8803 - MS Robotics Studio

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Outline

1. Introduction

2. MSRS Overview

3. A few details

4. Competitors

5. Summary

Background

- Construction of systems requires "glue" for integration
- That includes
  1. Communication framework
  2. Components in "standard libraries"
  3. A control/synchronization model
  4. Tools to support development

Communication

- Language neutrality
- Handling of structured data
- Efficient (latency / bandwidth)
- Multiple control models
  - Push, Pull, Synchronize, Subscription

Std. Component Libraries

- Interfaces to standard actuators / sensors
  - Odometry, Camera, IR sensors, Sonar, LIDARs, . . .
- Reference implementations
  - Mapping, Feature Extraction, Planning, Navigation, . . .

Tools for Development

- Integration with UML for other design methodology
- Code templates / reference models
- Integration with debuggers for efficient development
- Facilities to accommodate logging
- Methods for simulation
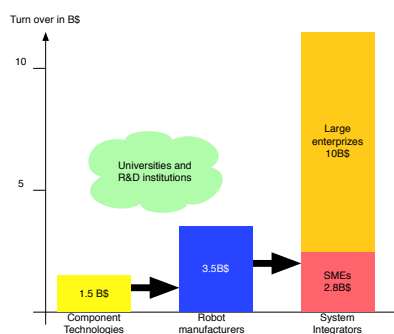- Methods for visualization of state

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A note on robot economy

Turn over in B$

10

5

Universities and R&D institutions

Large enterprizes 10B$

3.5B$

SMEs 2.8B$

1.5 B$

Component Technologies

Robot manufacturers

System Integrators

Source; EUROP / EuroStat / World Robotics

Microsoft Robotic Studio

- An attempt for Microsoft to enter the systems integrator market
- A framework for process communication and synchronization
  - CCR - Concurrency and Coordination Runtime
- A client model for application developments
  - DSS - Decentralized Software Services
- "Physics" based simulation
  - Based on the AGEIA package
- A framework for visual programming (PnP)

CCR

- Concurrency and Coordination Run-Time
- Based on .NET 2.0
- Asynchronous message passing framework
- Separating communication and computing
- Light weight process management
- Single DLL for interfacing to a number of languages
  - C#, C++, Python, VB
- Inspired by a web based services
- Used in applications such as MySpace

CCR

- Specification of IO ports
  - Types data channels
- Coordination primitives
  - Arbiters, Queues, Scheduling of IO
- Task Scheduling
  - Local task schedulers / impact of IO on processing

DSS

- Decentralized Software Services
- Defines standard I/O methods for services
  1. definition of a standard service identifier
  2. setup of a "service" contract for interaction
  3. object to capture service "state"
  4. methods to handle service requests
  5. error recovery methods
- Includes yellow page service
- Standard IO models (Push, Pull, Query, Subscription)

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Web based status

A trivial example

A little realism

Communication

Visual Programming

MSRS Simulation

- AGEIA / PhysX has a physics based simulation engine
- Exploits graphics hardware
- Simplified robot models
- Adequate for basic prototyping

Standard Interfaces

- Has interfaces for standard robots
  - Pioneer, iRobot Create, Lego NXT, Parallax, . . .
- Interfaces to standard sensors
  - USB camera, SICK LMS-221, Canon IR, Garmin GPS, . . .
- Number of supported units has grown significantly the last year

Getting to knoow MSRS

- Rich set of tutorials on the web
- CCR basics, DSS basics, to understand the basis
- C# knowledge is recommended
- Use Visual Studio 2005 Express Edition (Free)
- Sample Tutorials on simple actions and full systems
- KUKA Education Framework
  - Joint Control, Cartesian Control, Mobile Systems

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Competitors

OROCOS Open Robot Control System
  - Manipulator Oriented Open Source Control
ORCA Open Robot Control Architecture
  - Mobile Platforms software with rich library
Saphira Mobile Robotics / Pioneer System
Player-Stage Open Source Device Library
  - Most iwdely used OSS for robotics
ERSP Evolution Robotics Software Package
  - The objectives are the same as for MSRS
  - Comprehensive package - cost is a challenge

Short Comparison

System	Architecture	Language	Devices	Doc
MSRS	HD	C#, VB, C++, Python	Some	++
OROCOS	React	C++	Manip	++
ORCA	HD	C++/Java	Mobile	++
Saphira	HD/SHM	C, C++	Pioneer	+
Player	?	C++, Java,...	MANY	+++
ERSP	HD	C++, Python	ER1, ...	++

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Summary

- Brief introduction to MSRS
- Systems integration is key to success
- MSRS is one option and the future will be interesting
- C# / .NET knowledge a significant advantage
- There is a learning curve but now there are good tutorials and the documentation is OK.
- For 8803 there are standard drivers for all devices

Questions?

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