trinity

OBJECT DETECTION MODULE

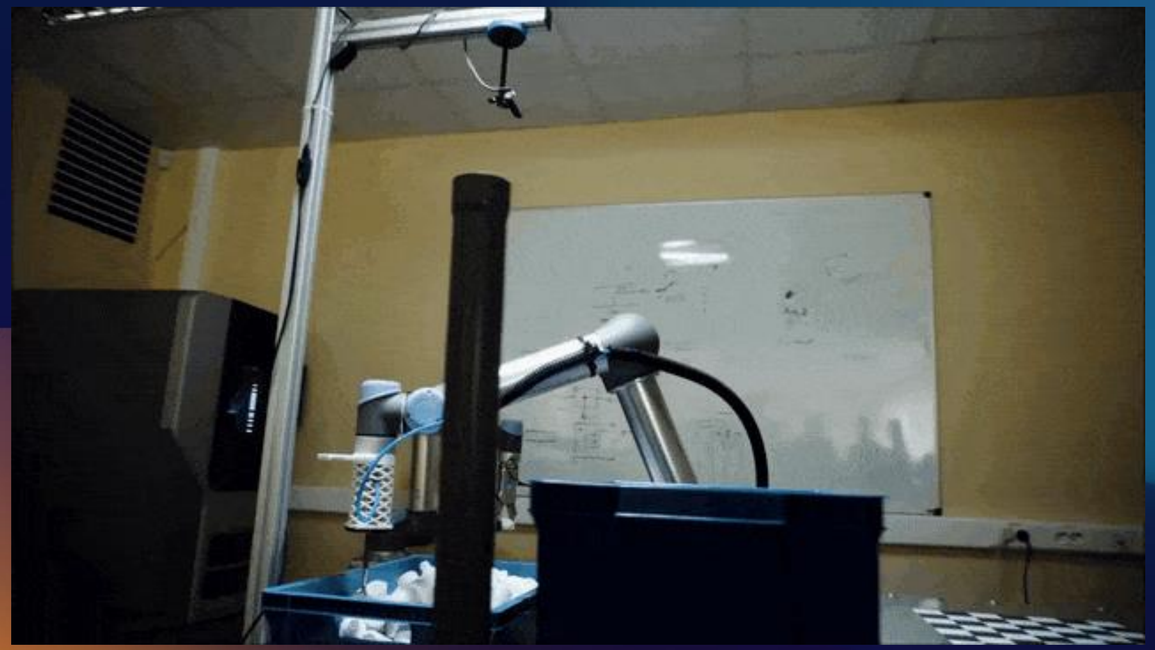
PRODUCTION MANAGER TUTORIAL

www.trinityrobotics.eu

The TRINITY project has received funding from the European Union's Horizon 2020 research and innovation programme under the GA 825196

Purpose of the module

- Perceive the changing environment (receive color frames and depth information of a region of interest from a camera sensor and extract the features about the objects of interest)
- Modify systems actions accordingly (The object detection module is mainly responsible for object detection from the bin that can be picked by an industrial robot)



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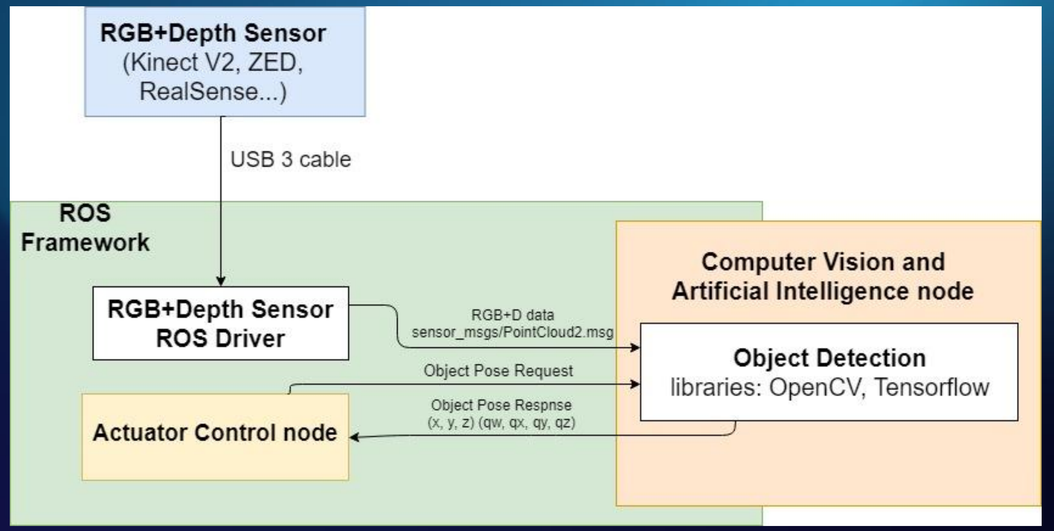
Module components

- The following hardware is used in the setup:
  - Two workstations (Standard desktop PCs with modern Nvidia graphics card for computer vision algorithms, HPC recommended for training process)
  - RGBD camera (Any ROS compatible device if the data can be published as PointCloud2)
  - Industrial robot – UR5 or any other actuator that can benefit from object detection

All the data is transferred via a standard ROS transport system with publish/subscribe and request/response semantics. This module subscribes to RGB+Depth sensor data and produces pose of the object: position (x, y, z) and orientation in quaternion format (qw, qx, qy, qz) as a response to ROS service request.



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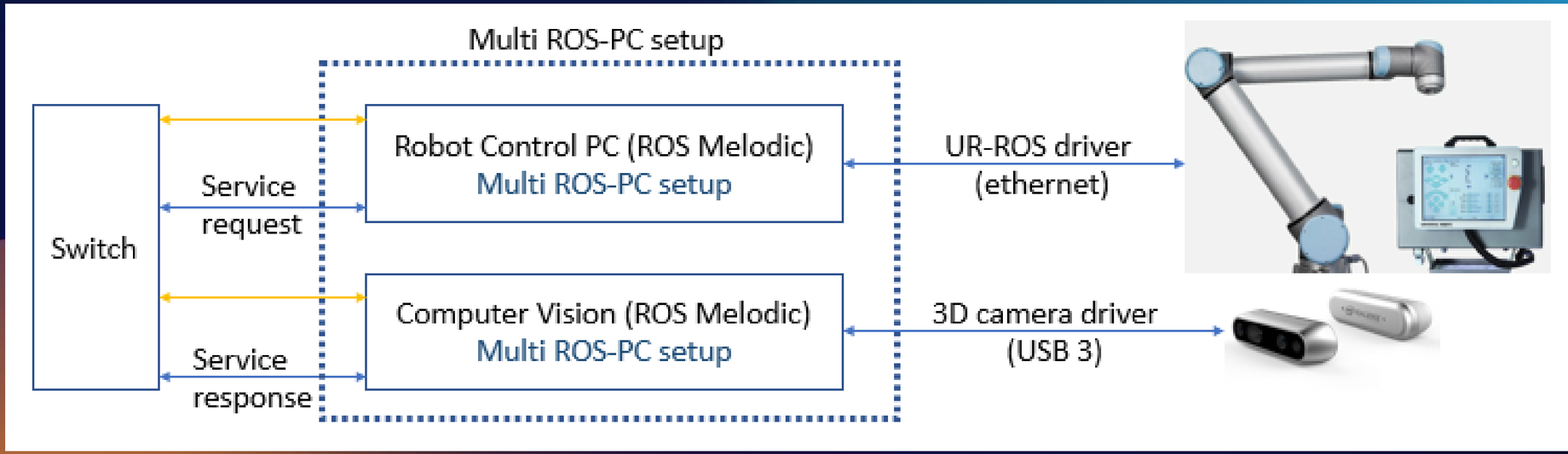
Hardware setup

- The original setup consists of 2 ROS (Melodic) PCs as Universal robot ROS driver requires real-time kernel, and computer vision algorithms requires NVidia graphics driver that are not compatible with each other. The computers are connected via switch. The Robot control PC should have an additional network card for independent connection to Universal robot UR5. The communication between Robot control PC and Computer Vision PC is done via ROS Service. The information passed through is mainly object data – position, orientation and type.



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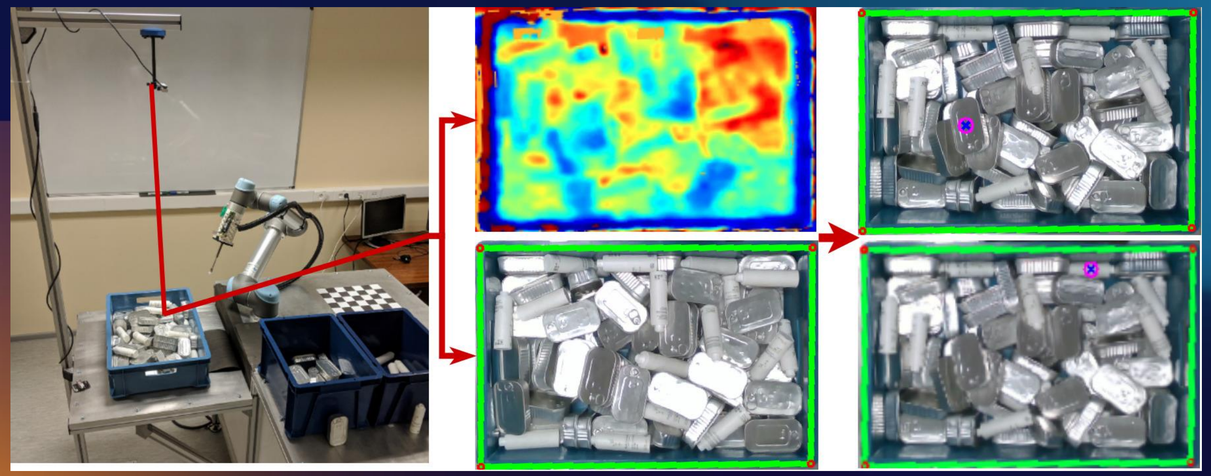
Environmental requirements & adaptability of the module

- This module was developed in a conjunction with a collaborative robot UR5, and with a medium sized objects. The module can work with wide variety of objects and integrated into variously sized systems. All the requirements mostly are hardware specific, especially for the RGBD cameras used. For example - for big objects a camera with respective field of view should be used, that covers the region of interest.
- Similarly the robot should be used which are suitable for the manipulation of the intended objects.
- The environmental lighting variations should be minimized and thus covered in the training data.



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Integration

- The module integration consists of the following steps:
  1. Acquire the training data
     a) Mount and setup the camera to acquire the data, label the acquired data manually
     b) Synthetically generate data (Using data generator version provided with module, or EDI can provide data generated)
     c) Combine manually gathered data with synthetic data
  2. Training (can be done on standard desktop PC with a modern NVidia graphics card, however usage of HPC is required to accelerate the training process)
  3. Integration to the actuator control module
     - Robot-Camera extrinsic calibration

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Object detection module

This module is available after an agreement with EDI, if you are interested in this module contact us: https://www.edi.lv/en/contacts/

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INSTITUTE OF ELECTRONICS AND COMPUTER SCIENCE

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Thank you!

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