A large number of power sources, operational in a microgrid, optimum power sharing and accordingly controlling the power sources along with scheduling loads are the biggest challenges in modern power system. In the era of smart grid, the solution is certainly not simple paralleling. Hence it is required to develop a control scheme that delivers the overall power requirements while also adhering to the power limitations of each source. As the penetration of distributed generators increase and are diversified, the choice of decentralized control becomes preferable. In this work, a decentralized control framework is conceived. The primary approach is taken where a small hybrid system is investigated and decentralized control schemes were developed and subsequently tested in a hardware in the loop in conjunction with the hybrid power system setup developed at the laboratory. The control design approach is based on the energy conservation principle. However, considering the vastness of the real power network and its complexity of operation along with the growing demand of smarter grid operations, called for a revamp in the control framework design. Hence, in the later phase of this work, a novel framework is developed based on the coupled dynamical system theory, where each control node corresponds to one distributed generator connected to the microgrid. The coupling topology and coupling strengths of individual nodes are designed to be adjustable. The layer is modeled as a set of coupled differential equations of pre-assigned order. The control scheme adjusts the coupling weights so that steady state constraints are met at the system level, while allowing flexibility to explore the solution space. Additionally, the approach guarantees stable equilibria during power redistribution. The theoretical development is verified using simulations in matlab simulink environment.