Holonic Multi-Agent Control of Intelligent Power Distribution Systems

NSF-CPS Award No. CNS – 1136040

Anil Pahwa, Sanjoy Das, Scott A. DeLoach, Bala Natarajan,

S. M. Shafiul Alam, Denise Case, M. Nazif Faqiry, Ahmad Malekpour

Kansas State University

This project will demonstrate a Holonic Multiagent System Architecture capable of adaptively controlling future electrical power distribution systems (PDS), which are expected to include a large number of renewable power generators, energy storage devices, and advanced metering and control devices. The project will produce a general, extensible, and secure cyber architecture based on holonic multiagent principles to support adaptive PDS. It will produce new analytical insights to quantify the impact of information delay, quality and flow on the design and analysis of the PDS architecture. Finally, it will develop a novel approach to automating PDS with high penetration of distributed renewable resources for higher efficiency, reliability, security, and resiliency.

The complex nature of future PDS will require them to adapt reactively and proactively to normal and anomalous modes of operation. The architecture produced by this project will be capable of optimizing performance and maintaining the system within operating limits during normal and minor events, such as cloud cover that reduces solar panels output. The architecture will also allow the operation of a distribution system as an island in emergencies, such as hurricanes/earthquakes, grid failures, or terrorist acts.