Summary of the Habilitation Thesis

The thesis begins by presenting briefly the author's evolution after defending the Ph.D. thesis considering scientific and professional perspectives, as well as regarding teaching and tutoring within the Automation and Applied Informatics Department.

Chapter 2 depicts studies focused on IIoT/Industry 4.0 interoperability and relies on 10 published works. It presents solutions that are conceived for integrating legacy protocols, followed by works focusing OPC UA key enabler of the industrial revolution, new specifications, improvements and perspectives for industrial scenarios. Finally, emerging protocol studies and protocol coexistence solutions are depicted for the automotive sector.

Chapter 3 presents 6 supervisory control and data acquisition related studies that were realized referring to IGSS, Android SCADA, and Node-RED SCADA. Starting from IGSS with the optimal resource allocation concept and a web module development, the chapter presents the mobile Android SCADA solution that was conceived and developed, first as a basic diagram and OPC UA client-server application, and then as a complex runtime and development system. Node-RED based SCADA was approached and published as a generic solution, and then developed in a complex application that was validated in industry.

Chapter 4 groups eleven studies oriented on increasing efficiency in an IIoT and Industry 4.0 context. The works targeted industrial scenarios mainly in the water sector (9 articles), but also in the automotive manufacturing (2 articles). The studies are introducing and developing the concept of a proactive historian and non-invasive solutions that reduce energy consumption, predict faults and indicator values. Also, other efficiency related improvements are described referring to wastewater networks issues in the water sector. The final section presents an efficiency increase solution in the automotive manufacturing, where image processing hardware-software structure was researched to detect electronic-control-unit defects at the production end-of-line.

Chapter 5 is presenting 3 recent studies, focused on structured and contextualized data propagation in an Industry 5.0 and digital transformation context. The research initiates establishing a foundation for a single-source-of-truth human-oriented data representation in a context of a virtual unified

space/unified namespace for digital transformation. The applicability of the solution can be both on the IT and OT levels and it is technology driven. The considered environments are Ignition and Node-RED. The solution succeeds to provide a bidirectional, edge-driven and flexible propagation of structured and graphically represented data using Sparkplug B protocol. The research is extended towards the OPC UA protocol in order to increase the impact over the OT level data transfer towards higher supervision levels.

The final chapter depicts the scientific and teaching plan, considering the subsequent progression within the academic career.