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Abstract. Gamification aims at addressing problems of MOOC (high dropouts, low success rates, lack of engagement, isolation, lack of individualization). We define our understanding of deep gamification and present the Gamifire infrastructure. We also point out planned development activities on this platform.

Keywords: Gamifire · Gamification · Architecture · Scalability · MOOC · Platform Independence · Infrastructure

1 Introduction

The success of MOOCs comes with downsides: high-drop out rates [3] and low engagement [5]. Gamification was initially introduced to improve situations of motivational gaps by applying elements of gaming into otherwise boring activities [4]. Relying mostly on game elements fostering extrinsic motivational factors (such as points, badges, and levels), mainly in a way that is not even challenging for those who need to be extrinsically motivated, gamification as seen so far does not exploit the true potential of human motivation and passion for learning [6]. Also, many approaches towards gamification fail due to the lack of a clear design methodology [8]. However, *deep gamification* as the thoughtful integration of gamification with the learning processes can be beneficial to learners [7]. We have developed a methodology for the gamification of MOOCs [2] backed up by a technological solution that aims to reliably support the process. In this article, we highlight the technical side of this research. The following research questions (Q) are investigated in this work: (q1) Can we develop a platform-independent, scalable deep gamification platform for the gamification of MOOC? (q2) Can we resolve the conflict between platform-independence and the required platform integration for deep gamification?

To answer the research questions and to base Gamifire on solid methodological grounds, our methodology comprises three main perspectives: (1) A *design perspective*, combining game design with problem-based selection of theories into an evaluation-based continuous improvement cycle. (2) A *user-experience and usability perspective*, taking the interplay of learning environment and gamification into account. (3) A *software-engineering perspective*, transforming outcomes of the other two perspectives into implementable requirements and architectural

specifications. Approaches towards gamification design frameworks have been extensively discussed in [8]. Our own approaches towards a methodologically sound gamification design and towards user-experience evaluation have been reported in [2, 1], respectively. This article takes the software-engineering perspective and reports the corresponding process steps and results.

2   Gamifire - Architecture and Implementation

Gamifire is implemented on top of the Google App Engine (GAE) cloud platform. Gamifire uses a three-tier architecture, with database back-end (cloud data-store), an application server, and front-end user-interface (UI) components. The back-end stores logging information collecting data about user interactions, time-stamps, and progress related data. Each game element/widget can also store widget specific data. The application server handles user related sessions, tracks user interactions, manages logging operations and generates feedback and UI-related content. To generate the UI, Gamifire relies on a library of game element widgets, which are triggered by the main application logic and which provide the individualized view on the game elements with respect to the user status. These UI elements are embedded into the MOOC platform by front-end integration, which means, they are added to the web-based front-end of the MOOC platform as partial HTML components. Through JavaScript introspection, these front-end elements gather user information from the MOOC platform and can thus synchronize user sessions and data between MOOC and Gamifire. Fig. 1 shows the general Gamifire component architecture and its integration into an (abstract) MOOC platform. Fig. 2 shows the user interface components displaying different game elements and components.

3   Conclusions and Future Work

With the implementation of Gamifire, we were able to show that it is possible to deliver a "scalable, platform-independent, cloud-based Infrastructure for deep gamification of MOOC". However, the implementation and application of Gamifire faces a number of trade-offs, which show, that some conceptual issues have to be addressed in future work: (1) The trade-off between platform-independence and deep gamification requires to be re-thought, in order to get rid of erroneous extra work. (2) The conflicts between some of the game elements requires us to offer more guidance to designers of MOOCs and gamification. To achieve this, more research on the effects of specific game element configurations needs to be performed. Overall, gamification remains a process requiring well-defined procedures and thought through concepts and implementations. With the development of Gamifire based on the methodology presented we contribute to a better understanding and applicability of deep gamification in the context of online learning.

Fig. 1: Architecture of the Gamifire platform
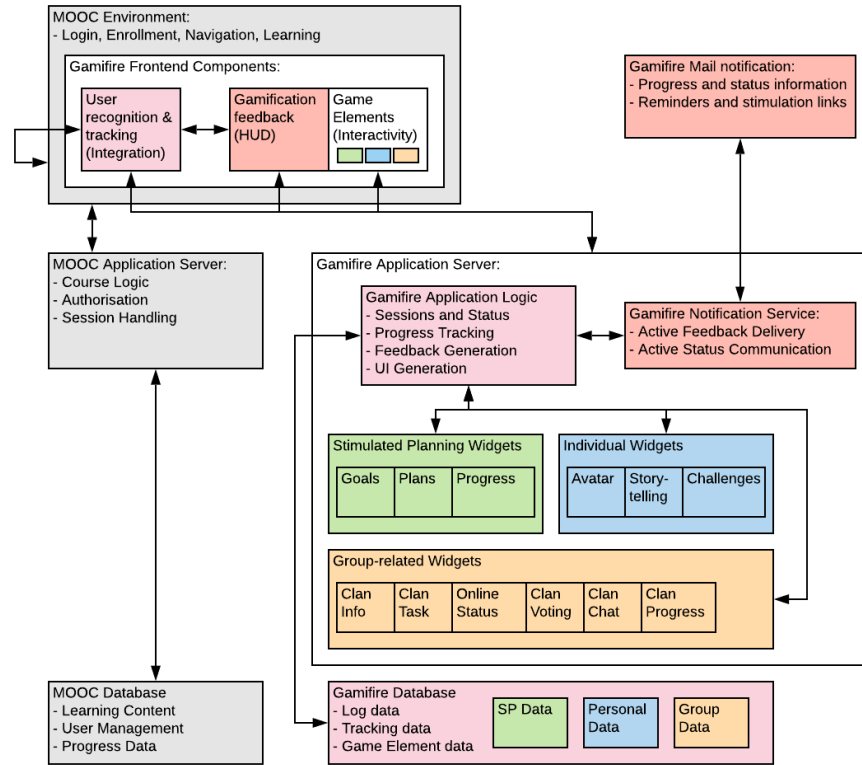
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(a) SP: Intentions   (b) SP: Intentions   (c) HUD: Feedback

(d) SP: Memo   (e) SP: Planning   (f) SP: Plan B

(g) Avatar   (h) HUD: Online status
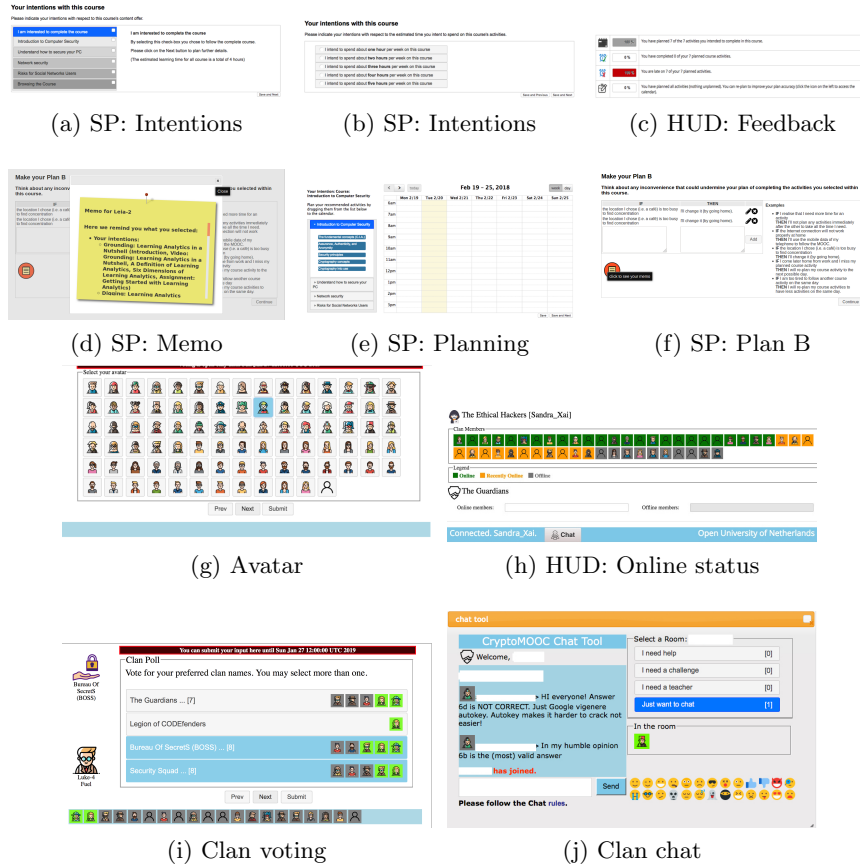
(i) Clan voting   (j) Clan chat

Fig. 2: Screen-shots of Gamifire UI components.

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