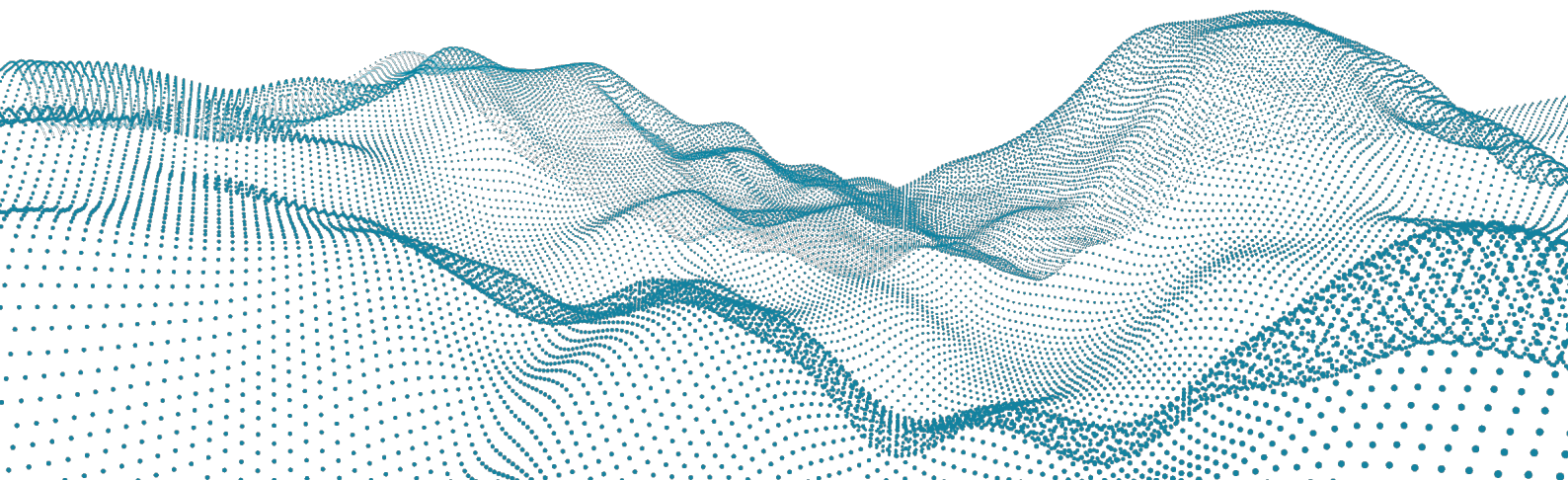




Roboception GmbH | April 2021

# rc\_visard 3D Stereo Sensor

FIRMWARE CHANGELOG



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## 1 21.04.1 (2021-04-20)

### 1.1 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

## 2 21.04.0 (2021-04-15)

### 2.1 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_visard` and is licensed with any of the modules ItemPick, BoxPick, or SilhouetteMatch. Otherwise it requires a separate LoadCarrier license to be purchased.

### 2.2 New Features

- 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_visard`
- WebGUI:
  - organize modules into detection modules and configuration modules
  - add import/export of grasps for SilhouetteMatch templates
  - new LoadCarrier detection module
  - new Regions of Interest page for configuring regions of interest for all detection modules
  - add optional item maximum dimensions to ItemPick Try-Out section
  - add fullscreen control to images in stream view

### 2.3 Improvements and Fixes

- LoadCarrier (`rc_load_carrier`)
  - return estimated dimensions of detected load carriers
  - improve load carrier detection in low contrast scenes
- 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_itempick`) 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 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

## 3 21.01.0 (2021-01-29)

### 3.1 New Features

- BoxPick (rc\_boxpick):
  - add prefer\_splits 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 as tarball with visualization images

### 3.2 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
- 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

### 3.3 Other Changes

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

## 4 20.11.0 (2020-11-23)

## 4.1 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

## 4.2 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

## 4.3 Other Changes

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

# 5 20.10.0 (2020-10-13)

## 5.1 New Features

- WebGUI:
  - 3D ROI visualization
  - simplified specification of grid size for calibration
- SilhouetteMatch (rc\_silhouettematch):
  - added load carrier detection
  - added grasp point specification
  - integrated CollisionCheck module
- StereoMatching (rc\_stereomatching):
  - smooth disparity interpolation
  - disparity border smoothing

- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - common loadcarrier and ROI dbs
- GigE Vision/GenICam:
  - add support for GevSCSP (stream channel source port) with fixed port 50010

## 5.2 Fixes

- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - updated grasp quality computation by taking distance into account

## 5.3 Other Changes

- Camera (rc\_stereocamera):
  - set default for maximum exposure time to 18 ms
  - add parameters exp\_auto\_average\_min and exp\_auto\_average\_max for fine tuning of auto exposure
- StereoMatching (rc\_stereomatching):
  - remove parameter disprange
  - remove parameter median
- IOControl (rc\_iocontrol):
  - Set default of out1\_mode to low
- GigE Vision/GenICam:
  - removed DepthMedian, DepthDispRange
  - add RcExposureAutoAverageMax and RcExposureAutoAverageMin
  - add DeviceLinkSpeed
  - minor updates and generic SFNC features

# 6 20.04.1 (2020-05-07)

## 6.1 Fixes

- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - fix ROI pose if external frame is used
  - fix rejection un-normalized input quaterions
  - set timestamp in response even if request is invalid
- TagDetect (rc\_april\_tag\_detect and rc\_qr\_code\_detect):
  - set timestamp in response even if request is invalid
  - always use full name for quality parameter (High, Medium, Low)
- SilhouetteMatch (rc\_silhouettematch):
  - always use full name for quality parameter (High, Medium, Low)
  - detect service: return -1 (invalid argument) if ROI offset is larger than image
- Hand-Eye calibration (rc\_hand\_eye\_calibration):
  - re-compute calibration on calibrate service call if robot\_mounted parameter changed
- REST API and Web GUI:
  - correctly report MAC and link speed even if no default gateway is set
  - show 'AdaptiveOut1 Reduction' value on camera page if this exposure mode is chosen
  - fix issues with floating image streams on Chrome

# 7 20.04.0 (2020-04-17)

## 7.1 New Features

- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - integrate new CollisionCheck module
  - add [load carrier filling level detection](#)
  - add load carrier overfilled flag
- SilhouetteMatch (rc\_silhouette):
  - support [calibration to closest base plane](#) via new plane\_preference parameter
- TagDetect (rc\_april\_tag\_detect and rc\_qr\_code\_detect):
  - add support for [external pose frame](#)
- Hand-Eye calibration (rc\_hand\_eye\_calibration):
  - support calibration for robots with constrained motion, e.g. 4 DOF
  - add [set\\_calibration service](#) to re-upload calibration previously retrieved via get\_calibration
- Camera:
  - add new [auto exposure mode AdaptiveOut1](#) that optimizes exposure for use with a projector
- Web GUI:
  - add [network configuration](#)
  - add download snapshot button on camera page
  - Try-out results can be downloaded as JSON file
  - show if device is not yet ready
- REST API:
  - add endpoints to change [network configuration](#)

## 7.2 Improvements and Fixes

- Stereo Matching (rc\_stereomatching):
  - improvement of sub-pixel interpolation which reduces disparity steps
- Camera:
  - fixed auto-exposure flicker in full sunlight
- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - improve segmentation and box detection
  - increase maximum number of ROIs and load carriers to 50
  - increase maximum allowed load carrier dimensions to 2m

## 7.3 Other Changes

- rc\_dynamics:
  - add return\_code to get\_cam2imu\_transform service
- REST API:
  - improve error messages for invalid requests
  - new return\_code values for adding elements, e.g. ROIs or load carriers:
    - \* 10: element was added but max capacity is now reached
    - \* -10: new element could not be added because the capacity was exceeded

## 7.4 New Components

- CollisionCheck (rc\_collision\_check): This module provides an easy way to check if a gripper is in collision with a load carrier. It is integrated with the ItemPick and BoxPick modules, but can be used as standalone product. This feature is currently only available as part of the 3D-R Vision & Handling Set from our partner J. Schmalz GmbH.
  - documentation: <https://doc.rc-visard.com/latest/en/collisioncheck.html>
  - access via REST-API and EKI interface
  - configurable via Web GUI



## 8 1.8.4 (2020-01-24)

### 8.1 Fixes

- EKI bridge: on error return more useful return\_code from corresponding module
- rc\_stereomatching:
  - Reset image buffer for static mode on trigger or switching to single shot
- rc\_stereocamera:
  - Fixed reporting of baseline in diagnostic messages

## 9 1.8.3 (2019-12-02)

### 9.1 Fixes

- SilhouetteMatch (rc\_silhouettematch): increase data acquisition timeout to 5s
- rc\_stereomatching: make acquisition\_trigger service available again
- REST-API:
  - improve serialization error messages
  - return http code 400 if service call failed with invalid argument

## 10 1.8.2 (2019-11-19)

### 10.1 Fixes

- fix model name for color sensors

## 11 1.8.1 (2019-11-18)

### 11.1 Fixes

- EKI bridge: fix handling of empty lists
- SilhouetteMatch (rc\_silhouettematch): performance improvements
- rc\_stereocamera:
  - Fixed error when choosing very small exposure region
  - Only apply new signal masks for GPIO outputs if they differ from the previous ones, so that the alternate pattern is not interrupted
- Web GUI: fix flipped grid visualization thumbnails on hand-eye-calibration page

## 12 1.8.0 (2019-10-07)

### 12.1 New Components

- SilhouetteMatch (rc\_silhouettematch): This module detects position and orientation of comparatively flat objects that are positioned on a plane, by matching the scene at hand to a previously taught template.

- documentation: <https://doc.rc-visard.com/latest/en/silhouettematch.html>
- shop: <https://roboception.com/product/silhouettematch/>
- access via REST-API
- configurable via Web GUI
- EKI bridge: The Ethernet KRL Interface (EKI Bridge) allows communicating with the rc\_visard from KUKA KRL via KUKA.EthernetKRL XML.
  - Use rc\_reason onboard software with KUKA robots without any external PC
  - documentation: <https://doc.rc-visard.com/latest/en/eki.html>
  - shop: <https://roboception.com/product/ekibridge/>

## 12.2 New Features

- Web GUI:
  - Hand-eye calibration: allow redoing poses
- rc\_stereomatching:
  - Add new acquisition mode SingleFrameOut1. This mode can be used to control an external projector. It sets the line source of Out1 to ExposureAlternateActive upon each trigger and resets it to Low as soon as the images for stereo matching are grabbed. (Requires IOControl license)

## 12.3 Fixes

- ItemPick (rc\_itempick):
  - bugfix for grasp computation on surfaces with holes
- GigE Vision/GenICam:
  - fix max PayloadSize

## 12.4 Other Changes

- REST-API:
  - save\_parameters and reset\_defaults return return\_code instead of just message string

# 13 1.7.0 (2019-07-22)

## 13.1 New Features

- GigE Vision/GenICam:
  - add ChunkComponentIDValue according to SFNC 2.5
  - add ChunkDecimationHorizontal ChunkDecimationVertical
  - add ChunkLineSource and ChunkLineSelector
- ItemPick (rc\_itempick):
  - sorting of grasps using gravity and size
  - accept lc and roi in camera pose\_frame even if request is for external
  - compute grasp quality from surface rmse
  - performance improvements

## 13.2 Fixes

- fix log rotation for nginx to prevent disk running full
- GigE Vision/GenICam:

- fix Decimation and Width for depth images in Low res
- also apply AcquisitionAlternateFilter for SynchronizedComponents except if it would result in no images being sent
- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - various small fixes/improvements

## 13.3 Other Changes

- rc\_dynamics:
  - added state-machine state "STOPPING"
- REST-API:
  - possibility to add/delete multiple datastream destinations at once
- ItemPick (rc\_itempick) and BoxPick (rc\_boxpick):
  - made pose\_frame argument always required

## 14 1.6.1 (2019-04-01)

### 14.1 Fixes

- Web GUI:
  - fix for new BoxPick page

## 15 1.6.0 (2019-03-28)

### 15.1 New Components

- BoxPick (rc\_boxpick): The optional on-board component of the rc\_visard, which provides a perception solution for robotic pick-and-place applications such as de-/palletizing and sorting of packets. It allows the detection of stationary items with rectangular surfaces and the determination of their position, orientation and size for picking.
  - documentation: <https://doc.rc-visard.com/latest/en/boxpick.html>
  - shop: <https://roboception.com/product/boxpick/>
  - access via REST-API
  - configurable via Web GUI

### 15.2 New Features

- Web GUI:
  - depth image: add single frame acquisition mode
  - page for new BoxPick component
- GigE Vision/GenICam:
  - add DecimationHorizontal and DecimationVertical as readonly features
  - report if system is ready (fully booted) via custom RcSystemReady feature

### 15.3 Fixes

- Web GUI:
  - Improve translation of labels and info boxes

- Various fixes in region of interest modal
- Fix race condition in hand-eye-calibration
- ItemPick (rc\_itempick):
  - scale all pixel parameters with resolution
  - various fixes/improvements for corner cases

## 15.4 Other Changes

- Web GUI:
  - Add acquisition mode parameter to depth image page
  - ItemPick, BoxPick, TagDetect, QRDetect: Request new detection only, if last response has arrived.
  - Hand-Eye-Calibration replace error modal popup with error message under each pose
- REST-API:
  - warn if service request contains unused args
  - itempick RegionOfInterest: only return actually used type (box or sphere)
  - also lock service calls of rc\_stereocamera, rc\_stereomatching and rc\_iocontrol if a GEV application is connected
- StereoPlus (rc\_stereomatching):
  - enable smoothing by default
- ItemPick (rc\_itempick):
  - deprecate item\_model\_tolerance parameter (now read-only)
- TagDetect (rc\_april\_tag\_detect):
  - performance improvements
- SLAM (rc\_slam):
  - improve map loading and resets/restarts

## 16 1.5.0 (2019-01-31)

### 16.1 New Features

- New Module: StereoPlus (rc\_stereomatching):
  - disparity image smoothing (enabled via smooth parameter)
  - full resolution disparity image
- Web GUI:
  - add exposure region selection via mouse
  - floating video streams
  - new parameters for StereoPlus (full resolution and smoothing)
  - allow deletion of hand-eye-calibration
  - hand-eye-calibration page shows current sensor mounting

### 16.2 Fixes

- Web GUI:
  - several layout/UI improvements and fixes
  - Hide white balance settings on calibration page
  - ItemPick update streams shown only after detection
  - fix kuka pose format calculations
- rc\_hand\_eye\_calibration:
  - If calibration error is NaN or Inf, return failure with status code 2 and a message
  - fix concurrency bug
- ItemPick (rc\_itempick):

- surface segmentation: fix return code when roi is empty
- GigE Vision/GenICam:
  - return correct baseline and focal\_length\_factor even before fully booted up
- IOControl
  - fix GPIO output when switching from active to low

## 16.3 Other Changes

- add baseline and color/monochrome version to model name, e.g. "rc\_visard 160m"
- GigE Vision/GenICam:
  - add GenICam parameters for StereoPlus:
    - \* add DepthSmooth (requires stereo\_plus license)
    - \* add Full quality (requires stereo\_plus license)
    - \* remove StaticHigh quality
    - \* add DepthStaticScene parameter (replacing StaticHigh, but also works in Full)
  - remove GevTimestampControlReset
  - add and fix TimestampLatch and TimestampLatchValue (GEV counterparts are deprecated)
  - add DeviceFirmwareVersion (same as DeviceVersion for now)
  - add sent\_frames, dropped\_frames and packet\_resends in REST-API status values
- SLAM (rc\_slam):
  - add return\_code in get\_trajectory response
  - add number of map\_frames in status values

## 17 1.4.0 (2018-10-19)

### 17.1 New Components

- ItemPick (rc\_itempick): The optionally available software component provides an out-of-the-box and model-free perception solution for robotic pick-and-place applications with suction grippers.
  - documentation: <https://doc.rc-visard.com/latest/en/itempick.html>
  - access via REST-API
  - configurable via Web GUI

### 17.2 New Features

- Web GUI redesign:
  - additional modules pages:
    - \* ItemPick
    - \* AprilTag and QRCode Detect
    - \* IOControl
  - camera page:
    - \* set gain manually
    - \* set white balance manually for color cameras
- GigE Vision/GenICam:
  - support for GigE Vision 2.1 MultiPart
  - add DepthAcquisitionMode and DepthAcquisitionTrigger
  - add SFNC 2.4 category PtpControl with
    - \* PtpEnable
    - \* PtpDataSetLatch
    - \* PtpStatus
    - \* PtpOffsetFromMaster
  - add AcquisitionMultiPartMode enum with

- \* SingleComponent: Immediately send one single component per frame/buffer when it becomes available.
- \* SynchronizedComponents: Only send a multipart frame/buffer iff all enabled components are available for that time.
- Improved auto exposure for reducing overexposure

## 17.3 Fixes

- REST-API:
  - return 400 error if parameter is out of min/max range
  - update Swagger UI to get correct cURL examples for Windows

## 17.4 Other Changes

- Web GUI:
  - removed French and Chinese translations

## 18 1.3.1 (2018-08-28)

### 18.1 Fixes

- REST-API:
  - fix error messages on service call failures (when some messages fields are of wrong type)
- GigE Vision/GenICam:
  - only reset block id when a new stream channel is opened
  - reduce latency on changing enabled components
- Web-GUI:
  - make doc links work in proxied environment

## 19 1.3.0 (2018-07-25)

### 19.1 New Components

- IO and projector control (`rc_iocontrol`): The optionally available software component allows read and write access to the `rc_visard`'s GPIOs, e.g. to synchronize with external pattern projectors.
  - documentation: <https://doc.rc-visard.com/latest/en/iocontrol.html>
  - access via REST-API
  - access via GigE Vision/GenICam interface:
    - \* category: DigitalIOControl, features: LineStatus, LineSource, etc.
    - \* custom AcquisitionAlternateFilter which makes it possible to receive only images with/without projector(gpio) on

### 19.2 New Features

- TagDetect (`rc_april_tag_detect` and `rc_qr_code_detect`):
  - add `detect_inverted_tags` parameter that allows detection of negative, i.e. black/white inverted QRcodes and AprilTags in front of black background.
  - possibility to specify approximate tag size to resolve ambiguous stereo tag matching

- GigE Vision/GenICam:
  - add support for setting exposure region:
    - \* ExposureRegionWidth, ExposureRegionHeight, ExposureRegionOffsetX, ExposureRegionOffsetY
  - support extended chunk mode
  - new SFNC 2.4 features:
    - \* Scan3dFocalLength, Scan3dBaseline, Scan3dPrincipalPointU, Scan3dPrincipalPointV
- SLAM (rc\_slam):
  - add services to persist and load onboard created maps (save\_map, load\_map, remove\_map)

## 19.3 Other Changes

- rc\_stereomatching:
  - remove force\_on parameter from public interface
- rc\_itempick:
  - add clustering\_max\_surface\_rmse parameter
  - performance improvements

## 19.4 Fixes

- rc\_stereo\_ins:
  - fixed correction offsets in case of long vision outages
- rc\_april\_tag\_detect and rc\_qr\_code\_detect:
  - fix memory leak
  - improved matching between left and right image
- REST-API:
  - fix locking of service calls if module is not licensed
  - make log download work in tunneled/proxied environment
  - fix persistent storage of boolean parameters
- GigE Vision/GenICam:
  - fixes for better compatibility with some clients
  - some nodes like PixelFormat, Width, Height now correctly depend on ComponentSelector
  - DeviceVersion: report image version instead of rc\_gev\_server version

## 20 1.2.1 (2018-05-04)

### 20.1 Changes

- rc\_gev\_server:
  - add packet\_size to status values in REST-API

### 20.2 Fixes

- rc\_slam:
  - fixed map localization
  - fixed various internal issues
  - do "restart" when "start"ed in HALTED, so the internal state is cleared.
- rc\_stereo\_ins and rc\_dynamics
  - fixes for communication timeouts
  - Use start on SLAM, not always restart (which drops the map)
- GigE Vision/GenICam:

- fix race on (un)subscribing to images on heartbeat timeout
- REST-API:
  - fix loading of saved boolean parameters at startup

## 21 1.2.0.1 (2018-04-05)

### 21.1 Fixes

- rc\_itempick:
  - Make sure that the grasp z-axis points into item (according to the camera z-axis)

## 22 1.2.0 (2018-03-29)

### 22.1 New components

- rc\_itempick
- rc\_april\_tag\_detection
- rc\_qr\_code\_detection

### 22.2 Changes

- rc\_hand\_eye\_calibration
  - add remove\_calibration service

### 22.3 Fixes

- request NTP servers from DHCP
- rc\_stereocalib
  - Force syncing of calibration files and images to disc
- Web GUI:
  - show hand-eye calibration images again
  - update chinese translation

## 23 1.1.1 (2018-02-22)

### 23.1 New Features

- rc\_stereocamera:
  - added parameters to select a rectangular region used for calculating auto exposure:
    - \* exp\_offset\_x, exp\_offset\_y, exp\_width and exp\_height

### 23.2 Changes

- rc\_hand\_eye\_calibration:
  - provide robot\_mounted bool with get\_calibration service
- REST API:



- include detailed info for all nodes (status, parameters, services) in log tarball
- limit to 10 destinations per datastream

## 23.3 Fixes

- GigE Vision/GenICam:
  - immediately sync network settings to disk after changes
- Web GUI:
  - minor update to chinese translations
- fix switching of partitions via magic packet (via rcdiscover)
- improve system robustness under high load
- REST API:
  - fixes for ros service call response to API mappings
  - fix: correctly boot into new image if sensor is power-cycled immediately after update
- rc\_stereo\_ins:
  - fix initialization when camera doesn't see anything
  - improve robustness
- rc\_slam:
  - autorecovery now also recovers the map
- rc\_dynamics:
  - improve performance and robustness

## 24 1.1.0 (2018-01-19)

- Web GUI now also in French and Chinese
- new "producer" field in rc\_dynamics\_msgs Frame and Dynamics
- REST API:
  - fix bool parameters, actually return true/false and validate input correctly
- first release of SLAM
- rc\_dynamics:
  - add start\_slam, stop\_slam, restart\_slam services



## rc\_visard 3D Stereo Sensor

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