A Platform for Pervasive Games for Research

Alexander Samodelkin, Paula Alavesa and Alexander Voroshilov
Center for Ubiquitous Computing, University of Oulu
Oulu, Finland
[firstname.lastname@oulu.fi]

ABSTRACT
Pervasive games take advantage of ubiquitous infrastructure of our urban environment. Their architecture can be complex. We have begun to develop a platform that makes it possible to create pervasive games from a simple location based mobile game to a complex pervasive live action role playing game. In this paper, we present the concept and current architecture of our platform and briefly describe the games that have been developed on top of it.

Author Keywords
pervasive games, mobile games, game development platform

ACM Classification Keywords
• *Human-centered computing~Ubiquitous and mobile computing systems and tools* • *Human-centered computing~Field studies*

INTRODUCTION AND BACKGROUND

Pervasive games are entwined with everyday life and various ubiquitous infrastructure from mobile bay stations to GPS satellites orbiting the Earth. They also tend to utilize various infrastructure related application programming interfaces in addition to public or private databases [1, 2, 3]. The architecture of a pervasive game can be quite complex in comparison to the architecture of a desktop PC or a mobile game. This means that academics hoping to develop their own pervasive games face the dilemmas of developing complex systems. Hence, for specific research purposes they might have to use plenty of resources.

Pervasive games research can be ethnographies on the existing games like Geocaching, but most often it is field trial or a case study that is conducted to formally evaluate a developed game prototype [1, 2, 3, 4]. One requirement for this kind of research is diminishing the interaction between the subject and the researcher [5]. Furthermore, as the game play can be intense and the end-result affects the disposition of the players, gathering timely data from player actions. Players can be scattered on a wide game area that further makes it difficult to observe the players, hence real time player tracking is beneficial [6]. It will make it easier to know where the players are or try to predict where they are heading enabling direct observation from the field as the researcher knows where to head to observe the players. In this paper, we describe a pervasive game platform (Figure 1) that has already been in part implemented as we will also describe two games that have been developed on top of our platform.

THE PLATFORM
The platform has a wide range of data collection and real-time player observation possibilities. It also supports single player and multiplayer or team play game architectures. To cover field research and specific research activities, the system is designed to be flexible in terms of game set up. This allows researcher to create a unique setup for a specific research question, although the platform is ideal for pervasive live action roleplaying (LARP). At the current stage the setup can differ by the number of gameplay areas, players and team sizes. By changing the components of the game such as amount of rewards, initial strength, spell sets and available power ups the duration of the game can also be influenced. Also, manipulation with the sets of spells and available power ups allows to create a case for studying the strategies of the players. The powerful instrument of the platform is quests editor, that allows the creation of different types of tasks, which can vary from finding certain places to completing more complicated task that are controlled by a researcher.

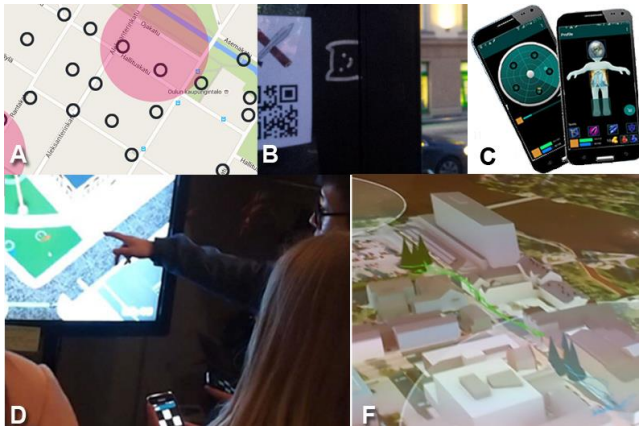

Figure 1. Selected platform features: (A) map of a game area and authored (B) quest marker locations, (C) the game app, (D) players by a display showing a virtual game scene and (F) MAPGETS [8] based real-time player tracking.

For further analysis, the system keeps tracking and logging all the game events and player movements in the database. The events have distinct user identifiers sorted by the type. At the same time, information about player movements can be visualized in real time on a map (Figure1: A) [8]. Furthermore, the system has embedded questionnaire system that allows to automatically collect answers scaled on Likert scale from 1 to 7 anytime during the game.

Technical Implementation

The platform and the games created on top of it follow the classic client server architecture (Figure 1).

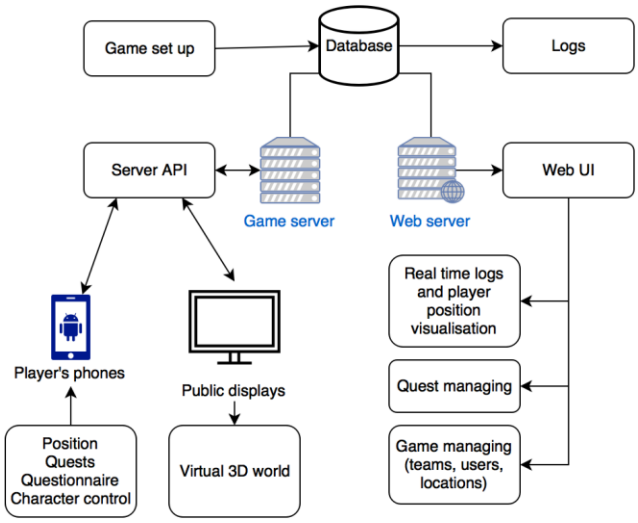

Figure 1. High level architecture of the system

CASE EXAMPLES

We developed four slightly different versions of a pervasive game on top of our platform; two versions of a indoors game: Campus Knights [7] and two versions of a citywide pervasive LARP: City Knights. The underlying game dynamics of these games is that of a typical pervasive LARP. The gameplay is focused on several main activities: completing quests, conquering one of the game location and fighting with the bosses. The first two activities happen in the physical world environment and encourage players to compete, while the boss fight happens in virtual 3D environment and is a type of team or player versus computer AI. At the same time, there are bunch of side activities that support the gameplay, such as accessing in-game store for power ups, selecting the spells to fight with the bosses as well as controlling the character in 3D environment. All versions were evaluated by field trials and relevant data on the targeted research aspects was gathered.

Case: Campus Knights

The target for research on Campus Knights was exploring the possibilities for co-located gameplay by pervasive displays [7]. By using the game as a platform two versions of the game were authored for comparison.

Case: City Knights

On the first City Knights trial the goal was to explore the sense of co-presence over three different kinds of game phases where the players were dispersed around the city, encouraged to disperse around specific game areas and co-located around a display depicting virtual game scenes. For this purpose, we collected questionnaire data as well. We also expanded the player observation possibilities by implementing a MAPGETS [8] based visualization of the player locations. On the second City Knights Trial the goal was to explore both the immersion by realistic game scene visualizations and the quality of answers on different kinds of embedded questionnaires when gathering timely data during gameplay where the intensity of the game varies. For these purposes, we created differing version of the questionnaires and for the virtual scenes we deployed three versions of the virtual game scene on game locations. This coincided with gathering of data from the field and conducting interviews with the participants.

DISCUSSION AND CONCLUSION

Although our platform is rough and requires further work, it has been used successfully on two game prototypes in four field trials to create and host a pervasive live action role playing game event that corresponds to a specific research requirement.

The game versions developed on the platform are still very similar and follow the same steps in the evolution of one pervasive LARP, hence they do not fully fit as an example of the variety of pervasive games out there. The complexity of these games has guided the development of the underlying architecture as a platform as each game version has resulted in improvements. Our platform would be best suited to host pervasive LARPs, yet those are amongst the most complex pervasive games to implement, stage and research.

Future work and Limitations

Although adjusting the different game elements to guide the game dynamics from a simple location based game to a mixed reality game can be done, these functions cannot yet be accessed from one interface by just anyone. In the future, we hope to improve these aspects to provide more accessible platform and improve the documentation. Once we are confident on the platform we plan to release it open source. For now, you can contact the authors if you want to contribute or use the current platform.

ACKNOWLEDGMENTS

This research was in part funded by Open Innovation Platforms spearhead project of the Six City Strategy funded by the ERDF and the City of Oulu. In addition, the Strategic Research Council at the Academy of Finland is acknowledged for financial support of the COMBAT project (293389).

REFERENCES

1. Markus Montola, Jaakko Stenros, and Annika Waern. 2009. *Pervasive games: theory and design*. Morgan Kaufmann Publishers Inc.

2. GPS Tycoon Game - Android Apps on Google Play. Retrieved September 13, 2016 from https://play.google.com/store/apps/details?id=com.gpstycoon&hl=en
3. Parallel Kingdom. *Parallel Kingdom*. Retrieved August 25, 2016 from http://www.facebook.com/parallelkingdom
4. Vlasios Kasapakis and Damianos Gavalas. 2015. Pervasive gaming: Status, trends and design principles. *Journal of Network and Computer Applications* 55: 213–236. https://doi.org/10.1016/j.jnca.2015.05.009
5. Michael D. Myers and Heinz K. Klein. 2011. A Set of Principles for Conducting Critical Research in Information Systems. *Mis Quarterly* 35, 1: 17–36.
6. Steve Benford, Carsten Magerkurth, and Peter Ljungstrand. 2005. Bridging the physical and digital in pervasive gaming. *Commun. ACM* 48, 3: 54–57.
7. Paula Alavesa, Alexander Samodelkin, Esa Jääskelä, Riku Tanskanen, Bo Li, Timo Ojala, and Hannu Kukka. 2016. Campus knights: situated pervasive display as a window into pseudo-immersive game world. In *Proceedings of the 5th ACM International Symposium on Pervasive Displays*, 132–139.
8. Mapgets Developers. Retrieved October 20, 2016 from https://developers.mapgets.com/