

- Development of SCADA/HMI systems for monitoring and control of industrial plants in many development environments (National Instruments LabVIEW, Mathworks MATLAB, Siemens WinCC, Movicon, General Electric iFix, etc.). Great interest is addressed in particular to the use of the OPC (OLE for Process Control) protocol and its variants in both classical and in the new OPC-UA (Unified Architecture). The Group also has the skills needed to develop (both in hardware and in software) of PC-based OPC Classic applications.
- Mathematical modeling of errors in the A/D and D/A signal conversion: the main objective of research is the metrological characterization of analog-digital converters and more generally of data acquisition and waveform recorders with the aim of defining unique methods of evaluation of uncertainty, with the associated test procedures, calibration and diagnostics.
- Detection and correction of errors in A/D and D/A converters: this subject is directly related to the previous one and proposes the development of a unified error model for digital waveform recorders/generators with the aim to identify appropriate correction techniques for the components of uncertainty present in them.
- Study of an automatic system for the detection and measurement of surface imperfections: the development of an automated system useful to detect, measure and characterize the flaws on opaque or semi-translucent surfaces. The goal, successfully reached, was to create a prototype for automatic online detection and cataloguing of defects on giant (6 m by 3 m) satin glass sheets.
- Characterization of current/voltage and voltage/voltage transducers for power quality measurement: its aim is the achievement of low-cost systems for calibration, possibly "in situ", current and voltage transducers devices increasingly being used in the performance analysis of industrial electrical systems.
- Definition and measurement of power quality indexes: is the correct definition and measurement, with appropriate instruments designed ad hoc, useful

parameters for the characterization, in terms of quality, of the electrical power systems, of electric power transmitted and received in the current electrical systems.

- Identification of air quality models: Treatment information tailored to the monitoring and environmental control is concerned the identification of air quality models, in order to describe the dynamics of the contaminants analyzed, highlighting any correlations between different pollutants. The techniques used are particularly useful for reconstructing and/or validate data gaps and provide the ability to operate on continuous time series and consistent data sets.
- Production of sensors for analysis of the microclimate of agricultural soils: the study concerns the design of sensors useful in the containment of environmental pollution, the detection of harmful environmental variables (metals, hydrocarbons, etc.). Microclimate and soil analysis, useful to exploit the potential of the soil, more economic (and environmentally friendly).
- Study and development of custom tools to model and monitor photovoltaic energy production: this research aims to create a tool for the preliminary evaluation of the performance of a photovoltaic system; the idea is to use a procedure for estimating the parameters of the mathematical model associated with the various components using a best-fitting technique on experimental data obtained in laboratory before the entry into operation and during the useful life of the plant.
- Biomedical signal processing for diagnostic applications: the research aims to the functional evaluation of simple motor acts in patients with Parkinson's disease or prosthetic limbs, and to the study of post-processing solutions for the enhancement of clarity of medical images (CT and MRI) to reduce the biological risk for the patient and the analysis time for the hospital.
- Creation of an ultrasound system for diagnostic applications: the estimation of the state of filling of the bladder in patients with enuresis or quadriplegics through the detection of ultrasonic echoes reflected from the bladder walls.
- Detection and automation systems for railway applications: it concerns the automatic detection and real-time diagnostics of defects and disorders

attributable to the rail-rail coupling that can produce annoying noise and danger to passengers.

- Open hardware/software meters for the management of renewable energy plants: this research aims for the design and prototyping of a system to measure and monitor the energy from renewable sources (wind, photovoltaic, etc.).
- Automatic interpretation and data entry for medical records: refers to the automated acquisition and fast data recognition related to laboratory tests of patients produced in non-standardized paper or electronic format.
- Drone bench: this research aims to design a test system to characterize both electrical and mechanical performances of UAVs (Unmanned Aerial Vehicles) propulsion subsystems (motor and propeller).

***Topics and supporting details:***

[https://docs.google.com/spreadsheets/d/1abK4VL31x14Wm9Fg0ICvcM\\_4nXvkoJr\\_tH165cjfZvY/edit#gid=1394839446](https://docs.google.com/spreadsheets/d/1abK4VL31x14Wm9Fg0ICvcM_4nXvkoJr_tH165cjfZvY/edit#gid=1394839446)