

# TK2



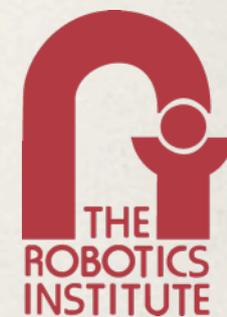
## What's New in Tekkotsu?

David S. Touretzky & Ethan Tira-Thompson

Carnegie Mellon Robotics Institute

*AAAI 2011 Robotics Workshop*

*Funded By National Science Foundation Award DUE-0717705*



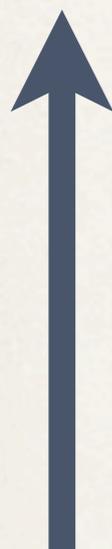


# What's New in Tekkotsu?

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- ❖ 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

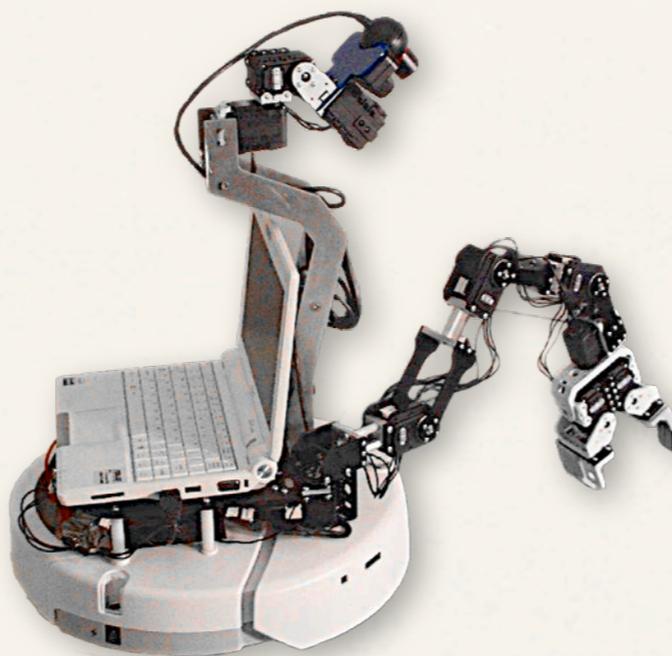


Manipulation

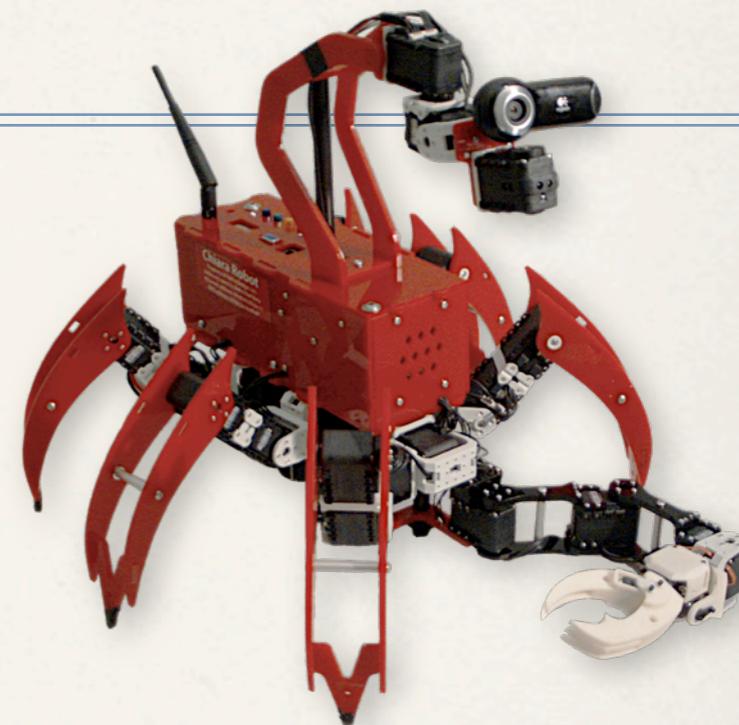
Mobility



Hand-Eye: \$995



Calliope



Chiara <\$4000



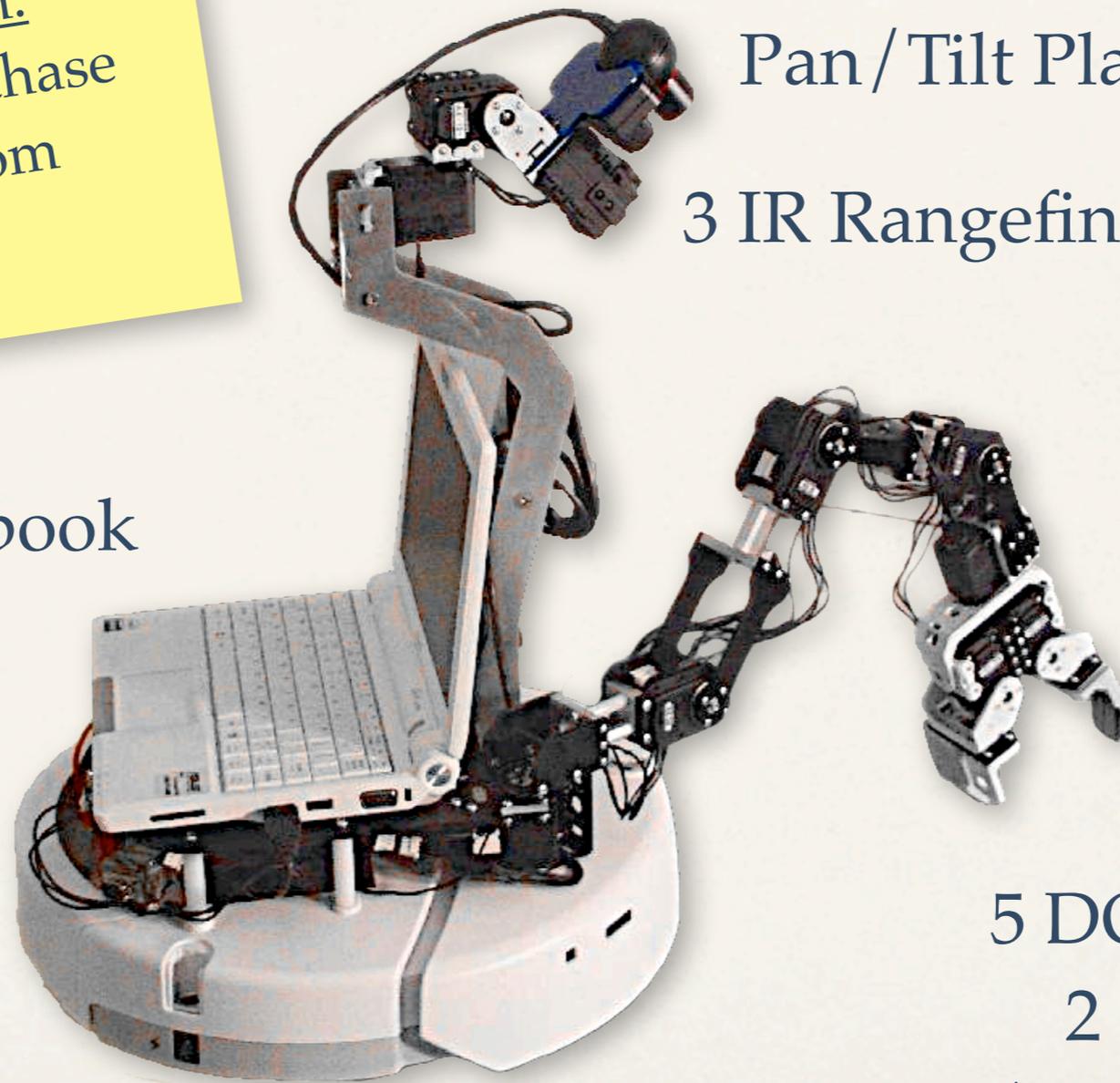
iRobot Create: \$785

# Tekkotsu Platforms

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

ASUS netbook

iRobot Create



Calliope

Pan/Tilt PlayStation Eye

3 IR Rangefinders

Eye & IR may  
be replaced  
by Kinect

Arm optional, or  
2<sup>nd</sup> arm may be added

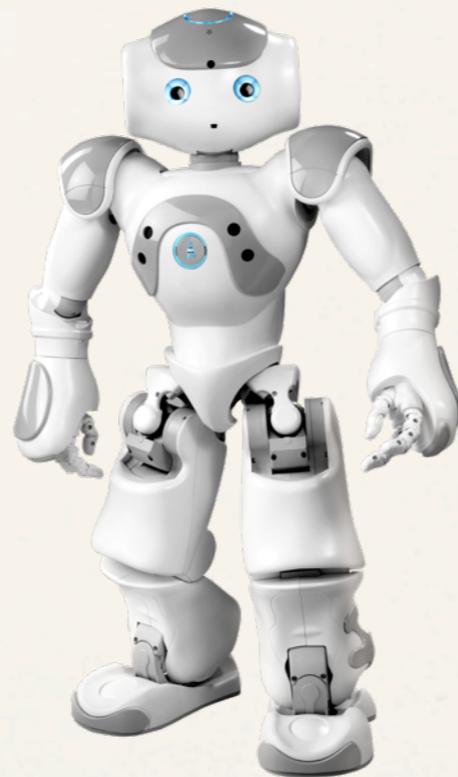
5 DOF Manipulator  
2 DOF Gripper  
(Robotis RX-Series)

# Ongoing Development

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Microsoft Kinect  
Jitu Das



Aldebaran Nao  
Orfanoudakis Emmanouil  
Intelligent Systems Laboratory  
Technical University of Crete



RoadNarrows SkewlZone  
Brainpack (sensor package)



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

# The Tekkotsu “Crew”

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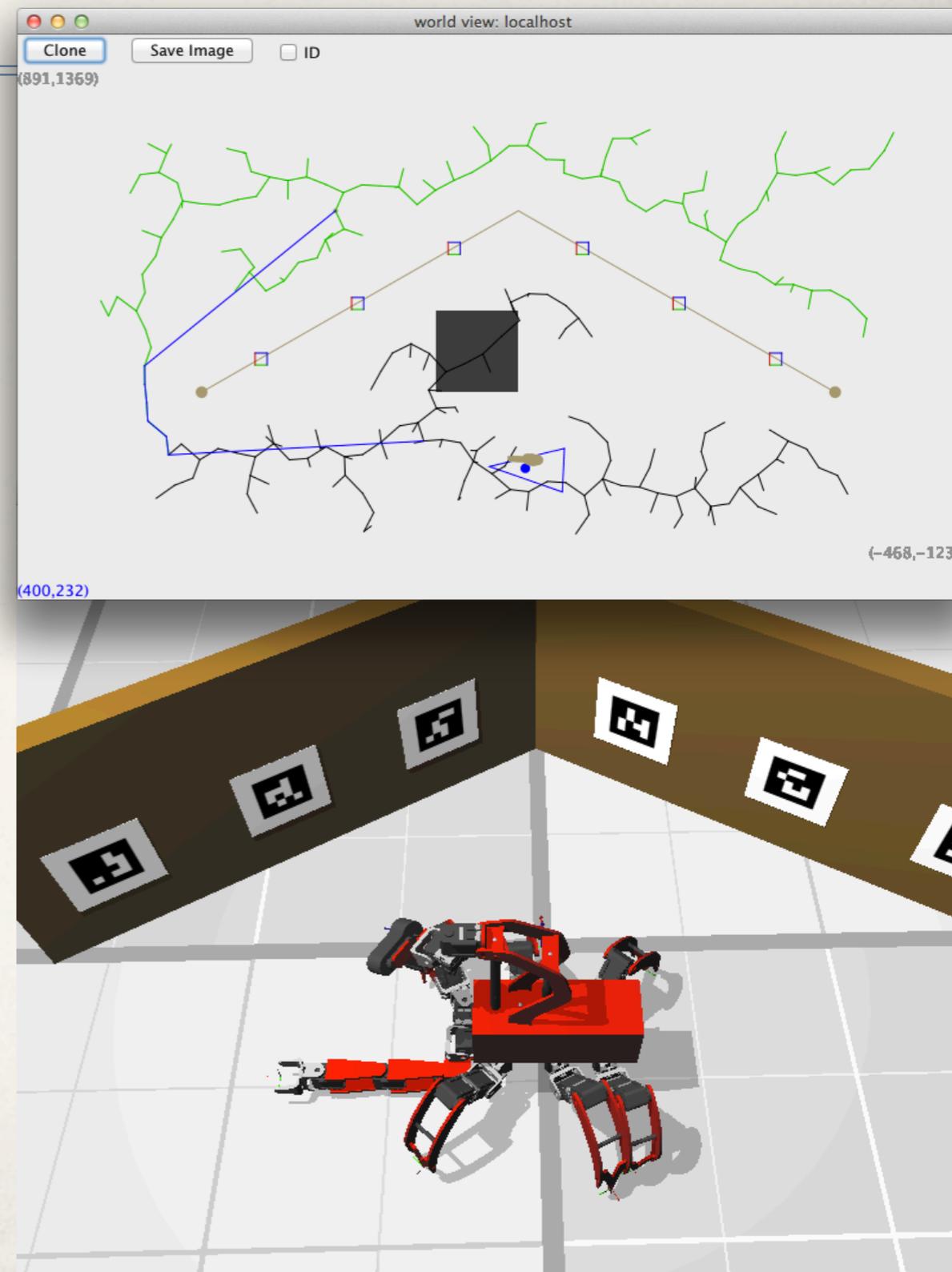
- ❖ AAAI 2010:

*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

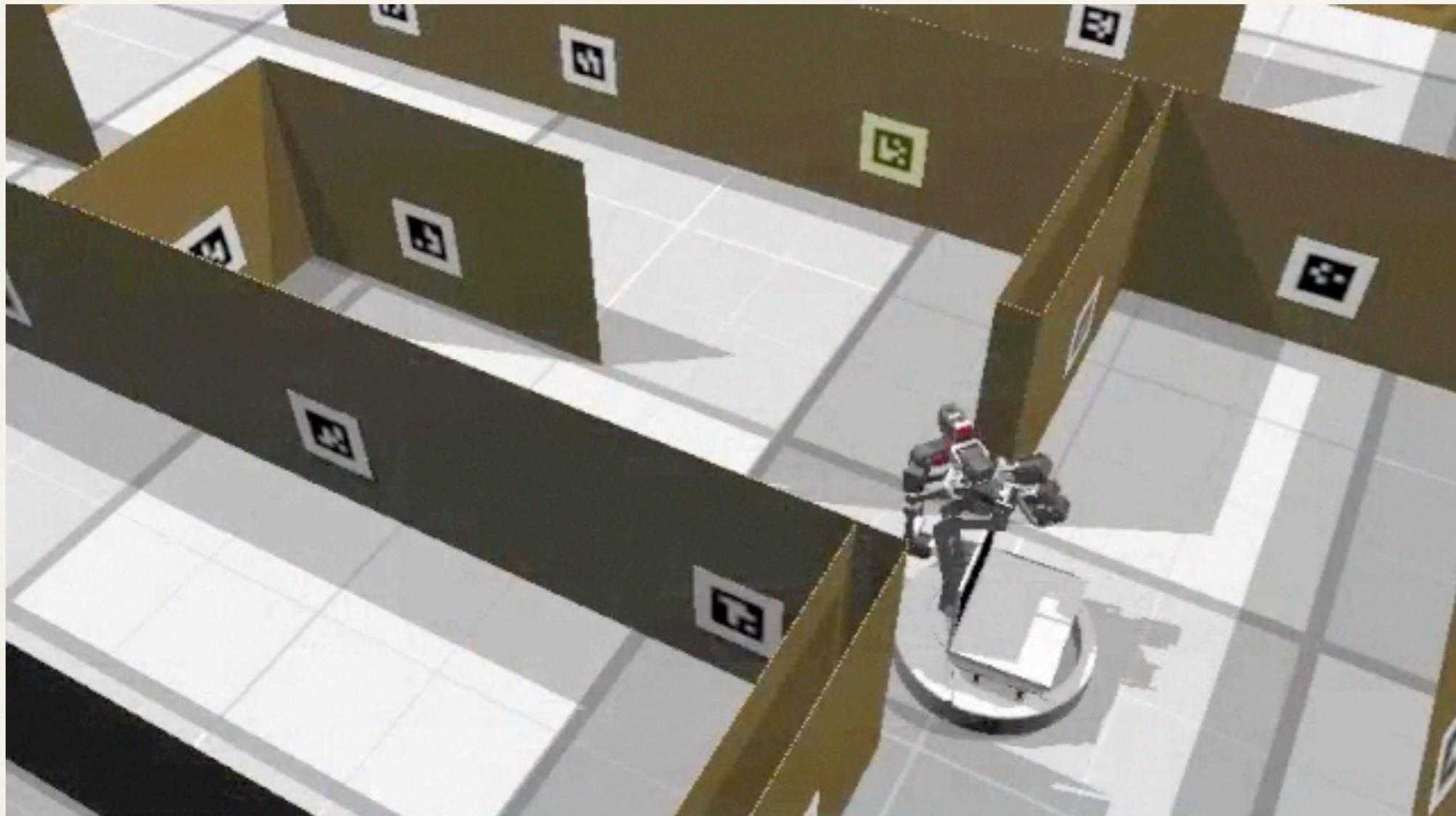
# The Tekkotsu “Crew”

- ❖ 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”

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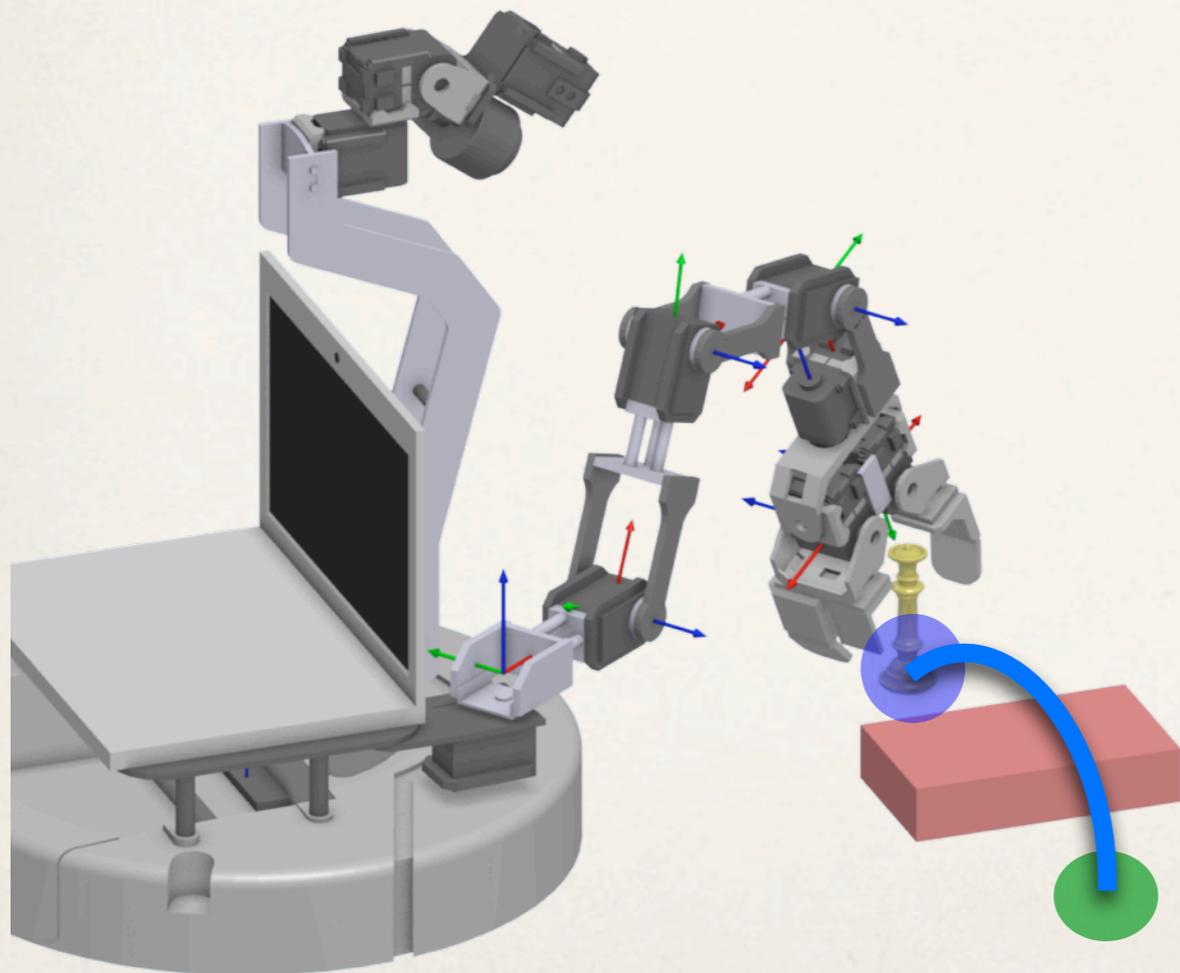
*Navigating with the Tekkotsu Pilot*  
Owen Paul Watson, Dave Touretzky (FLAIRS 2011)

# The Tekkotsu “Crew”

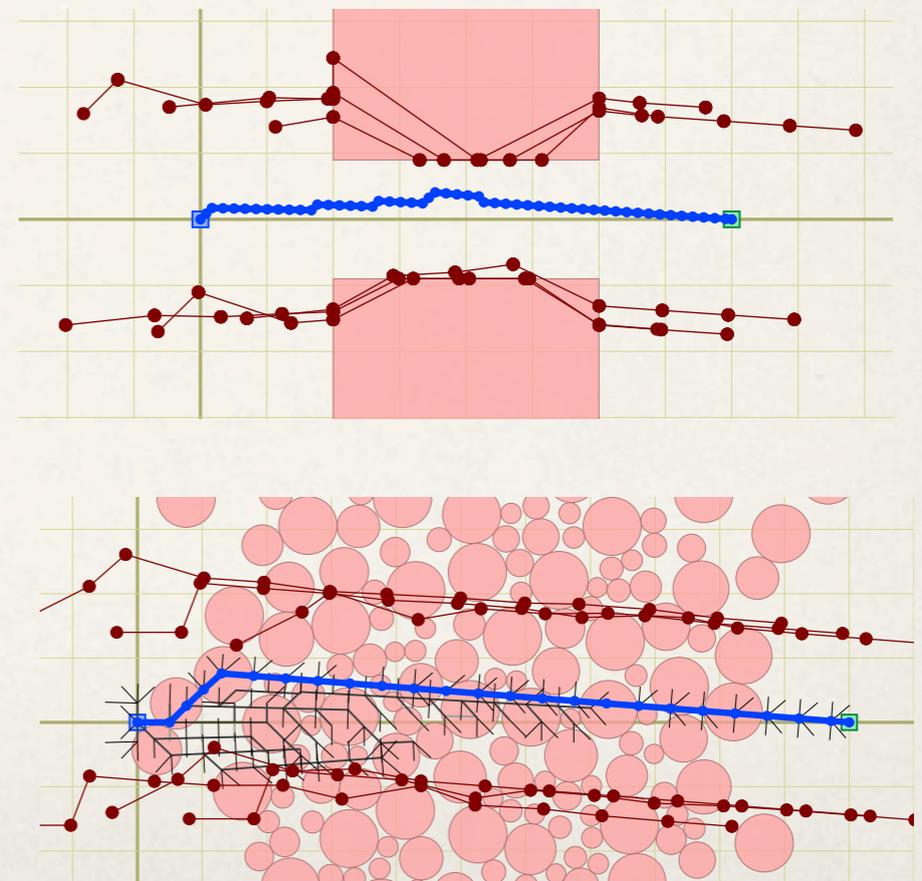
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- ❖ In development:

- ❖ 3D RRT for Calliope grasping

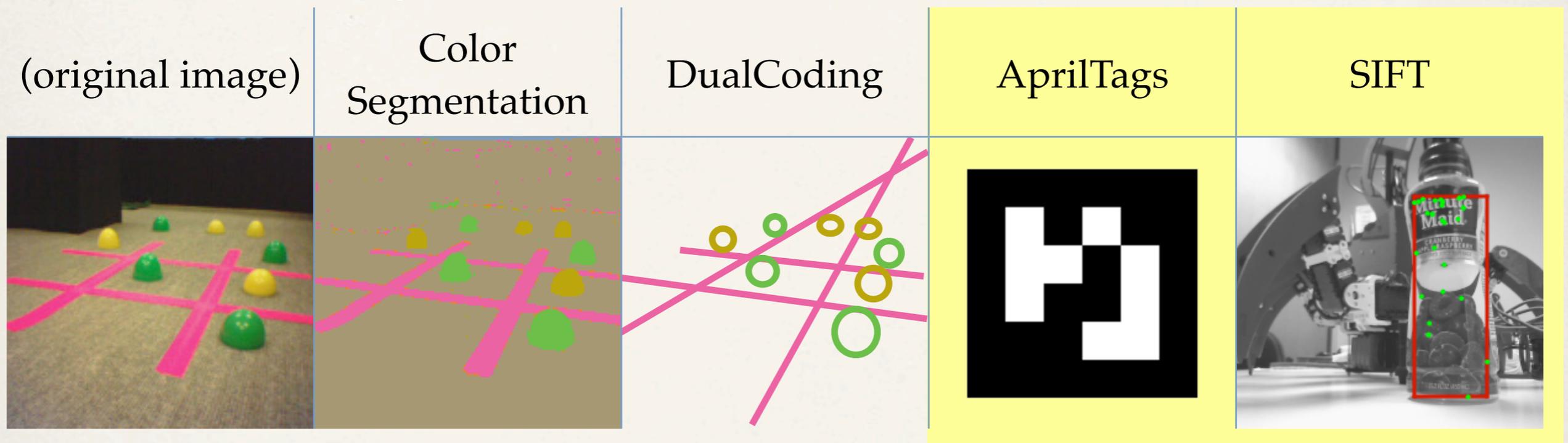


- ❖ Footstep-based planner for Chiara navigation



# New Vision Libraries

- ❖ Vision Processing



- ❖ 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

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- ❖ 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?

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