

Short-Term Scientific Mission
COST Action IC0801
Final Report

Host Institution: Centre for Intelligent Information Technologies
University Rey Juan Carlos – Mostoles, Spain

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1 Mission

The short term scientific mission (STSM) has been carried out during the months of May and June at the Centre for Intelligent Information Technologies (CETNIA) – University of Rey Juan Carlos (Spain), under the supervision of the Prof. Sascha Ossowski. The aim of this STSM was to apply the concepts of a particular *ecological approach for pervasive multi-agent systems* [1] to one of the case study of the *mIO! Project* [2], in order to evaluate the performance of the cited approach.

2 Background

In the last years, my group of research have been investigating the use of ecological metaphors as a reference architecture around to conceive, model, and develop a fully-fledged pervasive service framework and all the components within. Ecological metaphors conceive the future pervasive service frameworks as a spatial ecosystem in which services, data items, and resources are all modeled as autonomous individuals (agents) that locally act and interact according to a simple set of well-defined eco-laws. The space of the ecosystem is organized around a set of shared localities: niches. This ecological approach has already been applied into the area of adaptive advertising, particularly in the case study of ecosystems of displays. Simulations results [3] suggest that the cited approach has the potential to act as an effective general-purpose framework for spatially-situated and adaptive pervasive service ecosystems.

The case study considered was *tourism in Cordoba*. This case study considers the scenario where a couple of tourists arrive to Cordoba to spend the weekend, and provided with a PDA, they begin

to interact with the environment. A personal assistant suggests then, what are the best possible actions to follow according to some preferences of the tourist (stored into the PDA agenda), some considerations of the context (date, hour, their position, etc), the availability of services and selected methods of reputation and truths. The main process that collaborate with the personal assistance are: look the possible activities for the tourist , plan these activities, discovery of services that can help to perform the activities and the execution of them.

3 Objective

Considering the previous background, the main goal of the mission was to apply the concepts of local spaces (niches) and local interaction between components, which are inherently exhibited by the ecological model, into the case study of tourism in Cordoba, with the purpose of use and take into advance of the resources and services that are near to the tourist or into the niche where the tourist is situated.

In this context, the concepts of nested/hierarchical niches were applied into the presented scenario. The nesting local niches, which preserve the relationships among environments, facilitate the control and organization of the flow of data in complex and dynamic scenarios. For instance, a nesting niche is the hotel (considered as a composing niche), which is composed by other smaller niches (composed niches) like floors, and these again by rooms, and these again by the niches of the PDAs of the tourist. The last are considered mobile niches because they are continuously moving between the static niches of the rooms, floors, etc. with the tourist. The nesting niches concepts were applied into the discovery process of services (that directly interact with the personal assistant) to facilitate the discovery of local resources and services.

Furthermore, according to the ecological model, the complete services, devices and data resources were considered as individuals (agents). The agents were defined by the features that describe their behaviors and by their own needs, represented as the tuple $\langle \text{features}, \text{needs} \rangle$. In order to the discovery process takes place, the tuples have to be published into the appropriate shared niche. The discovery process naturally match the needs of an agent i with the corresponding features of the agent j , in other words: the agent j can satisfy the needs of the agent i . In case that the need of an agent could not be satisfied in the current niche, there are agents that monitor the niche and are in charge of redirect the tuple to other niches. Nested niches guide the flow of the redirection of the tuples not satisfied. Different ways of redirection of the tuple were analyzed in order to optimize the discovery process.

4 Conclusions and Further research

During my visit to the University of Rey Juan Carlos, I applied a particular ecological model to the case study of tourism in Cordoba in the frame of the *mIO! Project*, which implements a personal assistant that recommend activities to the tourist. Particularly, the locality concepts managed by the nested niches were analyzed and used for the discovery process of services of the personal assistant of the tourist.

The next step of the research is to evaluate, into a simulation and real environments, the effectiveness of the peculiar discovery process. This discovery process, which is based in local concepts, try to explore the use of the near resources and services in dynamic environments.

References

- [1] C. Villalba, F. Zambonelli. An ecological approach for large scale pervasive multi-agent systems. In the *Proceedings of the 4th AAMAS Workshop on Massive Multiagent Systems*, Budapest, HU, 2009.
- [2] mIO!. Technologies that provide mobile services in the intelligent universe of the future. <http://www.cenitmio.es/>
- [3] C. Villalba, F. Zambonelli. Simulation Experiences with an Ecological Approach for Pervasive Service Systems. In the *Proceedings of the 2nd ICAC Workshop on Bio-inspired Algorithms for Distributed Systems*, Washington, DC, USA, 2010.