

NextGen Power Mobility: Advancing Vehicle Power Distribution Systems

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Abstract: *The increasing demand for sustainable and efficient energy solutions in modern mobility necessitates the advancement of vehicle power distribution systems. This paper presents NextGen Power Mobility, an innovative framework integrating advanced energy storage, high-voltage rectification, and power distribution mechanisms to enhance vehicle power management. The proposed system optimizes the conventional battery charging mechanism, incorporating an externally added energy storage unit to support high-load electrical applications. Additionally, a Central DC Power-House and Inverter-based Distribution Center are introduced for efficient energy utilization across institutional campuses and smart grid environments. The study evaluates the feasibility of vehicle-to-grid (V2G) and vehicle-to-load (V2L) applications, ensuring sustainable energy transmission for community-based infrastructures such as emergency lighting, street lamps, and common premises power systems. The proposed design is analyzed for efficiency, scalability, and sustainability, demonstrating its potential in enhancing energy resilience, reducing dependency on fossil fuels, and improving distributed energy management. The findings contribute to the development of smart, self-sustaining vehicular power ecosystems capable of supporting both mobile and stationary applications in future transportation networks.*

Keywords: Vehicle Power Distribution, Energy Storage, High-Voltage Rectification, Inverter-Based Power Systems, Vehicle-to-Grid (V2G), Distributed Energy Management, Smart Mobility

