College of Engineering
Department of
Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

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Tureaud 103

A New Cooperative Behavior Control Paradigm: Emphasizing Prediction Over Communication

by Jamahl Overstreet.*

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In our near future, intelligent autonomous mobile robotic systems will be ubiquitous in everyday society, from personal to industry to military use. As the number of robotic systems geometrically increase, it is critical for these systems to be able to coalesce with neighboring intelligent entities, both organic and mechatronic. Therefore, the future paradigmatic vision of robot command and control must incorporate the basic necessities to allow for such collaboration with limited to no human-in-the-loop requirements. Many researchers address this issue by using models that emulate primitive cooperation of lower life-forms such as insects, flocks or herds, or elaborate means such as market-based bartering. The underlying perfunctory assumption for both methods is that there exists unlimited bandwidth to continuously communicate intentions and sharing of states; if left unchecked, this will further tax an already saturated wireless spectrum. Another major drawback is that they do not leverage the implicit intelligence of the autonomous systems themselves.

The proposed paradigm is a holistic approach for cooperation amongst synthetic intelligences that use "human" methods as its fundamental means of cooperation. As humans, we use our intelligence to predict the expected actions of our neighbors through an internal belief system, observations and learning. The discussion will focus on the development of the Autonomous, Cooperative, Command and Control Environment (AC3E) architecture that addresses the fundamental means of cooperation, and can be used as the total solution for facilitating autonomous cooperation between disparate, decentralized intelligent-autonomous agents. The significance of the paradigm AC3E is based on is that it addresses (i) a comprehensive philosophy for Cooperative Behavior Control (CBC) amongst non-uniform sets of heterogeneous agents, and (ii) the different components needed to realize such a system. The architecture comprehensively embeds the necessary pieces that solve the overall cooperative problem.

* Jamahl Overstreet received his B.S. and M.S degrees in the Mechanical Engineering Department from Polytechnic University in 1995 and 1999, respectively. His higher education focused on Robotic technologies specific to Control Systems, Mechatronics and Artificial Intelligence. In his professional tenure, he has held various academic and industrial positions. With respect to academia, he was the former General Engineering program director at Polytechnic University. Mr. Overstreet has also held many managerial positions specific to software and system research, development and integration. He has more than 10 years of experience in developing robotic systems, from platform to AI R&D. He was a Lead Engineer in the development of the Intelligent Navigation subsystem for the Autonomous Navigation System program of the Army's Future Combat Systems program, which was the largest contract ever awarded for a robotics project. His current research interests lie in the development of Cooperative Behavior Control methodologies, where he is pioneering a novel method of using prediction over communication to facilitate autonomous cooperation of heterogeneous intelligent-autonomous mobile systems with different levels of autonomy on mixed-initiative mission sets.