Seminar and Hands-On on Orocos

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Outline

1 Orocos Applications
   - Machine Control
   - Adaptive Control
   - Shared Control
   - Vision Integration
   - Distributed Control

2 Orocos Introduction

3 Pause

4 Use Case: “RoboCatcher”

5 Getting Started with Orocos
Outline

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4. Use Case: “RoboCatcher”

5. Getting Started with Orocos

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http://www.Orocos.org
Axes Control

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Constraint Based Control
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Online learning

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Placing a Car Window

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Milling a Human Bone
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Orocos Applications

Orocos Introduction  Pause  Use Case: “RoboCatcher”

Getting Started with Orocos

Summary

Machine Control
Adaptive Control
Shared Control
Vision Integration

Distribution in progress...

Middleware for Machine Control

OS

Device

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http://www.Orocos.org
Freely available on:
http://www.orocos.org
Coffee Break
RoboCatcher: Research Application

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RoboCatcher: Requirements

- **Software Framework**
  - Modular - Component Based
  - Online reconfiguration
  - User interactivity
  - Real-Time

- **Application Code**
  - Camera capturing
  - Car image recognition
  - Car state estimation
  - Online trajectory generation
  - Robot kinematics algorithm
  - Robot/gripper interfacing
RoboCatcher: Without Orocos

Camera Driver -> Image Recognition

Image Recognition -> Kalman Filter

Camera Driver -> Image

Image Recognition -> Car Location

Kalman Filter -> Robot

User Application -> Trajectory Generator

Trajectory Generator -> Robot

User Application -> Target Frame

Target Frame -> Trajectory Generator

Target Frame -> Kinematics

Trajectory Generator -> Robot

Joint Position Output -> Tool Frame

Joint Velocity Output -> Robot

Robot -> Gripper

"Classical" Component Application Setup

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RoboCatcher: With Orocos

- Camera Driver
- Image Recognition
- Kalman Filter
- Trajectory Generator
- Joint Vel. Output
- Robot
- Gripper

Orocos Applications
Orocos Introduction
Pause
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Getting Started with Orocos

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RoboCatcher: Camera

Data Flow:
Image Connection

Image Recognition

Camera Driver

bool fetchImage() command

Image* getImage() method

Execution Flow:
'methods' and 'commands'
Camera Methods

Methods: Synchronously *call*

Component Activity

Recognition Component (a)

Call Method: `getimage()`

Camera Component (b)
Camera Commands

Commands: Asynchronous send

Component Activity

Recognition Component (a)

Send Command: "fetchImage"

Camera Component (b)

Command Queue

Check
Completion Condition: imageFetched()
Camera Execution Flow

Methods: Synchronously *call*

- Call Method: `getimage()`

- Recognition Component (a)

- Camera Component (b)

Commands: Asynchronous *send*

- Send Command: "fetchImage"

- Check Completion Condition: `imageFetched()`

- Execute Command: `fetchimage()`

- Check Queue

- Command Queue

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RoboCatcher: With Orocos

Orocos Applications  Orocos Introduction  Pause  Use Case: "f"

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RoboCatcher: Kinematics

Trajectory Generator

- moveTo(p,t)
- moveJoint(q,r,v)
- start()/stop() methods

Joint Vel. Output

q_dot

to Robot

Connection from Kalman Filter

q6_robot Data Port

Online Interpolator

- target (p,t) Data Port
- start()/stop() methods

Joint Vel. Output

Kinematics

- getEndPosition() method
- getEndTwist() methods
- inverseVel(t,q_dot) method

Gripper

- getFrame() method
- open()/close() commands

q6_robot Data Port

q6_robot

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RoboCatcher: With Orocos

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Getting Started with Orocos

Summary

RoboCatcher: With Orocos

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RoboCatcher: Application Logic

Application Component

- Off
- Startup
- Shutdown
- Position Robot
- MoveToCar
- SafeStop
- Track&Grasp
- Real-Time State Machines

Real-Time Communication

http://www.Orocos.org
Orocos offers

- a software toolkit for building real-time components
- rich online browsable component interface
- user defined real-time state machines

Further Reference:
http://www.orocos.org