

## Development of an Interactive Display-Control Layout Design System for Trains Based on Train Drivers' Mental Models

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**Abstract :** Human error is the most salient contributing factor to railway accidents. To reduce the frequency of human errors, many researchers and train designers have adopted ergonomic design principles for designing display-control layout in rail cab. There exist a number of approaches for designing the display control layout based on optimization methods. However, the ergonomically optimized layout design may not be the best design for train drivers, since the drivers have their own mental models based on their experiences. Consequently, the drivers may prefer the existing display-control layout design over the optimal design, and even show better driving performance using the existing design compared to that using the optimal design. Thus, in addition to ergonomic design principles, train drivers' mental models also need to be considered for designing display-control layout in rail cab. This paper developed an ergonomic assessment system of display-control layout design, and an interactive layout design system that can generate design alternatives and calculate ergonomic assessment score in real-time. The design alternatives generated from the interactive layout design system may not include the optimal design from the ergonomics point of view. However, the system's strength is that it considers train drivers' mental models, which can help generate alternatives that are more friendly and easier to use for train drivers. Also, with the developed system, non-experts in ergonomics, such as train drivers, can refine the design alternatives and improve ergonomic assessment score in real-time.

**Keywords :** display-control layout design, interactive layout design system, mental model, train drivers

**Conference Title :** ICIEM 2016 : International Conference on Industrial Engineering and Manufacturing

**Conference Location :** Bangkok, Thailand

**Conference Dates :** December 12-13, 2016