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Distributed Intelligence Systems: A New Paradigm for Systems Integration

By

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Centralized systems have disadvantages that make them unsuitable for large-scale integration, including high reliance on centralized communication, high complexity, lack of scalability, and high cost of integration. The use of distributed intelligence system technologies avoids these weaknesses. Distributed intelligence systems are based on the use of cooperative agents, organized in hardware or software components, that independently handle specialized tasks and cooperate to achieve system-level goals and achieve a high degree of flexibility. By distributing the logistic and strategic requirements of a system, it is possible to achieve greatly improved robustness, reliability, scalability, and security. Key to achieving these benefits is the use of holonic system technologies that establish a peer-to-peer environment to enable coordination, collaboration, and cooperation within the network. Such systems require both hardware and software components.

This lecture provides an overview of the technologies of distributed intelligence systems that have been developed by the presenter and his company, students, and colleagues, in cooperation with the Holonic Manufacturing Systems Consortium, and members of the Technical Committee on Distributed Intelligent Systems of the IEEE Systems, Man, and Cybernetics Society. A hardware and software architecture will be described for a wireless distributed intelligence system infrastructure being developed at Intelligent Robotics Corporation in cooperation with the Intelligent/Distributed Enterprise Automation Laboratory of Simon Fraser University (www.ensc.sfu.ca/idea). Some applications of distributed intelligence systems will be described, including distributed trading of digital services, RFID personnel and goods tracking, wireless automated meter reading, and resource management in distributed energy systems.