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Beyond the hype: Real-world considerations for truck platooning implementation

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INTRODUCTION

A successful implementation of any new technology relies not only on technical feasibility, but also on the usefulness to achieve an intended objective and the acceptance and adoption by its targeted users. As with the entire transport sector, road freight transport is facing the revolution and the challenges posed by vehicle automation, whereas in this particular case, automation involves many aspects beyond the systems' use that go from drastic changes in work conditions to the reconfiguration of logistics operations. In this way, truck platooning is one of the most disruptive concepts related to driving automation that has emerged with enthusiasm from manufacturers and regulators, eager to demonstrate its technical feasibility and energy efficiency.

However, raising concerns about safety and real-world environmental and cost benefits cast doubt on the use cases of truck platooning, particularly regarding its feasibility for intermediate levels of driving automation and the adaptation to complex logistics processes. As OEM's refrain expectations and postpone implementation goals, and logistics operators reveal few knowledge and interest, it is important to recentre truck platooning research on human factors and understand the perspective of drivers, as end-users of the technology. We argue that, without their engagement and knowledge of real-world driving, it would be impossible to define the technology domain and use cases, and consequently to deliver useful and acceptable solutions.

RESEARCH METHODOLOGY

Under the research project TRAIN – Mapping risks and requirements for truck platooning using a driving simulator, we carried out five focus groups (FGs) with 6-8 professional truck drivers per session to characterize: (i) their activity and working conditions, (ii) their representations of automated driving systems (iii) the expected impacts of truck platooning implementation on their own activity, (iv) the expected impacts of truck platooning implementation on others' activity, and (v) the expectations for road freight transport in the near future. Based on the analysis of the FGs, we developed an online survey to target a wider audience of truck drivers,

supported by two well-established frameworks: the Technology Acceptance Model (TAM) and the Theory of Acceptance and Use of Technology (UTAUT). The questions emerging from the focus groups were then consolidated in a structured survey with the following sections: (i) sociodemographic characteristics, (ii) professional path and experience, (iii) knowledge and attitudes towards advances driver-assistance systems (ADAS) and automated/autonomous trucks, (iv) perceived value of automated trucks and truck platooning technology, (v) perceived risks of automated trucks and truck platooning technology, (vi) requirements for adoption of truck platooning technology, and (vii) intention to use automated trucks and truck platooning technology. Before the questions directly related to truck platooning, drivers are invited to watch a short demonstration video. Whenever possible, the responses are collected using a six-point Likert scale. This survey is currently open at https://bit.ly/trainreact.

In a first step, we explore the survey results using basic descriptive statistics. Then, we aim to conduct a more robust statistical analysis to identify relations between users' characteristics/knowledge/opinions and the intended use cases associated to different levels of technology development (level of automation) and operations model (e.g., single- or multi-company platoon). For that, a k-medoids cluster analysis will be conducted and, if the sample is robust enough, an exploratory factor analysis followed by structural equation modelling will be tested to identify latent constructs and quantify the correlations between the collected variables, the latent constructs, and the use cases.

PRELIMINARY RESULTS

Considering the responses obtained so far, drivers state they tend to use and are receptive to have training on new technologies once these are available in their vehicles (Avg=5.1; SD=0.9). Regarding social influence, drivers like to use the same technologies as their peers (Avg=4.7; SD=1.1).

Drivers generically perceive truck platooning as easy to use (Avg=4.4; SD=1.4). Regarding performance expectations, drivers see the reduction of emissions as the main benefit (Avg=4.6; SD=1.2), but are less assertive in relation to the reduction of traffic congestion (Avg=3.8; SD=1.7). Most believe the system is trustable (Avg=3.9; SD=1.6) but show some reserves about the maintenance of an adequate following distance and the interactions with other traffic. Therefore, truck drivers require to supervise (Avg=4.5; SD=0.9) and, if necessary, override automation (Avg=4.7; SD=0.8). The reluctance to lose control is also demonstrated by a neutral position towards the possibility of resting or doing other tasks. Drivers are also concerned with monotony and the risk of drowsiness while driving in automated mode (Avg=4.3; SD=1.5), but not so much with discomfort and motion sickness (Avg=2.9; SD=1.6). Liability in case of a crash (Avg=3.8; SD=1.5) and privacy issues (Avg=3.2; SD=1.7) are moderately considered. They adopt a neutral position in relation to the possibility of job elimination or reconfiguration.

Regarding the intention to use, truck drivers prefer to drive manually as platoon leaders (Avg=4.2; SD=1.6) or supervise the automated system as leaders (Avg=4.5; SD=1.3) or followers leaders (Avg=4.5; SD=1.6). They have a less positive view of unsupervised driving as leaders (Avg=3.1; SD=1.8) or followers (Avg=3.1; SD=1.9). They also show some reluctancy in traveling in convoy with drivers they do not personally know (Avg=3.2; SD=1.8).

DISCUSSION AND CONCLUSIONS

The preliminary results show that truck drivers are open to test new automated driving systems, but prefer to maintain a certain degree of control over automated driving systems. This aligns with the results from the FGs, where some previous safety-critical experiences related with the lack of maturity of ADAS currently present in their vehicles were reported. In this way, previous experience seems to hinder the trust in future technology. Therefore, based on their previous knowledge, truck drivers seem to prefer intermediate levels of automation over high- and full-automation over safety concerns. This seems a paradox, as high- and full-automation levels are arguably much safer than partial- and conditional-automation, as the former will only be introduced to the market and take the human driver out-of-the-loop when system limits constraints are solved.

Accordingly, the moderate trust and enthusiasm about the potential benefits of automated systems leads drivers to see full automation as a distant future. As being on-the-loop is an important requirement for truck drivers, changes to mandatory stops and resting periods will face resistance. Additionally, considering the shortage of professional drivers affecting the European road freight transport market, they do not perceive automation as an immediate threat to their job.

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