Monitoring Rail Positions With LabVIEW and NI Vision Software

Using an Automated Solution for Measuring Data Across 30 m

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- Véronique NEWLAND, NEW VISION Technologies

The Challenge:

Monitoring the conditions of a segment of the Paris Regional Express (RER) by measuring rail movements and helping the Régie Autonome des Transports Parisiens (RATP) automatically alter its maintenance schedule as necessary.

The Solution:

Using NI LabVIEW software and the NI Vision Development Module to develop a system to monitor the Paris RER.

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The RATP operates the Paris RER and the metro. It transports 3 billion passengers per year, making it one of the most widely used public transportation networks in the world. Therefore, it is crucial to ensure continuity of service with the highest security level.

A key element of the transportation system's infrastructure is the rails. After installing the rails, their positioning may vary depending on environmental conditions such as temperature. We must monitor these position changes. The previous method involved operators examining the rail edges by manually measuring rail and traffic conditions with a maximum frequency of one train every two minutes.

The new solution, RAILSHIFT, was developed by New Vision Technologies (NVT). NVT specializes in optical railway infrastructure control and develops innovative systems to meet associated challenges. RAILSHIFT is a completely autonomous system based on National Instruments software for acquiring, processing, analyzing, and reporting data.

Automating the track position reading makes the data more regular and is safer for operators. Additionally, we use image processing in this application to take instantaneous measurements of much larger areas.

There are several conditions to take into consideration when operating this device, including changing light intensity throughout the day, variations relative to objects around the rails such as electrical equipment and signs, and the movement of the device attached to the overhead cable along the rails.

A Scalable Communication Architecture

The solution consists of measuring stations equipped with a unit for acquiring, processing, and communicating data. NVT integrated the following components of each measuring station into a single enclosure:

- A 3.5 in. 2 GB PC card with an Intel Atom Windows 7 Professional processor to acquire and communicate camera data
- A digital, industrial, ultracompact GigE Vision camera with monochrome 1,350x1,024 pixel resolution
- A communication card for wireless dialogue between checkpoints that sends alerts via GPRS/3G

Custom Integration

We used LabVIEW software, a VI library of image processing systems, the NI Vision Development Module, and NI-IMAQdx driver software to control each of the 12 measurement systems.

The NI-IMAQdx driver software manages the interface between LabVIEW and the industrial camera while the Vision Development Module analyzes the acquired image to extract the rail positioning variations. We then use LabVIEW to analyze the track position measurements and send alerts via email when a critical threshold is reached.

We used LabVIEW to quickly develop a human-machine interface that is easy to use even for nontechnical people. Because of the built-in image processing capabilities in the Vision Development Module, we rapidly developed our application and can easily make changes to it in the future.

Portability of Software Based on LabVIEW

The project was carried out by successively prototyping the software and hardware. The initial feasibility phase of the study was conducted using an NI 1744 Smart Camera. During the deployment phase, the LabVIEW code from the feasibility phase was incorporated into the application, saving considerable development time.

A Powerful Stand-Alone Tool

The resolution of RAILSHIFT is ± 5 mm over a control area covering 30 meters.
There are many advantages to implementing this system. For example, the operators are alerted and can respond sooner when the rails are deformed. The system can also monitor rail expansion during the day to predict future events.

Overall, 12 measuring stations have been deployed and RATP plans to install eight new ones in the near future.

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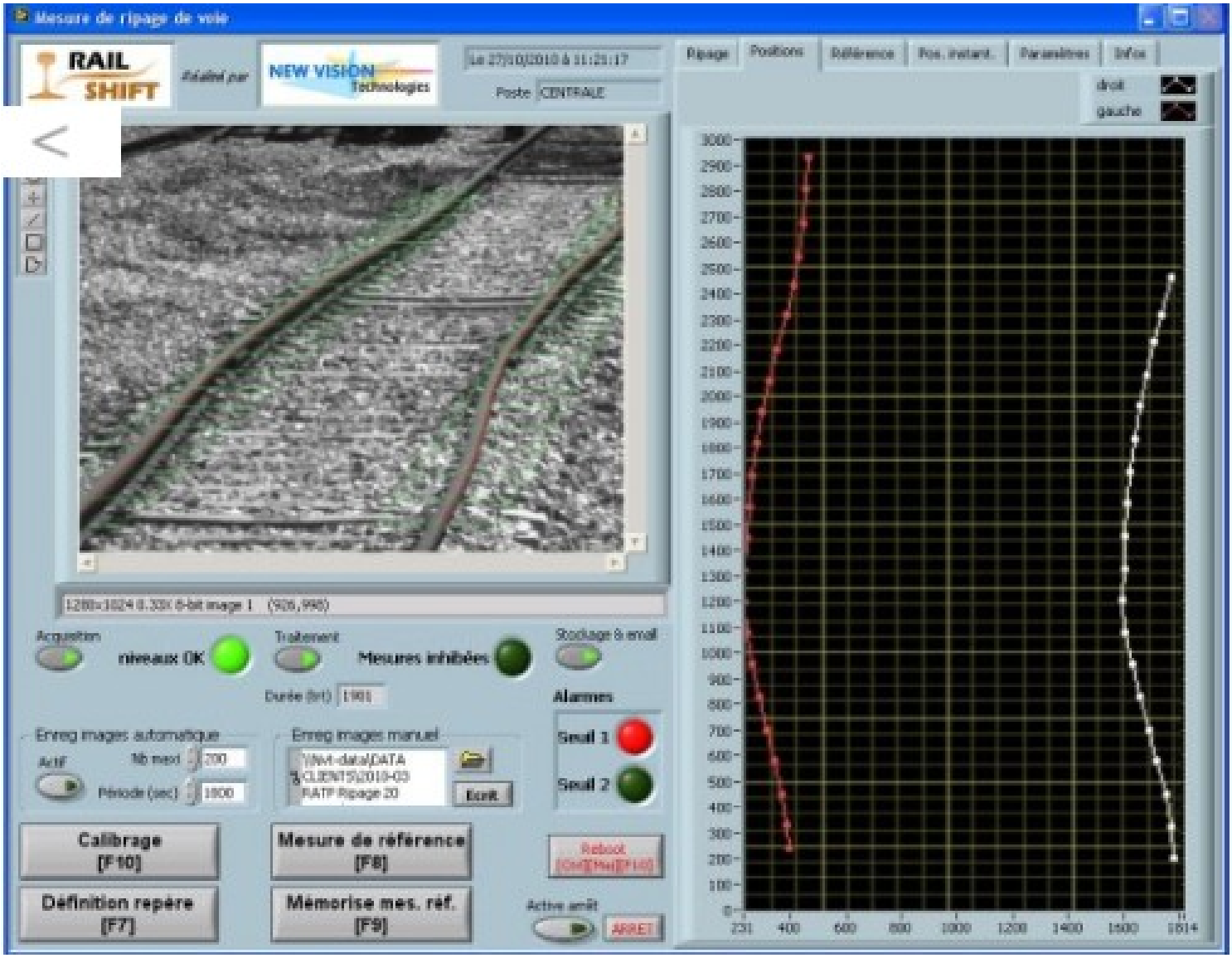

The user interface with visualization of the measured area and plotting of the position of the rails.
