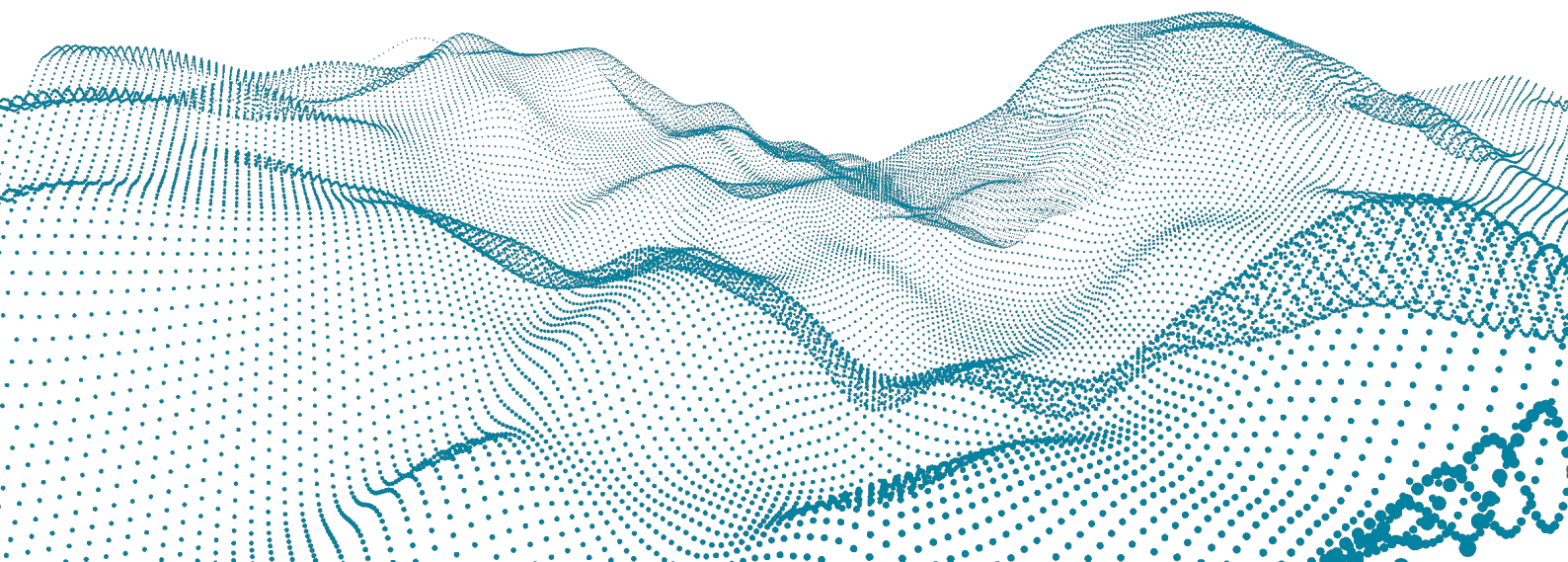


roboception

Roboception GmbH | April 2022

rc_cube Edge Computer

FIRMWARE CHANGELOG



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1 22.04.0 (2022-04-29)

1.1 New Features

- CADMatch (`rc_cadmatch`):
 - add optional [collision checking with the point cloud](#). This feature checks grasps on detected objects for collisions between the gripper and a watertight version of the point cloud. The point cloud mesh used for collision checking will also be visualized in CADMatch's 3D result visualization. This feature is disabled by default and can be enabled via the [check_collisions_with_point_cloud](#) parameter.
 - add support for pose prior only templates. Such templates require a pose prior for detection and allow for faster detection.
 - add `data_acquisition_mode` to [detect_object request](#). This allows the user to re-use the last acquired image for the next detection, which saves image acquisition time.
- Support for [gamma encoding for rc_viscore](#)

1.2 Improvements and Fixes

- gRPC interface:
 - add feature to get mesh with options for size, texture and watertight
 - add flag to request images in RGB8
- Stereo Matching (`rc_stereomatching`)
 - when `double_shot` mode is used without the `ExposureAlternateActive` mode in `IOControl`, the same image is used to fill holes with disparity values from a lower resolution
 - suppress artifacts in the disparity image near the left image border
- Hand-Eye Calibration (`rc_hand_eye_calibration`)
 - improve visual feedback by drawing fat green boundary if grid is fully detected and annotating even if it is only partially detected
- Camera Calibration (`rc_stereocalib`)
 - improve visual feedback if grid is fully detected in left and right image by drawing a fat green boundary
 - reset current error when grid is not recognized during verification
 - show the minimum and maximum error during verification
 - when calibrating an `rc_viscore`, temporary exposure settings with good defaults are used during manual calibration
- ItemPick/BoxPick (`rc_itempick/rc_boxpick`):
 - runtime optimization for Full resolution `rc_visard` depth images and `rc_viscore` images
 - add timeout after 25s for BoxPick's `compute_grasps` and `detect_items` services
- CADMatch (`rc_cadmatch`)
 - increase the maximum value of the `max_matches` parameter to 30
 - increase the maximum number of CADMatch templates to 50
 - improve bounding box detection of small objects in `rc_viscore` images
 - runtime optimization of edge pose refiner for `rc_viscore` images
 - return two grasps for each taught grasp on dihedral continuous symmetric templates (e.g. rings)
 - speed-up collision checking for continuous symmetric templates
 - add warning when all detected objects are outside the load carrier or region of interest
 - use minimum of edge and surface score as output score to simplify tuning of the `min_score` parameter
- SilhouetteMatch (`rc_silhouettematch`)
 - speed-up collision checking for continuous symmetric templates
- CollisionCheck (`rc_collision_check`)
 - add validation of pre-grasp offset
- AprilTag/QR Code (`rc_april_tag_detect/rc_qr_code_detect`)
 - return error when no hand-eye calibration available and external pose frame requested
- REST-API:
 - UserSpace: provide health info for containers if available

- add sensor_interfaces to system with available interfaces and their link_speed
- EKI bridge:
 - fix parsing of empty list elements and catch all exceptions
- WebGUI:
 - camera page shows the IOControl parameters for easier projector setup
 - separate download buttons for depth snapshots with and without point cloud mesh
 - add buttons to download/upload single LCs, ROIs, grippers
 - add validation of pre-grasp offset in Try-Out sections
 - improve robot pose fields in Try-Outs and 3D visualizations for robot-mounted cameras
 - CADMatch and SilhouetteMatch result visualization:
 - * improve visibility of grasps
 - * allow to hover and click grasps inside matches and matches inside load carriers
 - * add visualization of unreachable grasps that are filtered out due to the defined preferred TCP orientation
 - * add close button to notes for matches and grasps
 - interactive adding of pose priors by clicking into point cloud
 - add warning when collision checking is used without grasps in SilhouetteMatch and CADMatch
 - made axes in 3D visualizations wider
 - improve hand-eye calibration to update when new poses are added via RestAPI
 - add button to download rc_visard logs from rc_cube
 - disable reboot when system is not ready
 - show sensor interfaces on network page
 - UserSpace page: display apps and containers with status info and option to open http(s) services in iframe

1.3 Changes

- CollisionCheck (rc_collision_check)
 - The collision_dist parameter is applied only to load carriers and the SilhouetteMatch base plane instead of the gripper. Thus, this parameter is not used anymore for checking collisions between the gripper and other detected objects.

2 22.01.0 (2022-01-31)

2.1 New Components

- **Multiple camera pipelines:** The rc_cube allows multiple and different cameras (rc_visard, rc_viscore, blaze) to be connected at the same time.

Each camera can view a different part of the scene and has an associated pipeline which enables calibration to a robot and different detection modules.

The rc_cube S supports up to 2 camera pipelines, while the industrial-grade rc_cube I supports up to 4 camera pipelines.

For this the [software modules](#) now either belong to one camera pipeline or are globally available [database modules](#).

2.2 New Features

- Support for [rc_viscore](#) and [blaze](#)
- REST API:
 - introduce API v2 supporting multiple pipelines, see [migration information](#)
- BoxPick (rc_boxpick):
 - add [mode](#) parameter for unconstrained or packed grid layouts of boxes
 - add [manual_line_sensitivity](#) and [line_sensitivity](#) parameters to configure line detector
- CADMatch (rc_cadmatch):

- add support for [pose priors](#). This feature enables users to specify an indicative position and orientation for the object to detect and is recommended for applications where the object location is approximately known. Since the software does not need to search for objects in the whole image, the processing time is significantly reduced when pose priors are enabled.
- add support for templates with new [pose refinement](#) method which aligns the object CAD model to the 3D point cloud. This is useful e.g. for objects without sharp edges and enables a wider range of objects to be handled by CADMatch.
- WebGUI:
 - new layout with enhanced navigation side bar. This navigation side bar contains sub-menus to display the name of the current page and to make all pages reachable with one click. It also uses a responsive design with automatic collapsing on mobile devices
 - add multi-camera support
 - reorganize System page in multiple pages: Firmware & License, Camera Pipelines, Network Settings, GigEVision Status, Logs

2.3 Improvements and Fixes

- Hand-Eye calibration (`rc_hand_eye_calibration`):
 - wait until grid is detect in `set_pose` service (up to 1.5s)
 - add services `get_poses` and `delete_poses`
 - limit slot numbers to 0-15
- CADMatch (`rc_cadmatch`):
 - performance improvements
 - sort matches as well according to selected sorting strategy
 - increase number of configurable grasps per template to 100
 - retain existing grasps on template update if the new template does not contain any grasp
 - limit maximum number of returned grasps to 100
 - increase detection timeout to 12 seconds
- SilhouetteMatch (`rc_silhouettematch`):
 - sort matches as well according to selected sorting strategy
 - include request and response in detection dumps
 - add check for empty load carrier and that the object plane inside the detected load carrier
 - retain existing grasps on template update if the new template does not contain any grasps
 - increase matching timeout to 10 seconds
- LoadCarrier (`rc_load_carrier`):
 - include right image in detection dumps
- ItemPick (`rc_itempick`) and BoxPick (`rc_boxpick`):
 - include request, response and right image in detection dumps
 - draw load carrier rim in Surfaces and Grasps visualizations
- WebGUI:
 - allow creating and editing grippers with rotations and tree structure
 - new hand-eye calibration workflow showing stored poses and images
 - new annotations in camera calibration
 - added option to mirror images in camera calibration
 - automatic redirect when network settings have changed
 - decreased loop time in CADMatch Try-Out to 1 sec
 - higher resolutions of point cloud in 3D visualizations of ROIs, Load Carriers and SilhouetteMatch results
 - display resolution of current camera and depth image on the Camera and Depth Image pages
 - close fullscreen views by clicking anywhere or pressing ESC
 - make result tables automatically scroll to top when new results arrive
 - automatically update point cloud in SilhouetteMatch 3D result visualization when new result arrives
 - improved visibility of points inside a ROI or load carrier in 3D ROI or load carrier visualization
 - fixed SilhouetteMatch template aspect ratio for setting grasps
 - support setting of exposure regions or 2D ROIs by dragging rectangle in image on touch screens

- **UserSpace:**
 - free some more common ports for usage in UserSpace, see [restrictions](#)
 - support cloning of git repositories with docker-compose stack which mount config files into containers
 - add `rc_cube_monitoring` app template as docker-compose stack example
 - [API v2 endpoint](#) to query running apps and their published ports

2.4 Breaking Changes

- **ItemPick (rc_itempick):**
 - remove deprecated `item_model_tolerance` parameter
- The deprecated `load_carrier` services and parameters in the `ItemPick`, `BoxPick`, `SilhouetteMatch` and `CADMatch` nodes were removed. Please use the [services](#) and [parameters](#) provided by the `rc_load_carrier` module.
- **EKI bridge:**
 - The EKI bridge now reflects the API v2, please see the [migration notes](#)

3 21.10.0 (2021-10-26)

3.1 New Components

- **UserSpace:** New component that enables users to deploy and manage their own containers running on the `rc_cube`.

The UserSpace can be used for running e.g.:

- Collision-free motion planner
- Web service and cloud access, monitoring
- Vision pipelines
- Application programs

The REST API and gRPC interfaces can be used inside the UserSpace to obtain grasp points and image data, giving access to all activated `rc_reason` modules and connected sensors.

3.2 New Features

- **StereoMatching (rc_stereomatching):**
 - add `exposure_adapt_timeout` parameter
- **CADMatch (rc_cadmatch):**
 - add support for “partial” object templates. This feature enables CADMatch to detect only portions of a complete CAD model. Some of the use-cases that can benefit from a “partial” object template are:
 - * Large objects that cannot be entirely in one camera view
 - * Objects that are highly occluded when placed in a bin (e.g. large stacks of flat parts)
 - * Configurable objects (e.g. a switch that can change between two configurations)
 - * Partially solid objects: object that have a partially soft or changing structure (e.g. brushes)
- **REST API:**
 - parameters are now always saved automatically so `save_parameters` is not necessary anymore and hence deprecated
- **GigE Vision/GenICam:**
 - add `ChunkRcAutoExposureAdapting`
 - add `DepthExposureAdaptTimeout`

3.3 Improvements and Fixes

- **CADMatch (rc_cadmatch):**
 - improve grasp selection for continuous symmetric templates

- sort matches as well according to the selected sorter
- fix no colliding grasps visualized
- fix increasing memory usage on rc_cube S
- Hand-Eye calibration (rc_hand_eye_calibration):
 - fix corner case when entering wrong poses for 4DOF
- SilhouetteMatch (rc_silhouettematch):
 - improve grasp selection for continuous symmetric templates
 - sort matches as well according to the selected sorter
 - accept templates with zero height
 - improve match duplicate filter
 - limit minimum value of match_max_distance to 0.1
- WebGUI:
 - add UserSpace management to navigation menu if available
 - show placeholder when system is not connected or not ready
 - improve general warning and error messages
 - removed "save parameters" buttons from module pages as they are auto-saved now
 - improved marquee selection for 2D ROI and exposure region and added button to reset exposure region
 - improved template modal
 - * add tab with more details of the template
 - * show gripper in grasp visualization
 - * made grasp list more compact
 - add camera connection info to system page
 - add hint in preferred orientation visualization when z axis points towards the camera

3.4 Other Changes

- REST API:
 - Renaming of rc_stereocamera to rc_camera. For backwards compatibility the now deprecated name rc_stereocamera will redirect to rc_camera.
 - Renaming of rc_stereocamera_t1 to rc_camera_t1. For backwards compatibility the now deprecated name rc_stereocamera_t1 will redirect to rc_camera_t1.

3.5 Deprecations

- The load_carrier services and parameters in the ItemPick, BoxPick, SilhouetteMatch and CADMatch nodes are deprecated and **will be removed in January 2022 with version 22.01**. Please use the [services](#) and [parameters](#) provided by the rc_load_carrier module.
- The item_model_tolerance parameter in the ItemPick node is deprecated and **will be removed in January 2022 with version 22.01**.
- The node names rc_stereocamera and rc_stereocamera_t1 are deprecated and will be removed in a future version. Please use rc_camera and rc_camera_t1.
- The save_parameters service call is deprecated and will be removed in a future version.

4 21.07.1 (2021-08-04)

4.1 Improvements and Fixes

- WebGUI:
 - fix support for gitterboxes (Early Access preview feature)
 - fix interactive grasp rotation in SilhouetteMatch template modal
- REST API:
 - return 503 (instead of 500) if service is unavailable
 - cache dongle/license validity to speed up GET system/license

5 21.07.0 (2021-07-21)

5.1 New Components

- OPC UA Server: New module that allows communicating with the rc_visard and the rc_cube via the [OPC UA](#) communication protocol.

The OPC UA Server is available as an Early Access preview feature. Please contact us if you would be interested in testing the OPC UA interface.

5.2 New Features

- add grasp sorting strategy selection to [ItemPick](#), [BoxPick](#), [SilhouetteMatch](#) and [CADMatch](#)
- include grasps when downloading [SilhouetteMatch](#) and [CADMatch](#) templates
- LoadCarrier (rc_load_carrier):
 - add detection of gitter boxes/pallet cages by extending load carrier definition. This is available as an Early Access preview feature. Please contact us if you would be interested in testing this feature.
 - add pose_type to load carrier model to support [Exact Poses and Orientation Priors](#)
- WebGUI:
 - 3D visualization of grippers and colliding grasps in CADMatch detection result
 - add 3D result visualization to SilhouetteMatch
 - add interactive Menus to all 3D visualizations with Controls and View Options

5.3 Improvements and Fixes

- persist parameters across [firmware updates](#)
- support writing to vfat and exfat USB flash drives
- improve system ready notification at boot
- add sensor unavailable return code for cases where the sensor is not connected or not ready
- LoadCarrier (rc_load_carrier):
 - add snapshot dumps for last detection
- CADMatch (rc_cadmatch):
 - performance and latency improvements
- SilhouetteMatch (rc_silhouettematch):
 - fix bug that caused less object to be detected in some scenes
 - extend data included in snapshot dumps for last detection
- BoxPick (rc_boxpick):
 - improve detection with small dimension ranges
- ItemPick (rc_itempick):
 - fix segmentation for small clusters far away from camera
- WebGUI:
 - allow download of templates in SilhouetteMatch and CADMatch
 - new 3D orbiting control for unconstrained rotations
 - only show min distance warning if depth range is actually reduced
 - show hint if new rc_randomdot projector is connected
 - allow editing and deleting elements in Try-Out dropdowns
 - show if system requires a reboot when dongle is reconnected
- GEV server:
 - add ChunkLineStatus

5.4 Other Changes

- [reject IPs in internally used subnets](#): 172.23.42.0/24, 172.17.0.0/16
- Grasps and load carriers are internally migrated to new storage format and not available any more if a rollback to a previous firmware version is performed. It is advised to create a [backup](#) before upgrading if a rollback might be desired.

- CADMatch (rc_cadmatch):
 - pose_frame is always required in detect_object arguments
- REST API:
 - node status: rename stale to idle and add initializing
- IOControl [get_io_values service](#) changed to support varying number of IOs

5.5 Deprecations

- The load_carrier services and parameters in the ItemPick, BoxPick, SilhouetteMatch and CADMatch nodes are deprecated and will be removed in a future version. Please use the [services](#) and [parameters](#) provided by the rc_load_carrier module.

6 21.04.1 (2021-04-20)

6.1 Fixes

- network settings: fix check if IP is already in use when no route to given IP is available
- WebGUI:
 - fixed rotation of grid for SilhouetteMatch template visualization
 - only show full screen icons for depth images in continuous acquisition mode

7 21.04.0 (2021-04-15)

7.1 New Components

- **LoadCarrier** (rc_load_carrier): New module that allows setting and retrieving load carriers, as well as detecting load carriers and their filling levels.

The LoadCarrier module is an optional on-board module of the rc_cube and is licensed with any of the modules ItemPick, BoxPick, SilhouetteMatch or CADMatch. Otherwise it requires a separate LoadCarrier license to be purchased.

- **gRPC image streaming interface**: New rc_cube interface that can be used as an alternative to the GigE Vision / GenICam interface for getting camera images and synchronized sets of images (e.g. left camera image and corresponding disparity image).

7.2 New Features

- CADMatch (rc_cadmatch):
 - add [check_collisions_with_matches](#) parameter
- SilhouetteMatch (rc_silhouettematch):
 - add [check_collisions_with_matches](#) and [check_collisions_with_base_plane](#) parameters
- REST API:
 - add [backup/restore functionality](#) to download and upload the complete configuration of an rc_cube
- WebGUI:
 - organize modules into detection modules and configuration modules
 - add import/export of grasps for CADMatch and SilhouetteMatch templates
 - new LoadCarrier detection module
 - new Regions of Interest page for configuring regions of interest for all detection modules
 - possibility to directly update the firmware of the connected rc_visard
 - add optional item maximum dimensions to ItemPick Try-Out section
 - add fullscreen control to images in stream view

7.3 Improvements and Fixes

- LoadCarrier (rc_load_carrier)
 - return estimated dimensions of detected load carriers
 - improve load carrier detection in low contrast scenes
- CADMatch (rc_cadmatch):
 - performance improvements
 - allow collision check with all detectable objects
 - disambiguate equally good grasps for symmetric templates
 - fix parsing of symmetries during refinement
- SilhouetteMatch (rc_silhouettematch):
 - grasp sorting combines orientation and distance to preferred orientation
 - allow collision check with all detectable objects
 - disambiguate equally good grasps for symmetric templates
 - enforce detection timeout of 5 seconds
- ItemPick (rc_itepick) and BoxPick (rc_boxpick):
 - improve detection of small rectangles at large camera distances
 - added compartment to load carrier visualization
- REST API:
 - return object_uuid for CADMatch and SilhouetteMatch templates
- WebGUI:
 - allow up to 8 poses during Hand-Eye Calibration
 - moved Try-Out sections below image streams in all detection modules
 - add shortcuts to create Load Carriers, Regions of Interest and Grippers from the Try-Out section of all detection modules
 - show positions with four digit precision in detection result tables
 - show SilhouetteMatch 3D collision model when configuring grasps
 - show default values for all parameters in info boxes
 - ask if firmware update should be applied if filename indicates wrong image
 - show message if websocket connection is not available
 - also use port 80 for websocket
 - enforce max length of 60 characters for all IDs
 - show logs for EKI bridge
 - show why network setting could not be applied

7.4 Other Changes

- support NTFS and exFAT formatted USB flash drives
- GigE Vision/GenICam:
 - set model_name to rc_cube_S or rc_cube_X
- REST API:
 - report if userspace is available in system

8 21.01.0 (2021-01-29)

8.1 New Features

- BoxPick (rc_boxpick):
 - add prefer_splits parameter
- CADMatch (rc_cadmatch):
 - collision check with other detected objects
 - add grasp_filter_orientation_threshold parameter
- SilhouetteMatch (rc_silhouettematch):
 - collision check with other detected objects
- REST API:
 - UBJSON support, via application/ubjson mime type in Content-Type and/or Accept headers

- WebGUI:
 - Download last detection of ItemPick, BoxPick, SilhouetteMatch and CADMatch as tarball with visualization images

8.2 Improvements and Fixes

- ItemPick (rc_itempick):
 - improve segmentation of objects with dimensions and few 3D edges
- BoxPick (rc_boxpick):
 - improve box detection using confidence image for 2D edges as well
- CADMatch (rc_cadmatch):
 - improve refinement for flat objects
- Hand-Eye calibration (rc_hand_eye_calibration):
 - minimize geometric loop closure error instead of reprojection error and return more error values
- WebGUI:
 - downloadable JSON response of try-outs now matches full REST-API response
 - visualization image selection via dropdown
 - show version of connected rc_visard and warn if rc_visard firmware is not supported
 - improve grasp teaching and visualization of large CAD models

8.3 Other Changes

- REST-API:
 - return image version without device and 'v' prefix

9 20.11.0 (2020-11-23)

9.1 New Features

- SilhouetteMatch (rc_silhouettematch):
 - Add collision detection with base plane
- StereoMatching (rc_stereomatching):
 - New double_shot mode: Combine images from two subsequent stereo image pairs. This is meant for the use with a random-dot projector in ExposureAlternateActive or SingleFrameOut1 acquisition mode.
- Camera (rc_stereocamera):
 - New Out1High auto exposure mode: Adapt exposure time using only images with GPIO Out1 high. This is meant for the use with a random-dot projector in SingleFrameOut1 acquisition mode.
- WebGUI:
 - Japanese translation
 - Add snapshot download on depth image page (with disparity and pointcloud as ply)
 - Optionally show image that is actually used by stereo matching on depth image page
 - Download try-out requests as JSON

9.2 Improvements and Fixes

- BoxPick (rc_boxpick):
 - Fix missing detections in packed scenes
 - Also draw detected box in grasp visualization
- SilhouetteMatch (rc_silhouettematch):
 - Improve refinement
- Hand-Eye calibration (rc_hand_eye_calibration):
 - Service get_calibration strictly returns only saved result. Before it returned values of calibrate call, even if save_calibration was not called

- Service `set_calibration` implicitly calls `save_calibration`
- Extended collinearity check to ensure that positions are at least 3 mm apart from each other
- `CADMatch (rc_cadmatch)`:
 - Updated grasp sorting to also consider the matching score of the object the grasp is located on

9.3 Other Changes

- GigE Vision/GenICam:
 - add `DepthDoubleShot` feature
 - add `Out1High` to `ExposureAuto` enum
 - rename `RcAdaptiveOut1Reduction` to `RcOut1Reduction`

10 20.10.0 (2020-10-13)

First release

roboception

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FIRMWARE CHANGELOG

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