TUM Institute for Cognitive Systems (ICS)

OpenWalker

Module Description: Foot Step Planner (FSPM)

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1 Module Description

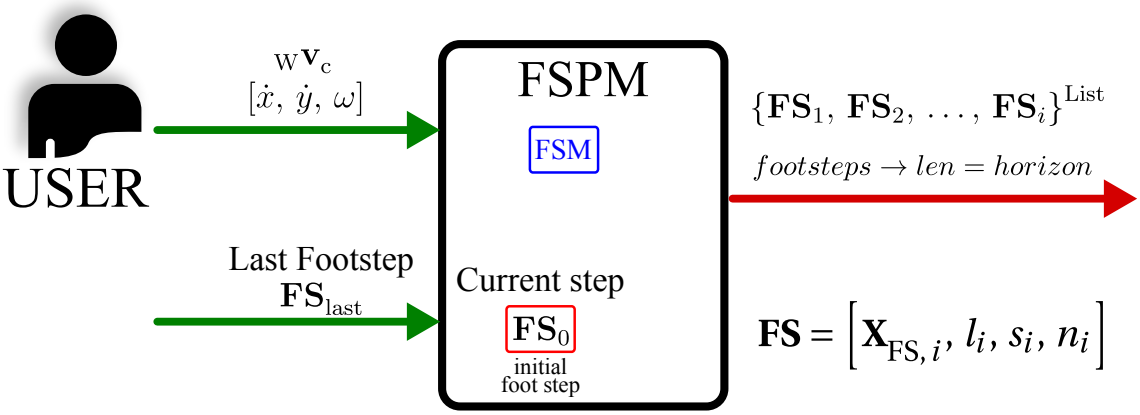

Figure 1.1: Foot Step Planner module: This module generates a set of footsteps from user velocity commands and adapts them according to the real footstep execution data.

The footstep planner generates a number of steps ahead proposing feasible footholds defined by the robot's kinematic parameters. The plan is generated from velocity commands defined by the user. The footstep planner also updates the plan when the step execution differs from the original plan. This could happen when the terrain conditions move the foot landing motion to a different location. Then the modified location is used to re-plan the following steps.

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2 Module Connections

2.1 Inputs

Symbol	Name	Type	Description
$\mathbf{v}_c \in \mathbb{R}^6$	Velocity Command	`CartesianVelocity`	Velocity command for the $\mathbf{x}-\mathbf{y}$ plane including rotation ω. The OpenWalker framework uses this module input to compute a feasible set of future footholds which enforce the walking execution to follow the velocity command.
FS	Last Footstep	`FootStep`	The end position of the last executed footstep. The OpenWalker framework uses this module input to adjust the plan of footsteps according to the actual execution of them.

2.2 Outputs

Symbol	Name	Type	Description
$\{\mathbf{FS}_i\}$	Footstep List	`FootStepList`	A list containing the planned footsteps.

2.3 Inter-Connections

This module can receive the input from any publisher of `geometry_msgs/Twist` messages, for example the `teleop_tools` packages. The Last Footstep is received from the Foot Trajectory Generator (FTG).

The output will provide the reference way-points for the DCM planner and the Foot Trajectory Generator (FTG).

2.4 Common Methods

There are several algorithmic methods for footstep planning using different sensors and map information. Some examples are the obstacle avoiding planner used in the humanoid robot ASIMO [1], the dynamic programming approach in [2], or the LIDAR based ROS packages `footstep_planner` and `visir_footstep_planner`.

References

[1] Chestnutt, Joel, et al. "Footstep planning for the honda asimo humanoid." Proceedings of the 2005 IEEE international conference on robotics and automation. IEEE, 2005.

[2] Kuffner, James J., et al. "Footstep planning among obstacles for biped robots." Proceedings 2001 IEEE/RSJ International Conference on Intelligent Robots and Systems. Expanding the Societal Role of Robotics in the the Next Millennium (Cat. No. 01CH37180). Vol. 1. IEEE, 2001.

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