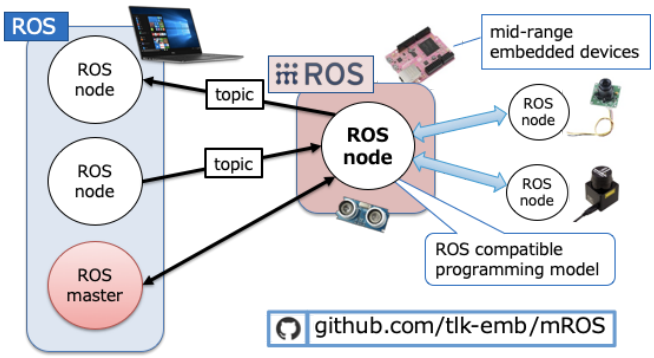
mROS and ZytleBot: Design Platforms for Embedded Robot Systems

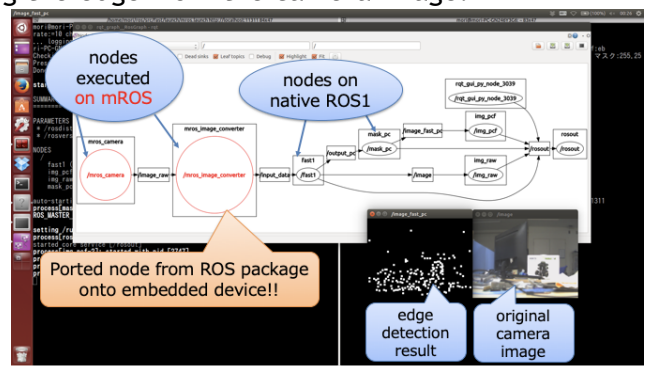
Hideki Takase[1,2] Yasuhiro Nitta[1] So Tamura[1]
1: Kyoto University, Japan 2: JST PRESTO, Japan

ROS (Robot Operating System) is an open-source and flexible framework for robot systems. ROS can accelerate your development experience because it provides almost all the functionality you need. We are researching design platforms for robot systems based on ROS. In our University Booth, we will present the current status of two research activities.

mROS is a lightweight runtime environment of ROS1 nodes. The main advantage of ROS is a large number of open-source packages to realize the component-based development approach. However, operating ROS1 nodes requires the desktop version of Linux. Therefore, we should select high-performance and power-hunger devices when employing ROS1.

mROS offers a ROS1-compatible communication library to be operated on the embedded mid-range processor which cannot be operated with Linux. You can port and operate ROS1 packages onto embedded devices directly. This means that power saving and real-time performance can be achieved on the edge nodes of distributed robot systems. We will show the case study of mROS on the distributed ROS system for detecting the edge from the camera image.





ZytleBot is an autonomous driving robot as an FPGA-integrated development platform utilizing the Xilinx programmable SoC. ZytleBot can run the course, turn right/left at the intersection, avoid obstacles, detect traffic signals and stop. All judgments and calculations necessary for driving are performed on the embedded system mounted on the robot.

In ZytleBot, the main autonomous driving system using ROS is running on a CPU, and high-load processing is offloaded to the FPGA to guarantee real-time property. FPGA preprocesses the road surface image acquired from the camera and calculates the HOG feature extraction for signal detection. We achieved about 5 times faster performance by utilizing the FPGA. We will demonstrate the signal detection task on the ZytleBot that won FPT'18 FPGA design competition.