Team

25 researchers coming from 3 laboratories of industrial research accredited by High Technology Network of Emilia-Romagna Region.

MechLav

MechLav is the industrial research laboratory of the Ferrara Technopole. It offers a wide range of engineering skills, solutions and technological services mainly in the area of mechanics and ICT.
The strength of the laboratory is that its researchers belong to the Departments of Engineering and Mathematics and Computer Science of the University of Ferrara, a feature that facilitates collaboration between disciplines and the creation of synergistic team work with complementary skills. This characteristic has allowed the development of many highly innovative industrial research projects, and partnership agreements, both with local companies and with national and international companies.

InterMech-MO.RE

InterMech-MO.RE is the Interdepartmental Center for Applied Research and Services in the Advanced Mechanics and Motoristics Sector of the University of Modena and Reggio Emilia. It offers companies specialized industrial research services on the subject of designing and developing new industrial products and processes; it promotes and coordinates intersectoral studies and research in the field of Advanced Mechanics and Motoristics and carries out related research activities (also in the sectors of ICT, Materials and Surfaces, Mechatronics, Industrial Design).

Raw-Power S.r.l.

Raw Power is a laboratory with experience and expertise in the design of static energy conversion systems, electrical machines and, more generally, electromagnetic conversion systems. In addition to design skills, the laboratory deals with diagnostics of electrical machines and electrical drives and modeling of mechatronic systems.

Companies involved: Bonfiglioli S.p.A - MARPOSS S.p.A

Research Laboratories

MechLav
University of Ferrara
InterMech-MO.RE.
University of Modena
and Reggio Emilia
Raw Power s.r.l.

Industrial Partners

BONFIGLIOLI S.p.A.
MARPOSS S.p.A.

www.diapro40.it info@diapro40.it

DiaPro 4.0
Diagnostics | Prognostics
Industry 4.0

POR FESR EMILIA-ROMAGNA 2014/2020
FSC Fondo per lo Sviluppo e la Coesione
UNIONE EUROPEA Fondo europeo di sviluppo regionale
RegioneEmilia-Romagna

DiaPro4.0: Cost-effective multisensory Diagnostic-Prognostic system integrated in mechanical drives of Industry 4.0

The Project

Maintenance advanced systems of the Industry 4.0 are based on predictive maintenance that guarantees remarkable benefits in terms of reliability and safety, and allows the implementation of e-maintenance systems and the development of new business models. The main characteristic of a predictive maintenance system is the way in which it collects and elaborates signals with the use of advanced diagnostic and prognostic algorithms.
In this sense, the DiaPro4.0 project aims to develop a competitive cost system, integrated in electromechanical drives, able to diagnose faults in rotors, gears, bearings and electric motors, to predict the Remaining Useful Life and to update the models used in the design phase on the basis of the data acquired on the machines in exercise.

The main activities carried out within the project were:

– the development of an innovative torque/speed sensor enabling indirect torque measurement from shaft angular positions (Bonfiglioli patent);

– the integration of several sensors (torque, speed, temperature, vibration) in a single device, totally wireless and equipped with an energy harvesting system (Bonfiglioli patent);

– the development of diagnostic and algorithms, enabling Remaining Useful Life evaluation on the basis of the actual operational history (torque/ speed);

– the development of decisional algorithms;

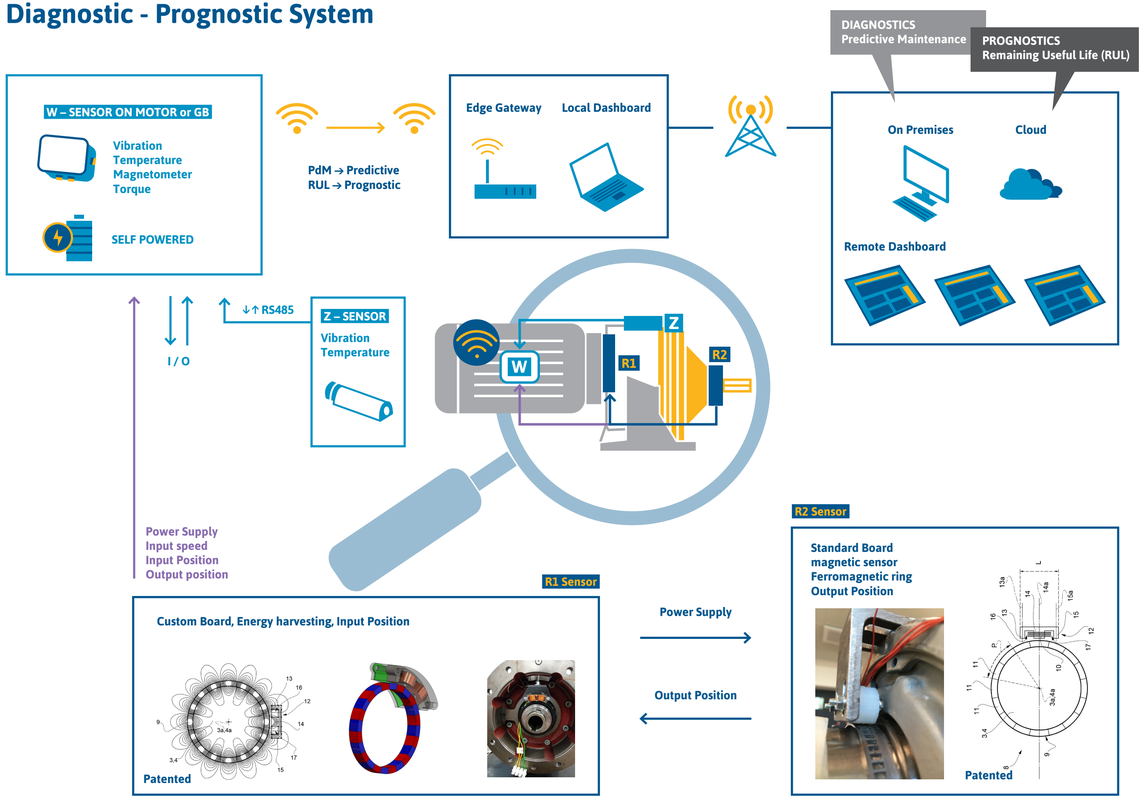
– data transfer to the cloud.

The project involves regional laboratories with experience and competence in the field of mechanical transmissions, Diagnostics and Prognostics. Also two companies take an active part in the project: Bonfiglioli S.p.A and Marposs S.p.A.

Phases

1. Innovative speed / torque sensors (indirect torque measurement)
2. Diagnostics based on multi-sensor acquisitions and identification algorithms
3. Prognostics based on the actual operational history
4. Development of the DiaPro4.0 demonstrator integrated into electromechanical drives
5. Experimental validation of effectiveness and final optimization of the DiaPro4.0 system

DiaPro4.0 Multisensor
Diagnostic - Prognostic System



Benefits resulting from the project

1. **High diagnostic reliability**
   identification of pitting in gears with an advance of 100h from machine downtime and bearing defects with an advance of 150h respect to catastrophic damage;
2. **High prognostic accuracy**
   estimate of Remaining Useful Life with a confidence range of ± 5%;
3. **Cost of the industrialized system**
   less than 30 to 50% of the systems on the market with performance inclusive of prognostics.