PhD proposal

Spatial Interaction within ambient environments

Practical Information

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Location : Laboratoire LIMSI-CNRS, Plateau du Moulon, Bât. 508, 91403 ORSAY, France.
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Expected Funding : Public : we are looking for a candidate by the end of February 2014, so as to apply to a Région Île-de-France grant.

Keywords : Human-Computer Interaction, Spatial Interaction, Ambient Intelligence.

Application deadline: 2/28/2014

Abstract

In this PhD thesis, we are interested to study how physical space can be used to carry out the interactions between users and ambient environments. The candidate will have to define a language notation for spatial interactions that will serve as a basis for a software tool that will allow a designer to easily specify spatial interactions within ambient environments. This tool will be used to conduct experimental studies to provide guidelines for spatial interactions design.

Context

Ambient environments aim to augment the physical environment with various sensors and actuators in order to assist users in their daily tasks. In this new type of environments, Human-Computer Interaction requires the definition of new interaction methods. In particular, the use of location sensors allows one to transform the physical space itself into a means of interaction. For example, the simple act of bringing a tag representing a video file close to another tag representing a screen in the house may trigger the playback of the video file on the corresponding screen.

Objectives

The aim of this PhD is to design a language for spatial interaction within ambient environments, to propose a notation for it and to use it for conducting studies on spatial interaction. We would like to identify the characteristics of objects that are related to the physical space (position, speed, acceleration, orientation, distance, etc.) and to identify those that may be relevant to be used in such a language. The candidate will also have to develop a software tool that will integrate this language and that will allow a designer to easily specify spatial interactions. The candidate will use this tool to conduct experiments to evaluate and compare different spatial interaction scenarios. The results of these experiments will serve to provide guidelines for spatial interaction design.

Work Program

1. Perform a state of the art on the field of spatial interaction.
2. Identify the pertinent elements that can be used to define a spatial interaction language.
3. Design a language and propose a notation for this language.
4. Develop a software tool that implements the language and makes the specification of spatial interactions easy for an interaction designer.
5. Define experiments to compare and evaluate different spatial interaction methods.
6. Propose guidelines for spatial interaction design, using the experiments results.

Extra Information

In order to conduct studies on ambient computing, LIMSI has built a smart room, called IRoom (Intelligent Room), equipped with various sensors and actuators. This room is used as an experimental platform for conducting these studies. The IRoom is equipped the UbiSense localization system that can locate different objects or different users in the room's 3D space. The IRoom and the UbiSense system will be used during this PhD to validate the proposed language and to conduct the experiments.

Videos showing the use of the UbiSense localization system in the IRoom are available here (the first three ones) : http://www.limsi.fr/Scientifique/ami/videos

The candidate will be recruited by LIMSI-CNRS, in the AMI group (Architectures and Models for Interaction). Located in Orsay, France. The PhD will be carried out in collaboration with the Department of Computer Science of Supélec, in the Heterogeneous Modeling and Verification group.

Candidates profile

The candidate will be required to hold a master of science in Computer Science by September 2014. We are looking for passionate candidates with strong problem-solving skills, proficiency in at least one programming language and excellent scientific writing abilities in English and/or French.

References

- S. Borkowski, G. Privat, Spatial interaction in ambient communication. Proceeding of ENACTIVE, 4th International Conference on Enactive Interfaces, At Grenoble, 2007.
- P. Fröhlich, R. Simon, L. Baillie, J. Roberts, R. Murray-Smith, Mobile Spatial Interaction. Extended Abstracts of CHI2007, Conference on Human Factors in Computing Systems, 2007.
- M. Duckham, R. Bennett, Ambient Spatial Intelligence. In Ambient Intelligence and Smart Environments, Volume 3: Behaviour Monitoring and Interpretation – BMI, pp. 319 – 335.