Humanoid Path Planner

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Outline

Path Planning

Given

- A robot (kinematic chain),
- obstacles,
- constraints,
- an initial configuration and
- goal configurations,

Compute a collision-free path satisfying the constraints from the initial configuration to a goal configuration.

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Historical perspective

- 1998: Move3D,
- 2001: Creation of Kineo-CAM, transfer of Move3D,
- 2006: Release of KineoWorks-2, development of HPP based on KineoWorks-2,
- 2013: kineo-CAM is bought by Siemens,
- December 2013: development of HPP open-source.

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Overview of the architecture

Modular: collection of packages

- package dependencies tracked by `pkg-config`,
- installation managed by `cmake` and a `git` submodule:
  `git://github.com/jrl-umi3218/jrl-cmakemodules.git`,
- programmed in `C++`,
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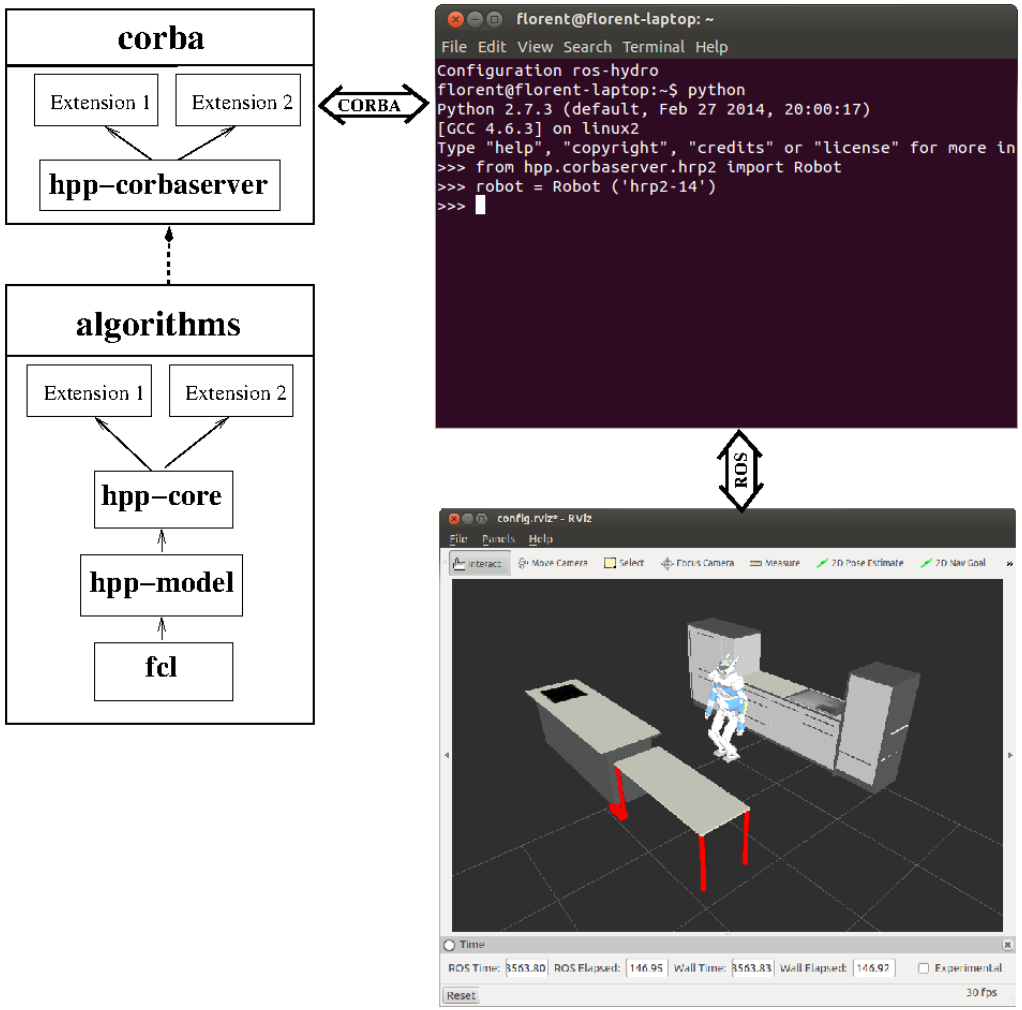

Software Development Kit

Packages implementing the core infrastructure

- Kinematic chain with geometry
  - `hpp-model`: implementation of kinematic chain with geometry,
    - tree of joints (Rotation, Translation, SO3: unit-quaternions),
    - moving fcl::CollisionObjects,
    - forward kinematics,
    - joint Jacobians,
    - center of mass and Jacobian.
- Path planning
  - `hpp-core`: definition of basic classes,
    - path planning problems,
    - path planning solvers (RRT),
    - constraints (locked dofs, numerical constraints)
    - path optimizers (random shortcut),
    - steering methods (straight interpolation)

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Extensions

Packages implementing other algorithms

- `hpp-model-urdf`: construction of robots and objects by parsing urdf/srdf files.
- `hpp-wholebody-step`: whole-body and walk planning using sliding path approximation,
- `hpp-manipulation`: manipulation planning (under development, not yet available).

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Python control

`hpp-corbaserver`: python scripting through CORBA

- embed `hpp-core` into a CORBA server and expose services through 3 `idl` interfaces:
  - `Robot` load and initializes robot,
  - `Obstacle` load and build obstacles,
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- Implement python classes to help user call CORBA services
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- `hpp-wholebody-step-corba`: control of humanoid specific constraints and algorithms,
- `hpp-manipulation-corba`: control of manipulation planning specific classes and algorithms (under construction, not yet available).

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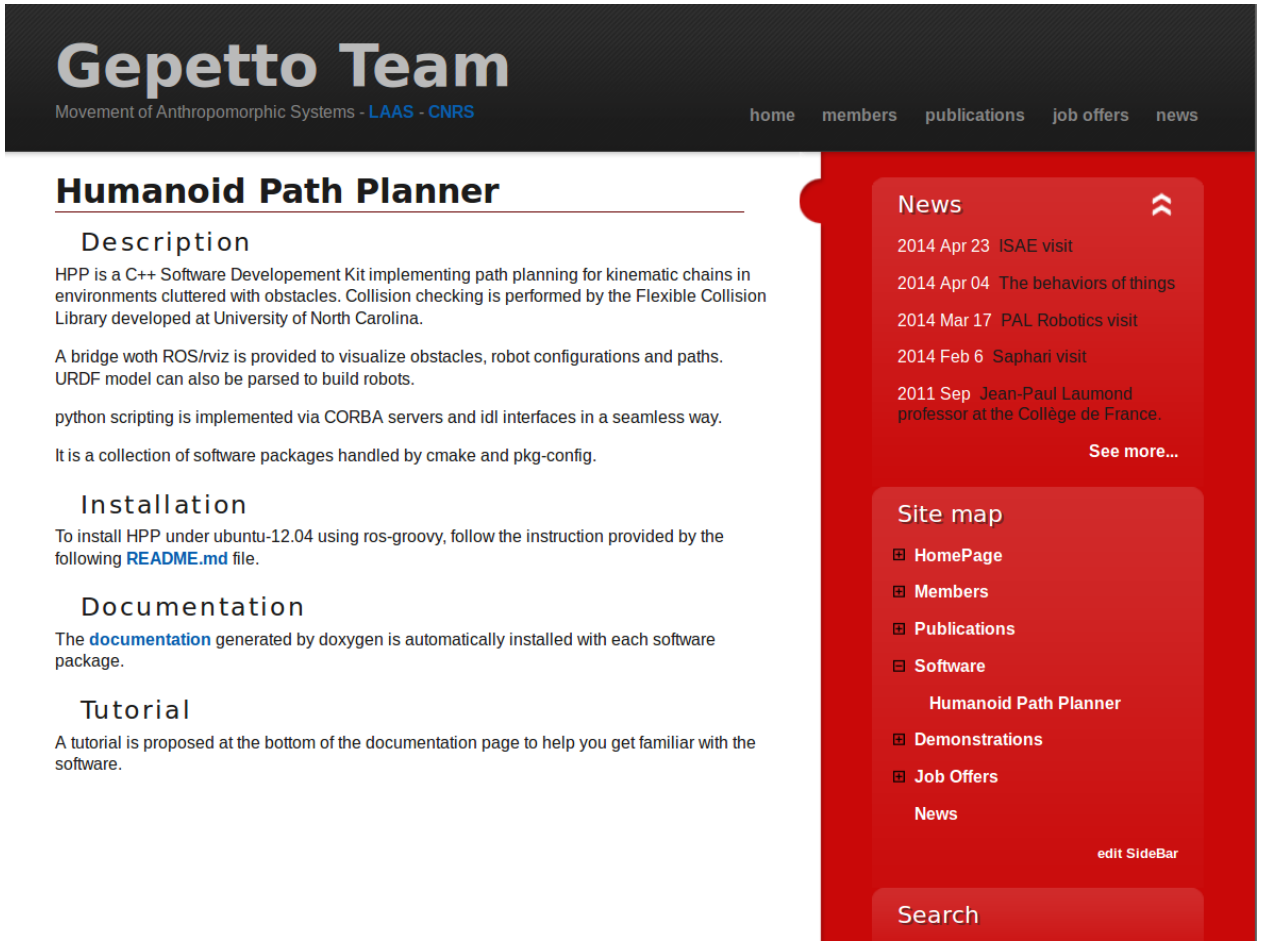
Visualization through ROS/rviz

Implemented by package `hpp_ros`.

Documentation

Entry point on Gepetto home page:

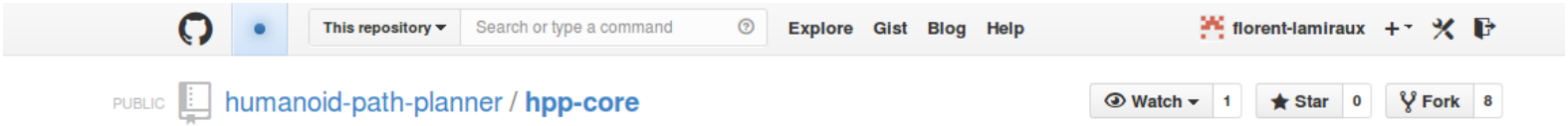


Installation

Go to
`https://github.com/humanoid-path-planner/hpp-doc`
and follow the installation instructions.

Keep informed

- Mailing list `hpp@laas.fr` to discuss issues related to the software,
- github notifications for issues related to individual packages



Demonstration