A.R.T.Forum
Automated Road Transport

Interreg
North Sea Region
ART-Forum
European Regional Development Fund

EUROPEAN UNION

Optimally Extending Public Transport with New AV-Serviced Routes

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While self-driving technology is still being perfected, planners are increasingly interested in the ability to leverage connected and autonomous vehicles (CAVs) to extend existing public transport (PT) systems. As part of the ART-Forum project, we proposed and demonstrated an artificial intelligence (AI) strategy that combines (multi-objective) global search algorithms with macro-level mobility simulations based on publicly available data to automatically discover optimal means of extending existing transport systems with new CAV-centred PT services. Insightful results across different scenarios are indicative of the ability of our approach to support efficient data-driven public transport planning.

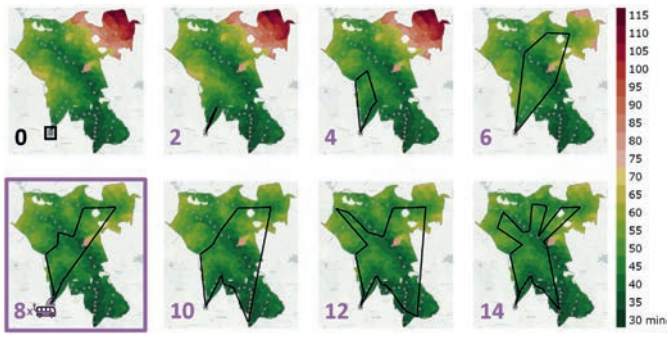
What are the key outcomes?

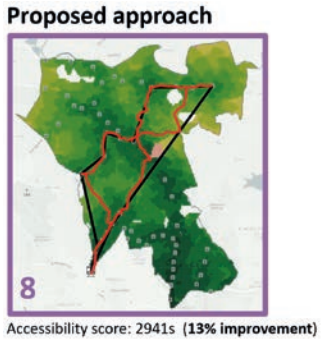
Using the software we developed as part of the project to implement the proposed AI strategy for optimal CAV deployment, we obtained several insightful results on real-life case studies defined together with our ART-Forum partners.

Thus, in our work with the **West Yorkshire Combined Authority** (WYCA), we mainly focused on urban PT modelling and discovering optimal cost-benefit trade-offs that could be achieved when using CAVs to improve average commuting time in three different zones within the Leeds Metropolitan Area. In one of these scenarios, we also collaborated with partners from **German Aerospace Center** (DLR) to refine our modelling using outputs obtained via micro-mobility simulations.

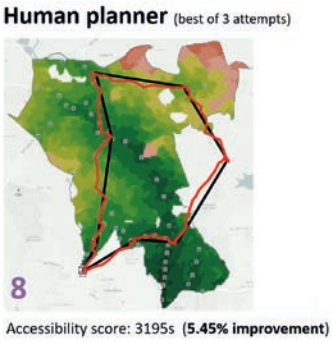
Together with partners from the **City of Mechelen** (Belgium) we focused on modelling PT commuting time across a wider area, with a special focus on the interplay between local and regional transport and its dynamic over a 24-hour cycle.

> *RGU modelling enabled us to explore CAV potential in West Yorkshire.*





Accessibility score: 2941s **(13% improvement)**



Accessibility score: 3195s **(5.45% improvement)**

In general, our results indicate that (i) important commuting time improvements of 13% – 30% could be obtained on niche CAV deployment scenarios and (ii) there is significant value in automating the production of realistic solutions that can tackle the increasingly complex challenges of public transport planning.

What are the next steps?

Valuable knowledge exchanged with partners and stakeholders throughout the project has helped to highlight key focus areas for the future development of our AI planning strategy. Thus, insights from ART-Forum workshops, qualitative research and pilots with autonomous shuttles indicate that the potential ability of CAVs to simultaneously reduce traffic congestion and improve mobility is seen as a (if not the) major benefit of the technology within the transport ecosystem. However, apart from developments in self-driving technology, careful planning of how to best deploy CAVs considering the unique characteristics of each application scenario can be critical to ensuring success. This means that one key element of our approach with potential for future research is increasing the flexibility of CAV deployment options in the simulation-optimisation framework.

To date, in most of the scenarios we modelled, focus has fallen on discovering optimal high-frequency PT services along circular routes. While this is suitable for rush-hour use cases, several shared mobility applications aim to use CAVs for their ability to deliver demand responsive transportation (DRT) in slacker hours of the day. Therefore, further developments of our approach will pivot towards temporally-variant journey demand models coupled with CAV behaviours that consider stop availability and dynamic routing and speed constraints. This can be supported by complementing the data sources on which the macro-level simulations rest with further information regarding passenger volumes and destinations. Finally, the effects of CAV deployment on traffic behaviour need to be assessed and fed back into the optimisation. Joint work with DLR indicates that this could be addressed by coupling our strategy with existing micro-level traffic simulation technologies.

> *AI-driven multi-modal optimisation can shape the future of city planning.*

Contact

To get in touch with ART-Forum, please visit our website

www.art-forum.eu

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