D. To, D. Kim, B-J. You, S-R. Oh. Network-based robots and user interaction framework. Gerontechnology 2008;7(2):222. Network-based robots serve and assist humans by imitating and providing human-like actions and behaviours based on service contents and intelligence software in external servers. These robots have a large set of basic behaviours and can perform many different tasks by using arms, hands, and mobility. Controlling a system with many degrees-of-freedoms and sensors, many real-time sensor data streams consumes a lot of CPU power. Therefore space for complicated high-level services is limited. This concerns recognition of faces, gestures and objects, and reasoning. The use of services on the external servers is a good solution. Such a network-based architecture makes the robot into a partner and assistant of human beings with external sensors or even a household network to create an intelligent environment. The architecture should provide functions that a robot can explore for its goal and users can explore the robot with the added ability provided by surrounding servers. Services can easily be added, removed or changed on the surrounding nodes while embedded control programs of the robot are less changeable. The architecture expects a robot with a stable embodied program. Whenever a new service is added, the system should be able to detect this new service and coordinate this new service within the existed system. The human-robot interface system provides all available services for accessing by other partners or users. Coordination is based on pre-defined rules. In some cases, knowledge discovery and exploration among networked nodes needs to be considered. The architecture therefore needs to support a knowledge description language and a reasoning system. Moreover, one network-based robot may play different roles: man, woman, kid, butler, house maid, etc. With each role, the behaviours and/or voices are changed accordingly. The architecture also needs to provide a solution to do it simply without reprogramming the coordination system in other servers. Users explore the system using their network access equipment such as a computer, a notebook or a PDA. The robot system may be off-line for battery charging or due to network problems. Users are, however, busy and hope to access the system as fast as possible. The architecture should provide a method to deal with this offline situation. Moreover, users normally are not robotic experts so they do not know exactly what to do. A graphical user interface with detail explanation and/or a simple scripting language for scenario, role and coordination describing are useful. A client server model, where each robot requests the services from external servers, can be a solution but it is not scalable. Whenever a new service is added, the client code on each network-based robot should be modified to access and to explore the service. Moreover, offline problem is difficult to solve in client-server model. Considering the above requirements, multi-agent technology is the method of choice for design. We propose a Network-Based Service Architecture (NBSA) and coordination method for robots to deal with the above mentioned problems. Next, a role-based method, which helps users to define the role of a robot, is proposed. A robot may change all its real implementations of behaviours without affecting the coordination script. In order to evaluate the proposed architecture for network-based robots, a number of experiments on a humanoid robot, MAHRU, have been conducted successfully by adopting JadeLeap middleware1 and FIPA standard2 on a system that consists of a PDA, a network-based humanoid named MAHRU, external ser-vice servers, and other mobile robots. An extension of Jess rule engine3 and correspond-ing implementation classes are developed for describing and implementing coordination. Experimental results show that the proposed framework provides an extendable ability and gives users the way to easily modify behaviours of the humanoid.

References

1. Bellifemine F, Caire G, Poggi A, Rimassa G. Journal of EXP – in search of innovation 2003;3:6-19
2. Foundation for Intelligent Physical Agents; www.fipa.org
3. Rule Engine for the Java Platform; http://herzberg.ca.sandia.gov/jess/

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