V-REP Integrated Paparazzi Simulation

November 29, 2018

Overview

Project goals

- Creation of a simulation environment for the SwarmLab copters
- Use existing Paparazzi infrastructure
- Should be easy to use and extend

Why do we even need a Simulation?

- TODO: insert picture of broken copter part
- Simulation allows experiments without risking potentially expensive hardware
- Exploration of a wide range of potential environments and conditions
- Scalability

Project idea

- Idea: V-REP plugin providing communication between Paparazzi and V-REP
- V-REP provides the copter state, Paparazzi the corresponding commands
- Main advantage: same code and infrastructure usable on simulated and real copters

Why a new framework?

- There are other simulators for Paparazzi
- None of them provide all needed functionality/convenience

JSBSim	Gazebo	ARGoS
no swarm capability	no GUI	only 2D

Base Architecture

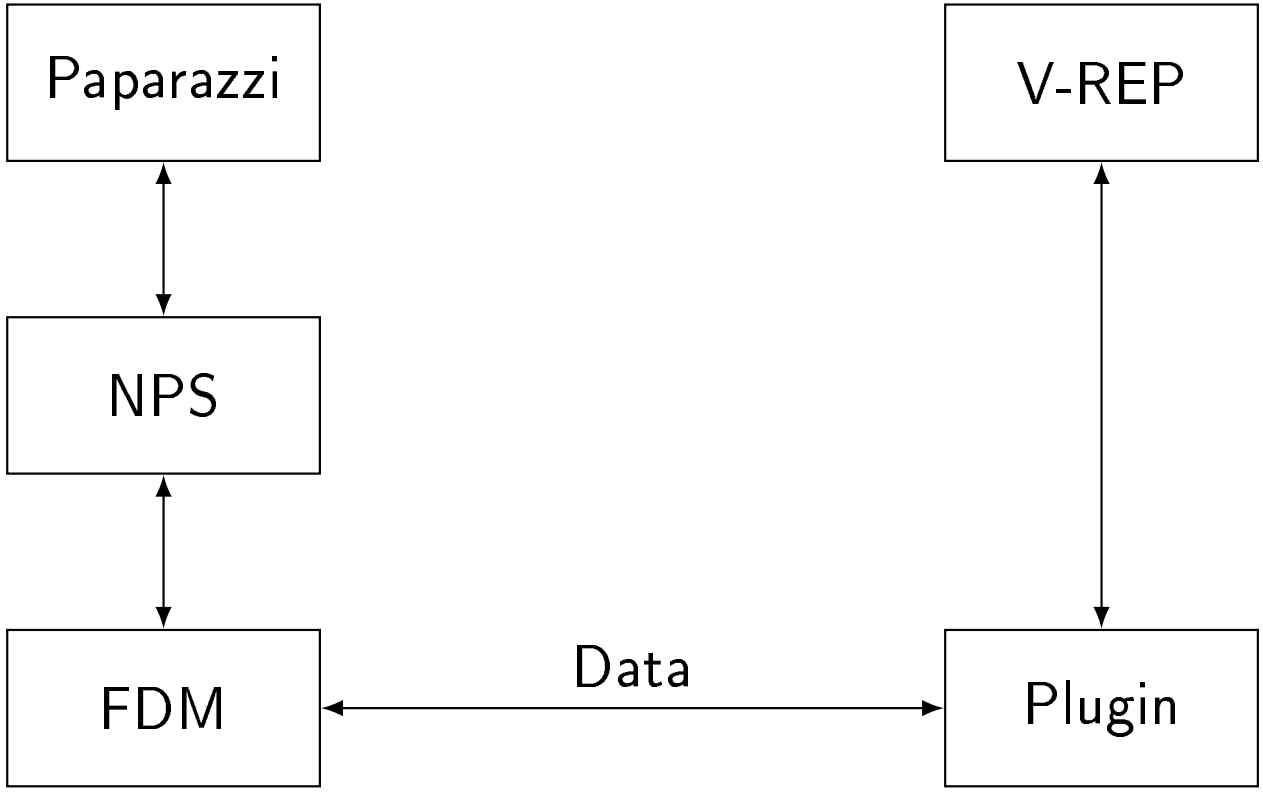
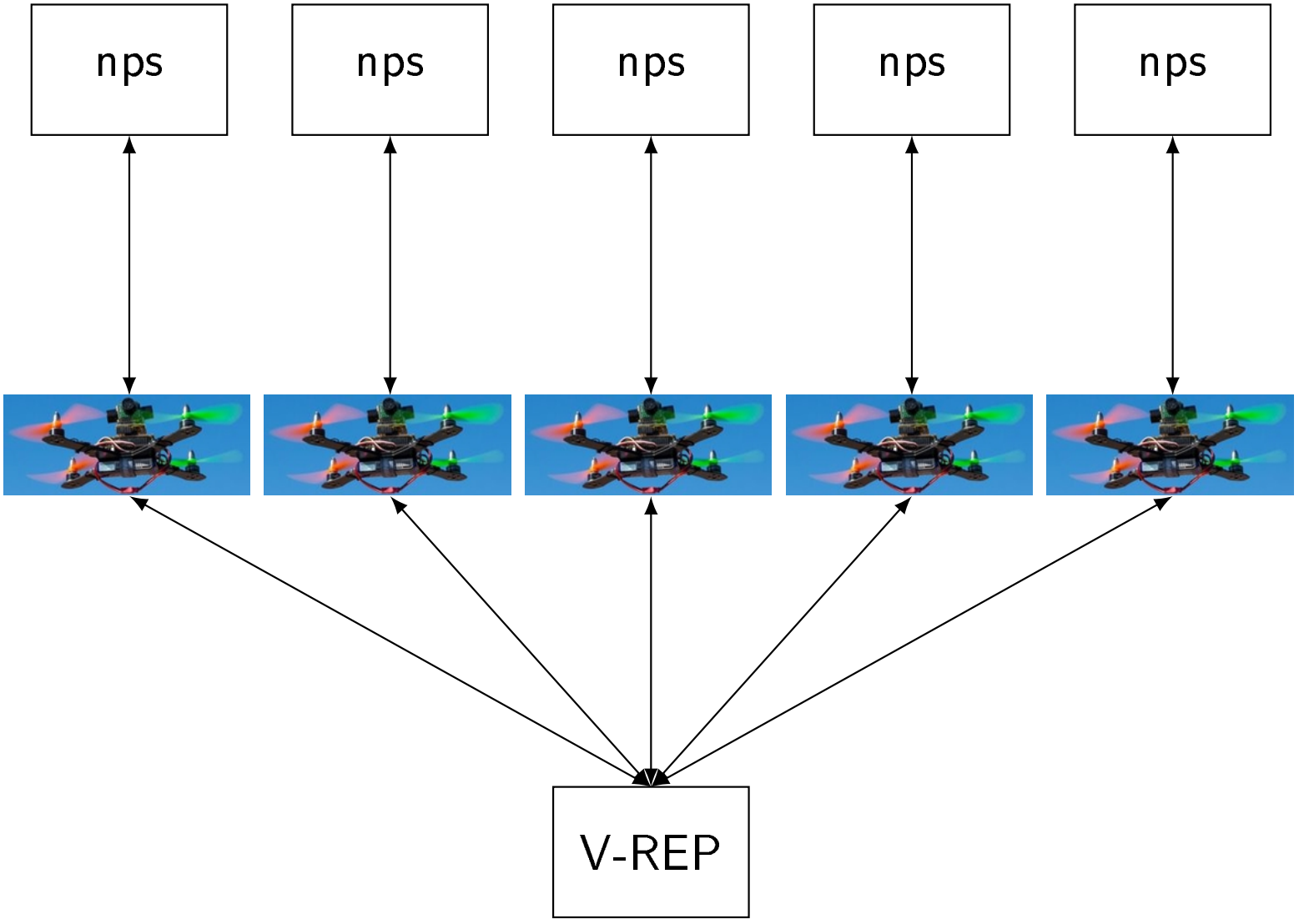


Figure 1: Basic simulation architecture

Connection Architecture



Loop overview

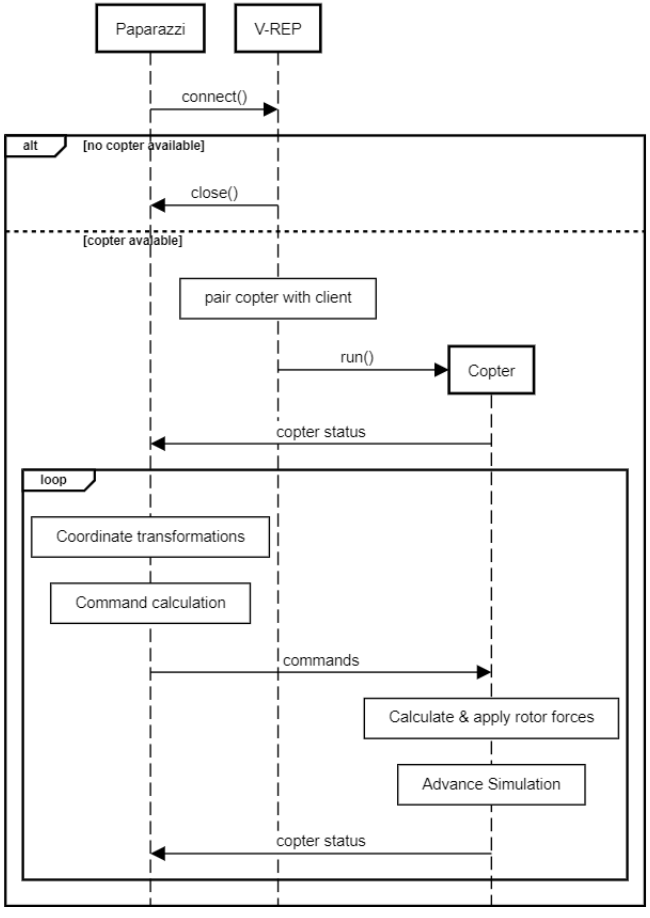


Figure 2: Simulation sequence overview

Exchanged data: V-REP

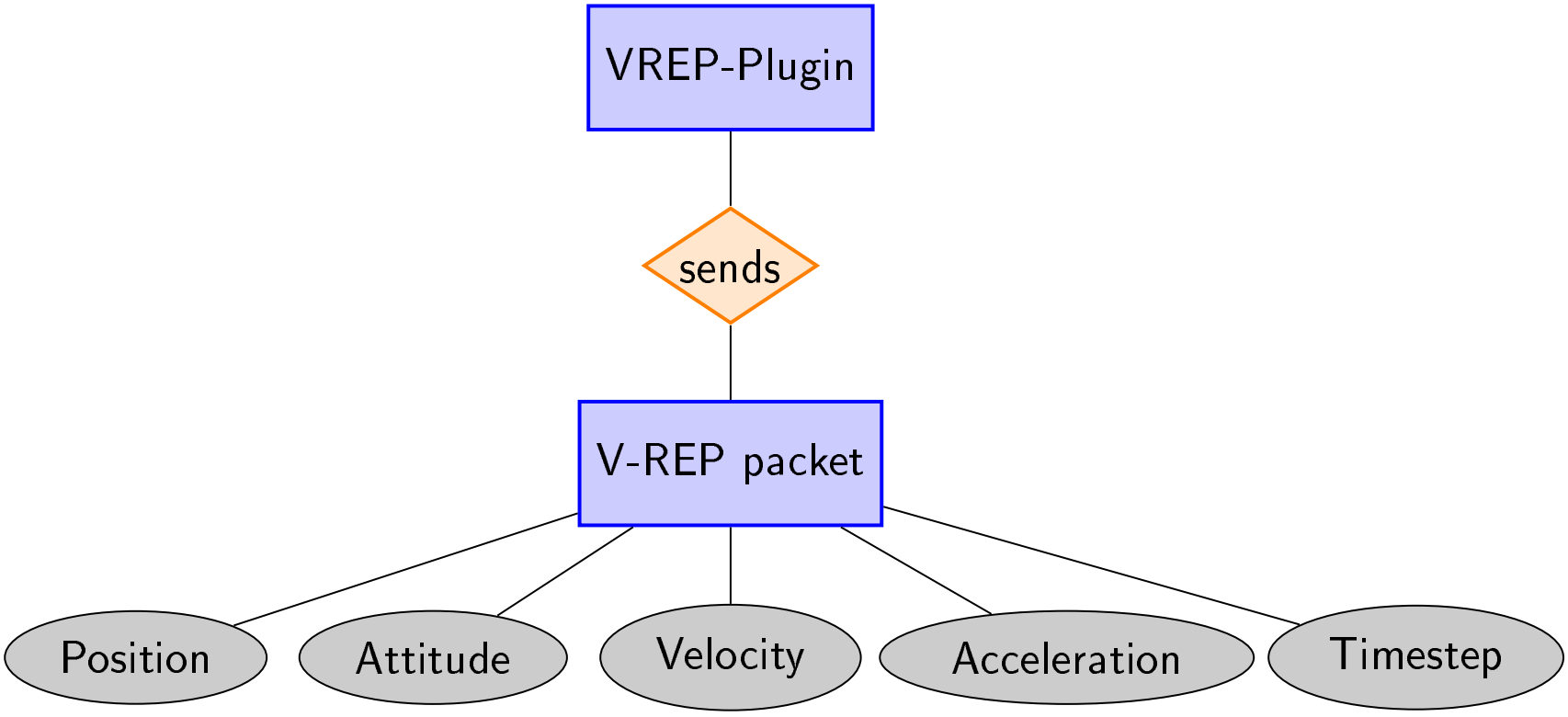


Figure 3: Data sent by V-REP to Paparazzi

Exchanged data: Paparazzi

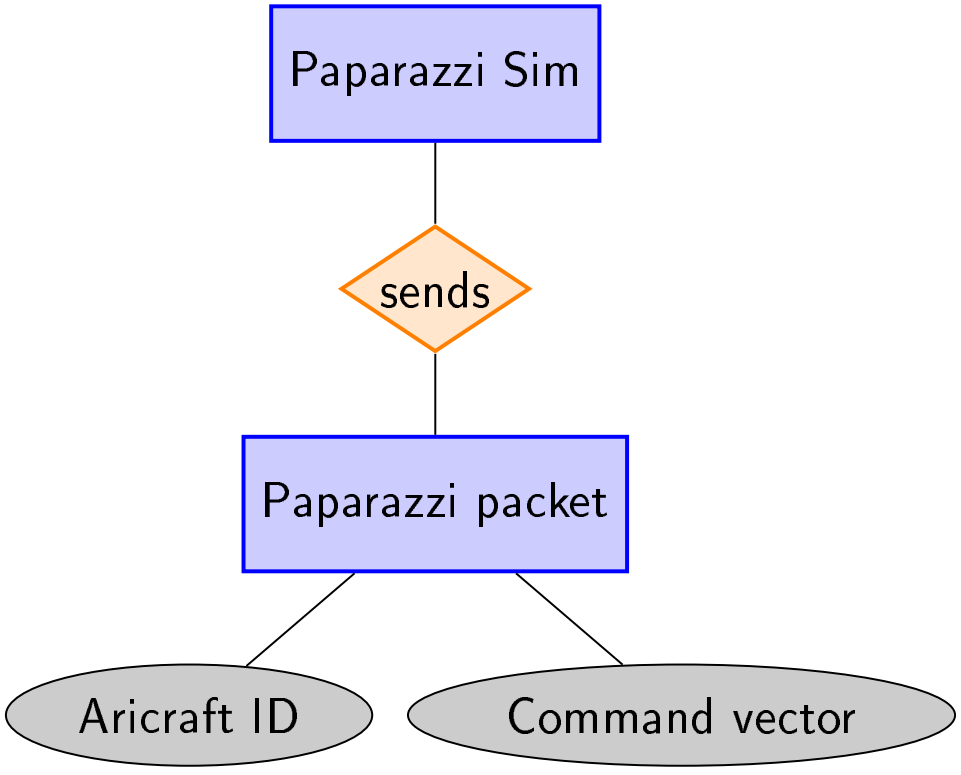


Figure 4: Data sent by Paparazzi to V-REP

Problems

- Coordinate transformations
- Connection stability

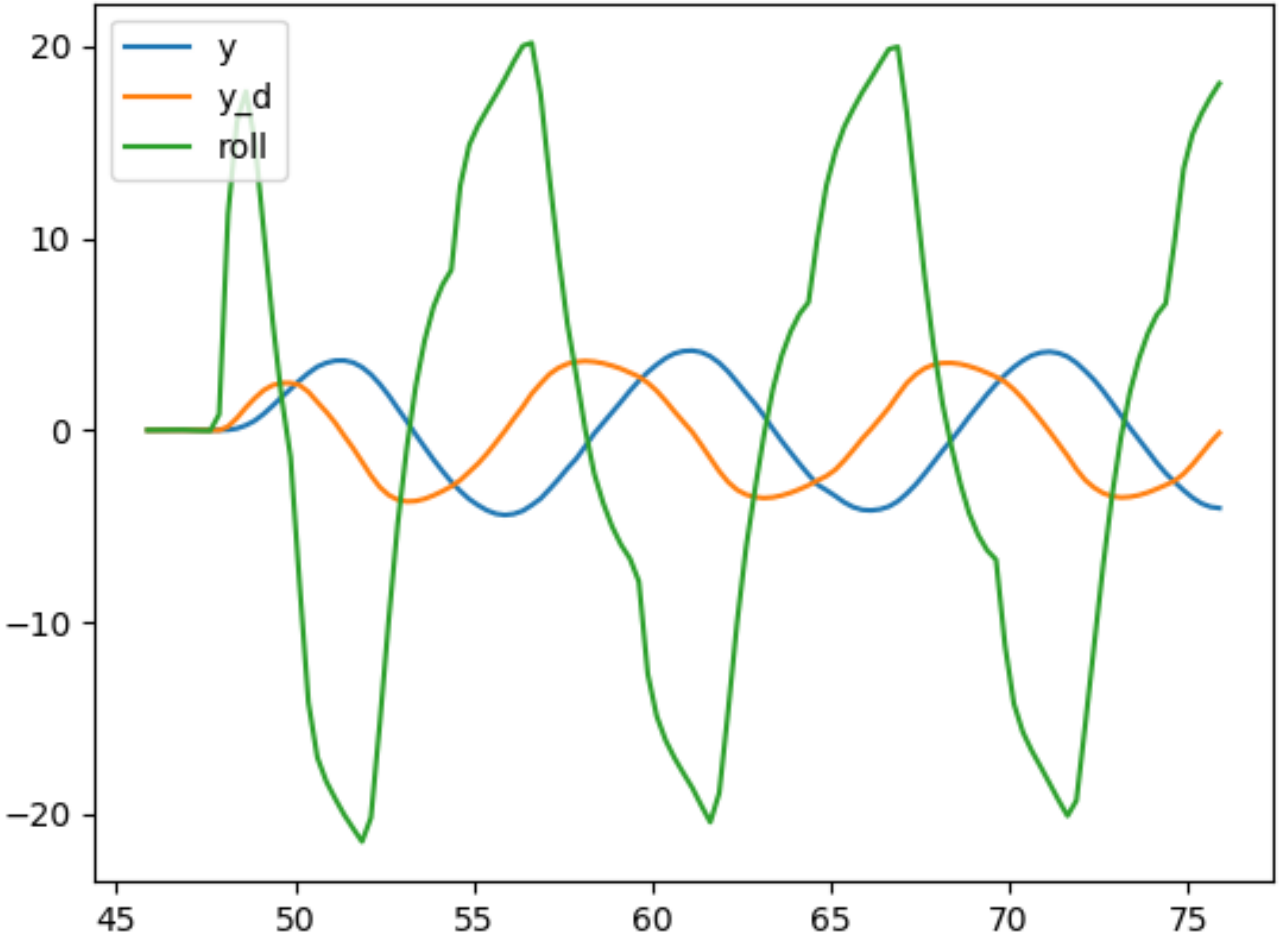
Coordinate transformations

- Paparazzi provides most functions for coordinates transformations
- But: 90 degree offset in the attitude quaternion
- Also: Rotation and acceleration values for x and y axes were switched
- $\rightarrow$ multiple interdependent sources of errors, difficult to debug

Connection stability

- Connection failure should not crash the entire simulation
- Correctly track connected and unconnected copters
- "Ghost Copters" lead to crashes

Evaluation: Simple flight plan



Satistics as well?

- insert statistic evaluation table

Demo

Thanks for your attention

- Special thanks: Christoph for always helpful advice and bug-hunting expertise

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