Towards Assessing Risk of Reality Augmented Safety-critical Socio-technical Systems

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Abstract. Augmented reality such as immersive visual technologies, extend human's capabilities. However, if risk in safety-critical socio-technical systems containing such technologies is not properly assessed, these technologies may lead to catastrophic consequences when extended humans are part of the systems. Current state-of-the-art risk modeling methods do not explicitly consider how these extended capabilities may fail. In this short paper, we propose an extension for modeling safety-critical socio-technical systems containing augmented reality-extended humans. Our extension builds on top of SafeConcert, which is a metamodel for modeling component-based system architectures composed of hardware, software, humans and organizations.

Keywords: Safety Modeling · Risk Assessment · Augmented Reality · Safety-criticality · Socio-technical Systems.

Augmented reality (AR) enhances humans' capabilities and provides the possibility to have AR-extended humans. For example, an AR display, inside a car, makes it possible for a driver to observe information regarding the blind spots and earn some capabilities that were absent in the absence of this technology. As new technologies might introduce new failure types, risk assessment modeling methods should be extended to consider their effects. Currently, there are techniques for safety modeling of complex safety-critical socio-technical systems. However, the gap is settled in the effect of new technologies such as AR and new type of failures that would be introduced to the system by using these technologies such as failure of AR-extended capabilities. Thus, we propose an extension of modeling elements for modelling AR-extended humans. Our extension makes use of our previously proposed taxonomy for classifying failure behavior of AR-extended humans, characterized by typical and AR-extended human functions.

In [4], we proposed a taxonomy based on state-of-the-art human failure taxonomies by considering AR-specific characteristics. More specifically, we provided a taxonomy for socio-technical systems containing visual AR-extended humans. SafeConcert [3] is a metamodel for modeling socio-technical systems, implemented as part of CHESS ML (CHESS Modeling Language) [1], which is a UML (Unified Modeling Language)-based modeling language. In SafeConcert, the modeling of socio entities is based on SERA [2] taxonomy.

Our extended model elements to model human components are shown in Fig.1. SafeConcert model elements are shown in grey color. Our extension of modeling elements are shown with white color, solid and dotted border, which dotted border is for elements modeling AR-extended human functions. For example, surrounded detecting represents a function that extends the human (the driver). The possible failure behavior should be considered during risk assessment. As Fig. 1 shows, our extension constitutes a step towards enabling assessing AR-specific risks.

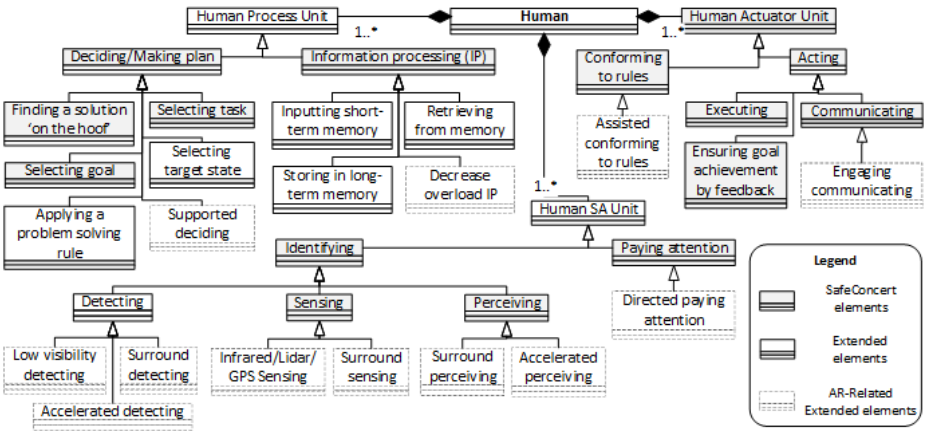

Fig. 1. Extended model elements to model human components

In this short paper, we extended SafeConcert, using a taxonomy that classifies AR-specific humans' failure behavior, to extend the elements for modeling AR-extended humans. We plan to illustrate and validate our extension on industrial case studies and we aim to extend current analysis techniques.

This research has received funding from the EU's H2020 programme under the Marie Skłodowska-Curie grant agreement No. 764951 (ImmerSAFE).

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