

Abstract

This paper describes the design of the system architecture for a reconfigurable modular humanoid robot.

Humanoid robots can potentially assist human activities in human daily environments such as offices, homes, and hospitals. It is desirable for users to reconfigure their own robots to suit their needs and preferences as they can customize their own personal computers and cars. In order to develop a practical humanoid robot which performs skillful tasks in a real world together with human beings, expandable and flexible robot system architecture is required.

Our solution to these needs of users and researchers is a reconfigurable modular humanoid robot that is adaptable to new environments and various tasks. We focus on the parallelism of humanoid robot functions and the concept of modular systems. The system architecture for reconfigurable modular humanoid robots differs from conventional humanoid robot architecture by pursuing modularity of mechanical, electronic, and software parts based on functional robots such as wheeled robots, arm robots, and so on. The major advantage of our architecture is that users can reconfigure humanoid robots to different types of robots by combining several functional robots. The functional robots operate by themselves without being the parts of humanoid robots. For example, the functional robot operates as an arm part of the humanoid robot when integrated into the humanoid robot, while it operates as an arm robot when separated from the humanoid robot.

We evaluated the efficiency of our proposed architecture through the experiences using reconfigurable modular humanoid robot prototype R1. Experimental results show that the proposed architecture achieves expandable and flexible reconfiguration for users and researchers by changing the robot configuration to different types of robots for many purposes. We believe that our reconfigurable modular humanoid robot will enable user-specific humanoid robots more easily than ever before.