Institute of Information Systems Engineering
Software Engineering
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Reference:	**QSE:ATG**
Topic:	**Agile Task Guidance**
Course Type:	Bakk-/Master Thesis, ASE or CS Project
Start:	As soon as possible
End:	To be defined
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Background

In a wide range of application areas, from drone field testing, over coordinated cooking, solving puzzles, experimentation in research labs, to training for reconfiguring or repairing technical systems, expert supervisors want to guide operators, such as testers, cooks, experimenters, or technicians, to conduct coordinated, repeatable processes, adapted to changing environments, such as varying material/data input, available tools and systems, or weather conditions. Figure 1 illustrates ATG application areas.

This project aims to explore in at least one application area *Agile Task Guidance* (ATG) that shall build on Behavior-Driven Development to design and validate method and tool prototypes, supporting an expert supervisor to specify actionable tasks, typically for a team of 3 to 6 human actors and machine actors, including sensors and software-intensive systems, as a foundation for configuring role-specific expert information systems that guide a role during a mission. A key goal is the improvement of process guidance, e.g., traceable field testing, repeatable cooking results, efficient experimentation, or low-risk repair. The project can build on preliminary data and prototypes.

Figure 1: ATG application areas - drone field testing and coordinated cooking.

ATG shall facilitate iterative quality improvement of process guidance in four steps:

(1) Scenario management: The supervisor shall specify phases and tasks with measurable pre- and post-conditions based on a domain model, such as drones with their properties and states.

(2) Guided mission and documentation: Human and machine actors conduct scenarios with their role-specific views. Mission observers document data, deviations, and issues in an event and task history. Role-specific expert information systems shall answer the question: What could I do next?

(3) Mission documentation retrospective: Human actors and observers validate collected field data and annotate issues with data, e.g., deviations of time stamps. This

retrospective of the event and task history is similar to the agile SE practice. The retrospective expert information system shall answer the question: What happened during the mission?

(4) Mission data analysis: The data analyst shall analyze event and task result data to calculate mission performance, as input to determine the quality level and options for improvement of the application processes.

Figure 2 illustrates ATG step (1) phases and tasks for cooking soft-boiled eggs with a human/computer cook actor. Computer functions can estimate the time for boiling the egg, based on the automated measurement of an egg's size, weight, and temperature. In a phase during ATG step (2), the cook can choose which tasks to start, depending on their fulfilled pre-conditions. The supervisor can specify tasks for the supervisor role to improve the guidance process.

Phase - Given	Given	When	Then	Priority
P01: Plan		Cooking manager shall specify the cooking order: size, delivery time, target consistency (soft-boiled), and number of eggs.	C10: Cooking order is specified; start P11, start P12	50
P12: Load		Cook shall fill a pot with cold water.	Pot filled with water	10
P12: Load		Cook shall fill a bowl with ice water (water and ice cubes).	Bowl filled with ice water	10
P11: Plan	C10	Cook shall input the egg parameters (egg size, egg temperature).	Egg parameters specified	20
P11: Plan		Cook shall estimate and record the time for boiling the egg (egg size/temperature, air pressure).	Boiling time specified	50
P11: Plan		Cook shall estimate and record the time for cooling the egg (egg size).	Cooling time specified	20
P12: Load		Cook shall put the batch of eggs into the pot.	Eggs in pot	40
P12: Load		Cook shall cover the eggs with cold water (fully submerged eggs).	C121: Eggs in pot covered with water; start P13	30
P13: Heat		Cook shall put the pot on high heat.	Water heating started	50
P13: Heat		Cook shall observe the pot until the water shows rolling boil.	Water in rolling boil	40
P13: Heat		Cook shall set the heating source to keep water simmering.	Water simmering	30
P13: Heat		Cook shall wait for the estimated boiling time (4 to 12 minutes).	C134: Boiling time finished	10
P14: Cool	C134	Cook shall drain the eggs.	Eggs boiled; start P14	10
P14: Cool		Cook shall put the eggs into a bowl filled with water and ice cubes	Egg in cooling bowl	40
P14: Cool		Cook shall wait for the estimated cooling time (1 to 2 minutes).	C143: Eggs cooled	30
P14: Cool	C143	Cook shall remove the eggs from the bowl and dry the eggs.	Soft-boiled eggs cooked, start P21	30
P21: Check		Cook shall check the cooked eggs for cracks, egg running out of the	Boiled eggs checked for cracks	30
P21: Check		Cook shall check the cooking state of the batch of eggs.	Soft-boiled eggs checked, start P22	30
P22: Delivery		Cook shall deliver the batch of soft-boiled eggs.	Soft-boiled eggs delivered	20

Figure 2: Behavior-driven task specification for cooking soft-boiled eggs with human/computer actors.

	A	B	C	D
11	Phase - Giv	Given	When	Then
12	P11: Plan		Estimate and record the time for cooling the egg (egg size).	Cooling time specified
13	P12: Load		Fill a bowl with ice water (water and ice cubes).	Bowl filled with ice water
14	P13: Heat		Wait for the estimated boiling time (4 to 12 minutes).	C134: Boiling time finished
15	P14: Cool	C134	Drain the eggs.	Eggs boiled; start P14
16	P14: Cool		Put the eggs into a bowl filled with water and ice cubes.	Egg in cooling bowl
17	P14: Cool		Wait for the estimated cooling time (1 to 2 minutes).	C143: Eggs cooled
18	P14: Cool	C143	Remove the eggs from the bowl and dry the eggs.	Soft-boiled eggs cooked, start P21
19	P21: Check		Check the cooked eggs for cracks, egg running out of the shell.	Boiled eggs checked for cracks
20	P21: Check		Check the cooking state of the batch of eggs.	Soft-boiled eggs checked, start P22
21	P22: Deliver		Deliver the batch of soft-boiled eggs.	Soft-boiled eggs delivered

Figure 2: Cook's view on relevant next tasks (in red box), based on pre-conditions and situational priority.

Figure 3 illustrates a role-specific user interface to inform a cook during ATG step (2) on the tasks that are ready to start, on the detail description of the current task, and on the event and task history, including observations similar to a log or social media history. The cook can start a task, finish a task successfully, report observations, issues, or task failures.

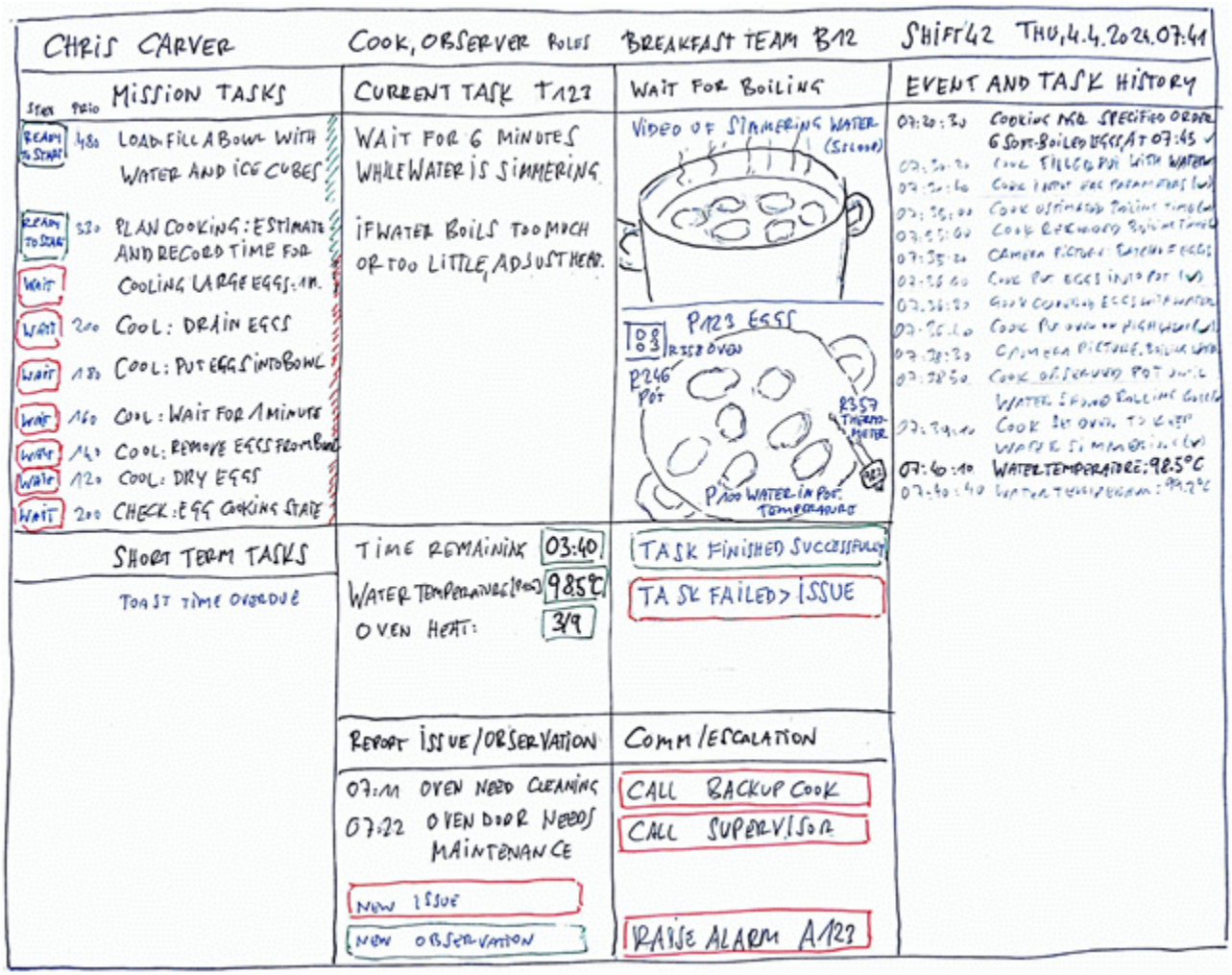

Figure 3: Behavior-driven task specification for cooking soft-boiled eggs with human/computer actors.

Goal of this project is to develop a web-based application for facilitating *agile task guidance and documentation*.

Tasks

- Depending on the application area and preliminary results, plan the project considering the following task candidates.
- Requirements engineering for a selected application
- User experience design, workflow analysis and design
- Design of a web-based application, typically mobile (tablet, mobile) application
- Viability analysis: identify challenges in practice
- A field study in the application area to identify requirements and task types
    - Levels: expert, novice, automation
    - Task conditions, task descriptions
- Identify and address typical special cases in the application area.
- Prototype design and evaluation of guidance and documentation functions.
- Design task templates for similar application cases.
- Integration of process documentation with semi-automated data analysis.

Expertise

For this topic, a set of skills is recommended (at least two are mandatory).

- Web application design, implementation, and validation.
- Programming skills, e.g., Java.
- Graph database skills, e.g., Neo4J/Cypher.
- Data modeling.
- Empirical evaluation, e.g., case study, pre/post comparison.
- Interest in a practical application domain, e.g., puzzle solving, pair programming, field testing, repair, cooking, or lab experimentation.

References

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