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A model-based framework to automate the analysis of users' activity in collaborative systems

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ABSTRACT

The automated analysis of users' activity in collaborative systems aims at characterizing the collective process established between the participants and contributing to improving the deficiencies that occur during the users' activity and that are identified by means of this characterisation. This type of analysis, however, requires the completion of complex and costly software development tasks such as capturing information about the actions carried out by the users, calculating low and high level variables to characterize the users' work and behaviour and, finally, defining different kinds of interventions to improve the users' experience solving this way all of those problems that have been detected. To enable the automation of these tasks, reducing the required development effort, we propose a framework that allows software developers to specify the processes of analysis of the activity supported by a collaborative system by means of visual languages in a model-based approach and to automate the analysis accordingly. This framework is used in two case studies. Firstly, the framework is applied for the collaboration analysis in a social network system. Secondly, the collaborative programming activity supported by the COLLECE system is analysed using the framework, and the impact of using the framework is then evaluated.

1. Introduction

At present, the knowledge society in which we live has a clear need for technological systems which can provide support for working, learning and playing in groups. Recent technological advances are introducing innovative improvements into the development of collaborative systems to support such activities. These innovations are not solely confined to the design of communication mechanisms, but also include the building of shared workspaces where users can solve or carry out common tasks collectively (González and Mark, 2005) and of coordination mechanisms that enable organised collaboration (Sire et al., 1999). In recent years, such improvements have resulted in a proliferation of systems to facilitate the communication between users (social networks, instant messaging, wikis, etc.) and the collaborative work aimed at solving problems in projects that, because of their scale or nature, must be approached in groups (electronic calendars, shared whiteboards, etc.).

At this point, it is worth noting that technology not only makes these collective activities possible but also opens the door to analyse how the activities occur (Dimitracopoulou, 2004). The process of *collaboration analysis* allows one to study the users' actions (Martínez et al., 2006) and to evaluate their impact on the collective process (Jermann and Dillenbourg, 2008). The attainment of this characterisation should be the starting point to providing perceptible improvements during the course of users' activity by means of assessments of the activity being carried out as well as modifications to the collaborative system's behaviour. Moreover, the results of such an analysis could be of interest to people outside the group of participants in the collective activity, who are usually evaluators or analysts interested in obtaining an assessment of specific aspects of the activity carried out by the users in groups.

There is a wide range of technological systems supporting collaborative activities that can benefit from a process of analysis. An example are computer-supported collaborative learning (CSCL) environments, which support the collaboration between students and their interaction with teachers in a structured teaching-learning process (Bravo et al., 2006). The students, organised in groups, collaborate by exchanging ideas and solving problems as a team. The teachers organise and supervise the learning activities by posing problems, uploading material and answering questions. Here, a process of analysis would allow the calculation of variables for characterizing the users' learning activity (e.g., students' participation in the collaborative process, average number of problems considered by a group, quality of the users' learning, etc.) can contribute to make an evaluation of the teaching and learning processes. Computer-supported

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