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## **Introductory Editorial: Safety and standards for connected and autonomous vehicles**

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### **Umar Zakir Abdul Hamid**

Autonomous Vehicle Software Product Development  
and Management,  
Sensible 4 Oy,  
Turuntie 42, 02650, Espoo, Finland  
Email: [umartozakir@gmail.com](mailto:umartozakir@gmail.com)

### **Azra Habibovic**

RISE Research Institutes of Sweden,  
Lindholmspiren 3A, SE-417 56,  
Gothenburg, Sweden  
Email: [azra.habibovic@ri.se](mailto:azra.habibovic@ri.se)

### **YanJun Huang**

School of Automotive Studies,  
Tongji University, 201804  
Shanghai, People's Republic of China  
Email: [huangyanjun404@gmail.com](mailto:huangyanjun404@gmail.com)

### **Georgios Papaioannou**

Centre for ECO2 Vehicle Design,  
Department of Engineering Mechanics,  
KTH Royal Institute of Technology,  
Teknikringen 8, SE-10044,  
Stockholm, Sweden  
Email: [papaioa@kth.se](mailto:papaioa@kth.se)

### **Mohsen Alirezaei**

Automated Driving,  
Siemens Industry Software and Services B.V.,  
Digital Industry – Software – Simulation and Testing Services,  
Automotive Campus 10, 5708 JZ,  
Helmond, The Netherlands  
Email: [mohsen.alirezaei@siemens.com](mailto:mohsen.alirezaei@siemens.com)

**Biographical notes:** Umar Zakir Abdul Hamid, PhD, has been working in the autonomous vehicle field since 2014 with various teams in different countries (Malaysia, Singapore, Japan, Finland). He is now the Team Lead of the Autonomous Vehicle Planning and Control Algorithm Development at Sensible 4 Oy, Finland, leading a team of 12 engineers. He is an active member of several Society of Automotive Engineers (SAE) Task Forces, focusing on the autonomous vehicle active safety topics. He is also one of the recipients of the Finnish Engineering Award 2020 for his contributions to the development of all-weather autonomous driving solution with Sensible 4. He has performed editorial tasks with *SAE International Journal of Connected and Automated Vehicles*, *SAE Technical Papers* and *International Journal of Vehicle Autonomous Systems*, among many others.

Azra Habibovic is senior researcher at the independent and non-profit organisation RISE Research Institutes of Sweden, and research area director for road-user behaviour at the research centre SAFER. She holds a PhD in Vehicle Safety Systems (2012) and an MSc in Electrical and Electronics Engineering (2006), both from Chalmers University of Technology, Sweden. Her research focuses on improving traffic safety and user experience by means of automation and connectivity. Her special interest is design and evaluation of interactions in and around automated vehicles, including interactions with vulnerable road users.

Yanjun Huang is a Professor at School of Automotive Studies of Tongji University. He received his PhD from the University of Waterloo in 2016, where he worked as a research associate. His research interest is mainly on the vehicle holistic control in terms of safety, energy-saving, and intelligence, including vehicle dynamics and control, HEV/EV optimisation and control, motion planning and control of connected and autonomous vehicles, and human-machine cooperative driving. He has published several books and over 80 papers in journals and conference. He is the recipient of IEEE Vehicular Technology Society 2019 Best Land Transportation Paper Award, the 2018 Best paper of Automotive Innovation, and top 10 most popular paper in *International Journal of Automotive Technology*. He is serving as Associate Editor and Editorial Board Member of *IET Intelligent Transport System*, *SAE International Journal of Commercial Vehicles* and *International Journal of Vehicle Autonomous Systems*, among many others.

Georgios Papaioannou received his PhD in Automotive Engineering from National Technical University of Athens (NTUA) at Greece in 2019. Recently, his PhD dissertation was awarded the second prize for its potential industrial impact among other NTUA graduates. After his graduation in the summer of 2020, he worked at Cranfield University, UK, as a Research Fellow extending his research in automated vehicles and human factors-oriented studies. Recently, he joined KTH Royal Institute of Technology of Sweden as a Postdoctoral Researcher at the Center for ECO2 Vehicle Design. His research interests include automated and human-driven vehicles, vehicle dynamics, human factors, suspension design, tyre modelling, optimisation, control and motion planning.

Mohsen Alirezaei received his PhD in Mechanical Engineering, Robotics and Control in 2011 and was a Postdoc researcher at Delft University of Technology in 2012. He was a Senior Scientist in the Integrated Vehicle Safety Department of TNO Automotive (2012–2019) and part time Assistant Professor at Delft University of Technology (2015–2019). He is currently working as a Fellow Scientist at Siemens Industry Software and Services in Helmond and is part time Assistant Professor at Eindhoven University of

Technology, the Netherlands. His research interests are verification and validation of automated and cooperative automated driving and advance driver assistance systems.

**Keywords:** autonomous vehicle; connected vehicle; safety; standards.

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## 1 Background

Active progress has continuously been made in the connected and autonomous vehicles (CAV) field in the past few years. Despite the COVID-19 global pandemic, positive developments were made in 2020 related to the CAV sector. For example, technology giant Amazon bought Zoox, an autonomous vehicle company for over USD 1 billion (Jindal et al., 2020). This manifests ongoing demand for the industry despite the glooming economic situation globally. Additionally, several recommendations and guidance on CAV safety were published throughout the year, which includes the best practice guidelines by Automated Vehicle Safety Consortium entitled ‘Data collection for automated driving system dedicated vehicles to support event analysis’ (<https://www.sae.org/standards/content/avsc00004202009/>). This signifies the increasing awareness of CAV safety among a number of groups of practitioners.

## 2 Objectives and aims of the special issue

However, despite the positive growth in the field, articles and concerns are still being reported regarding safe implementations of CAVs which highlight the public concerns on the said topics. Despite acknowledging the potential benefits of CAVs, some members of the public are still pessimists about CAV safety (Moody et al., 2020).

For CAV technology to be fully accepted, safety must be given high consideration in the development and production stages. As the full implementation of CAVs has the potential to reduce a significant amount of road fatalities, the whole process of designing, engineering and executing CAVs needs to be safe. Safety and standards should include considerations of software and automation systems, as well as the physical hardware designs. These require detailed investigations of the safety and standards for dependable CAVs. For example, among the widely discussed related keywords and standards of this topic are ISO 26262, ISO/PAS 21448 and SAE J2980.

Thus, this special issue on “Safety and Standards for Connected and Autonomous Vehicles” for *International Journal of Vehicle Design* is proposed to increase and spread the awareness on these topics among the public audience, researchers and practitioners. It aims to gather recent diverse background works and achievements related to the safety and standards for CAVs. The special issue is co-edited by experienced researchers of CAV domains based in Finland, Sweden, China and the Netherlands. The guest editors expect it to attract interest from multi-disciplinary sectors in the automotive fields, thus contributing to a safer CAV landscape.

### 3 Submissions Overview

As an overview, the submissions to this special issue consist of wide-spectrum state-of-the-art works on CAV safety and standards topics. In the works by Englund, Zhang et al. and Hamdi et al., discussions about the situational and environmental awareness for CAV in mixed-traffic scenarios are discussed. Zhang et al. and Jiang et al. in their papers highlight the advancements in control strategy for CAV manoeuvres, which is an important part of yielding comfortable and safe driverless navigation. The collision avoidance topics are discussed by Wang et al. and Ji et al. in their articles, where the planning and control modules of the CAV safety systems are investigated. As CAV consists not only of the vehicle navigation from point A to B, the special issue also discusses the fuel economy potential benefit related to CAVs in the work of Kavas-Torris et al.

### 4 Conclusions and expectations

As mentioned in the previous section, this special issue aims to discuss the safety and standards for CAV topics from the multi-angle point of view. Hopefully, the publication can improve the safety awareness among CAV practitioners and the public audience, thus subsequently increasing the user awareness, which can help to facilitate wide public acceptance of the technology.

### Acknowledgements

The editors would like to thank all the reviewers and authors involved in production of this special issue.

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