Adaptive E-Learning System for Social Devices using Gamification

Supta Richard Philip

October 28, 2013

Abstract

In recent years, E-Learning or online learning has become widely popular and it is adopted also in higher educational institutes. This type of virtual learning environment helps to deliver learning materials and lessons; online discussion, online class materials and files. Some of them are very popular, for example EdX, Coursera and Khan Academy which is operated by some world famous institutes or social welfare organizations. In this research, the principle of gamification will be used to enhance virtual learning environments to increase the user engagement. At the same time, User Centered Design methodology will be followed to develop an E-learning system which also supports adaptive functionality, e.g. learning from user behavior and suggesting content accordingly. Social Devices will be used to improve social learning. To ensure adaptability, Machine Learning approaches will be used and E-Learning system will show intelligent behavior, and shall proactively suggest users as well as system. Finally the goal of the research is to develop a new adaptive E-Learning solution for Social Devices enhanced by gamification which ensures positive user experience and learning effect.

Keywords: Social devices (SD), E-Learning, Gamification, Machine learning, Human-Computer Interaction (HCI), Mobile HCI, Intelligent and Adaptive HCI, User Centered Design.

1 Introduction

In today's technology-oriented and information-intense world, one of the greatest challenges is structuring, arranging, manipulating and delivering the information in a coherent, efficient and usable manner. There are a lot of research going on above mentioned fields in Human-Computer Interaction (HCI), mobile HCI, adaptive HCI and artificial intelligent, especially machine learning which handles complex algorithms to provide the system its learning ability using previous experiences. Human computer interaction and Mobile HCI, especially user centered design, help build such successful application or to find user requirements as much as close matching to the application and adopted technologies. Aim at comprehensively acquiring user requirements to improve the total quality of the application and user satisfaction to use the system. Recently the mobile HCI has introduced the concept of Social Devices (SD) which is the proactive mobile devices that aim to facilitate and increase social interactions [7]. The motivation and goal of this research is to propose and develop an adaptive and interactive E-Learning system for Social Devices enhanced gamification; a technique that increases user's engagement into the system and the goal of gamification is to engage people and to encourage them to participate, share and interact into the system [2]. Recently in many public social networks such as Foursquare, Stack Overflow and LinkedIn, gamification has been applied. Although AI and HCI explore computing and intelligent behavior and the fields have seen some crossover, until recently there was not very much research on advance mobile HCI with gamification.

2 Theoretical framework

E-Learning: In recent years, E-Learning or Online learning has become widely popular and is being adopted in higher educational institutes. An E-Learning system basically contains three components;

namely a learning management system, a set of e-courses and an infrastructure which supports the learning management system. A good e-learning solution should be more than an e-learning platform [3].

Gamification: Recently in many public social networks such as Foursquare, Stack Overflow and LinkedIn, gamification has been applied to increase the user engagement. The goal of gamification is to engage people and to encourage them to participate, share and interact in some group or community [2]. The most significant point about gamification is it changes peoples behavior. The more satisfying the experience the more effective it will be at changing behavior and accomplishing business and personal goals. In addition, recently researchers [4][8] found that application of gamification in the virtual words changes peoples' behavior and motivates them to get engaged more than before. Though, gamification has the potentials to change the students' behavior in case of participation, still there is no specific application of it for the E-Learning system. Therefore, in case of E-Learning system gamification could play a very important role to encourage the users to share their knowledge and to improve online learning experience.

Intelligent and Adaptive HCI: User centered Design is the part of Human Computer Interaction which is multidisciplinary area included various subjects and disciplines. Interaction Design is a process to develop interactive software which ensure usability that means the software should be easy to learn, effective to use, and should provide an enjoyable experience from the users perspective. The key views of Interactive Design are easy, effortless, and enjoyable to users [9]. This is also known as interactive product development methodology. On the other hand, User centered design (UCD) process is inscrutable understanding of the psychological, organizational and community factors that influences the use of web technology developed from the involvement of the user at every phase of the design and evaluation of the product [1]. The key point is that users should be involved in every step of development.

An Intelligent and Adaptive HCI might be an application which would be adaptive, to some extent, if it has the ability to recognize the user and remembers its searches, purchases and intelligently search or find, and suggest based on users need and choice. Most of this kind of adaptation is the ones that deal with cognitive and affective levels of user activity [6].

Social Devices (SD): Social Devices (SD) are the proactive mobile devices that aim to facilitate and increase social interactions. There are a lot of researches going on the possibilities of the concept of social devices (SD) to form new type of system where the devices, their users and possible witnesses interact with each other directly. The mobile phones are the central interaction devices in this concept since modern mobiles have divers range of capabilities: computing power, adaptable I/O and various sensors [5]. Social devices [10] are mobile phones that interact with each other in order to proactively trigger interaction between users in different social situations. This is a kind of intelligent and adaptive mobile applications which suggest users depending on their situations. These situations could be a wide variety of social contexts, e.g. cafes, offices, airports, parking lots, schools, and so on. New standards have been set already for people interaction with each other and share their everyday activities through online social media services. Typically current mobile services only support typically primarily social interaction for remote communications but co-located social interactions could be possible where people and proactive, context sensing mobile devices could be introduced [7].

In this research, our aim is to develop an intelligent and adaptive E-Learning mobile application that interacts with its user. The Social Devices still are very complex as theory and practice. Whenever we will able to give intelligence behaviors in any applications, then it must proactively suggest to users as well as the system itself. In this case, E-Learning system needs to learn from environment, users and previous experiences. That means mobile devices act as active participants and can initiate interaction among the devices and people. Those Social devices and its applications will support intelligent, adaptive and interactive mobile HCI and its applications.

3 Details of Proposed Research

Research Questions: The research questions will be as follows since I am interested in Mobile HCI, Social Devices, User Centered design, Machine Learning, Adaptive and Interactive application, E-Learning and gamification; and the research on designing an E-Learning system for social devices which enhances gamification.

1. How could we build an adaptive E-Learning system for adult students based on Social Devices?
2. How could we enhance the E-Learning system with principles of gamification to increase user's engagement?
3. How can gamification attract students, keep them engaged during the initial phase and continue active participation in E-Learning system?
4. Which machine learning techniques can be used to efficiently implement adaptive and proactive system based on user centered design methodology?

Research Objectives: The goal of this research is to develop an E-Learning system based on user centered design methodology for Social Devices. And the system will be adaptive and interactive from user perspective using some AI techniques and gamification science to increase user's engagement. Finally, the objective of the research will be to find out a perfect design methodology based on user centered design and gamification which will give an adaptive, intelligent and interactive E-Learning system interface and system functionalities using machine learning algorithms.

Methodology: The methodology that I will follow in this research is to design an E-Learning system for social devices based on user entered design. First of all, I will define the problem statements and extended the research questions and simultaneously I will study literature review to figure out the best approach for designing such a system. The target stakeholders group will be defined; here namely the adult student's between 18-22 years old and conduct a set of user study such as questionnaire, interviews, observations, focus group and workshops and field evaluations of a prototype to collect various qualitative and quantitative data. This user study will help to find out a set of stable requirements. After getting all response and result, I will analyze the collected data for proposed the E-Learning system to enhance gamification; namely use case and class diagram of the system. Before designing the system, tested some gamification techniques which increase user engagement in the system as well as tested some machine learning algorithms for best fitted with the system which will basically provide adaptive and intelligent functionalities; e.g. learn from environment, user's behavior, previous experiences and suggest accordingly. Then I will design an interactive prototype of the system for evaluation. The designed prototype could be mid fidelity or high fidelity which will decide at development time depending on research activities. Finally, I will do various evaluation processes; usability evaluation, user study. Depending on users feedback improvement of the design will be done and tested that design will fulfill user's needs and requirements. Finally, the system will be developed such a way its satisfy usability and users goals.

Expected Outcomes: The expected outcomes of the proposed study are as follows:

1. Contribute to HCI especially E-Learning after tested some machine learning algorithms for best fitted with the system which will basically provide adaptive and intelligent functionalities.
2. Help to HCI community in adaptive and intelligent HCI system design for Social Devices.
3. Gamification to enhance E-Learning system design which will change the user's behavior and encourage them in participation, which may improve online learning experience.
4. Contribute and publish paper in ACM CHI, MobileHCI, Ubicomp conferences, and journal of Personal and Ubiquitous Computing and International Journal of Mobile HCI.

4 Research Environment

Research Group: Human-Centered Technology (IHTE), Dept. of Pervasive Computing, Tampere University of Technology.
Supervisor: Professor Väänänen-Vainio-Mattila

5 Research Schedule

The Schedule of proposed doctoral research plan is as follows:

1. Literature Review (Jan-Dec 2014)
2. User study [Questionnaire, Field Survey, Interview, Observation etc.] (Jan-Apr 2015)
3. Data Analysis and Design (May 2015-Dec 2015)
4. Evaluation (Jan 2016-Mar 2016)
5. Follow steps 2, 3, 4 iteratively [more than two times](Apr 2016-Feb 2017)
6. Revision and Thesis Writing (Mar 2017-Dec 2017)

References

[1] Chadia Abras, Diane Maloney-Krichmar, and Jenny Preece. User-centered design. 2:763–768, 2004.

[2] SK Bista and S Nepal. Using gamification in an online community. *8th International Conference Conference on Collaborative Computing: Networking, Applications and Worksharing*, pages 611–618, 2012.

[3] K.S. Cheung and J. Lam. A framework for developing e-learning solutions. *2009 Fifth International Conference on Semantics, Knowledge and Grid A*, pages 294–297, 2009. doi: 10.1109/SKG.2009.44.

[4] Ya Chiang Fu. The game of life: Designing a gamification system to increase current volunteer participation and retention in volunteer-based nonprofit organizations. 2011.

[5] Pradthana Jarusriboonchai, Thomas Olsson, and Kaisa Väänänen-Vainio-Mattila. Roles , scenarios and challenges of social devices.

[6] Fakhreddine Karray, Milad Alemzadeh, Jamil Abou Saleh, and Mo Nours Arab. Human-computer interaction : Overview on state of the art. *International Journal*, 1(1):137–159, 2008.

[7] Niko Mäkitalo, Jari Pääkkö, Mikko Raatikainen, Varvana Myllärniemi, Timo Aaltonen, Tapani Leppänen, Tomi Männistö, and Tommi Mikkonen. Social devices : Collaborative co-located interactions in a mobile cloud.

[8] S O'DONOVAN. Gamification of the games course. *Acesso em*, pages 1–8, 2012.

[9] Y Rogers, H Sharp, and J Preece. *Interaction design: beyond human-computer interaction*. J. Wiley & Sons, 2002. ISBN 9780471492788.

[10] Kaisa Väänänen-Vainio-Mattila, Thomas Olsson, Jarmo Palviainen, and Pradthana Jarusriboonchai. Social devices as a new type of social system : Enjoyable or embarrassing experiences ? pages 1–5.