PhD in Computer and Control Engineering

Research Title: Industry 4.0

Funded by	DAUIN and Istituto Superiore Mario Boella

Supervisor	Prof. Claudio Demartini claudio.demartini@polito.it

Contact	http://areeweb.polito.it/grains-group/index.php

Context of the research activity	Lately, the term "Industry 4.0" has been devised to refer to the most recent, just started, industrial revolution, that predicts a production world in which semantic technologies are used in order to create machine-processable information, machines are interconnected via the Internet of Things (IoT) and the Internet of Services (IoS), and the huge amount of collected data – the so-called Big Data – are analyzed in order to deduce additional information. In this view, the present Ph.D. program aims at analyzing the state of the art of intelligent systems employed in the Industry, and at designing and developing new solutions that could bring benefits to this field. Developed solutions could range from the real-time monitoring of the production line, to the automation of productive processes, to the support during the identification of new suppliers/customers/employers on the basis of information related to industry's materials and processes, etc Activities will be carried out in collaboration with the Istituto Superiore Mario Boella.

Objectives	The research field is wide-spreading and could concern different Industry's areas: - Production: exploiting IoT and IoS to devise systems able to a) real time locate materials and parts anywhere and anytime, enabling a better products' traceability; b) monitor current stock levels; c) autonomously adapt the production line in order to make different products, addressing customers' demands, thus reducing wastes; - Maintenance: laying the foundations for a better identification of problems or faults in the production line, by means of classification and learning techniques enabling predictive maintenance;

- Human resources management: by developing instruments relying on semantics for the identification of competencies possessed by employees, and their match with the ones required for performing production/commercial/management/administrative activities, in order to plan suitable training or hiring policies.

- Logistics: by exploiting autonomous navigation techniques in order to coordinate driverless vehicles or drones to deliver materials inside the factory building, or directly to customers.

- Supply chain management: by devising an integrated architecture allowing a) the support of the identification of new suppliers/customers by processing information related to their produced goods or production processes; b) the exploitation of data extracted from client companies' production processes in order to improve the forecast.

- Product design/marketing: by relying on semantic techniques to analyze the voice of customers (to make an example, collected from social media).

- Ergonomics: by exploiting sensors data to identify workers bad postures, thus preventing occupational diseases.

The research activity will be focused on one or several of the above aspects/areas, on the basis of the research and commercial scenario that will be arising at the beginning of the Ph.D.

Exploited technologies/devices will be: Semantic Web technologies, IoT, IoS, Big Data, sensors, natural language processing techniques.

Outline of work plan

Phase 1 (1st year): Acquisition of knowledge, skills and competences related to technologies involved in the Ph.D.

Literature review (state of the art of semantic technologies, IoT/IoS, Big Data, etc. in the Industrial field). The outcome of this phase will be a survey, published into international journals. Selection of Industry areas/aspects/issues (among the ones described above) to be addressed and focus on one of them (with the aim of developing prototype solutions).

Phase 2 (2nd year): Identification of system requirements and definition of the architecture of the prototype. The outcome of this phase will be a conference paper. Development of the system and testing. The outcome of this phase will be a journal paper. Focus on another aspect among the ones identified in Phase 1 (subject to prior evaluation of changes in the research and commercial scenario).

Phase 3 (3rd year): identification of issues to be addressed/requirements and development of prototypal solutions (architecture, system development and testing). This phase will result in a conference and a journal paper. Composition of the thesis.

Skills and competencies for the development of the activity	Technical skills: Software Engineering, Computer Networks, Database
	Soft skills: Problem solving, communication, Team working
	Multidisciplinary and self-organization attitudes