CSTP Coordination Program of Science and Technology Projects
(CSTP: Council for Science and Technology Policy)

Common Platform Technology for Next Generation Robots

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*CSTP Coordination Program of Science and Technology Projects (Next Generation Robots)

OUTLINE

1. Background & Mission
2. What is Common Platform Technology?
3. Status of Projects
4. Conclusions
Industrial Robots – operational stock
Asia predominates the robot market.

Estimated operational stock by regions 2005

Estimated operational stock of industrial robots
by the main countries 2004 - 2005

1. Robot Market and Forecast in Japan

From JARA@2008
Current Robot Developments

Ministries

- Robots by MIC
- Robots by MLIT
- Robots by MAFF
- Robots by MEXT
- Robots by METI

Application (Examples)

- Network robots
- Construction robots
- Harvesting robots
- Rescue robots
- Human support robots

Various types of robot development for their needs

Independent developments

No redundant development

Basic technologies for all applications

Main Mission of CSTP Coordination Program of Science and Technology Projects (Next Generation Robots)

(CSTP: Council for Science and Technology Policy*)

- Establishment of Common Platform Technology for efficient robot developments as infrastructure for any application.
- Coordination among ministries for new robot markets.

*Council for Science and Technology Policy is one of the four councils of important policies of Cabinet Office of Japan. The CSTP is comprised by Prime Minister, relevant Ministers, and experts.
Organization of CSTP-CPSTP (2005~2009)

Council for Science & Technology Policy (CSTP)

Project Team
1. Post-Genome
2. Emerging and Re-emerging Infectious Diseases
3. Ubiquitous Networks
4. Next Generation Robots
5. Biomass Utilization Technologies
6. Hydrogen & Fuel Cell
7. Nano-bio-technology
8. Local Science & Technology Cluster

Special Coordination Funds for Promoting Science & Technology (MEXT)

Japan Science & Technology Agency (JST)

CSTP Coordinate Program of Science & Technology Projects (CPSTP)
- Project Directors
- Project Officers

Support

New Projects:
Common Platform Technology for Next Generation Robots

Ministries

2. Common Platform Technology for Next Generation Robot

Application (Examples)

Common platform
- Information Structured Environment
- Software Platform

Efficient development for various applications

Network robots
Construction robots
Harvesting robots
Rescue robots
Human support robots

Create new robot market
Enhance competitiveness

National projects in the government
Establishment of Information Structured Environment

We call the established information structured environment the “Environmental Platform.”

Concept of Software Platform
- Robot World Simulator -

Software supply
Available software

Middleware layer
Robot world simulator
(Common software platform)

R&D
(Ministry project)
R&D
(Industry)
R&D
(University)
Software developed by research and development

Software (Colored part shows middleware)

R&D
(Ministry project)
R&D
(Industry)
R&D
(University)
Research institute

CSTP-CPSTP
Four R&D Projects of CPSTP

1. Robot Town PJ: Robot Town, in which robots work in an ordinary environment using RFID tags and a distributed vision integrated by TMS
2. Human Behavior Measurement PJ: Information structured environment based on human positions, in which spatial information and record of human behaviors are linked
4. Robot Simulator PJ: Robot simulator composed of distributed object modules implemented by RT Middleware

The above projects were performed through Special Coordination Funds for Promoting Science and Technology of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Japanese Government.

Overview of the Common Platform Technology

Environmental Platform

Software Platform

1. Structured Environments
2. Software Modularization
3. Public facilities
4. Task space
5. Robot World Simulator
6. Measurement of Fields
7. Measurement of Human
8. Measurement of Objects

FY2006

FY2007

Robot town aims to collaborated work with robots and humans.

Layout of Embedded RFID tags

RFID tags (HF band and LF band) attached on the back side of a unit rectangular floor mat (0.5m x 0.5m).
Robot Town Open Experiment (Feb. 25, 2008)

Wheel Chair Robot Experiment

Robot handling Small Object and Display of Humans in Room


To realize robotic services for humans based on human behavior.

- Measure positions of humans and robots
- Structuring Environmental Information (Giving meanings in terms of space and behavior)
- Standardization (Position and error)

Relationship between space and behavior (Structuring on environmental information)

Service Application
Experimental Field:

Universal City Walk in Osaka, A Shopping Mall

Open Experiment at Universal City Walk in Osaka (Jan. 23, 2008)

A Robot Guiding A Human

Display of Status of Environment
Robotic Universal Design PJ: 2006-2008

Service Robots are hoped to do several tasks in various environments.

Make basic framework for manipulation.

AIST Experimental Rooms: Prototype

In order to show the advantage by structured environment and to prove sensor combinations, the experimental rooms were built.

Final environmental platform will be built in Kanagawa Robot Park.

List of installed devices
- Robot Platform
  - Omni directional robot
  - Differential 2 wheel robot with RFID reader, IMU
- Infrastructures
  - Pseudlite (GNSS)
  - Starlite (ETRI)
  - RFID
  - LRF (Hokuyo)
  - Checked floor
  - Ceiling camera
- Surveying instrument
  - Total-Station (Leica)

Sensors of the room
AIST Open Experiments (Oct. 23, 2007)

Standardization
- Task Template based on Pick & Place Task
- Universal Handle with CLUE

( CLUE: Coded Landmark for Ubiquitous Environments)

Pick & Place Tasks in Information Structured Environment

Universal Handle

Universal Container Handling Experiments

OpenHRP3: Open architecture Human-Centered Robotics Platform 3

- **Schedule**
  - The simulator is open for unlimited users from June 2008.
  - Eclipse Public License v 1.0

- **Simulation**
  - Dynamics, Path planning, Visual navigation

- **Basic library**
  - Interference check, Kinematics & inverse-kinematics
  - Center of gravity, ZMP
  - GUI

- **Development**
  - Linux / Windows
  - Java-SDK, Java3D, C/C++, OmniORB

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Examples of Simulations

- **Closed Loop Linkage Mechanism**
- **Porter Robots**
- **Humanoid Robot**
- **Mitsubishi PA-10**
Feature of Common Platform Projects

- RT Middleware as an international standard is used in Common Platforms.
- Kansai platform will be used for METI, MIC and other projects.
- Localization of robot position proposed for an international standard will be used in Common Platforms.
- Robot Simulator OpenHRP3 is widely used in other robot projects.

Project Relationship

PJ names are not official here.
Conclusions

1. Necessity and status of common platform technology for next generation robots are introduced as an important infrastructure of robot development.

   1) Information Structured Environmental Platforms
      - Robot Town PJ (finish)
      - Human Behavior measurement PJ (ongoing)
      - Robotic Universal Design PJ (ongoing)

   2) Software Platform
      - OpenHRP3 PJ (finish)

2. Promote the use of platforms
   - Continue to other national projects

3. Coordination among related ministries are advancing.

Thank you for your attention!

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