International Journal of Internet, Broadcasting and Communication Vol.7 No.2 109-112 (2015)
http://dx.doi.org/10.7236/IJIBC.2015.7.2.109

IJIBC 15-2-16

A Study on the Trolley Sliding Condition Inspection System

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Abstract

The Korean electric railway is growing rapidly such as speed of 300km/h in high speed section and 230km/h in the conventional railway section. But, power supply failure occurs because of loss of contact, defective catenary system and high speed vehicle. Therefore preventive maintenance way based reliability has been applied. Typical example is the facility inspection method using trolley inspection system. But it is required differentiated inspection method to prevent problem such as inspection errors.

In this paper, a study on the trolley sliding condition inspection system using monitoring techniques is performed for performance enhancement of inspection system. It proposed the efficient maintenance method through monitoring the deviation and height of contact wire after installing inspection system on the top of train which operates in the metropolitan area. Inspection errors were decreased by virtually monitoring the video of faulty facilities. Also those facilities were identified through the impact sound analysis and tests at the main catenary section.

Keywords: *Inspection system, Sliding, Catenary, Monitoring*

1. Introduction

Catenary contacts directly pantograph on railway vehicle and supply required electricity for operating trains, therefore an interactive interface between wires and pantograph is very important. Declination, height of catenary or other necessary factors must be maintained within an adequate range to supply stable electricity to trains. But the variance of catenary shape caused by high frequency of train operation, railway conditions, temperature, etc can be causes of load malfunctions[1][2]. So, Preventive maintenance ways based on reliability are applied to prevent from those malfunctions. Among them, a representative example is facility inspection methods using a catenary inspection system. By the way, the current inspection system offers detection results as a graph form, which is hard for us to get accurate results[3][4].

In this paper, the research has been conducted with the video monitoring technique to improve performance of the detection system. The testing detection system consists of two parts, one of which is the device installed on a roof of car to measure sliding state between catenary and a pantograph by sampling a

Manuscript Received: Jun. 25, 2015 / Revised: Jul. 21, 2015 / Accepted: Jul. 30, 2015
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video and sound. Another is a data analyzing device.

As a result, Detection errors were decreased by virtually monitoring the video of faulty facilities. Also those facilities were identified through the impact sound analysis and tests at the main catenary section.

2. The proposed inspection system

Catenary sliding condition inspection was installed on the train that runs the metropolitan area for catenary pantograph sliding condition inspection. And this system measures the catenary and high deviation on the train top as shown in figure 1.

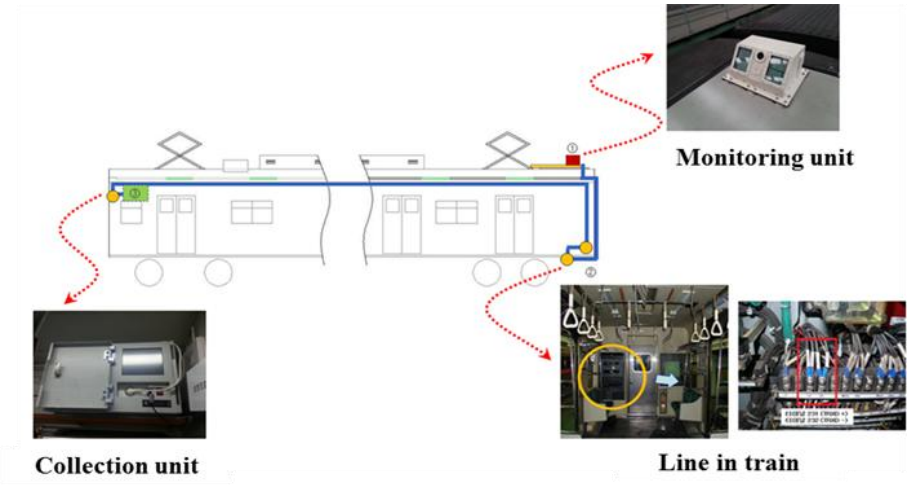

Figure 1. Configuration of the proposed detection system

Catenary sliding condition inspection system consists of the monitoring unit and the collection unit because Primary purpose is monitoring the catenary pantograph and sliding condition. The system consists of a monitoring unit and the collection unit.

The monitoring unit is composed of camera for monitoring between the pantograph and the catenary and additional devices for maximizing the camera performance.

The collection device stores the images taken with the catenary and pantograph at high speed. And Filters for removing the effect of the external light source and temperature/humidity control devices and lighting fixtures for normal device operation were installed.

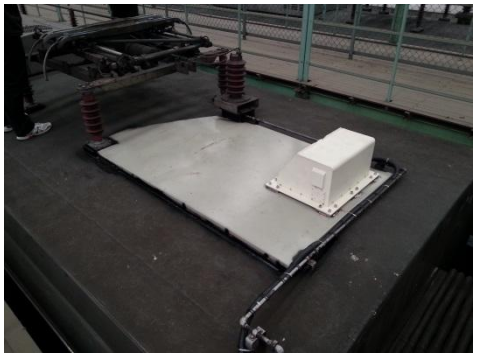

Figure 2. Monitoring unit

Figure 3. High-speed shooting camera

3. Experiment result

Video monitoring is a method for detecting and monitoring sliding state between catenary and pantograph photographed by a camera at the electric train in real time internal. Catenary excursion and height of the dynamic conditions is determined by visual inspection of experts in the operating conditions of the electric train. Catenary sliding condition inspection system video monitor is shown in figure 4.

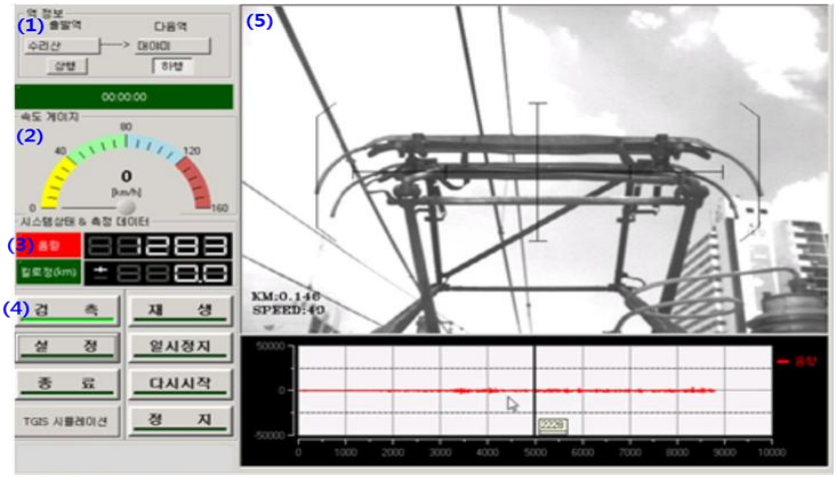

Figure 4. Catenary sliding condition inspection system video monitor

Information data shown in the figure are as follows.

(1) Station information: Station information transmitted from the train station systems
(2) Speed gauge: Speed of train which runs
(3) Distance Gauge: Driving distance from the train station transmitted from the operation information
(4) Various switches: operation switch of the inspection system
(5) Video monitor: Visual display of sliding state between catenary and pantograph

The horizontal axis of the graph is represented in the video monitor shows deviation (±250 ㎜) and the vertical axis shows height of the catenary (4,850 ㎜ ~ 5,500 ㎜) of the catenary.

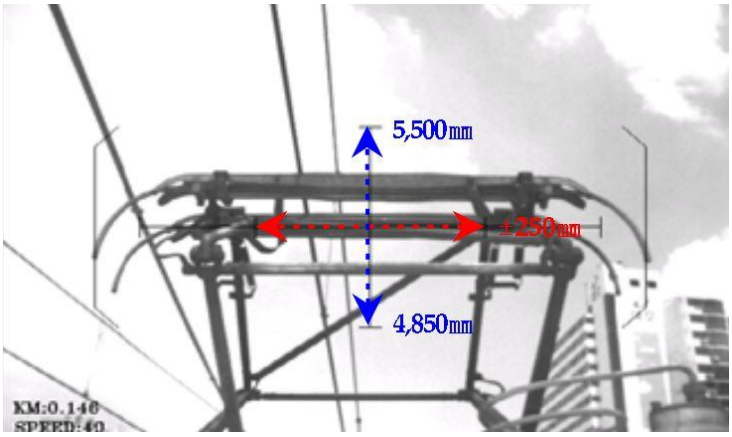

Figure 5. Pantogragh of video monitor

The catenary deviation and the height out of normal range can be confirmed in real time defect as shown in figure 5.

Table 1. Result of comparing existing inspection system and proposed system (2013)

Operating Month	Existing inspection system		Proposed inspection system	
	Abnormal point inspection	Inspection results	Abnormal point inspection	Inspection results
March	4point	Incorrect judgment	0	Good
April	73point	Incorrect judgment	0	Good
May	4point	Incorrect judgment	0	Good

Table 1 is result of comparing existing inspection system and proposed system. To check the status of the catenary, visual inspection is performed in field because conventional system inspection without video equipment.

92 normal point of operation section is inspected. Result of inspection for comparison. Result of Existing inspection detected abnormal points; 4 point in March, 73 point in April, 4 point in May. But proposed system didn't detect abnormal point. Thus this system is correctly working.

4. Conclusion

Catenary contacts directly pantograph and supply required electricity for operating trains, therefore an interactive interface between wires and pantograph is very important. So Inspection system must be highly reliable. In this paper, new inspection system is proposed. This system is higher reliability than existing system. Next system that integrates video monitoring and sound systems will be performed.

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