HAL
open science

AUTOM AT ICS: Research activities on Automation

Célia Martinie, Philippe Palanque, Marco Winckler, Regina Bernhaupt

To cite this version:

Célia Martinie, Philippe Palanque, Marco Winckler, Regina Bernhaupt. AUTOM AT ICS: Research activities on Automation. 5th International Conference on Application and Theory of Automation in Command and Control Systems (ATACCS 2015), Sep 2015, Toulouse, France. pp.0. hal-01534806

HAL Id: hal-01534806

https://hal.science/hal-01534806v1

Submitted on 8 Jun 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Open Archive TOULOUSE Archive Ouverte (OATAO)
OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in : http://oatao.univ-toulouse.fr/
Eprints ID : 16928

The contribution was presented at ATACCS 2015 :
https://www.irit.fr/recherches/ICS/events/conferences/ataccs/ataccs2015/

To cite this version : Martinie De Almeida, Celia and Palanque, Philippe and Winckler, Marco Antonio and Bernhaupt, Regina *AUTOM AT ICS: Research activities on Automation.* (2015) In: 5th International Conference on Application and Theory of Automation in Command and Control Systems (ATACCS 2015), 30 September 2015 - 2 October 2015 (Toulouse, France).

Any correspondence concerning this service should be sent to the repository administrator: staff-oatao@listes-diff.inp-toulouse.fr

AUTOM AT ICS: Research activities on Automation

C. Martinie[1], P. Palanque[1], M. Winckler[1] & R. Bernhaupt[1,2]

[1] IRIT, University of Toulouse
118, route de Narbonne
31042 Toulouse, France
{lastname}@irit.fr

[2] ruwido austria gmbh
Köstendorfer Straße 8
5202 Neumarkt a. W., Austria
{firstname.lastname}@ruwido.com

ABSTRACT

ICS (Interactive Critical System) team is a research group focusing activities around the design, construction and certification of dependable, usable and fault-tolerant interactive systems. In this context, ICS team at IRIT has been actively involved in automation-related research activities for many years with a specific focus on Operation-automation collaboration. In the field of ATM ICS group was a partner of SPAD (System Performance under Automation Degradation) WPE project, and is a member of the Higher Automation Level in ATM (HALA) research network of SESAR. This article provides an overview of the research activities on automation performed by ICS team.

Author Keywords

Automation, ATM, usability, resilience, interactive systems.

ACM Classification Keywords

D.2.2 [Software] Design Tools and Techniques - *Computer-aided software engineering (CASE)*, H.5.3 Group and Organization Interfaces.

INTRODUCTION

Université Paul Sabatier (UPS) is a university of science with 7 departments. In the international CWTS ranking in 2015, UPS ranked 241 of best universities worldwide. The IRIT (Institut de Recherche en Informatique de Toulouse) was founded in 1990 with the objective of federating, under a unique research laboratory, all the researchers and lecturers engaged in computing sciences in Toulouse area. It gathers 250 PhD students, 250 researchers, lecturers and professors. IRIT, with the Interactive Computer Systems (ICS) team [6], is a worldwide involved research group in the field of design and construction of dependable, usable and fault-tolerant interactive systems. In this context, ICS team at IRIT-UPS has been actively involved as partner of SPAD [22] (WPE) project, and is member of the Higher Automation Level in ATM (HALA) research network [5] of SESAR [21].

This article gives an overview on research activities that are led around the topic of automation by ICS team at IRIT-UPS. Next section presents the projects dealing with automation in which ICS team has been (or is currently) involved in. Third section presents the main research topics related to automation on which the ICS team is contributing. Fourth section presents the computer-aided software environment tools that are supporting the research activities related to automation. Lastly, fifth section summarizes ICS team publications that are related to automation.

FUNDED PROJECTS DEALING WITH AUTOMATION

There are several projects, with current or recent ICS team participation, that are dealing with task allocation [4] and more generally speaking, automation. The following paragraphs gives an overview of these projects.

SPAD

In this SESAR WPE project, ICS team was involved in work packages dealing with operators' tasks description and assessment of increased complexity of tasks induced by automation degradation. These contributions have been published in major scientific conferences such as SAFECOMP [15] and International Journal on Human.-Computer Studies [12].

HALA!

HALA! is a research network on Higher Automation Levels in Aviation (SESAR). ICS team at IRIT-UPS is one of the partners of the HALA! Research network in particular in charge of the ATACCS conference organization. Within this project ICS team at IRIT-UPS extended its expertise in the area of ATM by also provided the consortium with expertise in the area of interactive cockpits engineering and satellite ground segments [7].

TORTUGA & MARACASS

Tortuga is a project funded by CNES (French National Space Agency) and stands for Tasks, Operations, Reliability & Training for Users of Ground Applications. It aimed at providing a better operability of satellite ground segments, in which automated procedures are running. The In this project, ICS team has proposed and tested a tool-supported framework to design and develop ground segment applications along with the associated training applications for the operators of these ground segment applications. MARACASS project [7] (which stands for Models and Architectures for the Resilience and Adaptability of Collaborative Collision Avoidance System for Spacecraft) was a follow up of TORTUGA [23] targeting at multi-user application.

Living room 2020

The goal of Living Room 2020 is to develop interaction solutions that are ready for the market, and support cross-media usage. Based on a set of methodological developments to investigate various user experience factors, these solutions will be evaluated and improved. This project has been developed in collaboration with the company ruwido specialized in the design, development and production of remote controls in the field of interactive TV [2].

RESEARCH TOPICS DEALING WITH AUTOMATION

Designing interactive computing systems in such a way that as much functions as possible are automated has been the driving direction of research and engineering both in aviation and in computer science for many years. In the 80's many studies (e.g. [19] related to the notion of mode confusion) have demonstrated that fully automated systems are out of the grasp of current technologies and that additionally migrating functions [8**Erreur ! Source du renvoi introuvable.**] from the operator to the system might have disastrous impact on safety and usability and operationality of systems. Allocating functions to an operator or automating them, raises issues that require a complete understanding of both operations to be carried out by the operator and the behavior of the interactive system. This is why ICS team research is centered on the field of Human-Computer Interaction.

Automation and HCI

The mains scientific contributions of ICS team deal with notations, processes and tools for the design, implementation and evaluation of interactive systems thus having a strong bias towards software engineering or more specifically speaking Interactive Systems Engineering. That trend of work in the area of interactive systems engineering has been applied in various application areas including Air Traffic Management with a focus on interactive applications for Data Link communications between cockpit and ground.

Automation and modelling

ICS team at IRIT-UPS has been involved in several projects dealing with the modelling of tasks, procedures and automation as well as task allocation between human operators and systems. Application domains include interactive cockpits (especially new interactive applications compliant with ARINC 661 specification standard), satellite ground segments (command and control systems for various types of satellites) and UAVs command and control systems (French Department of Defense funding).

Automation and user experience

While it is clear that it is appropriate and necessary to spend efforts and resources on identifying automation surprises in the domain of safety-critical system, other application domains can benefit from this procedure. This includes application domains such as large web applications and mass market systems such as home entertainment and computer games. For example, in the home entertainment domain, user problems due to the unexpected behavior of the interaction technique can be more expensive than the system itself. One hotline call (for an interactive TV provider) is usually more expensive than the actual production cost of the remote control.

SUPPORTING TOOLS

The following tools provide support to our research activities related to automation.

Petshop

ICS group has developed a formal notation for the engineering of interactive systems called ICOs (Interactive Cooperative Objects) [1]. The ICO notation is a formal description technique devoted to specify interactive systems. Using high-level Petri nets for dynamic behavior description, the notation also relies on object-oriented approach (dynamic instantiation, classification, encapsulation, inheritance and client/server relationships) to describe the structural or static aspects of systems.

In order to edit and execute ICO models, the notation is supported by the CASE tool PetShop. PetShop framework also provides tools to support user evaluations and formal analysis of models. In addition PetShop describes and simulates OS independent multi-touch interfaces (by connecting dedicated APIs to its kernel).

Hamsters

HAMSTERS (which stands for Human-centered Assessment and Modeling to Support Task Engineering for Resilient Systems) is a task modeling language with a supporting tool [10] and a tutorial is available here [17]. It is widely inspired by existing notations and tools and takes advantages from all of them. Similarly to MAD and CTT, qualitative time is expressed using LOTOS-like temporal operators attached to the parent node. Quantitative time is represented by expressing task duration (such as with CTT) and delay before tasks availability. The implementation of HAMSTERS was done with the objective of making it easily extendable and it results in a CASE tool that contributes to the engineering of task models. HAMSTERS features a task model simulator as a dedicated API for simulating the execution of task sequences [9].

Dreamer

DREAMER [16] is a tool-supported notation for addressing these problems of traceability and coverage of both requirements and design options during the development process of interactive systems. This tool can be used to identify various options for tasks allocations but also to support systematic comparison of tasks allocations. The use of criteria for comparing the options provides support for explicitly dealing with KPI in the ATM domain.

LIST OF RELATED PUBLICATIONS

The list of publications that are related to the research projects dealing with automation is available in the References section from number [11] to number [18]. Members of ICS team have also been involved in the

organization of a workshop on automation in HCI conferences [3].

ACKNOWLEDGMENTS

This work was partly funded by HALA! SESAR research network and SESAR WPE SPAD project.

REFERENCES

1. Barboni E., Martinie C., Navarre D., Palanque P. & Winckler M. Bridging the gap between a behavioural formal description technique and a user interface description language: Enhancing ICO with a graphical user interface markup language. Sci. Comput. Program. 86: 3-29 (2014)
2. Bernhaupt R., Cronel M., Manciet F., Martinie C. & Palanque P. Transparent Automation for Assessing and Designing better Interaction for Partially Autonomous Interactive Systems. ATACCS 2015.p. 41-49, ACM DL.
3. Bernhaupt, R. Boy, G. A., Feary, M., Palanque, P. Engineering automation in interactive critical systems. In proc. of ACM Conference on Human-Computer Interaction. CHI Extended Abstracts 2011, p. 69-72.
4. Boy, G. A. Cognitive Function Analysis for Human-Centered Automation of Safety-Critical Systems. In proc. of ACM Conference on Human-Computer Interaction, CHI 1998. p. 265-272. ACM Press.
5. HALA! Research Network. Higher Automation Levels in ATM. http://www.hala-sesar.net/. Last accessed on August 28th, 2015.
6. Interactive Critical Systems (ICS) team. http://www.irit.fr/recherches/ICS/index.html. Last accessed on August 28th, 2015.
7. MARACCASS. Models and Architectures for the Resilience and Adaptability of Collaborative Collision Avoidance System for Spacecraft. http://www.irit.fr/recherches/ICS/projectsummary/projectmaraccass.html. Last accessed on August 28th, 2015.
8. Martinie C., Palanque P., Barboni E., Ragosta M. Task-model based assessment of automation levels: Application to space ground segments. SMC 2011: 3267-3273.
9. Martinie C., Palanque P., Ragosta M., Fahssi R. Extending procedural task models by systematic explicit integration of objects, knowledge and information. ECCE 2013: 23:1-23:10
10. Martinie C., Palanque P., Winckler M. Structuring and Composition Mechanisms to Address Scalability Issues in Task Models. INTERACT (3) 2011, LNCS, Springer Verlag, 589-609
11. Martinie, C., Barboni, E., Navarre, D., Palanque, P., Fahssi, R., Poupart, E., Cubero-Castan, E. Multi-models-based engineering of collaborative systems: application to collision avoidance operations for spacecraft. Proc. of EICS 2014, pp. 85-94.
12. Martinie, C., Navarre, D., Palanque, P. A multi-formalism approach for model-based dynamic distribution of user interfaces of critical interactive systems. International Journal on Human.-Computer Studies 72(1): 77-99 (2014).
13. Martinie, C., Palanque, P., Pasquini, A., Ragosta, M., Rigaud, E., Silvagni, S. (2012) Using Complementary ModelS-Based Approaches for Representing and Analysing ATM Systems' Variability. ATACCS 2012, London, UK, ACM DL, 2012.
14. Martinie, C., Palanque, P., Ragosta, M. Some Issues with Interaction Design and Implementation in the Context of Autonomous Interactive Critical Systems. ACM CHI conference (Workshop on End-user Interactions with Intelligent and Autonomous Systems) 2012. p.:25-30.
15. Martinie, C., Palanque, P., Ragosta, M., Sujan, M. A., Navarre, D., (2013) Understanding functional resonance through a federation of models: preliminary findings of an avionics case study, SAFECOMP 2013, LNCS, Springer Verlag.
16. Martinie, C., Palanque, P., Winckler, M, Conversy, S. DREAMER: a design rationale environment for argumentation, modeling and engineering requirements. ACM Conference on Design of Communication (SIGDOC) 2010: 73-80.
17. Palanque P. & Martinie C. Designing and Assessing Interactive Systems Using Task Models. CHI Extended Abstracts 2015: 2465-2466
18. Palanque, P., Bernhaupt, R., Montesano, F., Martinie, C. Exploiting gaming research and practice for engineering interactive critical systems. ATACCS 2011.p. 41-49.
19. Palmer, E. "Oops, it didn't arm." - A Case Study of Two Automation Surprises. 8th International Symposium on Aviation Psychology, Ohio State University (1995).
20. Ragosta M., Martinie C., Palanque P., Navarre D. & Sujan M-A. Concept Maps as a Glue for Integrating Modeling Techniques for the Analysis and Re-Design of Partly-Autonomous Interactive Systems. ATACCS 2015.p. 64-75, ACM DL
21. SESAR, Single European Sky initiative. http://www.sesarju.eu/. Accessed August 28th, 2015.
22. SPAD. System Performance under Automation Degradation. http://www.hala-sesar.net/projects/spad. Last accessed on August 28th, 2015.
23. TORTUGA. Tasks, Operations, Reliability & Training for Users of Ground Applications. http://www.irit.fr/recherches/ICS/projects/tortuga/ . Last accessed on August 28th, 2015.