# SERO Robotersteuerung

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# Chapter 1

# Robotermodellierung MoveIt! Path Planning mit Gazebo

## 1.1 1. Clone git repository

```
git clone https://github.com/nils93/Robotermodellierung.git sero_ws && cd sero_ws
```

## 1.2 2. Start the setup.sh

```
./setup.sh
```

## 1.3 3. Enjoy the ultimate sero experience!

# Chapter 2

# ROS Computation Graph

## 2.1 Description

This overview shows how the main ROS components interact in the SERO robotic workcell:

- MoveIt planners
- HMI ImGui interface
- Controllers and robot descriptions
- Gazebo simulation

## 2.2 Full Computation Graph

## 2.3 Simplified Graph (Nodes only)

# Chapter 3

# SERO HMI Interface

## 3.1 ImGui-Based GUI for Manual Robot Control

This image shows the graphical Human-Machine Interface (HMI) used to control the SERO robot arms. The GUI is implemented in Python using the ImGui library (pyimgui + OpenGL) and communicates with MoveIt via ROS.

Key elements:

- On the left: selection of the active planning group and a button to move to the predefined home pose.
- In the center: fields to define relative and absolute Cartesian motions (TCP-based).
- On the right: a live image of the selected robot, current TCP position, and movement confirmation.
- Below: button-based incremental movement in XYZ and RPY space.

The GUI is designed for real-time feedback and fast manual positioning during development and testing.

# Chapter 4

# Namespace Index

## 4.1 Namespace List

Here is a list of all namespaces with brief descriptions:

hmi_gui . . . . . 11

# Chapter 5

# File Index

## 5.1 File List

Here is a list of all files with brief descriptions:


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# Chapter 6

# Namespace Documentation

## 6.1 hmi_gui Namespace Reference

### Functions

- def move_to_home (group_name)
- def move_relative_rpy (group, droll_deg, dpitch_deg, dyaw_deg)
- def move_relative (group, dx, dy, dz)
- def move_to_absolute_pose (group, pose)
- def load_texture_from_png (path)

### Variables

- list planning_groups = ["sero_1_arm", "sero_2_arm", "sero_3_arm"]
- list tcp_links = ["sero_1_tcp", "sero_2_tcp", "sero_3_tcp"]
- int current_index = 0
- group = moveit_commander.MoveGroupCommander(planning_groups[current_index])
- float relative_x = 0.0
- float relative_y = 0.0
- float relative_z = 0.0
- float step_size = 0.2
- window = glfw.create_window(1400, 800, "SERO HMI", None, None)
- impl = GlfwRenderer(window)
- pkg_dir = os.path.dirname(os.path.abspath(__file__))
- dictionary image_paths
- dictionary textures = {}
- tex_id
- width
- height
- changed
- list group_name = planning_groups[current_index]
- list current_group_name = planning_groups[current_index]
- w
- h
- current_pose = group.get_current_pose(tcp_links[current_index]).pose
- step
- abs_pose = Pose()

- x
- y
- z
- orientation
- list move = [0.0, 0.0, 0.0]
- base_pose = group.get_current_pose(tcp_links[current_index]).pose
- target = Pose()
- success = group.plan()
- wait
- float rot_step = 5.0
- list rpy_move = [0.0, 0.0, 0.0]

### 6.1.1 Function Documentation

#### 6.1.1.1 load_texture_from_png()

```
def hmi_gui.load_texture_from_png (
              path )
```

```
@brief Loads a PNG image as an OpenGL texture for ImGui.

@param path Absolute path to the PNG image file.
@return (texture_id, width, height) tuple.
```

#### 6.1.1.2 move_relative()

```
def hmi_gui.move_relative (
              group,
              dx,
              dy,
              dz )
```

```
@brief Moves the robot TCP relatively in Cartesian space.

@param group MoveGroupCommander instance.
@param dx Relative X offset in meters.
@param dy Relative Y offset in meters.
@param dz Relative Z offset in meters.
```

#### 6.1.1.3 move_relative_rpy()

```
def hmi_gui.move_relative_rpy (
              group,
              droll_deg,
              dpitch_deg,
              dyaw_deg )
```

```
@brief Rotates the robot TCP relative to its current orientation.

@param group MoveGroupCommander instance.
@param droll_deg Roll offset in degrees.
@param dpitch_deg Pitch offset in degrees.
@param dyaw_deg Yaw offset in degrees.
```

#### 6.1.1.4 move_to_absolute_pose()

```
def hmi_gui.move_to_absolute_pose (
              group,
              pose )
```

```
@brief Moves the robot TCP to a given absolute target pose.

@param group MoveGroupCommander instance.
@param pose Target geometry_msgs/Pose object in world coordinates.
```

#### 6.1.1.5 move_to_home()

```
def hmi_gui.move_to_home (
              group_name )
```

```
@brief Moves the selected robot to its predefined home pose.

@param group_name Name of the MoveIt planning group (e.g. "sero_1_arm").
```

### 6.1.2 Variable Documentation

#### 6.1.2.1 abs_pose

```
hmi_gui.abs_pose = Pose()
```

#### 6.1.2.2 base_pose

```
hmi_gui.base_pose = group.get_current_pose(tcp_links[current_index]).pose
```

#### 6.1.2.3 changed

```
hmi_gui.changed
```

#### 6.1.2.4 current_group_name

```
list hmi_gui.current_group_name = planning_groups[current_index]
```

#### 6.1.2.5 current_index

```
hmi_gui.current_index = 0
```

#### 6.1.2.6 current_pose

```
hmi_gui.current_pose = group.get_current_pose(tcp_links[current_index]).pose
```

#### 6.1.2.7 group

```
hmi_gui.group = moveit_commander.MoveGroupCommander(planning_groups[current_index])
```

#### 6.1.2.8 group_name

```
list hmi_gui.group_name = planning_groups[current_index]
```

#### 6.1.2.9 h

```
hmi_gui.h
```

#### 6.1.2.10 height

```
hmi_gui.height
```

#### 6.1.2.11 image_paths

```
dictionary hmi_gui.image_paths
```

**Initial value:**

```
1 =  {
2     "sero_1_arm": os.path.join(pkg_dir, "../resources/sero_1_arm.png"),
3     "sero_2_arm": os.path.join(pkg_dir, "../resources/sero_2_arm.png"),
4     "sero_3_arm": os.path.join(pkg_dir, "../resources/sero_3_arm.png")
5 }
```

#### 6.1.2.12 impl

```
hmi_gui.impl = GlfwRenderer(window)
```

#### 6.1.2.13 move

```
list hmi_gui.move = [0.0, 0.0, 0.0]
```

#### 6.1.2.14 orientation

```
hmi_gui.orientation
```

#### 6.1.2.15 pkg_dir

```
hmi_gui.pkg_dir = os.path.dirname(os.path.abspath(__file__))
```

#### 6.1.2.16 planning_groups

```
list hmi_gui.planning_groups = ["sero_1_arm", "sero_2_arm", "sero_3_arm"]
```

#### 6.1.2.17 relative_x

```
hmi_gui.relative_x = 0.0
```

#### 6.1.2.18 relative_y

```
hmi_gui.relative_y = 0.0
```

#### 6.1.2.19 relative_z

```
hmi_gui.relative_z = 0.0
```

#### 6.1.2.20 rot_step

```
hmi_gui.rot_step = 5.0
```

#### 6.1.2.21 rpy_move

```
list hmi_gui.rpy_move = [0.0, 0.0, 0.0]
```

#### 6.1.2.22 step

```
hmi_gui.step
```

#### 6.1.2.23 step_size

```
hmi_gui.step_size = 0.2
```

#### 6.1.2.24 success

```
hmi_gui.success = group.plan()
```

#### 6.1.2.25 target

```
hmi_gui.target = Pose()
```

#### 6.1.2.26 tcp_links

```
list hmi_gui.tcp_links = ["sero_1_tcp", "sero_2_tcp", "sero_3_tcp"]
```

#### 6.1.2.27 tex_id

```
hmi_gui.tex_id
```

#### 6.1.2.28 textures

```
dictionary hmi_gui.textures = {}
```

#### 6.1.2.29 w

```
hmi_gui.w
```

#### 6.1.2.30 wait

```
hmi_gui.wait
```

#### 6.1.2.31 width

```
hmi_gui.width
```

#### 6.1.2.32 window

```
hmi_gui.window = glfw.create_window(1400, 800, "SERO HMI", None, None)
```

#### 6.1.2.33 x

```
hmi_gui.x
```

#### 6.1.2.34 y

```
hmi_gui.y
```

#### 6.1.2.35 z

```
hmi_gui.z
```

# Chapter 7

# File Documentation

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## 7.2 doc/ros_overview.dox File Reference

## 7.3 README.md File Reference

## 7.4 setup.sh File Reference

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## 7.6 src/sero_multi_station/CMakeLists.txt File Reference

## 7.7 src/sero_multi_station_moveit_config/CMakeLists.txt File Reference

### Functions

- cmake_minimum_required (VERSION 3.1.3) project(sero_multi_station_moveit_config) find_package(catkin REQUIRED) catkin_package() install(DIRECTORY launch DESTINATION $

### 7.7.1 Function Documentation

#### 7.7.1.1 cmake_minimum_required()

```
cmake_minimum_required (
            VERSION 3.1.  3 )
```

## 7.8 src/station_peripherals/CMakeLists.txt File Reference

## 7.9 src/sero_hmi/package.xml File Reference

## 7.10 src/sero_multi_station/package.xml File Reference

## 7.11 src/sero_multi_station_moveit_config/package.xml File Reference

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## 7.13 src/sero_hmi/scripts/hmi_gui.py File Reference

### Namespaces

- hmi_gui

### Functions

- def hmi_gui.move_to_home (group_name)
- def hmi_gui.move_relative_rpy (group, droll_deg, dpitch_deg, dyaw_deg)
- def hmi_gui.move_relative (group, dx, dy, dz)
- def hmi_gui.move_to_absolute_pose (group, pose)
- def hmi_gui.load_texture_from_png (path)

### Variables

- list hmi_gui.planning_groups = ["sero_1_arm", "sero_2_arm", "sero_3_arm"]
- list hmi_gui.tcp_links = ["sero_1_tcp", "sero_2_tcp", "sero_3_tcp"]
- int hmi_gui.current_index = 0
- hmi_gui.group = moveit_commander.MoveGroupCommander(planning_groups[current_index])
- float hmi_gui.relative_x = 0.0
- float hmi_gui.relative_y = 0.0
- float hmi_gui.relative_z = 0.0
- float hmi_gui.step_size = 0.2
- hmi_gui.window = glfw.create_window(1400, 800, "SERO HMI", None, None)
- hmi_gui.impl = GlfwRenderer(window)
- hmi_gui.pkg_dir = os.path.dirname(os.path.abspath(__file__))
- dictionary hmi_gui.image_paths
- dictionary hmi_gui.textures = {}
- hmi_gui.tex_id
- hmi_gui.width
- hmi_gui.height
- hmi_gui.changed
- list hmi_gui.group_name = planning_groups[current_index]
- list hmi_gui.current_group_name = planning_groups[current_index]
- hmi_gui.w

- hmi_gui.h
- hmi_gui.current_pose = group.get_current_pose(tcp_links[current_index]).pose
- hmi_gui.step
- hmi_gui.abs_pose = Pose()
- hmi_gui.x
- hmi_gui.y
- hmi_gui.z
- hmi_gui.orientation
- list hmi_gui.move = [0.0, 0.0, 0.0]
- hmi_gui.base_pose = group.get_current_pose(tcp_links[current_index]).pose
- hmi_gui.target = Pose()
- hmi_gui.success = group.plan()
- hmi_gui.wait
- float hmi_gui.rot_step = 5.0
- list hmi_gui.rpy_move = [0.0, 0.0, 0.0]

7.14 src/sero_multi_station/config/joint_state_controller.yaml File Reference

7.15 src/sero_multi_station/config/trajectory_controller.yaml File Reference

7.16 src/sero_multi_station/launch/bringup_moveit.launch File Reference

7.17 src/sero_multi_station/launch/bringup_moveit_just_sim.launch File Reference

7.18 src/sero_multi_station/launch/control_utils.launch File Reference

7.19 src/sero_multi_station/launch/factory_station.launch File Reference

7.20 src/sero_multi_station/launch/sero_multi_station_empty_↩ world.launch File Reference

7.21 src/sero_multi_station/robot_description/sero_multi_station.urdf File Reference

7.22 src/sero_multi_station_moveit_config/config/cartesian_limits.yaml File Reference

7.23 src/sero_multi_station_moveit_config/config/chomp_planning.yaml File Reference

7.24 src/sero_multi_station_moveit_config/config/fake_controllers.yaml File Reference

7.25 src/sero_multi_station_moveit_config/config/gazebo_↩ controllers.yaml File Reference

7.26 src/sero_multi_station_moveit_config/config/joint_limits.yaml File Reference

7.27 src/sero_multi_station_moveit_config/config/kinematics.yaml File Reference

7.28 src/sero_multi_station_moveit_config/config/ompl_planning.yaml File Reference

7.29 src/sero_multi_station_moveit_config/config/ros_controllers.yaml

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