(15) Title

Safety analysis of level crossing obstruction detecting system using STAMP/STPA method

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Abstract

For railway operators, the importance of ensuring safety at level crossings is increasing.

As one of measures to ensure safety at level crossings, East Japan Railway Company (JR-East) has "obstruction detecting devices" that detect obstacles such as automobiles in a level crossing, and "obstruction warning signals" that emit special signal light (flashing red LED light, etc.) to the train approaching to a level crossing on detection of obstacles at the level crossing. Through the functions of these devices, we are trying to prevent collision accidents between trains and obstacles at level crossings (these series of equipments are referred to as "level crossing obstacle detection systems" in this presentation). Also, the level crossing obstacle detection system exchanges the information with the level crossing controller which detects an approach of a train to the level crossing and controls the operation of warning lights and barrier machines. In addition, the train driver who recognized a special signal light emission is supposed to stop the train promptly.

In this study, we analyzed JR-East's level crossing obstacle detection system using the STAMP/STPA method, identified hazard causal factors (HCF), and extracted design safety constraints for eliminating HCF. This shows an example of safety analysis in the system where machines and human beings cooperate, but also how the railway-specific safety design is reflected in the control structure was considered.

【System overview】
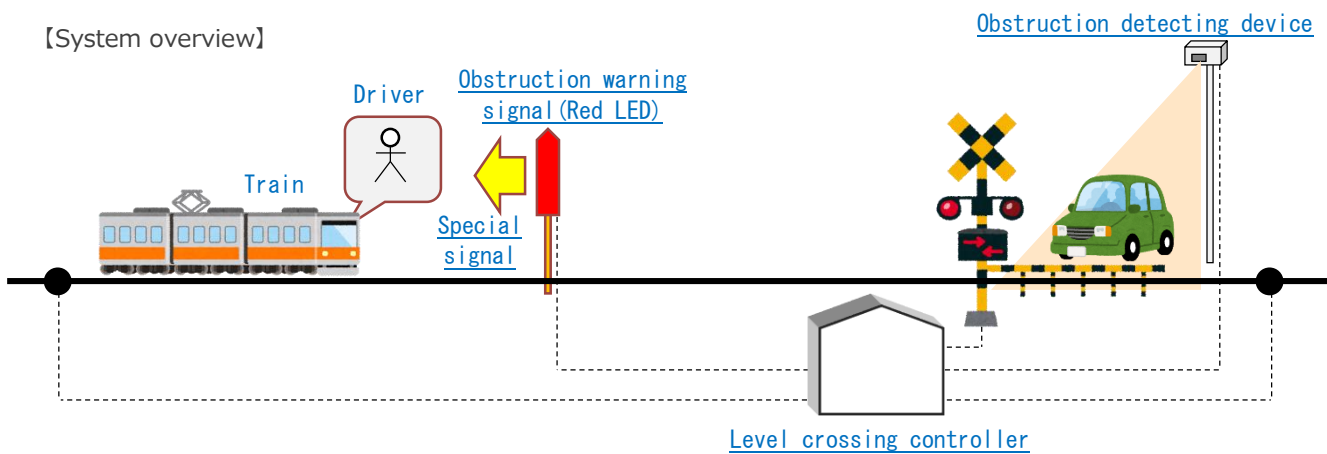
Keywords

(1) Level crossing

(2) Obstruction detecting device

(3) Obstruction warning signal

(4) Special signal