car body shell doors and interiors

Human–Machine Interface in Transport Systems: An Industrial Overview for More Extended Rail Applications

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Since the 1920s, with the first radio-controlled vehicle, researchers have been pursuing the development of autonomous vehicles without drivers.
Today, companies are increasingly interested in investing in the technologies that enable autonomous driving, as the advantages that large-scale adoption of self-driving vehicles could offer become more visible. With the intent of moving towards autonomous driving, the transport industry has been employing a great number of diverse Human Machine Interface (HMI) design and command systems in commercial or experimental operation.

The role of HMI in semi-autonomous vehicles, and thus their study, is extremely important as their design must give the driver awareness of the situation to effectively regain control if called upon to intervene, as it could be in the case of emergencies. A successful HMI not only let the user gain awareness of the situation, but also builds confidence in the capabilities of the vehicle.

Studying the role of HMI in fully autonomous vehicles, on the other hand, is a way to address the problem of social fear regarding this technology and support its introduction into the market.

With the double aim of meeting the expectations of train drivers and staff engaged in HMI automation functions and facilitating its progressive introduction, CARBODIN focused on identifying the required inputs and available outputs of various systems and operator preferences.

To better understand the HMI potential applied to railways, the authors investigate how HMI is used in other transport modes and its advantages.

Firstly, the study focused on automatic and semiautomatic control systems developed by manufacturers of surface vehicles outside the railway field, such as trucks, cars and ships.

The authors included those systems that present potential application to railway vehicles, ensuring the high level of safety typical of guided transport systems and the possibility of a fast switch from autopilot to manual operation and vice versa.

The advantages of HMI are indeed impressive. For example, the Tesla car autopilot suggests when to change lanes to optimise the route and makes adjustments to avoid remaining behind slow vehicles. It also automatically guides the vehicle through junctions and onto highways exits based on the selected destination. Another example - this time in the naval sector - is the FALCO, which can alter the vessel course and speed automatically during the approach to a quay, and dock in a fully-automated manoeuvre without human intervention

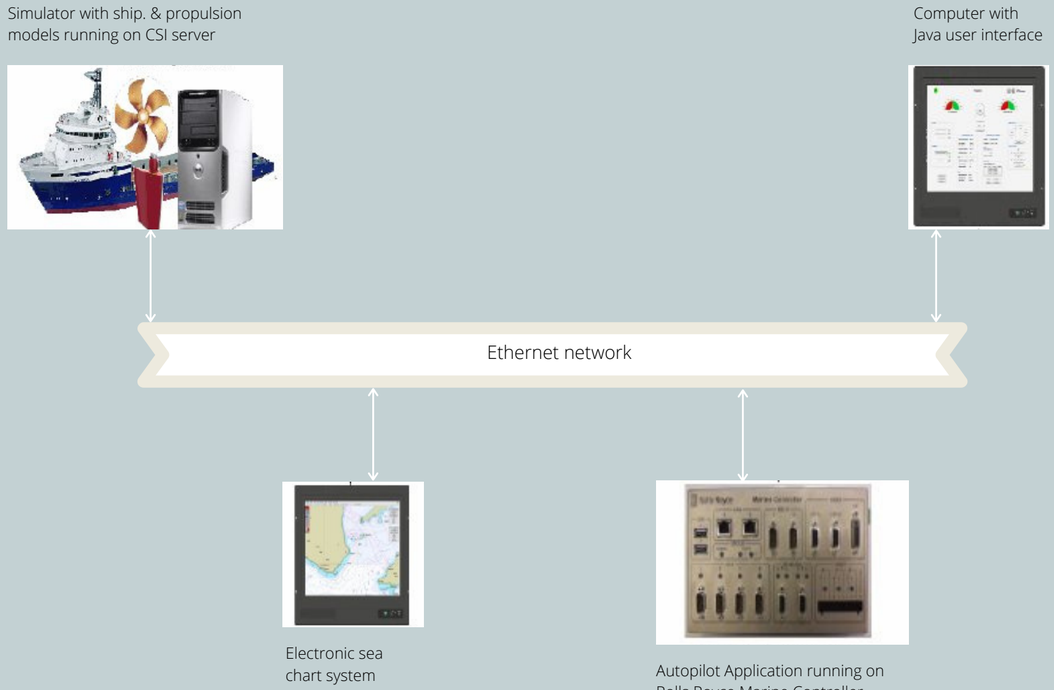

Fig. 1 – The FALCO autopilot

Fig. 2 – PSCHITT-RAIL simulator interface.

Fig. 3 Integrated CAE 7000XR flight simulator

Similarly, the authors analysed simulators developed for various transport systems that may potentially apply to railway vehicles and possibly be suitable for driver training activities. Rail simulators able to deal with operational situations including traffic conflicts (e.g., nodes, junctions, level crossings) as the PSCHITT-RAIL simulator, the SPICA RAIL, the OKTAL SYDAC simulators, and the IFFSTAR-RAIL have been analysed, together with cars aviation and integrated simulators.

The study analyses how HMIs can incorporate human factors, including eye- and heartbeat- tracker technologies, and includes a comprehensive review of gesture control systems as operational tools to put them into practice.This research is indeed essential as it provides a detailed HMIs categorisation, including their technical approaches and current issues. Furthermore, all the investigated systems have reached a sufficient level of maturity to be implemented in the design of train driver cabins. These findings are promising as they will allow the Rail sector to employ HMIs for new, more extended applications.

Link to the full Paper.

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