Acoustic Emission (AE) is a phenomenon of transient elastic wave generation in materials under stress having sources in rotating machinery including impacting, cyclic fatigue cracks, friction, turbulence, material loss, cavitation, leakage, etc. of great importance for machining health conditions monitoring. The good predictive maintenance means to reduce the operating risk, avoid plant failures, provide reliable equipment, operating costs, eliminate defects in operating plant and maximise production.

WIRELESS SENSORS NETWORK (WSN) SYSTEM CONCEPT DESIGN
Our project MOSYCOURSIS recent developments in sensing technology, and miniaturised radio transceivers for condition monitoring based on development of more innovative ideas:

- Smart AE sensor incorporating on-board data acquisition, signal conditioning and data processing system capable of storing data for preprocessing, threshold comparisons and pre-diagnosis algorithms execution.
- Low cost - low power consumption electronics.
- Sizeable solution with a separate stackable module, allowing to place each module (signal processing, communications, signal conditioning and energy harvesting) into a single global enclosure for hermeticity away from the sensor.
- Local wireless network communication system suitable for hazardous conditions and capable of transmitting processed signal. Built in antenna better for hermeticity.
- Local power harvesting able to supply enough energy to the sensor. Different energy sources are considered (thermal, solar and vibration).
- Algorithms based on artificial intelligence for translating the condition of acoustic emissions from the mechanics to faults in the machinery (system), and to perform machine diagnosis for degradation assessment.
- Simple user interface for processing of pre-diagnostic information.

APPLICATIONS RESULTS FOR SPECIAL EQUIPMENTS MONITORING
- The injection molding machines are the most complex equipments covering all mechatronic areas like: industrial electronics, automation, CAM/Computer Assisted Manufacturing, robotics, hydraulics, mechanics, tooling a.s.o
  - The Structure of the WSN sensor system based on four basic modules:
    - Transducers modules (transducers and signal conditioning electronics)
    - Signal processing unit module (local digital signal processor, ADC, Signal conditioning a.s.o.)
    - Power management module (energy storage and management)
    - Interfaces module (communications)
  - The Study of AE generated by main hydro-mechanical parts:
    - Hydraulic pump and parts: servo-valves, distributors, motor etc.
Mechanical parts exposed to wearing and cracking as ball bearings and sleeve bushing.

Mosytron value recorded every 30 seconds from the pump side (red) and Mosytron value (blue) recorded every 10 minutes.

MORE CHALLENGES TOWARDS OF WIDER APPLICATIONS AREAS
The powering a wireless sensing node for self-powered wireless sensing systems as advancement from the state of the art gives at widest industrial or transportation machinery application.
1. Blowers monitoring
2. Wind turbine gearboxes
3. Wind turbine generators
4. Wind turbine yaw system positioning
5. Automotive gearboxes
6. Split torque gearbox bearing
7. Reciprocating machinery gearboxes for very slow rotating machinery
8. Alternative machinery or non-continuous machine actuation

FURTHER IMPLEMENTATION WORKS OF GREAT POTENTIAL APPLICATIONS:
- Transportation machinery and equipments;
- Metrological instrumentation and related in-situ/on lab applications;
- Medical instrumentations and health monitoring;
- Structural health monitoring for civil and industrial engineering works.