Proposition de recherche doctorale

Framework for Ambient Assistive Living: Handling Dynamism and Uncertainty in Real Time Semantic Services Provisioning

Mots clés :

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Résumé du projet de recherche (Langue 1)

The heterogeneity of the environments as well as the diversity of patients' needs and profiles are major constraints that challenge the spread of ambient assistive living (AAL) systems. AAL environments are usually evolving by the introduction or the disappearance of sensors, devices and assistive services to respond to the evolution of patients’ conditions and human needs. In addition, each patient has a specific profile that influences the choice of interaction devices and requires particular assistive actions. The selection of the required assistive actions affects the decision on the set of sensors that needs to be installed. Therefore, a generic framework that is able to adapt to such dynamic environments and to integrate new sensors, devices and assistive services at runtime is required. Implementing such a dynamic aspect may produce an uncertainty derived from technical problems related to sensors reliability or network problems. This uncertainty impacts the information and the events received by the framework. It is also related to human behaviors, where the situation of the assisted person is imprecise and the system is not able to classify his activity. Therefore, a notion of uncertain should be introduced in context representation and decision making in order to deal with this problem. During this thesis, we have developed a dynamic and extendible framework able to adapt to different environments and patients' needs. It allows the integration of new assistive services, sensors and interaction devices at runtime, and then their inclusion into the reasoning process in order to provide the appropriate assistive services for end-users when needed. This was realized based on our proposed approach of semantic Plug&Play mechanism. We have used different approaches, mainly the modular approach with the use of the Open Service Gateway initiative (OSGi) for implementation, the declarative approach, using the semantic web technologies for environment representation and for reasoning, and the Device Profile for Web Services (DPWS) mechanism for sensors and devices discovery and interaction with the framework. In order to handle the problem of uncertain information related to technical problems, we have proposed an approach for uncertainty measurement based on intrinsic characteristics of the sensors and their functional behaviors, then we have provided a model of semantic representation and reasoning under uncertainty coupled with the Dempster-Shafer Theory of evidence (DST) for decision making. The developed framework evolved during on field work and real world deployment in a collaborating nursing home. Through our deployment approach, we have identified the principal requirements we have dealt with in this thesis, and performed a technical performance validation of the framework with an analysis of the collected data.