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Bridging sustainability to cyber physical systems: The cybernetic factory

Mauro Onori
KTH Royal Institute of Technology, Sweden

Cyber Physical Systems has become a major trend and with it a number of technologies that have been present for decades have been swallowed up into one single term. This presentation will sum up the current and past developments within CPS including the details of successful implementations of such systems in pre-industrial demonstrators. Industrially available embedded controllers, enabling the first re-configurable assembly systems were launched within the IDEAS FP7 project and included modular systems, multi-agent development platforms and an array of supporting software tools. This work then led to the openMOS Horizon 2020 project that is attempting to reach industrial standardization with some specified protocols and communication approaches. Nonetheless CPS is now broadening its spectrum and also encompasses cloud technologies that will open the way for remote monitoring, remote diagnostics and options we may not even have thought of today. All these potential opportunities, well detailed in the IIP Roadmap 2030, led the research team to propose the Cybernetic Production System approach. Spanning from self-configuration to self-organization and self-diagnostics, this proposed vision will hereby be detailed, including active European projects and other supporting technologies that are essential to its success: Adequate business models, human-robot collaboration and circular economy strategies.

onori@kth.se

A unified transition to massively robotized systems under spatial grasp technology

Peter Simon Sapaty
National Academy of Sciences, Ukraine

Large numbers of robotic facilities have already been accumulated worldwide in practically any sphere of human activity, and their further development is taking place with increasing speed in both civil and military areas. But in many cases they still remain as specialized devices with dissimilar, proprietary architectures and management and control. To embed advanced robotics into human societies in even greater scale (which is one of key trends of the 21st century), especially in critical areas, we must develop more general and universal approaches to their tasking and autonomous decision-making, also integration with human command and control infrastructures. The presentation will describe a high level, integral, gestalt-based formalism that can effectively express complex operations and top decisions in both physical and virtual environments regardless of who (humans) or what (robots) should perform them and in which numbers. This allowing us to make implementation in dynamic environments where manned and/or unmanned resources (and watershed in between) are determined not in advance but rather at runtime, depending on the current circumstances, where scenarios (say, of rescue missions) should always survive and fulfill objectives. The related Spatial Grasp Technology (SGT) will be described which can be implemented in distributed dynamic networks of communicating interpreters (embedded into individual equipment of soldiers, robots, smart sensors, etc.); these networks collectively executing integral and very compact mission scenarios in Spatial Grasp Language (SGL). SGT extensively uses mobile cooperative program code which can self-recover and self-redistribute after indiscriminate failures and damages of individual system components. Different exemplary scenarios in SGL will be presented and explained, including global awareness in distributed environments with parallel collection and dissemination of important information, say on discovered targets; advanced swarm robotic operations (represented on different system levels and their mixtures); tracing, identification, and analyzing mobile units of different natures in distributed spaces (say, from elderly people lost in urban environments to dangerous low flying objects with complex and unpredictable routes, etc.). SGT, already prototyped in different countries and tested on numerous networked applications, can be quickly ported on any platform needed.

sapaty@immsp.kiev.ua
peter.sapaty@gmail.com