Web-based Smart Checklists for Guiding Performers of Safety-Critical Human-Intensive Processes

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Checklists have been shown to reduce human errors and to improve performance in some safety-critical human-intensive processes (HIPs) used in industries such as aviation and healthcare. We refer to a process as human-intensive if the contributions of human performers have significant impact on the process outcomes and require substantial domain expertise. Although checklists have been shown to be helpful for certain HIPs, the limitations of traditional checklists might partially explain resistance to their acceptance in some domains. For example, traditional checklists are often static, lacking the ability to adapt the information they show to process performers depending on the current context of the process that is being performed. Traditional checklists also often lack details about how process performers should respond to exceptional situations, even though human errors and inefficiencies often arise in such situations.

This project builds on an approach for generating context-sensitive smart checklists based on detailed formal process models. These process models specify both the normative ways to perform a complex, human-intensive process as well as a variety of exceptional situations that might arise and how process performers should respond to those situations. The smart checklists are dynamically updated based on how the performance of the process proceeds and provide guidance for both normative and non-normative situations based on the underlying detailed process model.

The focus of this project is to develop and evaluate a web-based interface for smart checklists. Such smart checklists run in a web browser and, thus, are accessible from various computing devices (e.g., desktops, mobile phones, and tablets with different operating systems) and should be relatively easy to use given the pervasiveness of web interfaces and most people’s familiarity with them. We expect that the web-based smart checklists would allow for quick prototyping of different user interface designs which should facilitate research on the human-computer interaction (HCI) aspects of the smart checklists project. We also expect that the web-based smart checklists would facilitate the personalization of smart checklists based on the role a process performer plays in the process.

Two undergraduate software engineering students from Quinnipiac University and their professor collaborated with researchers from UMass Amherst to design, implement, and evaluate the web-based smart checklists. We created a software architecture that establishes a bridge between a process model interpreter running on a server and smart checklists running in a client’s browser. An initial prototype was developed and demonstrated and we are currently evaluating this prototype on part of a blood transfusion medical process. That evaluation includes collecting feedback from domain experts on the web-based interface for the smart checklists, obtaining feedback from researchers on the ability of the proposed software architecture to support rapid
prototyping and exploration of the HCI aspects of the smart checklists, and measuring the reliability of the current prototype. Through this project, students gained experience with working on an interdisciplinary team, learned software engineering technologies beyond ones covered in the undergraduate curriculum, and contributed to a novel approach for reducing human errors and inefficiencies in safety-critical human-intensive processes, such as medical procedures.

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