Equality, Diversity and Inclusion within the Train Driver Population and Its Impact on the Acceptance and Use of Driver Advisory System

1. Project Background, Aim, and Objectives:

Driver Advisory Systems (DAS) are considered on the transition pathway for train automated driving and recognised as a means of optimising train performance to reduce energy consumption. This project aims to identify the impact of drivers from different backgrounds on the reaction of DAS. The project team will firstly arrange a workshop and a survey with drivers and staffs from rail operators to identify their acceptance on DAS. The team will then develop a new DAS to improve the driving approach and verify the system on a train cab simulator. The project started in June 2022 and finished in September 2022.

2. Project Outcomes:

The project team had a few discussions with staff from Hefei Metro (China) and Nottingham Tram regarding the use of DAS. The attendances include train drivers, driver trainers, and operation managers. The project team presented and introduced the features of the DAS. The attendances were very interested in the system and gave a few useful comments, including the interface layout recommendations, system installation location suggestions, voice assistant, driver's performance analysis, and so on.
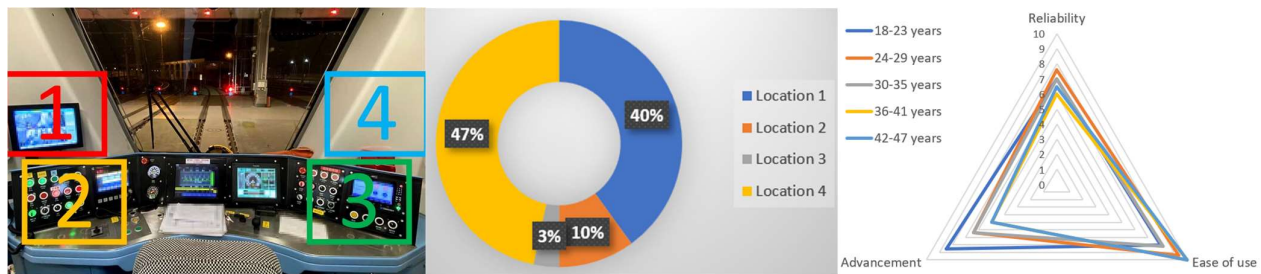

Figure 1 Driver survey sample results

Based on the conversation and the survey results, the project team found that drivers from different backgrounds perform differently. For example, new drivers prefer shining and new functions (e.g., voice assistant), whereas experience drivers prefer a quiet and easy-running environment to avoid confusion. The operation managers are also interested in how to verify and improve their drivers' behaviour. Hefei Metro is very interested in this system and is considering funding a collaborative project to apply the system in practice.
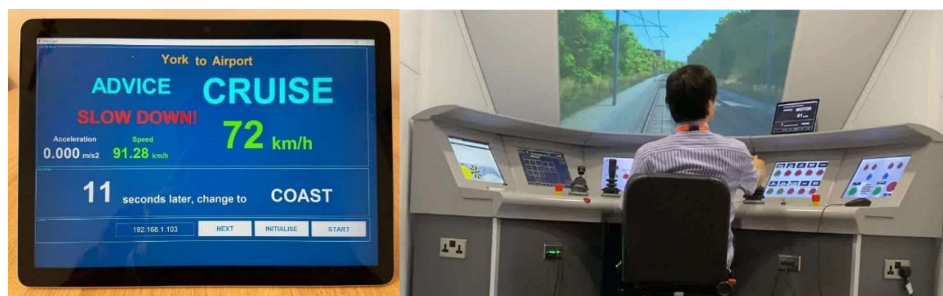

Figure 2 Developed new DAS system and tests

Based on the driver's survey results, the project team improved an existing DAS with new functions added, such as voice assistant, theme changing, etc. In order to evaluate the performance of the new system, the project team carried out a test on the UoB BCRRE train cab simulator, which uses virtual reality to give a realistic interactive experience that allows users to learn how to optimise their decisions and driving behaviour. A comparison study was considered (driving with/without the DAS) to identify the performance of the improved DAS when driving the train.

The test results are shown in Figure 3. When the train is controlled without advice from the DAS, the driver is trying to keep the train at a constant speed after the train reaches the target speed. As results, the train keeps on consuming energy during this cruising mode and spends 14.7 kWh of energy. For comparison, when the DAS is applied, the train is using coasting mode after reaches to the target speed, thereby consuming less energy (-11%).
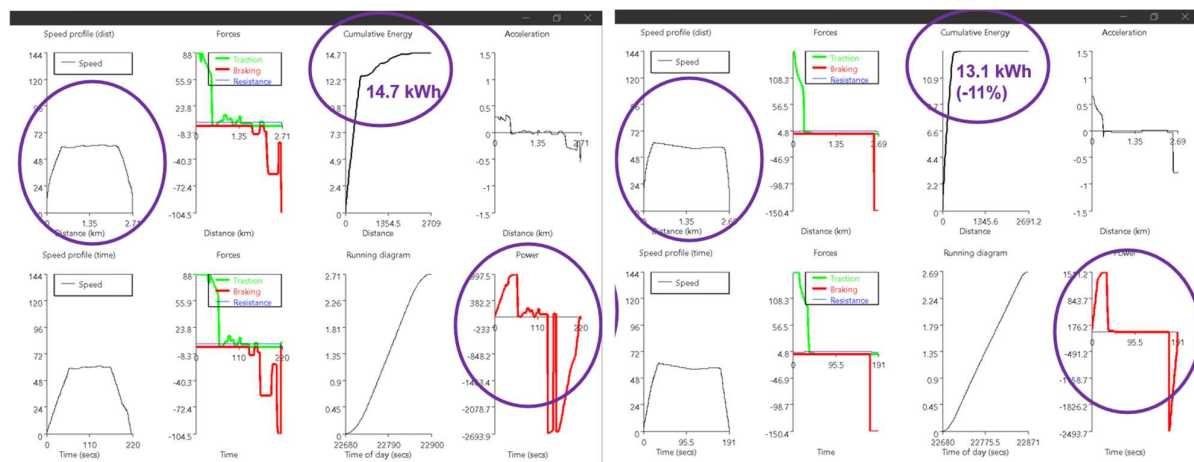

Figure 3 Comparison of the test results, without DAS (left) and with DAS (right).

3. Project Publications and Follow-on Funding

The project outcomes contributed to the development of two journal articles on energies (impact factor 3.004). Furthermore, the system developed from this project will be used in a few follow-on projects to expand its impact, including projects with Ricardo Rail and Nottingham Tram, please see the details below.

1. The project team is going to work with Ricardo Rail and Nottingham Tram to carry out a trial test of the system. The improved DAS developed from this DTE project will be used to improve the driving strategy and reduce energy consumption. The project has been approved and the work will start in the middle of January. The new system also received attentions from Manchester Tram and Glenelg-Adelaide trams in Australia.
2. The project team is going to apply for EPSRC Impact Acceleration Account (IAA), Knowledge Transfer Acceleration Fund. An industrial company will be involved in the project to develop business cooperation, support research commercialisation, and boost the research impact.