News Release
Railway Technical Research Institute
March 19, 2026

RTRI Develops Real-Time Detection and Automatic Response System for Abnormalities in Pantographs and Overhead Contact Lines

The Railway Technical Research Institute (RTRI) has developed a system that, during train operation, detects abnormalities in pantographs and overhead contact lines in real time and, by sending alerts to train crew and automatically lowering pantographs, mitigates damage caused by such abnormalities and reduces the impact on subsequent service disruptions.

1. Development background

When abnormalities occur in pantographs, or when a train runs into foreign objects such as plastic sheets that have become entangled in overhead contact lines, electrical equipment and rolling stock can be damaged. These incidents can lead to large-scale service disruptions to railway operation, creating a strong need to mitigate such damage.

2. Outline of the system

This system consists of two technologies: real-time abnormality detection and automatic response (see Figure).

(1) Real-time abnormality detection

- Cameras installed on the roof and in the driver's cab continuously monitor the pantograph and overhead contact lines while the train is running, and image processing units detect abnormalities.
- Two algorithms were developed for abnormality detection.

(a) Pantograph abnormality detection algorithm

Object-detection AI is combined with decision rules uniquely developed by RTRI to detect abnormalities in pantographs (such as component detachments and deformations).

- Detachment of pantograph components can be detected within one second.

(b) Foreign object detection algorithm

Foreign objects around overhead contact lines vary widely in type and shape, so the system detects them by combining an AI that can specify detection targets even based on abstract or ambiguous instructions with an algorithm uniquely developed by RTRI for identifying foreign objects.

- Foreign objects such as plastic sheets can be detected even when they are approximately 40 m ahead of the train.

(2) Automatic response

- When an abnormality is detected, the system automatically lowers pantographs

within three seconds and sends alerts to the train crew and the operation control center (OCC), via public communication networks.

- In the event of a foreign object flying into the overhead contact line, if the train speed is approximately 50 km/h or less, the pantographs can be automatically lowered before they reach the foreign object, thereby preventing damage.

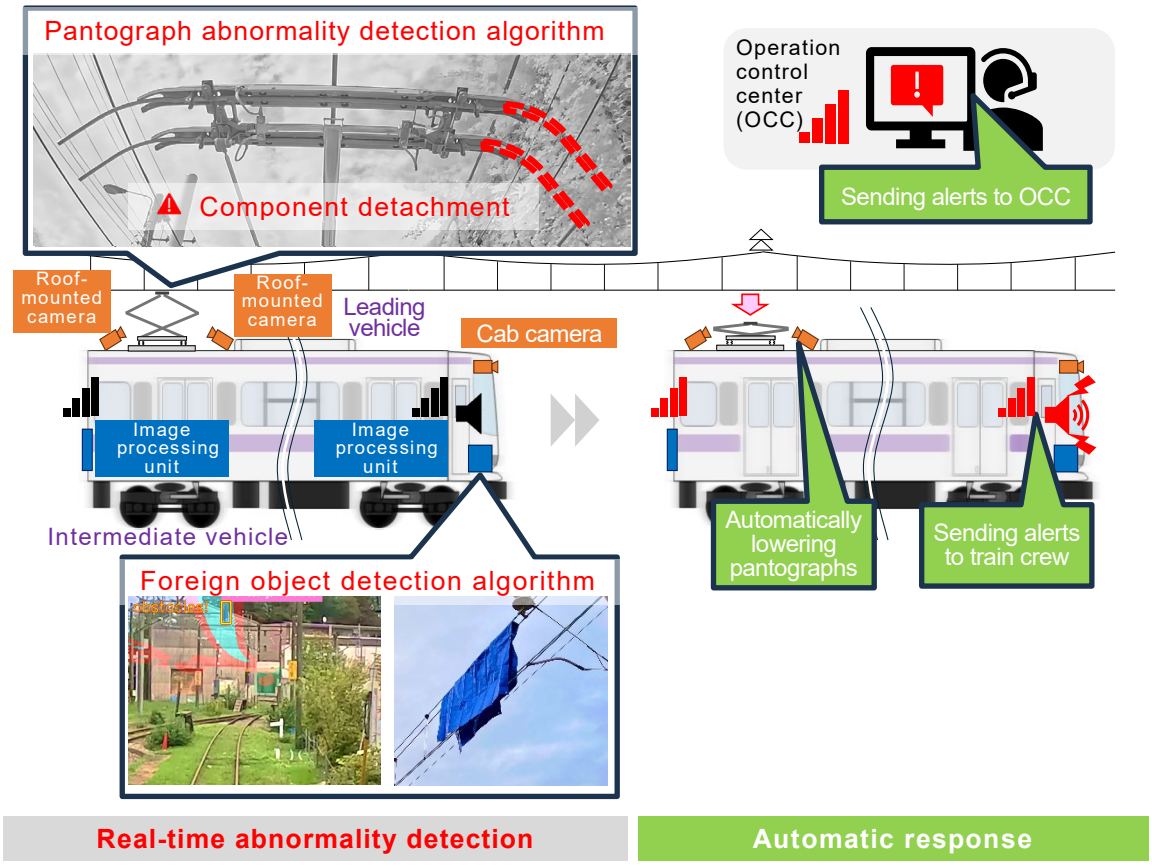

Figure – Outline of the system

3. Future developments

Aiming for practical implementation, RTRI plans to further improve detection accuracy and downsize the image processing units, each of which is currently about 50 cm by 50 cm.