The PlayMate System

9.1 Introduction

Research in CoSy was scenario driven. Two scenarios were created, the PlayMate and the Explorer. One of the integration goals of the project was to build integrated systems that addressed the tasks in these two scenarios. This chapter concerns the integrated system for the PlayMate scenario.

The work described here on the PlayMate scenario is concerned with understanding, at a systems level, the problems that an intelligent system must face if it must interact with humans in an object rich environment. In particular the goal is to understand how a robot can interact with a human in a space in which they both manipulate objects, and in which they can talk about those objects. This requires many abilities. The robot must be able to understand and generate references to objects, actions with them, their properties and spatial relationships. It must understand how actions alter the relationships between objects, be able to recognise actions the human performs with objects, and it must be able to learn about the effects of actions on objects, both by discovery and by watching others. If there are several opportunities for action it must choose between a number of potential goals at any one time.
Finally, since it is working with a human, the human may change the world while the robot is acting. Thus the robot must meet many of the requirements that we outlined in Chapter 2, and utilise many of the technologies that were described in the chapters leading up to this one. This chapter describes how these technologies were integrated to solve some of the tasks that exist in the PlayMate scenario. It describes both the complete PlayMate system, and the major innovations that cut across the PlayMate and the Explorer. It is important to note that the system described here is the last of a series of systems [1, 2, 17, 18]. Each of these systems was been used as an experimental platform, and the lessons learned at each stage were used to revise the cognitive architecture (see Chapter 2), and the systems level engineering approach.

To help us in our exposition we will use a single example that runs through the chapter and shows the various problems that we encounter in building a robot with multiple modes of sensing and action. The script for this example is given in Figure 9.2. The PlayMate robot is stationary, but positioned next to a table which holds a number of objects. It has two head mounted cameras, and an arm with a parallel-jaw gripper and a camera on the wrist. The objects are everyday cardboard packages such as small cereal boxes, or brightly coloured shapes (triangles, squares, circles) with differently coloured handles as seen in Figure 9.1.

The ability to handle this script requires that the robot be able to solve a number of problems. First, it must be able to understand not just the content, but the role of an utterance in the interaction, when the human says "This