This thesis focuses on researching and developing a product designed to safely and effectively connect batteries in parallel, ensuring both safety and longevity. Currently, there are only a limited number of devices on the market that provide battery connections in parallel. Typically, batteries are connected in parallel directly without any additional circuitry. Some of the devices currently available on the market are so poorly designed that reports of fire incidents in electric vehicles continue to emerge. Chapter 1 discusses industry analysis, competitive analysis, product surveys, user surveys, and the wish specifications for the product.

Chapter 2 covers the applications of BMS, the fundamental components of BMS, charge balancing circuits, and various types of converters. It then explains a basic battery management system and the latest advancements in BMS. Finally, it discusses the parallel operation of batteries and the topologies used for connecting batteries in parallel. After examining each module and considering the desired specifications, a target specification is established at the end of this chapter.

Chapter 3 provides an in-depth design of all modules. It primarily covers the design of the DC-DC converter, sensing circuit, control algorithm, and the controller used for the active interconnection of the battery. The flowchart, circuit design, and simulation are carried out during the design phase.

Chapter 4 discusses the engineering and fabrication processes of the product in detail. It provides comprehensive information on the PCB layout, routing, mounting, and assembly of the hardware modules. Additionally, the chapter thoroughly examines the device's performance using Hysteresis control and PI control for the interconnection of DC supplies.

Chapter 5 concludes with user instructions, a comparison between PI and hysteresis controllers, recommendations for the next generation, and the future scope of the product.