

MOTION PLANNING BENCHMARKS

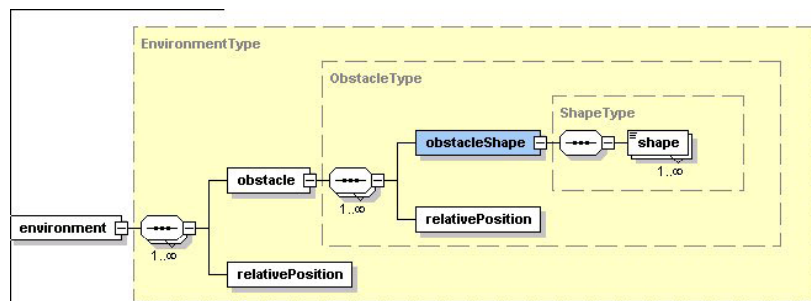
This initiative is a repository for motion planning benchmark problems maintained by the University of Parma. It aims at including benchmarks designed by different research groups and documentation describing the file formats currently used by the available planning tools to define their problems. Also, links and useful information regarding motion planning research projects are available. The repository is intended to serve as the basis for further discussion on the requirements and the design of benchmarks in motion planning.

The data sets follow the so-called Motion Planning Markup Language (MPML), an XML-based input format that has been proposed by the University of Parma, in such a way that the structure, content and semantics of valid XML files describing the robots and the workspace are defined by a set of XML-Schema documents. A Java3D tool to visualize motion planning scenarios that uses the XML format is also part of the system.

The repository includes data sets about:

- robots
- workspaces
- benchmark problems

The workspace may contain an arbitrary number of obstacles which are described by their position in the workspace and their shape. The shape is described as a composition of one or more basic objects (see figure). Some representative examples are shown in the figure.

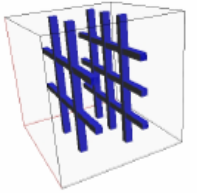
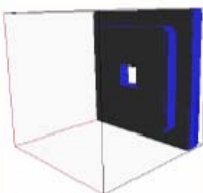
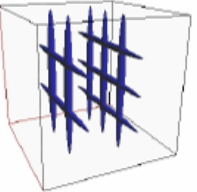
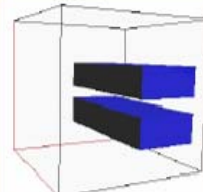


Structure of a workspace

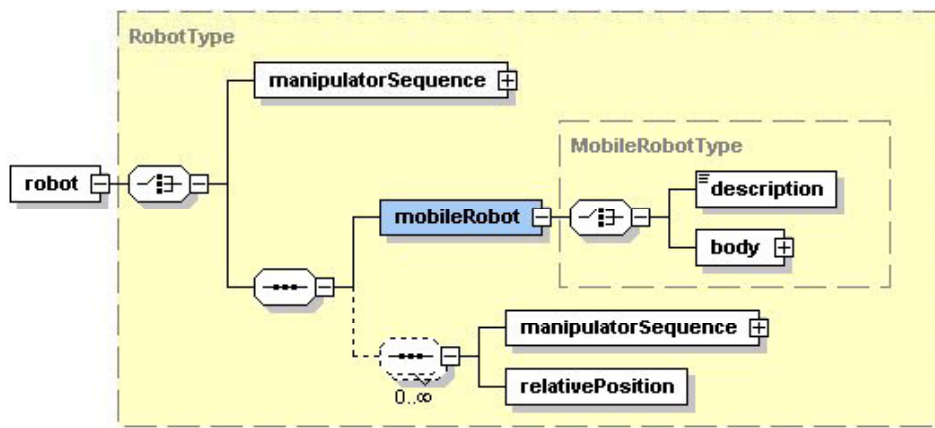
Different kinds of robots are supported, such as:

- mobile robot on the plane
- free-flying robot
- manipulator
- sequence of manipulators
- union of mobile robot and one or more manipulator sequences



They are described similarly in a hierarchical way (see figure). For instance, manipulators and kinematic chains are described as sequences of links. Some representative examples are shown in the figures.

	Name: Grid Description:		Name: Hole Description:
	Name: Modified Grid Description:		Name: Narrow Description:

Examples of workspaces



Structure of a robot

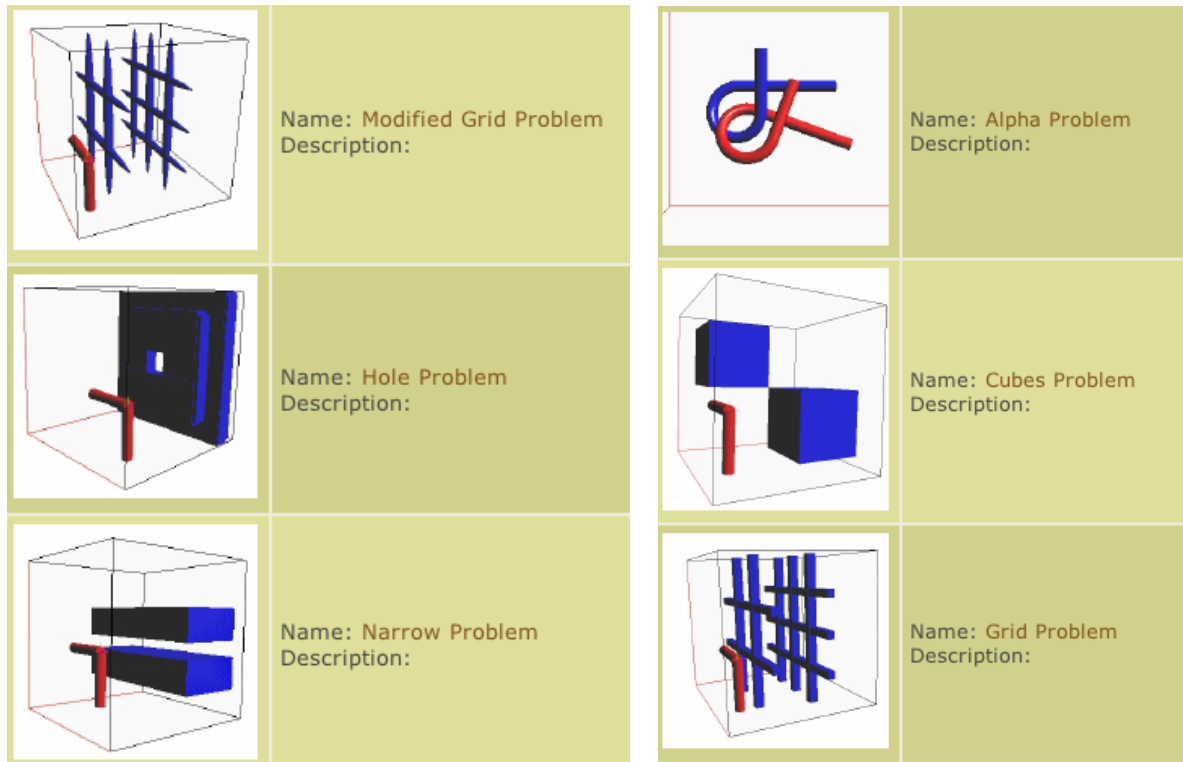
	Name: Manus Robot Description: a six dof manipulator robot for wheelchairs
	Name: Nomad 200 Description: the well known mobile robot
	Name: Manus and Nomad 200 Description: Manus manipulator mounted on top of a Nomad 200 mobile robot

Examples of robots

Examples of benchmark problems follow Hwang's taxonomy [Hwang 92], and comply with his requirements, that is, they must be realistic and non-pathological problems with at least one example satisfying the following criteria:

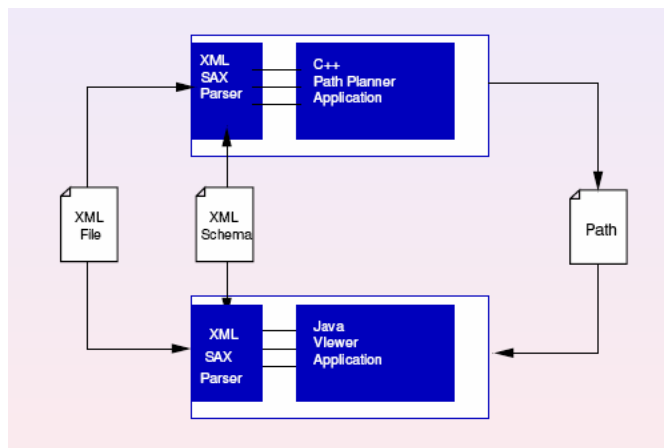
1. Number of obstacle ≥ 5 , some concave obstacles,
2. Solution paths nontrivial, must utilize all available dofs,
3. Narrow space at some point
4. A trap in the space requiring backtracking

Some representative examples of the available problems are shown in the figures.



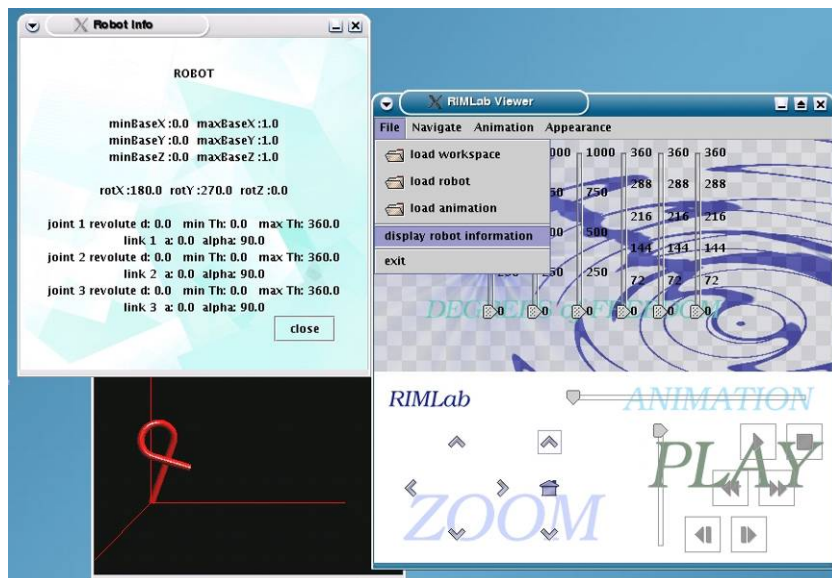
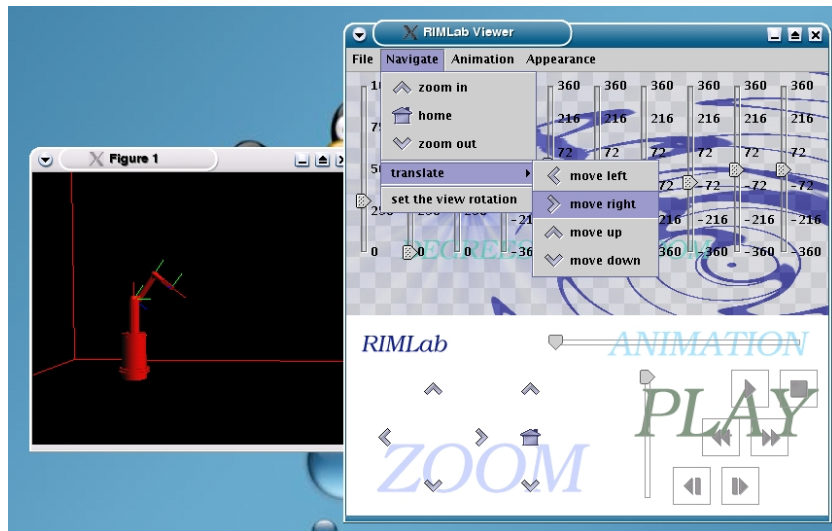
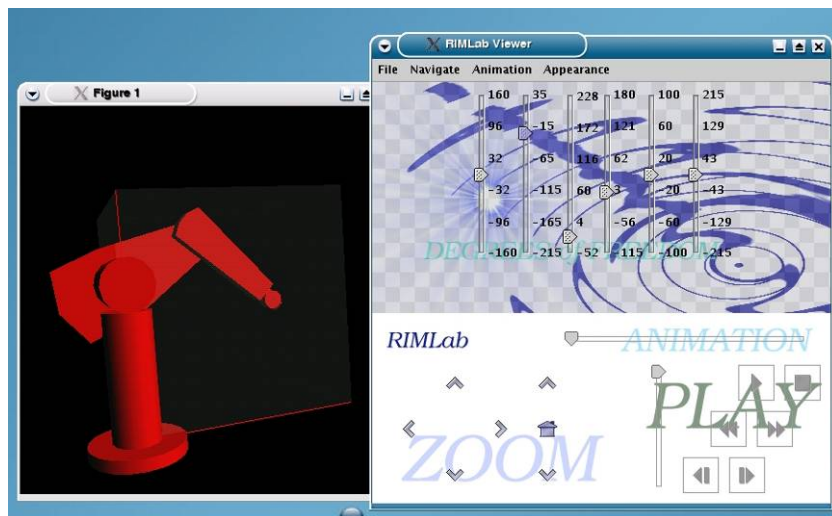
Examples of benchmark problems

The environment also incorporates a 3D tool to visualize results; that is, a viewer for MPML which is decoupled of the application.



Structure of the MPML 3D Viewer

Some snapshots of the viewer are included:



More information can be found at the official website: <http://mpb.ce.unipr.it>