TOWARDS INDUSTRIAL-GRADE ROBOT CONTROL IN ROS

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THE NEED FOR A NEW ROS DRIVER

Clouded landscape
• More than 200 variants of a ROS driver for UR robots exist.
• Instability towards API changes

A lot could be improved
• Many, especially new features are lacking
• Sub-optimal performance
• Only preliminary e-Series support

The new driver
• ROSIN FTP in collaboration with FZI
GOALS

Ease of use
• Easy and plug-and-play to use a UR robot with ROS

Performance
• Full utilization of all features of the robots
• As industrial grade an interface as current ROS practice allows

Stability
• The driver will build on stable and versioned APIs
• The driver will be integrated into the software testing regime of Universal Robots

Community
• The driver will remain open source and relying on future community contributions
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ROS DRIVER

Beta Program Launch - June 1st 2019

73 beta partners from 12 countries
- 13 from Large entreprises
- 16 from SMEs and startups
- 12 from Research organizations
- 14 from Universities
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ROS DRIVER

Public Launch – October 9th 2019

Hosted at Universal Robots GitHub
- 25 daily unique clones!
HIGHLIGHTS

• Stable control interfaces
• Teach-pendant integration
  • Use ROS as part of a program
  • Pause, stop, restart and scale speed
• Factory Calibration in ROS
• Safety compliance speed scaling
• eSeries tool communication forwarding
• Full safety system compliance
PROGRAMMING FLOW INTEGRATION

Use ROS where it is needed and be in full control of the robot during ROS control.
CALIBRATION FOR ABSOLUTE ACCURACY

• All UR robots are individually factory calibrated for absolute accuracy

• Factory calibration not directly applicable for ROS
• Change structure to match URDF
CALIBRATION CORRECTION

- Transform DH parameters to 6D representation
- Move in arm segments on their rotation axis
- Save resulting 6D parameters of each joint as `.yaml` parameter set
- Automatically happening at start
- Parameter sets are saved in `$ROS_HOME$
- Launch files provide a `serial_number` argument to load correct calibration
COLLABORATIVE & SAFE
Safety compliance in ROS
THE PROBLEM
WITH SAFETY COMPLIANCE CONTROLLER
e-Series TOOL COMMUNICATION IN ROS

Tool communication connector
- RS485 Software UART, up to 5 Mbps

UART in ROS
- Forwarded as virtual serial port to ROS machine
- Re-use of existing drivers for serial devices in ROS
WHAT’S NEXT?
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ROS DRIVER 2.0

Industrial-grade performance, features and reliability
TOWARDS INDUSTRIAL-GRAGE

Industrial-grade performance and stability require an interface that respect real-time constraints and leverage the full performance of all components.

- Easy access to all control interfaces in ROS
- Exploit the full motion quality and responsiveness of the robot
- Industrial stability and robustness
- Integrated and seamless cooperation between ROS and Robot
- Making the way for using ROS for actual production and technology commercialization
GOALS

• Easy-to-use cartesian motion interface in ROS
  • Definition of Cartesian input for robot control (Try to set a standard)
  • New hardware interfaces for Cartesian commands.

• Seamless switching of execution flow between ROS and robot
  • On the robot execution of movements and functions in real-time
  • A Further enhanced coupling of ROS Control and the UR Controller
  • Real-time use of new robot features

• ROS as a Service
  • Two-way communication channel between ROS and Robot controller
  • User-defined ROS actions and services can be called from a UR program tree
    lowering the barriers of utilizing ROS-I inside an industrial automation process
PERFORMANCE ACROSS REAL-TIME BARRIERS

• Ensuring hard real-time decisions in the robot controller

• Enabling seamless transition to soft real-time ROS control when needed for advanced tasks
SUPPORTING NEW FEATURES
REACTIVE MOTION PROGRAMMING (NEW 5.3-5.4)

• Fully reactive and event driven motions

• Movement and actions until events

• Contact detection
  • Disturbance tolerant
  • Detects hard and relatively soft contacts
  • Retraction to contact surfaces

• Utilize 2 ms hard real-time responses
DYNAMIC PATH-OFFSET (NEW 5.6 – 5 DAYS AGO)

- Dynamic path-offset allows real-time adjustment to robot motions in 6DOF

- Motions can be compensated relative to
  - Tool of the robot
    - e.g. weaving for welding, admittance control
  - Base of the robot
    - E.g. Use with mobile robots or linear axis
CALL TO ACTION

UNIVERSAL ROBOTS ROS DRIVER

Leverage your UR robots by using the new driver, and give us your feedback


PROVIDE YOUR INPUT FOR THE 2.0 DRIVER

Contact us on ros@universal-robots.com for feedback and ideas
THANKS!

DON’T FORGET TO TRY THE NEW DRIVER