The SafetyOps Dilemma: a Systematic Mapping Study on Rapidity in Safe AD Development - Supplementary Materials

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I. Extracted data

Table I presents the extracted information about the selected studies in a concise and organized manner, making it easy for readers to review and compare the studies. It includes essential information such as the year of publication, the industry addressed, whether the study is peer-reviewed, or the source of the study. Table I provides a useful reference for researchers to gain a better understanding of the field.

II. Excluded studies

On the other hand, Table II lists some of the excluded studies, identifying the reason for exclusion (rationale). Other studies, as discussed in the study, are excluded for their quality, rigour, or usage of non-empirical methods.

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TABLE I
EXTRACTED INFORMATION ABOUT THE INCLUDED STUDIES

Year	Title	First author	Industry	Peer reviewed	Source
2018	Data Centric Communication and Containerization for Future Automotive Software Architectures	S. Kugele	Automotive	Yes	IEEE Xplore
2018	Safely Entering the Deep A Review of Verification and Validation for Machine Learning and a Challenge Elicitation in the automotive industry	M. Borg	Automotive	Yes	Journal of Automotive Software Engineering
2018	It takes three to tango: Requirement, outcome/data, and AI driven development	J. Bosch	embedded systems (automotive)	Yes	Google Scholar
2018	Requirements engineering in the age of societal-scale cyber-physical systems: The case of automated driving	K. Czarnecki	Automotive	Yes	IEEE Xplore
2019	Software engineering for automated vehicles addressing the needs of cars that run on software and data	K. Czarnecki	Automotive	Yes	IEEE Xplore
2019	The Automotive Take on Continuous Experimentation A Multiple Case Study	F. Giaimo	Automotive	Yes	IEEE Xplore
2019	Continuous Deployment for Dependable Systems with Continuous Assurance Cases	F. Warg	Systems engineering	Yes	IEEE Xplore
2019	A model driven engineering framework to support the functional safety process	B. Meyers	Functional safety engineering (automotive)	Yes	IEEE Xplore
2020	SafetyOps	U. Siddique	Safety engineering (automotive)	No	Google Scholar
2020	SafeOps a concept of continuous safety	C. Fayollas	Safety engineering (automotive)	Yes	IEEE Xplore
2021	Developing SEooC - Original Concepts and Implications when Extending to ADS	R. Johansson	Safety engineering (automotive)	Yes	Google Scholar
2021	Towards Establishing Continuous-X Pipeline Using Modular Software-in-the-Loop Test Environments	I. Raghupatruni	Automotive	Yes	SAE Technical Paper series
2022	Architecture as a Backbone for Safe DevOps in Automotive Systems	S. Kugele	Automotive	Yes	IEEE Xplore
2022	An Industrial Experience Report about Challenges from Continuous Monitoring Improvement and Deployment for Autonomous Driving Features	A. Nouri	Automotive	Yes	IEEE Xplore
2022	Continuous Learning Approach to Safety Engineering	R. Johansson	Safety engineering (automotive)	Yes	Google Scholar
2022	STPA Driven Multilevel Runtime Monitoring for In Time Hazard Detection	A. Jayakumar	Safety engineering	Yes	Springer
2022	Automating Safety Argument Change Impact Analysis for Machine Learning Components	C. Cārlan	Safety engineering	Yes	IEEE Xplore
2022	DevOps and Safety? SafeOps! Towards Ensuring Safety in Feature-Driven Development with Frequent Releases	P. Munk	Safety engineering	Yes	Springer
2022	Towards Continuous Safety Assurance for Autonomous Systems	P. Schleiss	Safety assurance	Yes	IEEE Xplore

TABLE II
LIST OF EXCLUDED STUDIES IDENTIFYING THE REASON FOR EXCLUSION

Year	Title	First author	Rationale
2020	Towards a Taxonomy for Eliciting Design Operation Continuum Requirements of Cyber Physical Systems	J. Ayerdi	CPS requirement engineering with a railway industry case study, not specific to safety.
2021	Towards a continuous certification of safety critical avionics software	C. Baron	Avionics method, no mention of automotive/safety applicability.
2020	DevOps in an ISO Regulated Environment A Multi-vocal Literature Review	M. Lie	DevOps for medical devices, not automotive/safety-related.
2020	A Continuous Certification Methodology for DevOps	F. and Gaudenzi	Generic paper, no claims about automotive/safety applicability.
2020	Fast track lifecycle using SafeScrum and The Agile Safety Case	T. Myklebust	Not peer-reviewed, quality low.
2020	Integration of Security Standards in DevOps Pipelines: An Industry Case Study	F. Moyón	It is not related to safety and automotive.
2021	Developing and Operating Artificial Intelligence Models in Trustworthy Autonomous Systems	M. Martínez-Fernández	Trustworthiness of autonomous systems in DevOps, not safety-related.
2020	Continuous Experimentation for Automotive Software on the Example of a Heavy Commercial Vehicle in Daily Operation	F. Giaimo	Heavy vehicle experimentation, challenging for safety-critical applications in vehicles.
2022	ACIA A Methodology for identification of Architectural Design Patterns that support Continuous Integration based on Continuous Assessment	F. Helwani	Is not related to safety.
2023	Seven Lessons Learned From Automotive Software Supplier Collaborations	V. Antinyan	Not safety-relevant.
2021	Proposing a Framework for Impact Analysis for Low Code Development Platforms	M. Overeem	Not related to automotive safety.
2015	Service Dependability with Continuously Revised Assurance Cases by Multiple Stakeholders A Case Study	K. Kuramitsu	About education services, not automotive safety-critical applications.
2021	DDI A novel technology and innovation model for dependable collaborative and autonomous systems	E. Armengaud	Not related to DevOps.
2019	Industrial Perspective on Reuse of Safety Artifacts in Software Product Lines	R. Wolschke	Focuses on reusing components and artifacts in new projects, not continuously changing components. Only a small part discusses integrating safety, which requires further research.
2021	Requirement Engineering Challenges for AI intense Systems Development	H. Heyn	Is not related to safety applications.
2022	Improving Documentation Agility in Safety Critical Software Systems Development For Aerospace	J. Silva Cardoso Rodrigues	Is about aerospace with the need for further investigation on the applicability of the solution in the automotive industry and validation through industry case studies.
2020	A case study of agile software development for safety Critical systems projects	M. Borg	It is not related to the automotive industry.
2016	Agile safety case for vehicle trial operations	T. Myklebusta	It provides an oversimplified safety case for low-speed AD in Agile and does not consider high-speed AD and customer vehicles in the context of ISO or ISO. However, it may be useful as a general safety argument description.
2020	A Preliminary View on Automotive Cyber Security Management Systems	C. Schmittner	Is not relevant to safety or DevOps.
2020	Scenarios in the Loop Integrated Requirements Analysis and Automotive System Validation	R. Wiecher	Discusses devOps and safety separately without providing any solutions or challenges for DevOps safety.
2022	Towards an AI driven business development framework A multi case study	H. John	Discusses AI in general with some content on MLOps and safety, but not specifically DevOps safety.
2021	Machine Learning Development Audit Framework Assessment and Inspection of Risk and Quality of Data Model and Development Process	J. Stodt	Not related to safety or DevOps.
2022	Intelligence Driven Software Performance Assurance	M. Moghadam	Is a PhD thesis about machine learning and not relevant to DevOps.
2016	Organic Evolution of Development Organizations An Experience Report	J. Shahrokni	It is not related to the safety of DevOps.
2019	On the Nature of Automotive Service Architectures	V. Cebotari	It is not related to the safety of DevOps.
2017	Deliverable Internet of Things Risk Analysis and Assessment	G. König	It is not related to the safety of DevOps.
2021	Exploring the Assessment List for Trustworthy AI in the Context of Advanced Driver Assistance Systems	M. Borg	It is not related to the safety of DevOps.
2021	ADS Safety Assurance Future Directions	M. Gyllenhammar	It is not related to the safety of DevOps.
2022	Taxonomy of Machine Learning Safety A Survey and Primer	Z. Mohseni	It is not related to the safety of DevOps.
2019	Software Verification and Validation Technologies and Tools	M. Rodriguez	It is not related to the safety of DevOps.
2023	An investigation of challenges encountered when specifying training data and runtime monitors for safety critical ML applications	H. M. Heyn	Focuses on the safety of machine learning, not DevOps safety.