

A Platform for Ubiquitous Context-Sensitive Applications

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This position paper briefly describes some of the research at the knowledge engineering group of VTT Electronics. We are currently involved in the development of a platform facilitating the construction of ubiquitous applications. The platform aims to provide basic features needed by any system of ad-hoc co-operating components, but particularly takes the requirements of mobile users into account.

The platform assumes an environment with sensors, actuators and services. No restrictions are made as to whether the sensors and actuators are embedded into the rooms, into mobile hand-held devices or worn by the user. Instead, each component is provided with sufficient intelligence to tell what service they provide. This allows for ad-hoc addition of new components to the system, enhancing the performance of the whole.

The basic middleware of the platform attempts to hide the means of communication used by the system for the transfer of data. Common broker techniques like CORBA, D-COM and RMI are utilised to provide this abstract interface and actual data transfer can be done over wireless as well as wired connections. Our current system is mainly implemented in Java and RMI based.

Our proposed solution for the actual component communication is derived from intelligent agent research. Ubiquitous components are registered to a service, which aids in locating suitable components to solve a given task. Upon registration, the components convey their capabilities by means of statements in a suitable knowledge representation language and linked to a given ontology. Also the services provided by the different components are communicated by means of this knowledge representation.

When an application within the ubiquitous environment wishes to achieve a goal, it first determines the resources needed (e.g. knowledge about the environment itself, the identity of the user, means of communication with the user), subsequently finds the necessary resources by means of the register service and obtains the required information from these resources. Achieving the goal may also include interaction with the user, or activating an actuator in the environment.

The resources are mainly sensors and actuators in the environment. They can also be regarded as services, just like possible information services or common knowledge services.

In our opinion this approach will allow for a generic framework for ubiquitous applications. New modules can be added ad-hoc whenever available. Users walking from one area to another will be able to communicate with the local services available in their immediate surroundings as well as with services at a distance otherwise important to them. The main challenge in this research is the definition of a suitable communication language and the manner in which the components are co-operating to achieve their goals. Intelligent agent research has provided us with some tools (KIF; KQML, etc), but still fall short of a complete solution. Also the use of ontologies and knowledge bases in this context is a challenging task.