SoC) and local pollutant concentrations. By treating environmental purification as a secondary energy buffer, the system maximizes the utilization of surplus solar power, minimizes grid dependency during peak periods, and provides simultaneous green mobility and localized carbon sequestration. The resulting architecture operates as a self-optimizing node that adapts to the shifting energy and environmental requirements of a high-density urban ecosystem.

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