GRANT AGREEMENT N. 871245

Deliverable 7.4

Mature software architecture for SPRING-ARI

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Main Author: PAL

Contributors: NA

Dissemination: CO - Confidential Deliverable

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

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DOCUMENT FACTSHEET

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Responsible Partner	PAL
Work Package	WP7: WP Robot Customization and Software Integration
Task	T7.4: Intermediate Software Integration Cycle
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Dissemination level	[ ] PU (public) [X] CO (confidential)

CONTRIBUTORS AND HISTORY

Version	**Editor**	**Date**	**Change Log**
1.1	PAL	2/11/2022	The structure of the document was created
1.2	PAL	8/12/2022	The Deliverable was completed, reporting all the SW development and integration realized after the Deliverable D7.3.

APPROVALS

Authors/editors	Approved by INRIA

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EXECUTIVE SUMMARY

The aim of this deliverable is to provide the specifications of customized SPRING Robot, defined in T7.1 Robot Customisation Design, where the software components developed by partners will be integrated in the subsequent tasks of WP7 (T7.2, T7.3, T7.4 and T7.5) and used for validation in WP1.

The document will:

- Explain the general specifications of PAL Robotics ARI robot
- Gather design requirements based on project objectives and partner feedback
- Propose new solutions for vision and audio architecture that provides the highest quality sensing module, based on specified requirements, including the integration of a 360º camera for human behaviour understanding and navigation, as well as a sound acquisition board, to enable multi-person sound tracking and localisation
- Detail the overall hardware and software specifications of the robot

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CONTENTS OF DELIVERABLE

The aim of this deliverable is to present the second version of the software architecture of the SPRING-ARI robot, considering the user-cases defined as part of WP1, and the modules being developed between WP2 to WP6.

This deliverable is a **code** deliverable. As such, this report simply briefly presents the outcome of the second phase of the architecture development, and outlines the progress made on the integration of software components.

As specified at the beginning of the project, the code itself is hosted as git repositories at **https://gitlab.inria.fr/spring.**

Note that:

- The actual components are under the responsibility of each partners, and are not covered by this deliverable
- The actual testing and deployment of the architecture is covered

The other partners of the consortium have integrated their respective modules and applications.

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1.GENERAL OVERVIEW

The SPRING Delivreable D7.4 is about delivering the **Mature Software Architecture** for the SPRING robot. The Mature Software Architecture is the second iteration of the architecture, after the first one, presented in D7.3.

Compared to the initial software architecture, this new version:

- Is completely specified (however, some nodes are not yet fully implemented or released);
- Relies on the ROS4HRI standard (https://www.ros.org/reps/rep-0155.html, note that **this standard itself has been developed by PAL Robotics in the frame of the SPRING project**);
- Has been deployed on the partners' robots;
- Has been tested in several occasion at the Broca hospital, both during internal integration weeks, and during the Broca user study which took place in October 2022.

This deliverable is a **code** deliverable. As specified at the beginning of the project, the code itself is hosted as a set of git repositories at **https://gitlab.inria.fr/spring.**

In particular, the SPRING architecture is formally described in this repository:

https://gitlab.inria.fr/spring/wp7_ari/spring-architecture

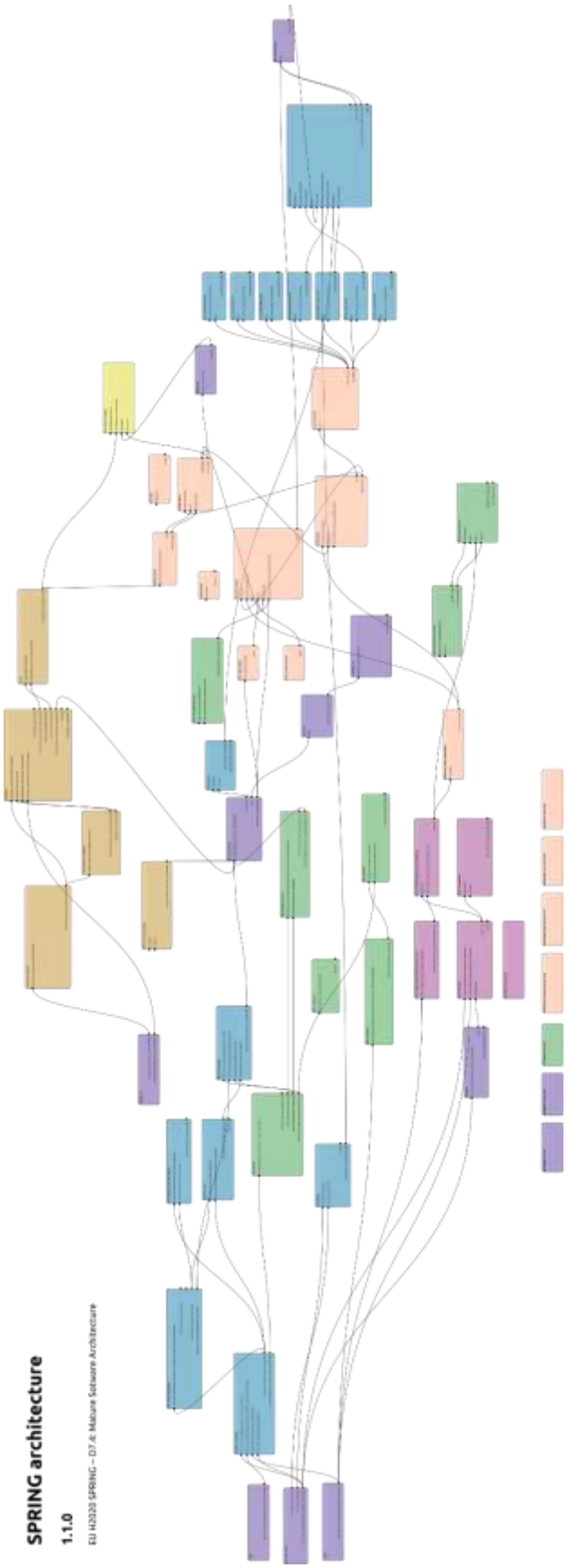
The rest of this document, presenting the list of ROS nodes and their relationships, has been automatically generated from the formal architecture description. Note that a tool (called Boxology) has been specifically developed for the project to easily visualise, edit and export the architecture. The tool is available here: https://github.com/severin-lemaignan/boxology/tree/spring

OVERVIEW OF MODULES

Node	Partner	Status	Description
riva_asr	BIU	released (version main)	Speech recognition based on NVIDIA Riva
audio_processing_mode	BIU	released (version BIU_dev)	Audio pre-processing (incl. noise cancellation)
source separation + localisation	BIU	not yet released	Sound source separation and localisation
speakers_id	BIU	not yet released	Speaker identification based on voice embeddings
Voice-body matching	BIU	not yet released	Matching between localised voices and detected bodies
InLoc Server	CVUT	not yet released	Indoor localisation server
Object detection/identification/localisation	CVUT	not yet released	Object detection/identification/localisation
Occupancy map	CVUT	not yet released	Occupancy map generation
Semantic mapping	CVUT	not yet released	Semantic mapping
InLoc-ROS	CVUT	not yet released	ROS wrapper for the InLoc server
Robot GUI	ERM	not yet released	Touchscreen-based user interface
audio_msgs	HWU	released (version spring_dev) (dependency)	
interaction_manager_msgs	HWU	released (version spring_dev) (dependency)	
robot_behaviour_msgs	HWU	released (version spring_dev) (dependency)	
social_scene_msgs	HWU	released (version spring_dev) (dependency)	
dialogue_arbiter	HWU	released (version spring_dev)	Main dialogue manager
social_scene_context_understanding	HWU	released (version spring_dev)	Semantic scene and social interaction description

Node	Partner	Status	Description
alana_node	HWU	not yet released	ALANA chatbot
google_translate	HWU	not yet released	ROS wrapper for Google-based translation
social_state_analyzer	HWU	not yet released	Social scene understanding
social_strategy_supervisor	HWU	not yet released	High-level interaction supervisor
ros_petri_net_node	HWU	not yet released	Petrinet-based task planning
dialogue_speech	HWU	not yet released	Speech pre-processing (incl. end of speech detection)
interaction_manager	HWU	released (version spring_dev)	Coordination of the interaction-related nodes
recipe_planner	HWU	released (version spring_dev)	Coordination of task planning
go_to_person_action_server	INRIA	not yet released	Robot action server (person approach)
go_to_position_action_server	INRIA	not yet released	Robot action server (navigation to location)
go_to_body_action_server	INRIA	not yet released	Robot action server (body approach)
look_at_person_server	INRIA	not yet released	
look_at_action_server	INRIA	not yet released	Robot action server (generic ‘look at’ action)
look_at_position_action_server	INRIA	not yet released	Robot action server (‘look at person’ action)
slam_rtabmap	INRIA	not yet released	SLAM node based on RTBmap
behavior_generator	INRIA	released (version devel)	Coordination of behaviour generation
front_fisheye_2d_body_pose_detector	INRIA	released (version main)	2D skeleton estimator
body_to_face_mapper	INRIA	released (version main)	Face-body matching
front_fisheye_body_tracker	INRIA	released (version devel)	Frontal body detector
go_to_group_action_server	INRIA	not yet released	Robot action server (group approach)
group_detector	INRIA	released (version main)	Group detection (incl. f-formations)
basestation_republisher	INRIA	released (version master)	Node to republish compressed video streams on the SPRING basestation
body_3d_tracker	INRIA	released	Laser-based 3D people pose

Node	Partner	Status	Description
		(version main)	estimation
hri_msgs	PAL	released (version 0.1.1) (dependency)	
spring_msgs	PAL	released (version 0.0.2)	
respeaker_ros	PAL	released (version master)	Microphone array driver
fisheye	PAL	not yet released	frontal fisheye camera driver
raspicam	PAL	not yet released	RGB head camera driver
dialogue_say	PAL	not yet released	text-to-speech server
Robot functional layer	PAL	not yet released	robot's hardware interfaces
hri_person_manager	PAL	released (version master)	Probabilistic fusion of faces, bodies, voices into persons
torso_rgbd_camera	PAL	not yet released	Frontal RGB-D camera driver
knowledge_core	PAL	released (version 2.8.0)	Robot's RDF/OWL knowledge base
people_facts	PAL	released (version 0.2.2)	Semantic bridge between human perception and the knowledge base
ORB SLAM	PAL	not yet released	ORB SLAM for robot localisation and mapping
wp4_msgs	UNITN	released (version master) (dependency)	
Activity reco	UNITN	not yet released	Activity recognition
Non-verbal behaviours	UNITN	not yet released	Non-verbal behaviour generation
mask_detector	UNITN	released (version master)	Face mask detector
depth_estimation	UNITN	released (version main)	Monocular depth estimation
User visual focus	UNITN	not yet released	Estimation of user gaze focus
gaze_estimation	UNITN	released (version devel)	Monocular gaze estimation on planar image
User attention estimation	UNITN	not yet released	Monocular attention estimation on planar image
soft_biometrics_estimator	UNITN	released (version master)	Estimation of soft-biometrics (age, gender)


SPRING architecture
1.1.0
EU H2020 SPRING – D7.4: Mature Software Architecture

DETAILED DESCRIPTION OF EACH MODULE

BIU

audio_processing_mode

This node performs:

- speech echo cancelation,

- single microphone audio enhancement,

The node audio_processing_mode (id: audio_processing_mode*) is maintained by BIU.*

Status

Implemented. Current release/branch: BIU_dev

Source code repository:

https://gitlab.inria.fr/spring/wp3_av_perception/speech-enhancement

Inputs

- Topic subscription: /audio/raw_audio [spring_msgs/RawAudioData]

Outputs

- Topic publication: /audio/enh_audio [spring_msgs/RawAudioData]

Dependencies

- spring_msgs/RawAudioData

riva_asr

The node riva_asr (id: riva_asr*) is maintained by BIU.*

Status

Implemented. Current release/branch: main

Source code repository:

https://gitlab.inria.fr/spring/wp3_av_perception/riva_asr_ros_client

Inputs

- Topic subscription: /h/v/tracked [hri_msgs/IdsList]
- Topic subscription: /humans/voices/<id>/audio [audio_common_msgs/AudioData]

Outputs

- Topic publication: /humans/voices/<id>/speech [hri_msgs/LiveSpeech]

Dependencies

- hri_msgs/LiveSpeech
- hri_msgs/IdsList
- audio_common_msgs/AudioData

source separation + localisation

The node source separation + localisation (id: sourceseparationlocalisation) is maintained by BIU.

Status

Not yet implemented or released

Inputs

- Topic subscription: /audio/enh_audio [spring_msgs/RawAudioData]

Outputs

- Topic publication: /audio/doa* [std_msgs/Float32]
- Topic publication: /audio/stream* [audio_common_msgs/AudioData]

Dependencies

- std_msgs/Float32

- spring_msgs/RawAudioData
- audio_common_msgs/AudioData

speakers_id

The node speakers_id (id: speakers_id*) is maintained by BIU.*

Status

Not yet implemented or released

Inputs

- Topic subscription: /audio/doa* [std_msgs/Float32]
- Topic subscription: /audio/stream* [audio_common_msgs/AudioData]
- Topic subscription: /audio/ego_audio [audio_common_msgs/AudioData]
- Topic subscription: /audio/enh_audio [spring_msgs/RawAudioData]

Outputs

- Topic publication: /humans/voices/<id>/is_speaking [std_msgs/Bool]
- Topic publication: /h/v/tracked [hri_msgs/IdsList]
- Output: /audio/vad
- Topic publication: /h/v/known [hri_msgs/IdsList]
- Topic publication: /humans/voices/<id>/doa [std_msgs/Float32]
- Topic publication: /humans/voices/<id>/audio [audio_common_msgs/AudioData]
- Topic publication: /humans/candidate_matches [hri_msgs/IdsMatch]

Dependencies

- std_msgs/Bool
- hri_msgs/IdsList
- std_msgs/Empty

- std_msgs/Float32
- audio_common_msgs/AudioData
- hri_msgs/IdsMatch
- spring_msgs/RawAudioData

Voice-body matching

The node Voice-body matching (id: voicebodymatching*) is maintained by BIU.*

Status

This node is not yet implemented.

Inputs

- Input: tf: /face_id (tf)
- Input: tf: /voice_id (tf)

Outputs

- Topic publication: /humans/candidate_matches [hri_msgs/IdsMatch]

Dependencies

- tf/transform_listener
- hri_msgs/IdsMatch

CVUT

InLoc-ROS

The node InLoc-ROS (id: inlocros*) is maintained by CVUT.*

Status

This node is not yet implemented.

Inputs

- Input: localisation prior

- Topic subscription: /camera_torso/color/image_torso [sensor_msgs/Image]
- Topic subscription: /camera_head/color/image_head [sensor_msgs/Image]

Outputs

- Output: dense 3d map
- Output: tf: /odom (tf)

Dependencies

- std_msgs/Empty
- tf/transform_broadcaster
- sensor_msgs/Image

InLoc Server

The node InLoc Server (id: inlocserver*) is maintained by CVUT.*

Status

Not yet implemented or released

Inputs

Outputs

Object detection/identification/localisation

The node Object detection/identification/localisation (id: objectdetectionidentificationlocalisation*) is maintained by CVUT.*

Status

This node is not yet implemented.

Inputs

- Topic subscription: /camera_head/color/image_raw [sensor_msgs/Image]

Outputs

- Topic publication: /detected_objects [spring_msgs/DetectedObjectArray]

Dependencies

- sensor_msgs/Image
- spring_msgs/DetectedObjectArray

Occupancy map

The node Occupancy map (id: occupancymap*) is maintained by CVUT.*

Status

This node is not yet implemented.

Inputs

- Input: dense 3d map
- Input: TF (bodies)

Outputs

- Topic publication: /map_refined [nav_msgs/OccupancyGrid]

Dependencies

- std_msgs/Empty
- nav_msgs/OccupancyGrid

Semantic mapping

The node Semantic mapping (id: semanticmapping*) is maintained by CVUT.*

Status

This node is not yet implemented.

Inputs

- Input: dense 3d map
- Topic subscription: /detected_objects [spring_msgs/DetectedObjectArray]

Outputs

- Output: scene graph

Dependencies

- std_msgs/Empty
- spring_msgs/DetectedObjectArray

ERM

Robot GUI

The node Robot GUI (id: robotgui*) is maintained by ERM.*

Status

This node is not yet implemented.

Inputs

- Input: /tts/feedback
- Input: additional support material
- Topic subscription: /humans/voices/<id>/speech [hri_msgs/LiveSpeech]
- Input: speech output

Outputs

Dependencies

- std_msgs/Empty
- hri_msgs/LiveSpeech

HWU

alana_node

The node alana_node (id: alana_node*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

- Input: /get_answer

Outputs

- Output: /response

Dependencies

- std_msgs/Empty

dialogue_arbiter

The node dialogue_arbiter (id: dialogue_arbiter*) is maintained by HWU.*

Status

Implemented. Current release/branch: spring_dev

Source code repository: git@gitlab.inria.fr:spring/wp5_spoken_conversations/dialogue.git

Inputs

- Input: /eos
- Input: /dialogue_speech
- Input: interaction messages

Outputs

- Output: DialogueState
- Output: next utterance

Dependencies

- std_msgs/Empty

dialogue_speech

The node dialogue_speech (id: dialogue_speech*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

- Topic subscription: /humans/voices/<id>/speech [hri_msgs/LiveSpeech]

Outputs

- Output: /dialogue_speech
- Output: /eos

Dependencies

- std_msgs/Empty
- hri_msgs/LiveSpeech

google_translate

The node google_translate (id: google_translate*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

- Input: /get_answer

Outputs

- Output: /response

Dependencies

- std_msgs/Empty

interaction_manager

The node interaction_manager (id: interaction_manager*) is maintained by HWU.*

Status

Implemented. Current release/branch: spring_dev

Source code repository: git@gitlab.inria.fr:spring/wp5_spoken_conversations/interaction.git

Inputs

- Input: semantic scene description
- Input: TF
- Input: input
- Input: dialogue state
- Input: robot state
- Topic subscription: /humans/persons/<id>/softbiometrics [hri_msgs/Softbiometrics]

Outputs

- Output: gestures

Dependencies

- std_msgs/Empty
- hri_msgs/Softbiometrics

recipe_planner

The node recipe_planner (id: recipe_planner*) is maintained by HWU.*

Status

Implemented. Current release/branch: spring_dev

Source code repository: git@gitlab.inria.fr:spring/wp5_spoken_conversations/plan_actions.git

Inputs

- Input: semantic scene description
- Topic subscription: /humans/persons/<id>/softbiometrics [hri_msgs/Softbiometrics]
- Input: dialogue state

Outputs

- Output: interaction state
- Output: plan

Dependencies

- std_msgs/Empty
- hri_msgs/Softbiometrics

ros_petri_net_node

ros_petri_net_node is…

The node ros_petri_net_node (id: ros_petri_net_node*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

- Input: plan

Outputs

- Output: look_at goals
- Output: navigation goals

Dependencies

- std_msgs/Empty

social_scene_context_understanding

The node social_scene_context_understanding (id: social_scene_context_understanding*) is maintained by HWU.*

Status

Implemented. Current release/branch: spring_dev

Source code repository: git@gitlab.inria.fr:spring/wp5_spoken_conversations/interaction.git

Inputs

- Input: scene graph

Outputs

- Output: semantic description

Dependencies

- std_msgs/Empty

social_state_analyzer

The node social_state_analyzer (id: social_state_analyzer*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

- Input: /humans/persons/tracked

Outputs

- Output: output?

Dependencies

- std_msgs/Empty

social_strategy_supervisor

The node social_strategy_supervisor (id: social_strategy_supervisor*) is maintained by HWU.*

Status

Not yet implemented or released

Inputs

Outputs

- Output: output?

Dependencies

- std_msgs/Empty

INRIA

basestation_republisher

The node basestation_republisher (id: basestation_republisher*) is maintained by INRIA.*

Status

Implemented. Current release/branch: master

Source code repository: https://gitlab.inria.fr/spring/wp3_av_perception/docker_republish

Inputs

- Input: /torso_front_camera/aligned_depth_to_color/image_raw/theora
- Topic subscription: /front_camera/fisheye/image_raw/compressed [sensor_msgs/CompressedImage]
- Input: /head_front_camera/color/image_raw/compressed
- Input: /torso_front_camera/color/image_raw/theora

Outputs

- Topic publication: /*_basestation/head_front_camera/... [sensor_msgs/Image]
- Topic publication: /*_basestation/fisheye/... [sensor_msgs/Image]

Dependencies

- std_msgs/Empty
- sensor_msgs/CompressedImage
- sensor_msgs/Image

behavior_generator

The code is primarily developed at INRIA by Timothée Wintz.

The node behavior_generator (id: behavior_generator*) is maintained by INRIA.*

Status

Implemented. Current release/branch: devel

Source code repository: https://gitlab.inria.fr/spring/wp6_robot_behavior/robot_behavior

Inputs

- Input: tf: /person_id (tf)
- Input: /joint_states
- Topic subscription: /rtabmap/proj_map [OccupancyGrid/OccupancyGrid]
- Topic subscription: /go_towards [GoTowards/GoTowards]
- Input: /h/g/tracked
- Input: /humans/persons/tracked
- Topic subscription: /navigate [Navigate/Navigate]
- Topic subscription: /look_at [LookAt/LookAt]
- Input: status

Outputs

- Topic publication: /head_controller/command [JointTrajectory/JointTrajectory]
- Topic publication: /nav_vel [Twist/Twist]
- Output: status
- Output: tf: ? (tf)

Dependencies

- JointTrajectory/JointTrajectory
- tf/transform_listener
- Twist/Twist
- std_msgs/Empty
- OccupancyGrid/OccupancyGrid
- GoTowards/GoTowards

- tf/transform_broadcaster
- Navigate/Navigate
- LookAt/LookAt

body_3d_tracker

The node body_3d_tracker (id: body_3d_tracker*) is maintained by INRIA.*

Status

Implemented. Current release/branch: main

Source code repository: https://gitlab.inria.fr/spring/wp3_av_perception/body_3d_tracker

Inputs

- Topic subscription: /tracker/tracker_output [std_msgs/String]
- Topic subscription: /front_camera/fisheye/image_raw [sensor_msgs/Image]

Outputs

- Output: tf: /body_id (tf)
- Topic publication: /humans/bodies/tracked [hri_msgs/IdsList]

Dependencies

- tf/transform_broadcaster
- hri_msgs/IdsList
- std_msgs/String
- sensor_msgs/Image

body_to_face_mapper

The node body_to_face_mapper (id: body_to_face_mapper*) is maintained by INRIA.*

Status

Implemented. Current release/branch: main

Source code repository: node associates detected bodies to detected faces in image-space.
REPO:https://gitlab.inria.fr/spring/wp3_av_perception/body_to_face_mapper

Inputs

- Topic subscription: /humans/faces/TEST_ID_FACE/roi [hri_msgs/NormalizedRegionOfInterest2D]
- Topic subscription: /humans/bodies/<id>/roi [hri_msgs/NormalizedRegionOfInterest2D]
- Topic subscription: /humans/faces/tracked [hri_msgs/IdsList]
- Topic subscription: /humans/bodies/tracked [hri_msgs/IdsList]

Outputs

- Topic publication: /humans/candidate_matches [hri_msgs/IdsMatch]

Dependencies

- hri_msgs/IdsMatch
- hri_msgs/NormalizedRegionOfInterest2D
- hri_msgs/IdsList

front_fisheye_2d_body_pose_detector

This node estimates the 2.5D (x,y,theta) pose of nearby persons.

The node front_fisheye_2d_body_pose_detector (id: front_fisheye_2d_body_pose_detector*) is maintained by INRIA.*

Status

Implemented. Current release/branch: main

Source code repository: https://gitlab.inria.fr/spring/wp3_av_perception/front_fisheye_2d_body_pose_detector

Inputs

- Topic subscription: /front_camera/fisheye/image_raw [sensor_msgs/Image]
- Topic subscription: /tracker/tracker_output [std_msgs/String]

Outputs

- Topic publication: /humans/bodies/<id>/skeleton2d [hri_msg/Skeleton2D]

Dependencies

- sensor_msgs/Image
- hri_msg/Skeleton2D
- std_msgs/String

front_fisheye_body_tracker

2D body detector and tracker, based on the FairMOT algorithm. This code is primarily developed at INRIA by Luis Gomez Camara.

The node front_fisheye_body_tracker (id: front_fisheye_body_tracker*) is maintained by INRIA.*

Status

Implemented. Current release/branch: devel

Source code repository: https://gitlab.inria.fr/spring/wp3_av_perception/multi-person_visual_tracker/

Inputs

- Topic subscription: /front_camera_basetation/fisheye/image_raw/compressed [sensor_msgs/CompressedImage]

Outputs

- Topic publication: /humans/bodies/<id>/cropped [sensor_msgs/Image]
- Output:
- Topic publication: /tracker/tracker_output [std_msgs/String]
- Topic publication: /humans/bodies/<id>/roi [hri_msgs/NormalizedRegionOfInterest2D]

Dependencies

- sensor_msgs/CompressedImage
- sensor_msgs/Image

- std_msgs/Empty
- std_msgs/String
- hri_msgs/NormalizedRegionOfInterest2D

go_to_body_action_server

The node go_to_body_action_server (id: go_to_body_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /go_towards [GoTowards/GoTowards]

Dependencies

- GoTowards/GoTowards
- std_msgs/Empty
- ControllerStatus/ControllerStatus

go_to_group_action_server

The node go_to_group_action_server (id: go_to_group_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /go_towards [GoTowards/GoTowards]

Dependencies

- std_msgs/Empty
- GoTowards/GoTowards
- ControllerStatus/ControllerStatus

go_to_person_action_server

The node go_to_person_action_server (id: go_to_person_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]
- Input: goal

Outputs

- Topic publication: /go_towards [GoTowards/GoTowards]

Dependencies

- ControllerStatus/ControllerStatus
- GoTowards/GoTowards
- std_msgs/Empty

go_to_position_action_server

The node go_to_position_action_server (id: go_to_position_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /go_towards [GoTowards/GoTowards]

Dependencies

- GoTowards/GoTowards
- std_msgs/Empty
- ControllerStatus/ControllerStatus

group_detector

The node group_detector (id: group_detector*) is maintained by INRIA.*

Status

Implemented. Current release/branch: main

Source code repository: https://gitlab.inria.fr/spring/wp4_behavior/group_detector

Inputs

- Input: /h/p/tracked
- Input: tf: /body_id (tf)

Outputs

- Topic publication: /h/g/tracked [hri_msgs/IdList]
- Topic publication: /humans/group/<id>/ [hri_msgs/IdList]

Dependencies

- std_msgs/Empty
- hri_msgs/IdList
- tf/transform_listener

look_at_action_server

The node look_at_action_server (id: look_at_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /look_at [LookAt/LookAt]

Dependencies

- LookAt/LookAt
- std_msgs/Empty
- ControllerStatus/ControllerStatus

look_at_person_server

The node look_at_person_server (id: look_at_person_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /look_at [LookAt/LookAt]

Dependencies

- std_msgs/Empty
- LookAt/LookAt
- ControllerStatus/ControllerStatus

look_at_position_action_server

The node look_at_position_action_server (id: look_at_position_action_server*) is maintained by INRIA.*

Status

Not yet implemented or released

Inputs

- Input: goal
- Topic subscription: /controller_status [ControllerStatus/ControllerStatus]

Outputs

- Topic publication: /navigate [Navigate/Navigate]

Dependencies

- Navigate/Navigate
- std_msgs/Empty
- ControllerStatus/ControllerStatus

slam_rtabmap

The node slam_rtabmap (id: slam_rtabmap*) is maintained by INRIA.*

Status

This node is not yet implemented.

Inputs

- Input: torso_front_camera/infra/
- Input: /torso_front_camera/imu

Outputs

- Topic publication: /slam/occupancy_map [OccupancyGrid/OccupancyGrid]
- Output: tf: /odom (tf)

Dependencies

- OccupancyGrid/OccupancyGrid
- std_msgs/Empty
- tf/transform_broadcaster

Other

PAL

dialogue_say

The node dialogue_say (id: dialogue_say*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

- Input: speech [std_msgs/String]

Outputs

- Output: /tts/feedback

Dependencies

- std_msgs/Empty

fisheye

The node fisheye (id: fisheye*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

Outputs

- Topic publication: /torso_front_camera/color/image_raw [sensor_msgs/Image]

Dependencies

- sensor_msgs/Image

hri_person_manager

The node hri_person_manager (id: hri_person_manager*) is maintained by PAL.*

Status

Implemented. Current release/branch: master

Source code repository: git@gitlab.inria.fr:spring/wp7_ari/hri_person_manager.git

Inputs

- Topic subscription: /humans/candidate_matches [hri_msgs/IdsMatch]

Outputs

- Output: /h/p/…
- Topic publication: /h/p/tracked [hri_msgs/IdsList]
- Output: tf: /person_id (tf)

Dependencies

- std_msgs/Empty
- hri_msgs/IdsList
- tf/transform_broadcaster
- hri_msgs/IdsMatch

knowledge_core

The node knowledge_core (id: knowledge_core*) is maintained by PAL.*

Status

Implemented. Current release/branch: 2.8.0

Source code repository: https://gitlab.inria.fr/spring/wp7_ari/knowledge_core

Inputs

- Topic subscription: /kb/add_fact [std_msgs/String]

Outputs

- Output: service: /kb/query

Dependencies

- std_msgs/String
- std_msgs/Empty

ORB SLAM

The node ORB SLAM (id: orbslam*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

- Topic subscription: /camera_torso/color/image_raw [sensor_msgs/Image]

Outputs

- Output: tf: /odom (tf)
- Topic publication: /map [nav_msgs/OccupancyGrid]

Dependencies

- tf/transform_broadcaster
- nav_msgs/OccupancyGrid
- sensor_msgs/Image

people_facts

The node people_facts (id: people_facts*) is maintained by PAL.*

Status

Implemented. Current release/branch: 0.2.2

Source code repository: https://gitlab.inria.fr/spring/wp7_ari/people_facts

Inputs

- Input: /h/p/…

Outputs

- Topic publication: /kb/add_fact [std_msgs/String]

Dependencies

- std_msgs/Empty
- std_msgs/String

raspicam

The node raspicam (id: raspicam*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

Outputs

- Topic publication: /head_front_camera/color/image_raw [sensor_msgs/Image]

Dependencies

- sensor_msgs/Image

respeaker_ros

The node respeaker_ros (id: respeaker_ros*) is maintained by PAL.*

Status

Implemented. Current release/branch: master

Source code repository: git@gitlab.inria.fr:spring/wp7_ari/respeaker_ros.git
BIN:respeaker_multichan_node.py

Inputs

Outputs

- Topic publication: /audio/ego_audio [audio_common_msgs/AudioData]
- Topic publication: /audio/raw_audio [respeaker_ros/RawAudioData]

Dependencies

- audio_common_msgs/AudioData
- respeaker_ros/RawAudioData

Robot functional layer

The node Robot functional layer (id: robotfunctionallayer*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

- Input: input

Outputs

- Output: /joint_states

Dependencies

- std_msgs/Empty

spring_msgs

The node spring_msgs (id: spring_msgs*) is maintained by PAL.*

Status

Implemented. Current release/branch: 0.0.2

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Source code repository: git@gitlab.inria.fr:spring/wp7_ari/spring_msgs.git NOT EXECUTABLE

Inputs

Outputs

torso_rgbd_camera

The node torso_rgbd_camera (id: torso_rgbd_camera*) is maintained by PAL.*

Status

Not yet implemented or released

Inputs

Outputs

- Output: torso_front_camera/infra/
- Output: /torso_front_camera/imu
- Topic publication: /torso_front_camera/color/image_raw [sensor_msgs/Image]

Dependencies

- std_msgs/Empty
- sensor_msgs/Image

UNITN

Activity reco

The node Activity reco (id: activityreco*) is maintained by UNITN.*

Status

This node is not yet implemented.

Inputs

- Topic subscription: /humans/bodies/<id>/skeleton_2d [hri_msg/Skeleton2D]

Outputs

- Output: [?] output

Dependencies

- hri_msg/Skeleton2D
- std_msgs/Empty

depth_estimation

The node depth_estimation (id: depth_estimation*) is maintained by UNITN.*

Status

Implemented. Current release/branch: main

Source code repository: https://gitlab.inria.fr/spring/wp4_behavior/depth-estimation

Inputs

- Topic subscription: /head_front_camera/color/image_raw/compressed [sensor_msgs/CompressedImage]

Outputs

- Topic publication: /depth_estimation [sensor_msgs/Image]

Dependencies

- sensor_msgs/CompressedImage
- sensor_msgs/Image

gaze_estimation

This node uses deep learning to estimate, on a given frame, the focus of attention of a detected face. It outputs the 2D coordinate of the most likely focus of attention, in the image space.

The node gaze_estimation (id: gaze_estimation*) is maintained by UNITN.*

Status

Implemented. Current release/branch: devel

Source code repository: https://gitlab.inria.fr/spring/wp4_behavior/gaze-estimation

Inputs

- Topic subscription: /depth_estimation [sensor_msgs/Image]
- Topic subscription: /humans/faces/TEST_ID_FACE/roi [sensor_msgs/RegionOfInterest]

Outputs

- Output: GazeFrame [2D point in heatmap]

Dependencies

- std_msgs/Empty
- sensor_msgs/Image
- sensor_msgs/RegionOfInterest

mask_detector

Detects presence of a facial mask

The node mask_detector (id: mask_detector*) is maintained by UNITN.*

Status

Implemented. Current release/branch: master

Source code repository: https://gitlab.inria.fr/spring/wp4_behavior/mask-detection BIN:mask_detector.py

Inputs

- Topic subscription: /*_basestation/head_front_camera/... [sensor_msgs/Image]

Outputs

- Topic publication: /humans/faces/TEST_ID_FACE/cropped [sensor_msg/Image]
- Topic publication: /humans/faces/TEST_ID_FACE/has_mask [wp4_msgs/FaceMask]
- Topic publication: /humans/faces/tracked [hri_msgs/IdsList]

- Topic publication: /humans/faces/TEST_ID_FACE/roi [hri_msgs/NormalizedRegionOfInterest2D]

Dependencies

- sensor_msg/Image
- sensor_msgs/Image
- wp4_msgs/FaceMask
- hri_msgs/IdsList
- hri_msgs/NormalizedRegionOfInterest2D

Non-verbal behaviours

The node Non-verbal behaviours (id: nonverbalbehaviours*) is maintained by UNITN.*

Status

This node is not yet implemented.

Inputs

- Topic subscription: /humans/faces/TEST_ID_FACE/roi [hri_msgs/RegionOfInterest]
- Topic subscription: /humans/voices/<id>/raw_audio [spring_msgs/RawAudioData]

Outputs

- Topic publication: /humans/faces/TEST_ID_FACE/expression [hri_msgs/Expression]

Dependencies

- hri_msgs/Expression
- hri_msgs/RegionOfInterest
- spring_msgs/RawAudioData

soft_biometrics_estimator

Detects age/gender

The node soft_biometrics_estimator (id: soft_biometrics_estimator*) is maintained by UNITN.*

Status

Implemented. Current release/branch: master

Source code repository: git@gitlab.inria.fr:spring/wp4_behavior/wp4_behavior_understanding.git

Inputs

- Topic subscription: /head_front_camera/color/image_raw/compressed [sensor_msgs/CompressedImage]
- Topic subscription: /humans/faces/tracked [hri_msgs/IdsList]

Outputs

- Topic publication: /humans/candidate_matches [hri_msgs/IdsMatch] [face reco/face reco]
- Topic publication: /humans/faces/TEST_ID_FACE/softbiometrics [hri_msgs/SoftBiometrics]

Dependencies

- face reco/face reco
- sensor_msgs/CompressedImage
- hri_msgs/IdsList
- hri_msgs/SoftBiometrics

User attention estimation

The node User attention estimation (id: userattentionestimation*) is maintained by UNITN.*

Status

This node is not yet implemented.

Inputs

- Input: TF (faces)

- Topic subscription: /humans/faces/TEST_ID_FACE/roi [hri_msgs/RegionOfInterest]

Outputs

- Output: tf: /face_id_gaze (tf)
- Output: x,y + attention heatmap

Dependencies

- std_msgs/Empty
- tf/transform_broadcaster
- hri_msgs/RegionOfInterest

User visual focus

The node User visual focus (id: uservisualfocus*) is maintained by UNITN.*

Status

This node is not yet implemented.

Inputs

- Input: gaze direction
- Input: depth
- Input: scene
- Input: attention

Outputs

- Topic publication: /humans/interactions/gaze [hri_msgs/Gaze]
- Output: who's looking at what?

Dependencies

- std_msgs/Empty

- hri_msgs/Gaze

Non-executable dependency: audio_msgs

Module audio_msgs (id: audio_msgs) is overseen by HWU.

Status

- Current release: spring_dev

Dependencies

Non-executable dependency: hri_msgs

Module hri_msgs (id: hri_msgs) is overseen by PAL.

Status

- Current release: 0.1.1

Dependencies

Non-executable dependency: interaction_manager_msgs

Module interaction_manager_msgs (id: interaction_manager_msgs) is overseen by HWU.

Status

- Current release: spring_dev

Dependencies

Non-executable dependency: robot_behaviour_msgs

Module robot_behaviour_msgs (id: robot_behaviour_msgs) is overseen by HWU.

Status

- Current release: spring_dev

Dependencies

Non-executable dependency: social_scene_msgs

Module social_scene_msgs (id: social_scene_msgs) is overseen by HWU.

Status

- Current release: spring_dev

Dependencies

Non-executable dependency: wp4_msgs

Module wp4_msgs (id: wp4_msgs) is overseen by UNITN.

Status

- Current release: master

Dependencies

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CONCLUSIONS

The final software architecture including the complete SW developed within the project will be reported in the D7.5.