

A Few Benefits of IMS Membership

- The IMS Center can work with company members to develop company-specific projects. In addition, these projects can be executed by either a research team at the center, or with dedicated, on-site researchers working at the company itself.
- An IMS Company members can receive leveraged research results (at least a 15:1 ratio) from its membership investment.
- Company members can share the best practices and experiences gained in different IMS test beds.

IMS Center Site Strengths

University of Cincinnati	University of Michigan	University of Missouri-Rolla
1. IMS Watchdog Agent Prognostics Toolbox	1. Advanced Prognostic Algorithm Development	1. Wireless Sensing & Monitoring
2. Watchdog Hardware and Software Platform Development & Distributed Agent Design	2. Decision Support Tools for Maintenance Scheduling & Simulation	2. Diagnostics & Prognostics of Actuators, Valves, etc.
3. Smart Machines and Critical Rotary Machinery Components PdM: bearing, motor, cables, etc.	3. Prognostics for Machinery, Networked Systems and Sensor Degradation	3. Integrated Wireless Watchdog Agent Development
4. Remote Monitoring and Embedded Prognostics Standards	4. Research on Embedded Prognostics	4. Embedded Diagnostics & Prognostics

IMS Member Companies



NSF I/UCRC Since 2001
www.imscenter.net

Center for Intelligent Maintenance Systems

ims

The Center for Intelligent Maintenance Systems was established in 2001 as an NSF Industry/University Cooperative Research Center (I/UCRC), through a partnership between the University of Cincinnati and the University of Michigan. In 2005, the center expanded to add a new satellite site, the University of Missouri-Rolla. To date, the center has conducted over 70 research projects and test beds, in partnership with over 50 member companies and sponsors.



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IMS Center Research Team - 2006



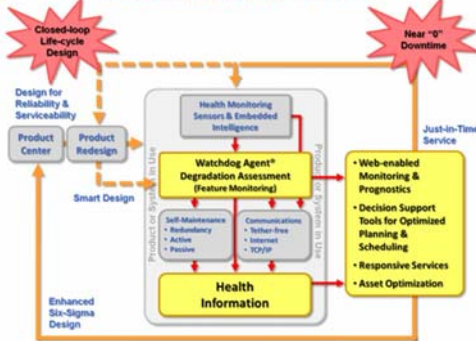
Vision & Mission Statement:

The IMS Center's vision is to enable products and systems to achieve, and sustain, near-zero breakdown performance; ultimately transforming the traditional "fail and fix" maintenance practices to a "predict and prevent" methodology. The center is focused on frontier technologies in embedded and remote monitoring, prognostics and intelligent decision support tools. Its mission is to serve as a center of excellence for the creation and dissemination of a systematic body of knowledge in intelligent e-maintenance systems that will ultimately impact next-generation product and service systems with six-sigma quality.

Maintenance Decision Support Tools (DST)

DSTs facilitate maintenance operations in the most production-efficient manner when one or more machines are likely to fail, according to the prediction made by prognostic algorithms. They prioritize maintenance work-orders and balance limited resources by minimizing possible losses in productivity, and the length of downtime.

IMS "System of System" Approach



Watchdog Agent® Toolbox of Algorithms

Signal Processing and Feature Extraction Tools	
• Time-frequency / Time-frequency Moments	• Fourier Transform / Frequency Bands
• Wavelets / Wavelet Packet Energies	• Autoregressive (AR) Modeling / AR Model Results
• Wavelets Tree Decomposition / Wavelet Moments	• Expert-extracted Features
Performance Assessment Tools	
• Logistic Regression	• Feature Map Pattern Matching
• Hidden Markov Model (HMM) Based Performance Assessment	• Neural Network Pattern Matching
• Statistical Pattern Recognition	• Particle Filter-based Performance Assessment
Health Diagnosis Tools	
• Hidden Markov Model (HMM) Based Diagnostic Tool	• Support Vector Machine (SVM) Based Diagnostic Tool
Performance Prediction Tools	
• Match Matrix Prediction	• Elman Recurrent Neural Network Prediction
• Autoregressive Moving Average (ARMA) Prediction	• Fuzzy Logic-based Prediction

Hardware platforms



ADVANTECH
eAutomation
UNO-2160



NATIONAL INSTRUMENTS
CompactRIO

Applications



What is the Watchdog Agent??

The Watchdog Agent® can assess and predict the performance of a process, or equipment based on the input from sensors, historical data and operating conditions. Performance-related information can be further extracted via multiple sensor inputs through signal processing, feature extraction and sensor fusion techniques. The historical behavior of process signatures can be utilized to predict future behavior, and thus enable forecasting of the process' or machine's performance. Proactive maintenance can therefore be facilitated through the prediction of potential failures before they occur. The goal of which is to transform the traditional maintenance practices of "fail and fix" to a "predict and prevent" methodology, and ultimately to enable products and machines to achieve zero-breakdown performance and productivity.

IMS Systematic Prognostics Approach



Wireless-based Prognostics & Sensor Technologies

The IMS Center has developed a wireless-based prognostics platform which consists of wireless sensors, MOTE sensor networks, self-powered wireless modules and an application protocol. These technologies have been implemented in a number of industrial applications, including compressors, power tools, assembly equipment and hydraulic hoses, etc.



Wireless MOTE