Control of Networks of Unmanned Vehicles

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At Berkeley we have been interested in design schemes for network of complex networks of semi-autonomous agents. These networks are characterized by interaction between discrete decision making and continuous control. The control of such systems is often frequently organized in hierarchical fashion to obtain a logarithmic decrease in complexity associated with the design, We have used as examples three classes of systems to motivate the design approach:

1. Intelligent Vehicle Highway Systems (IVHS)
2. Air Traffic Management Systems (ATMS)
3. Unmanned Aerial Vehicles

Over the last five years or so, a group of us have developed a set of design approaches which are aimed at designing control schemes which are live, deadlock free, and "safe". Our design methodology is to be considered an alternative to the verification based approaches to hybrid control systems design, and is an interesting blend of game theoretic ideas, planning and fault handling in a probabilistic framework, mathematical and temporal logic and planning ideas from robotics. In today's talk, I will focus on design problems involved in coordinating groups of Unmanned Aerial Vehicles (UAVs). Problems to be addressed include:

1. Design of embedded software for real-time control.
2. Vision based landing and navigation.
3. Pursuit Evasion problems for multi-UAV missions.

The last set of issues touches on issues of decentralized map making, computationally tractable solutions of pursuit evasion games with partial information and probabilistic verification. The work on UAVs is joint with (in alphabetical order) Joao Hespanha, Hyoun Jin Kim, John Koo, Maria Prandini, Omid Shakernia, David Shim, and Claire Tomlin.

K.G. Larsen and M. Nielsen (Eds.): CONCUR 2001, LNCS 2154, p. 36, 2001.