What’s New in Tekkotsu?

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What’s New in Tekkotsu?

Hardware Evolution:
- Calliope
- Kinect support

Software Evolution:
- Pilot and Grasper - unified RRT planner
- Localization now a Pilot service
- Additional libraries: SIFT, AprilTags

Updated Robotics Curriculum
Tekkotsu Platforms

Manipulation

- Hand-Eye: $995

Mobility

- Calliope
- Chiara <$4000
- iRobot Create: $785
Tekkotsu Platforms

Open source design: Build yourself or purchase fully assembled from RoPro Design

Pan/Tilt PlayStation Eye
3 IR Rangefinders

ASUS netbook
iRobot Create
Calliope

5 DOF Manipulator
2 DOF Gripper
(Robotis RX-Series)

Eye & IR may be replaced by Kinect
Arm optional, or 2nd arm may be added
Ongoing Development

Microsoft Kinect
Jitu Das

Aldebaran Nao
Orfanoudakis Emmanouil
Intelligent Systems Laboratory
Technical University of Crete

Kondo KHR-2
Aaron Parker & Jason Tennyson
Southern Illinois Univ. Edwardsville

RoadNarrows SkewlZone
Brainpack (sensor package)
The Tekkotsu “Crew”

• AAAI 2010: The Tekkotsu “Crew”: Teaching robot programming at a higher level
  • Lookout - controls sensors such as camera and rangefinders
  • Map Builder - uses Lookout to search for objects or construct maps
  • Pilot - path planning and localization via Map Builder results
  • Grasper - performs manipulations specified from map references
The Tekkotsu “Crew”

- Pilot and Grasper now share unified RRT planner for both navigation and manipulation.
  - Pilot can now plan for destination orientation
  - GraphicsData groups DualCoding shapes to reduce UI clutter (e.g. particle filter samples)
The Tekkotsu “Crew”

Navigating with the Tekkotsu Pilot
Owen Paul Watson, Dave Touretzky (FLAIRS 2011)
The Tekkotsu “Crew”

* In development:
  * 3D RRT for Calliope grasping
  * Footstep-based planner for Chiara navigation
New Vision Libraries

- Vision Processing

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<tr>
<th>(original image)</th>
<th>Color Segmentation</th>
<th>DualCoding</th>
<th>AprilTags</th>
<th>SIFT</th>
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- AprilTags from Edwin Olson at U. Mich (ported from Java to C++)
- SIFT from David Lowe at UBC (implemented from publication)
- Both built as standalone libraries for further reuse
Curriculum Updates

*Lectures, Labs, Tutorials, Homeworks, oh my!*

*Battle-tested course materials:*
http://chiara-robot.org/Course

- Lab 1: Walking the dog; compiling Tekkotsu behaviors
- Lab 2: State machines and the Storyboard tool
- Lab 3: Visual routines and sketches
- Lab 4: Local map builder and shapes
- Lab 5: Postures and motion sequences
- Lab 6: Using the Pilot to Move
- Lab 7: Gestalt Perception
- Lab 8: Kinematics
- Lab 9: Looking Glass
- Lab 10: Path Planning

- Homework 1: state machine programming problems from lab 2
- Homework 2: Color image segmentation
- Homework 3: Complete Lab 3 exercises
- Homework 4: Parsing the Tic-Tac-Toe Board
- Homework 5: Particle filter bingo
- Homework 6: Gestalt Perception (finish Lab 7)
- Homework 7: Complete Lab 8 exercises

*New wiki-based materials:*
http://wiki.tekkotsu.org

- Lab: Teleoperation and Sensor Observer
- Lab: Mirage and Virtual Worlds
- Lab: State Machines
- Lab: Storyboard Tool
- Lab: Events and the Event Logger
- Lab: MapBuilder and Shapes
- Lab: Tekkotsu and Software Engineering
- Lab: The Pilot and Odometry
- Lab: The Pilot and Localization
- Lab: The Pilot and Path Planning
- Lab: AprilTags

- Tutorial: State Machine Intro
- Tutorial: Defining New Node Classes
- Tutorial: Particle Filter Internals
Questions?