

SmartOffice: Design of an Intelligent Environment

Christophe Le Gal, Jérôme Martin, Augustin Lux, James L. Crowley

Abstract—

This paper presents our Intelligent Environment called *SmartOffice*. In the *SmartOffice* the user can work as in a normal office. The office's intelligence observes the user in order to anticipate his intentions and augments his environment to communicate useful information. Computers are involved in user activities in order to help in everyday tasks. The system interacts with users using voice, gesture or movement.

The *SmartOffice* provides a test-bed for collaboration and combination of independant modules integrated into a single coherent application. Integration requires a flexible working environment in which module developers should not worry about low-level communication between modules. This paper presents a flexible resource-oriented integration protocol, which we argue is necessary to build such an environment. All modules need not be aware which resources can be provided by each module. They communicate, using an XML-based protocol, with the supervisor which acts as a resource-server. The supervisor is programmed using a rule-based language, in which the addition or the suppression of a module requires only the suppression of the corresponding rule.

Two major modules of the *SmartOffice* are considered to illustrate the role of the supervisor: The first module is the *MagicBoard*, an ordinary white board augmented by a camera and a video-projector.

To guess the user-intentions, the system must constantly be aware of the location of the users in the *SmartOffice*. Therefore we need a user localization module. This is the second module that we describe. An example of the tracking architecture is presented.

This paper has been published in IEEE Intelligent Systems July/August 2001 number. See <http://computer.org/intelligent>.

REFERENCES

- [1] S. Addams, *The Dilbert Future*, United Features Syndicate, Inc., 1997.
- [2] M. Weiser, "The world is not a desktop," *Interactions*, pp. 7-8, Jan. 1994.
- [3] M.H. Coen, "Design principals for intelligent environments," in *Proceeding American Association for Artificial Intelligence 1998 Spring Symposium on Intelligent Environments*, Stanford, CA, USA, Mar. 1998.
- [4] Oren Etzioni, "Intelligence without robots: A reply to Brooks," *AI Magazine*, vol. 14, no. 4, pp. 7-13, 1993.
- [5] M. H. Coen, "The future of human-computer interaction or how i learned to stop worrying and love my intelligent room," *IEEE Intelligent Systems*, March/April 1999.
- [6] M. H. Coen, "Building brains for rooms: Designing distributed software agents," in *Ninth Conference on Innovative Applications of Artificial Intelligence. (IAAI97)*, Providence, R.I., 1997.
- [7] Mission Support Directorate, Mission Planning and Analysis Division, NASA, 87-FM-9, JSC-22552, *CLIPS Reference Manual, Version 4.0*, march 1987.
- [8] W. F. Clocksin and C. S. Mellish, *Programming in Prolog*, Springer-Verlag, New York, 1981.
- [9] A. Lux and B. Zoppis, "An experimental multi-language environment for the development of intelligent robot systems," in *Proc. of the 4th International Symposium on Intelligent Robotic Systems*, 1997, Ravi is available at WWW <http://www-prima.imag.fr/Ravi>.
- [10] V. Quercia and T. O'Reilly, *X Window System User's Guide*, O'Reilly & Associates, 1989.
- [11] D. Hall and J. L. Crowley, "Tracking fingers and hands with a rigid contour model in an augmented reality," in *MANSE'99*, 1999, submission.
- [12] A. Kendon, "The biological foundations of gestures : Motor and semiotic aspects," in *Current Issues in the Study of Gesture*, Nespoulous, Perron, and Lecours, Eds. Lawrence Erlbaum Associates, Hillsday, N.J., 1986.
- [13] Keith Dana Martin, "A computational model of spatial hearing," M.S. thesis, Cornell University, 1995.
- [14] D. Hall, C. Le Gal, J. Martin, O. Chomat, T. Kapuscinski, and J. L. Crowley, "Magicboard: A contribution to an intelligent office environment," in *Proc. of the International Symposium on Intelligent Robotic Systems*, 1999.
- [15] J.L. Crowley and C. Discours, "The SAVA skeleton system," in *Vision as Process. Basic Research on Computer Vision Systems*, J.L. Crowley and H.I. Christensen, Eds., pp. 23-45. Springer, 1994.
- [16] O. Chomat and J.L. Crowley, "Probabilistic recognition of activity using local appearance," in *Computer Vision and Pattern Recognition (CVPR'99)*, Apr. 1999, pp. 104-109.
- [17] O. Chomat, *Caractérisation d'Éléments d'Activités par la Statistique Conjointe de Champs Réceptifs*, Ph.D. thesis, Institut National Polytechnique de Grenoble, 2000.
- [18] B. Schiele and J. L. Crowley, "Probabilistic object recognition using multi-dimensional receptive field histograms," in *Proc. of the ICPR*, 1996.

E-mail: Christophe.Le-Gal@inrialpes.fr