Abstract of Ph.D. Thesis
"Control and Implementation of Microgrids Employing Renewable Energy Sources For EV Charging Infrastructure"
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This thesis presents the design, modelling, control, and implementation of hybrid microgrid configurations—centered around both common AC and DC bus architectures The research investigates the operational characteristics and control challenges associated with both common AC bus and common DC bus-based microgrids. Particular emphasis is placed on developing robust control strategies for voltage regulation, unity power factor operation, power quality improvement, and seamless transition between grid-connected and islanded modes under dynamic conditions. Moreover, emphasis on robust control under non-ideal grid scenarios is also part of proper investigation. Interlinking converters and shared converter topologies are explored for their role in coordinating power exchange between AC and DC domains while ensuring operational performance and minimizing harmonic distortion.

Additionally, this work evaluates the integration of multiple solar arrays and energy storage systems in parallel configurations to meet the high-power demands of modern loads, such as fast-charging EV stations. The thesis proposes unified control frameworks that support synchronized grid interfacing, dynamic load management, and power sharing among renewable and conventional sources Comprehensive simulations and hardware-based validations are carried out under various operating scenarios, including grid disturbances, load transients, and source intermittencies. The findings demonstrate the effectiveness of the proposed configurations and control methods in ensuring reliable, flexible, and high-performance operation of hybrid microgrid systems.