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RAILWAY CONDITION MONITORING DRIVEN BY ARTIFICIAL INTELLIGENCE & SMART SENSING TECHNOLOGIES

- Advanced fault detection
- Predictive maintenance
- Asset management



Condition Monitoring for Railway Infrastructure and Rolling Stock

There is a prevalent trend in the railway industry to move from inefficient and costly traditional scheduled maintenance regimes to predictive and condition based ones. A prerequisite for adopting condition-based maintenance and predictive maintenance for railway assets is the availability of condition monitoring systems that can effectively and continuously monitor

mission critical components. A railway condition monitoring system based on AI and fiber-optic sensing technology allows real-time and continuous monitoring of both railway infrastructure and rolling stock has found its niche as an indispensable tool to serve this new railway maintenance trend.

Novelties

The advanced smart railway monitoring systems based on optical fiber sensors are able to monitor the operation condition and structural health of trains and railway infrastructure. These systems can efficiently and effectively monitor the conditions of rail tracks, overhead line, third rail, train key structures and mission critical running gears, etc.

Fiber Bragg Grating (FBG) sensors are miniature optical sensors in standard optical fibers. Hundreds of FBG sensors along a single optical fiber as long as 100 km can be utilized to measure many different parameters such as temperature, strain, vibration, acceleration and inclination, replacing many different types of conventional sensing systems. These features greatly enhance the versatility of the FBG sensing systems, thus providing the railway industry with a very cost-effective integrated solution.



Optical fiber sensor fabrication facility

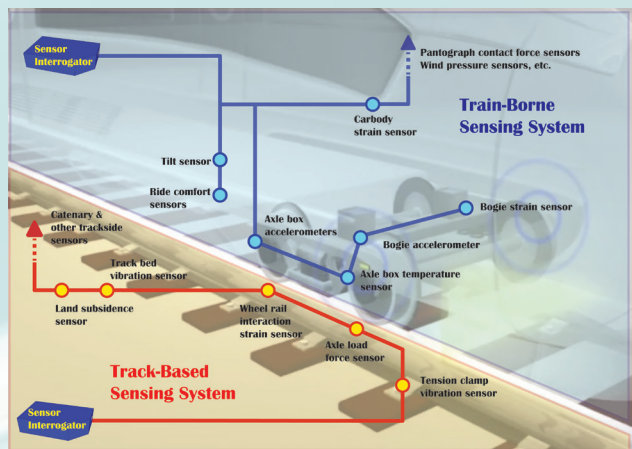
Fiber-optic Sensing Networks for Railway Condition Monitoring

Optical sensing networks offer plenty of advantages including small and light weight, non-conductivity, immunity to electromagnetic interference, resistance to corrosion, long transmission distance, low noise, high signal fidelity, etc. Therefore, they provide an excellent platform for the development of railway condition monitoring system.

In addition, fiber-optic sensors for condition data acquisition can be installed in hostile and difficult-to-access locations where conventional electrical sensors cannot be used. The availability of new types of condition data enriches the railway condition database that can help the development of pristine fault detection capabilities and prognostic

functions through advanced data analysis and deep learning.

Such monitoring systems can oversee the conditions of mission critical components on both rolling stock and infrastructure including train running gears, tracks, overhead line and third rail.



Railway condition monitoring system for train and track monitoring based on optical fiber sensing technology

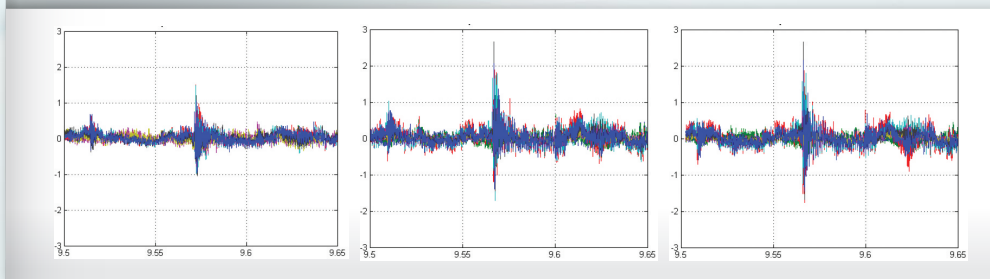
RailSen® - Integrated Railway Condition Monitoring Solution

RailSen® is a comprehensive railway condition monitoring solution based on sensing and monitoring systems installed on tracks and servicing trains. It aims to enhance the cost effectiveness of railway operation and asset.



Features of the solution

- online rolling stock and infrastructure condition information to facilitate operation
- extensive and continuous railway condition data for advanced data analytics
- AI and pervasive data analytics for advanced fault signature recognition
- support prognostic and condition based maintenance
- tools for asset performance evaluation and life cycle cost optimization

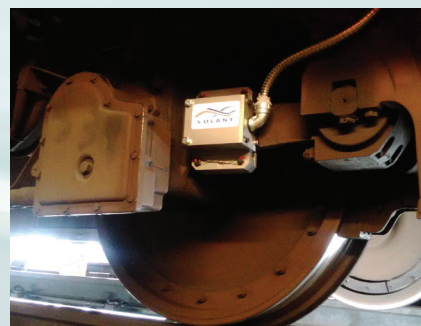


Rolling stock mission critical components

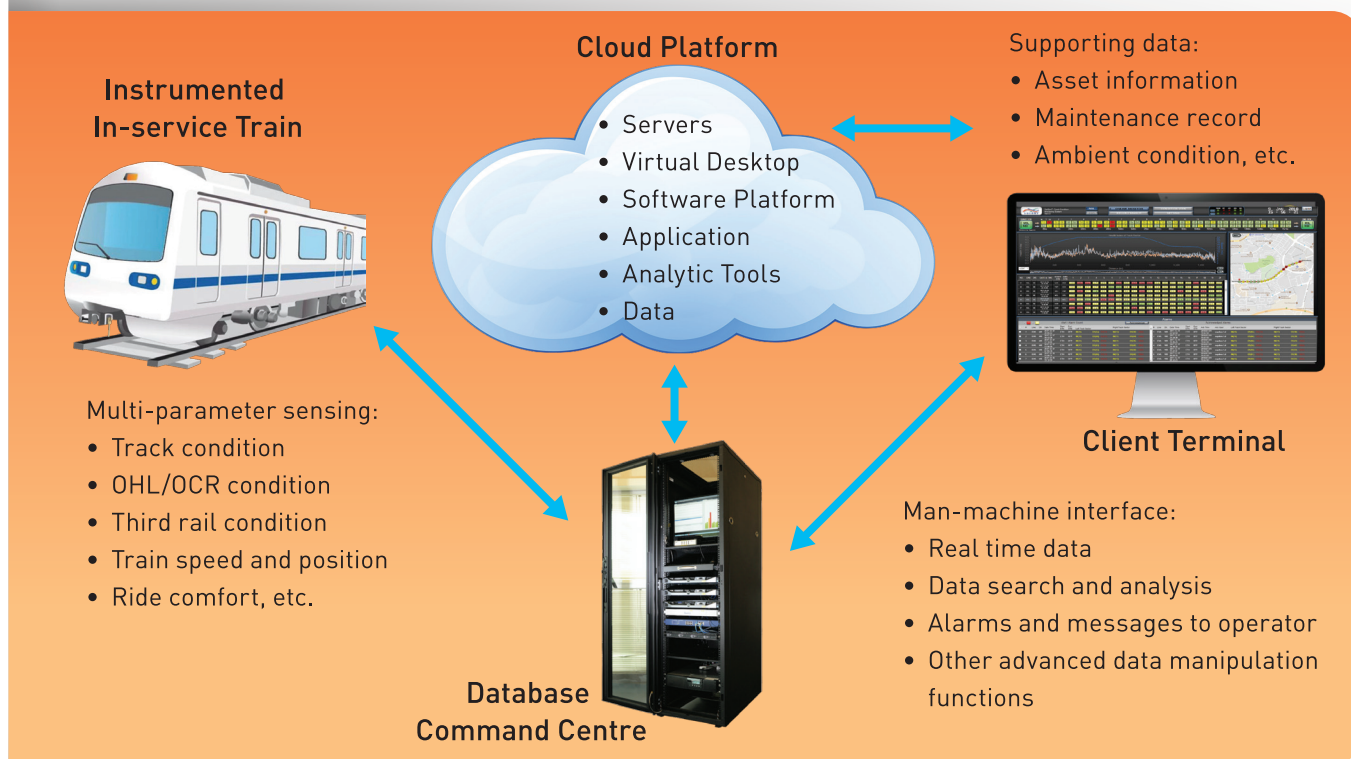
- wheel
- primary suspension
- secondary suspension
- damper
- key structural components

Railway infrastructures

- Track corrugations, dip weld, broken rail, sleeper hard spot
- OHL and OCRC
- Third rail



Smart Data Analytics Enabled by Cloud Computing



Achievements: Awards, Patents & Publications

- Third Prize, The Berthold Leibinger Innovationspreis 2014
- Chinese and European patents
- A book chapter published in Bentham eBooks
- University Pavilion Outstanding Product Award (2nd class), China International Industry Fair 2010
- Gold Prize, 12th China International Industry Fair, 2009
- Gold Medal, 37th International Exhibition Inventions New Techniques and Products Geneva, 2009
- Special Prize of the Technological University Malek-Ashtar - I.R. Iran, 2009
- Bronze Award, 5th China International Exhibition of Inventions, 2004
- Gold Medal, 32nd International Exhibition Inventions New Techniques and Products Geneva, 2004
- Gold Award, Hong Kong International Invention Expo 2000



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