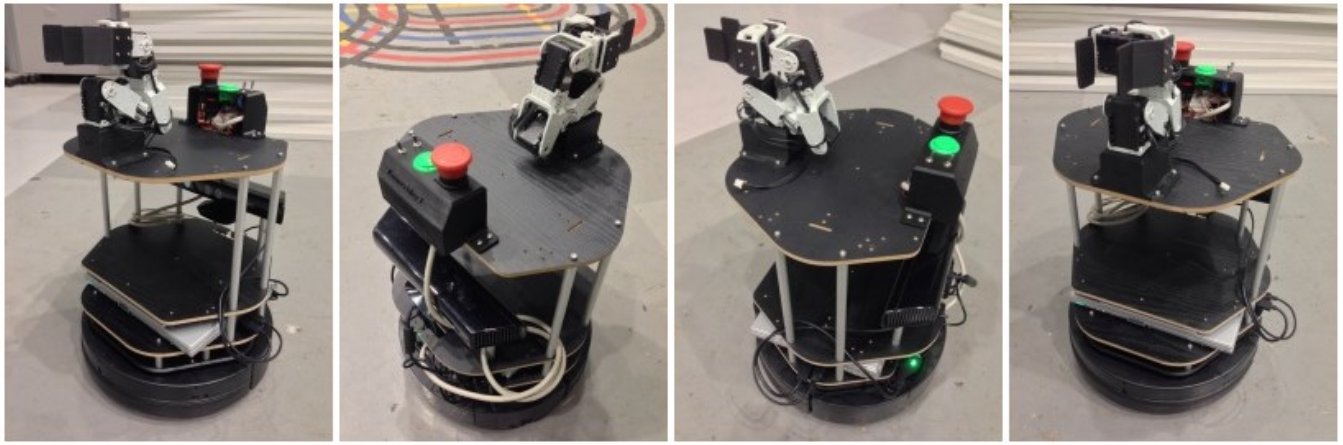
# 基于家庭服务机器人DIY的机器人教育

# Robotics Education by Home Service Robot DIY



合肥 2018-11-24 | 南开大学 Jeffrey 陈图川

**Jeffrey Too Chuan TAN（陈图川）**

# 简历

【教育背景】

2007 - 2010 **The University of Tokyo (日本)**, Department of Precision Engineering, Doctor of Engineering
2004 - 2007 **Universiti Tenaga Nasional (马来西亚)**, Master of Mechanical Engineering
1999 - 2003 **Universiti Tenaga Nasional (马来西亚)**, Bachelor of Mechanical Engineering (Hons.)

【工作经验】

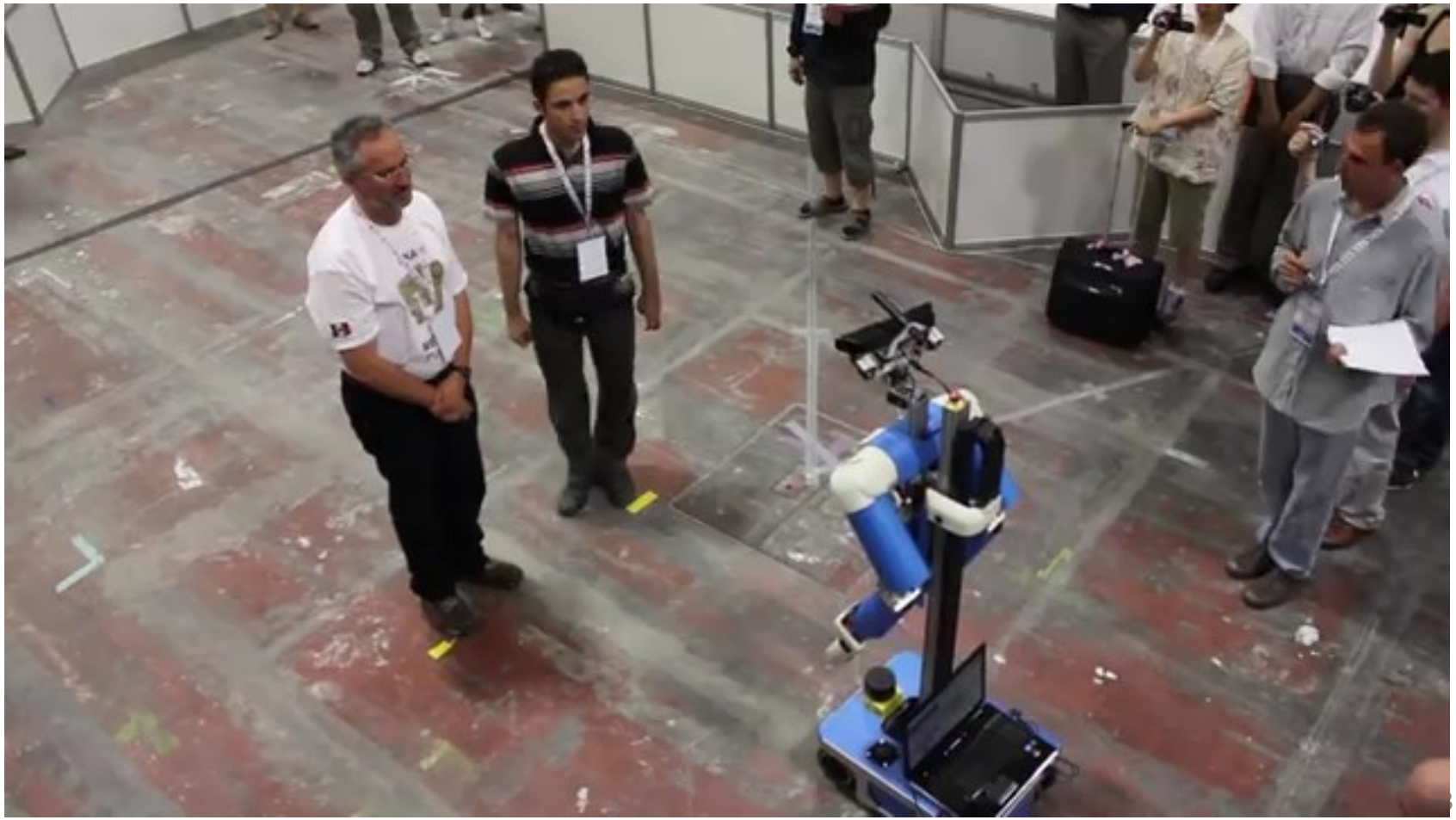
**2017 – 现今 副教授，南开大学（中国）《天津市青年千人计划》**
**2017 – 现今 特别研究员，玉川大学（日本）**
2014 - 2017 Project Assistant Professor, Institute of Industrial Science, The University of Tokyo (日本)
2015 - 2017 Adjunct Lecturer, Tokyo City University (日本)
2013 - 2014 Project Researcher, Institute of Industrial Science, The University of Tokyo (日本)
2011 - 2013 Project Researcher, National Institute of Informatics (日本)
2010 - 2011 Project Researcher, Graduate School of Engineering, The University of Tokyo (日本)
2004 - 2007 Tutor, Universiti Tenaga Nasional (马来西亚)

【国际学术组织兼职】

2016 - 现今 Committee (Service and Junior), **World Robot Summit**
2016 - 现今 Organizing Committee, **RoboCup Federation (@Home)**
2015 - 现今 Committee, **RoboCup@Home Education**
2014 - 现今 Organizing Committee, **RoboCup Japan (@Home)**

# RoboCup@Home 家庭组

RoboCup@Home旨在促进服务和助手机器人技术的发展，以使其未来的民间应用成为可能。比赛包含一组衡量标准，用以评估机器人在真实家庭环境中和其他场景中的能力。比赛的关键技术有：人机交互(human-robot interaction and cooperation)，动态环境中的导航，计算机视觉和自然光照条件下物体的识别，操纵物体，适应性行为和自适应学习(adaptive behaviors and learning)，环境智能(ambient intelligence)和系统集成(system integration)。



# 基于家庭服务机器人DIY的机器人教育

青少年的机器人教育 vs 大学的机器人科研

- Bottom-up vs Top-down
- 抽象问题 vs 现实问题/实际运用

人工智能，云计算与大数据的普及

- 人工智能的学习平台

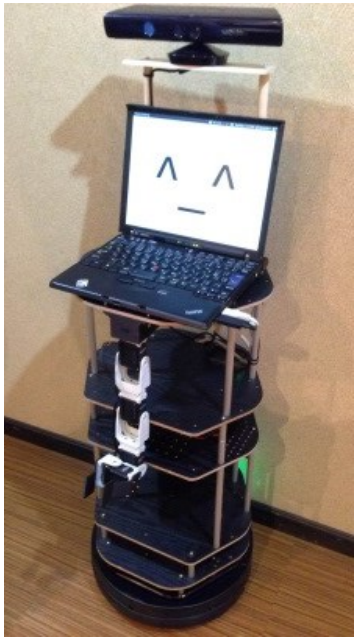
# 目录

1. 起源: KameRider队伍
2. 家庭服务机器人DIY，你我都做得到
   a. 机器人的腿: 移动平台，室内导航
   b. 机器人的眼: 机器人视觉，物件识别
   c. 机器人的手: 机械手臂，抓取物件
   d. 机器人的嘴: 语音识别，人机交互
   e. 机器人的脑: 人工智能，机械学习，云计算与大数据
3. 基于家庭服务机器人DIY的机器人教育
   RoboCup@Home Education Initiative


http://openbotics.org/kamerider/

# 1. 起源: KAMERIDER队伍

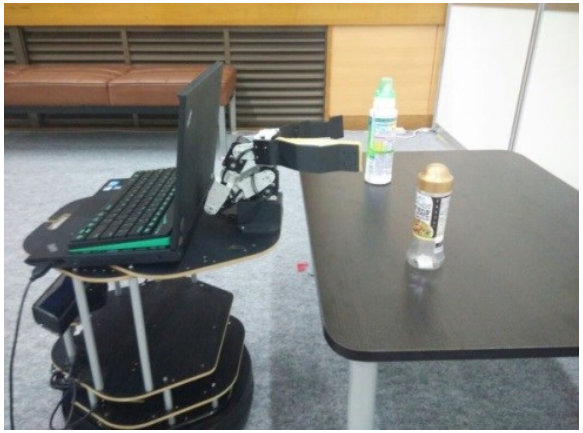
# 起源: KameRider队伍



- 2013 KameRider队伍建立
- 2014 RoboCup Japan Open参赛
  - 日本人工智能学会奖
    [Standard Platform for RoboCup@Home]


# 2015 国际连队 东大-南开-UTM

- 2015 RoboCup Japan Open参赛
  - Education Challenge冠军



# 参加RoboCup国际大赛

- 国际RoboCup 2015合肥参赛
  - 总排行第7位
  - 简易的机器人开发手法，受到国际赛裁判们的肯定和鼓励

# 2016 国际连队 东大-南开-UTM-芝浦工大

- 2016 RoboCup Japan Open参赛
  - Education Challenge亚军
- 国际RoboCup 2016 Leipzig参赛
  - 总排行第7位


# 2017 国际连队 南开-UTM-芝浦工大

- 2017 RoboCup Japan Open参赛
  - Education Challenge冠军
- 国际RoboCup 2017名古屋
  - 获得国际赛参赛权


# 历届比赛中取得的成就

南開大學 新闻网
NEWS.NANKAI.EDU.CN NEWS.NKU.CN
首页 觉悟网 学习网 大学报

您当前的位置：南开要闻 正文

## 南开学子荣获日本机器人大赛冠军

来源：南开新闻网 发稿时间：2015-05-17 10:48

**南开新闻网讯**（记者 乔仁铭）近
陪，本科生牛雪松、金乾隆、李丰廷
队，荣获日本福井县举办的2015RO

南開大學 新闻网
NEWS.NANKAI.EDU.CN NEWS.NKU.CN
首页 觉悟网 学习网 大学报

您当前的位置：媒体南开 正文

## 中国科学报：机器人道路上的追梦者——记RoboCup日本公开赛三连冠得主南开大学团队

来源：中国科学报2017年6月27日8版 发稿时间：2017-06-27 17:33


8 科创 INNOVATION 中国科学报

机器人道路上的追梦者

——记 RoboCup 日本公开赛三连冠得主南开大学团队

中科院院士

一对学霸双胞

南開大學 新闻网
NEWS.NANKAI.EDU.CN NEWS.NKU.CN
首页 觉悟网

您当前的位置：南开要闻 正文

## 南开学子日本机器人世界公开赛再夺冠

来源：南开新闻网 发稿时间：2017-05-10 15:45

**南开新闻网讯**(通讯员 韩书宁 霍菲)近日，在南开大学计算机与控制工程学院段峰副教

南開大學 新闻网
NEWS.NANKAI.EDU.CN NEWS.NKU.CN
首页 觉悟网 学习网 大学报

您当前的位置：南开要闻 正文

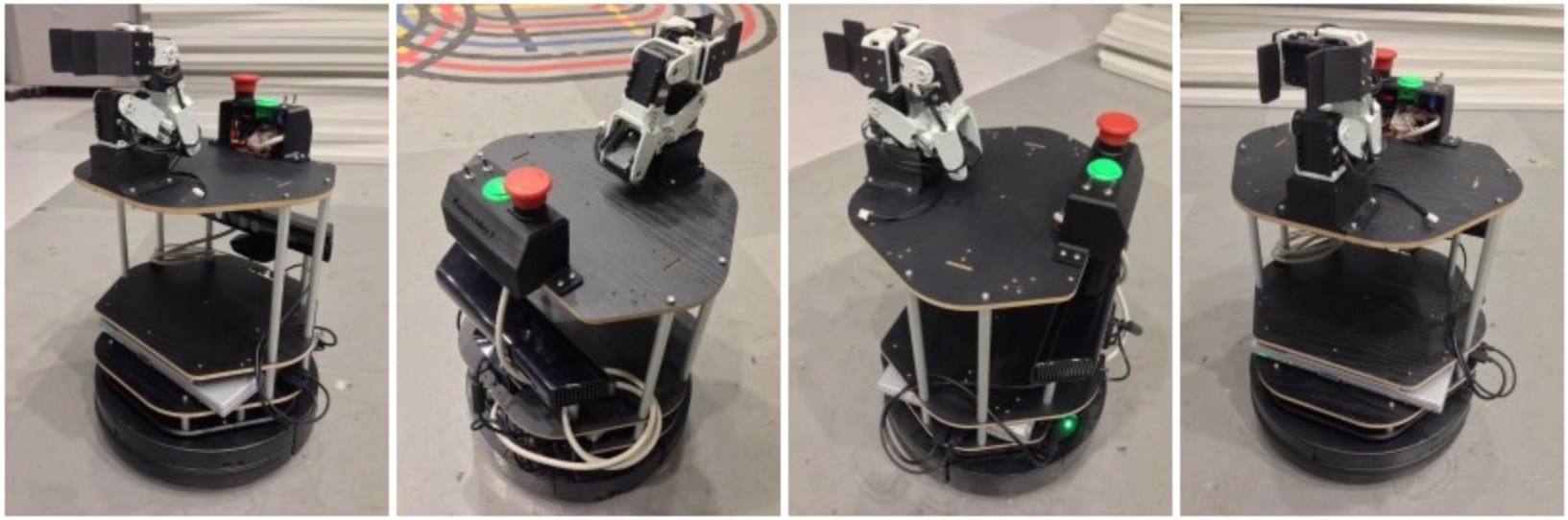
## 南开学子夺冠2017年亚太机器人世界杯

来源：南开新闻网 发稿时间：2017-12-25 11:28

**南开新闻网讯**(通讯员 梁长浩)日前，2017年亚太机器人世界杯(RoboCup Asia-Pacific,

# 历届比赛中取得的成就

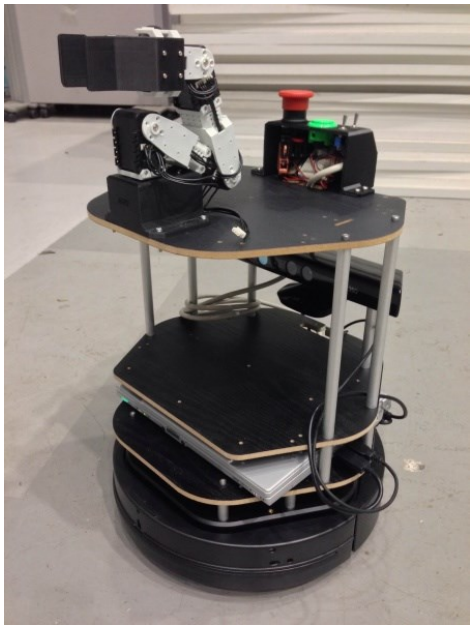
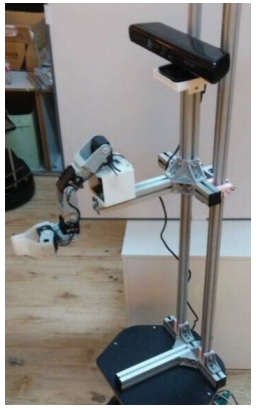
2018 RoboCup Japan Open 2018 Ogaki, RoboCup @Home Education [2nd Place]
2018 RoboCup机器人世界杯中国赛, RoboCup家庭组技术挑战赛 [冠军]
2017 RoboCup Asia-Pacific 2017 Bangkok, RoboCup @Home [1st Place]
2017 RoboCup Asia-Pacific 2017 Bangkok, RoboCup @Home [1st Place]
2017 RoboCup Asia-Pacific 2017 Bangkok, RoboCup @Home Education [1st Place]
2017 RoboCup 2017 Nagoya, Japan (International), RoboCup @Home SSPL [Overall ranked 4th out of 7 qualified teams]
2017 RoboCup Japan Open 2017 Nagoya, RoboCup @Home Education [1st Place]
2017 RoboCup Japan Open 2017 Nagoya, RoboCup @Home Simulation [2nd Place]
2016 RoboCup 2016 Leipzig, Germany (International), RoboCup @Home League [Overall ranked 7th out of 23 qualified teams]
2016 RoboCup Japan Open 2016 Aichi, RoboCup @Home Education [2nd Place]
2016 RoboCup Japan Open 2016 Aichi, RoboCup @Home Simulation [1st Place]
2015 RoboCup 2015 Hefei, China (International), RoboCup @Home League [Overall ranked 7th out of 17 qualified teams]
2015 RoboCup Japan Open 2015 Fukui, RoboCup @Home SPL [1st Place]
2015 RoboCup Japan Open 2015 Fukui, RoboCup @Home Simulation [3rd Place]
2014 Intelligent Home Robotics Challenge 2014 [Overall 3rd Place]
2014 Intelligent Home Robotics Challenge 2014 [Mobile Robot Category 3rd Place]
2014 Japanese Society for Artificial Intelligence (JSAI) Award [Standard Platform for RoboCup @Home]
2014 RoboCup Japan Open 2014 Fukuoka, RoboCup @Home Simulation [First Runner Up]
2013 Japanese Society for Artificial Intelligence (JSAI) Award [SIGVerse for RoboCup @Home Simulation]
2013 RoboCup Japan Open 2013 Tokyo, RoboCup @Home Simulation [First Runner Up]



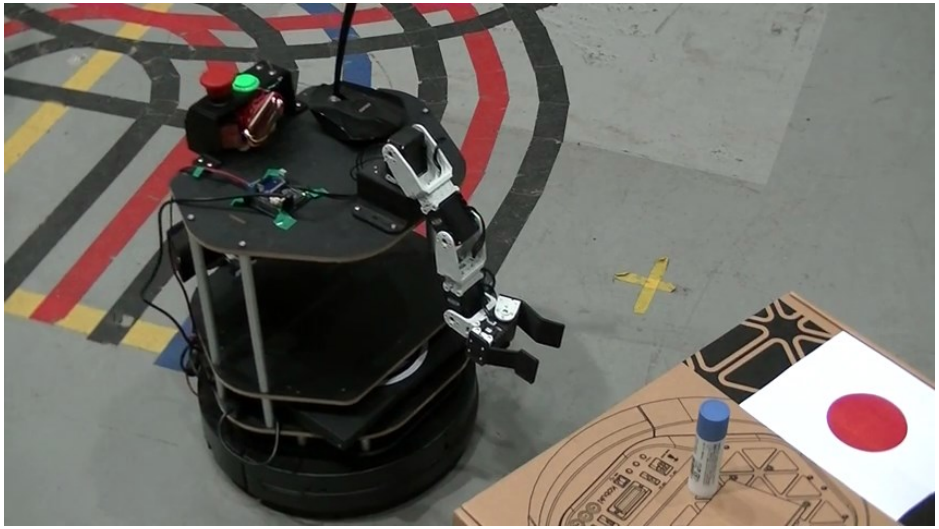
http://www.robocupathomeedu.org/robots

# 2. 家庭服务机器人DIY，你我都做得到

# 家庭服务机器人的开源教育平台



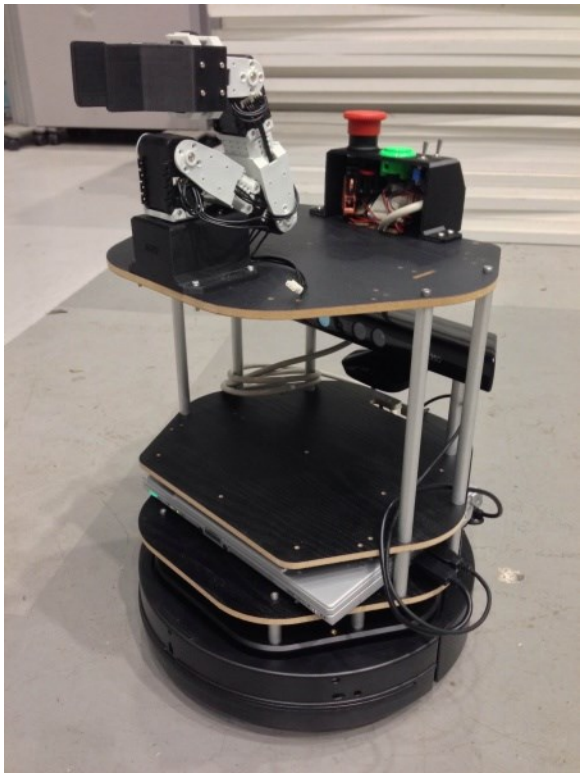




# 基本概念

- 开源教育平台
  - 简易入门级平台，成本廉宜，广泛的开源社区支持
- 现今设计
  - 基本机器人平台
  - 模块化加载项

# 系统细节

- 移动平台
  - TurtleBot2 (Kobuki)
- 机器人视觉
  - Kinect for Xbox 360
- 机械手臂
  - TurtleBot Arm
  - 升降平台
- 人机交互
  - 数码I/O
  - 安卓界面
  - 机器人脸部表情系统
- 软件框架
  - 导航
  - 抓取物件
  - 语音识别
  - 人物/物件识别



# 多元的机器人组合

- RoboCup Japan Open 2015和RoboCup 2015合肥赛中，KameRider队伍机器人不同的硬件组合


# 开源的解决方案

开源家庭服务机器人教育平台

- 开放课程教材: http://www.robocupathomeedu.org/learn
- 开源代码: https://github.com/robocupathomeedu/
- 机器人视频: https://www.youtube.com/user/kameriderteam

# 硬件成本

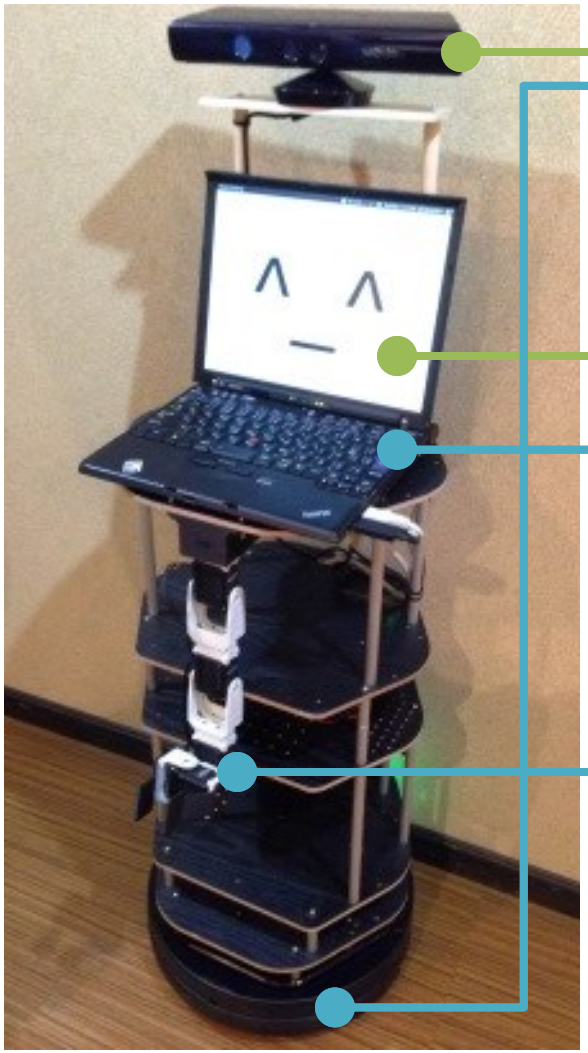
- 目前机器人的硬件成本

| Item | Qty | Cost (USD) |
|---|---|---|
| **Mobile platform (TutleBot2)** | 1 | 1,000 |
| **Robot arm** | 1 | 600 |
| **Elevated upper platform** | 1 | 600 |
| **Motion sensor (MS Kinect)** | 2 | 500 |
| **Electronics and miscellaneous** | 1 | 300 |
| **Controller and interface system (Laptop PC)** | 1 | 2,000 |
| **Total** | | **5,000** |

**ORP: ~5,000 USD**

**PR2: ~400,000 USD**

# 家庭服务机器人DIY，你我都做得到



a. 机器人的**腿**
   - 移动平台，室内导航

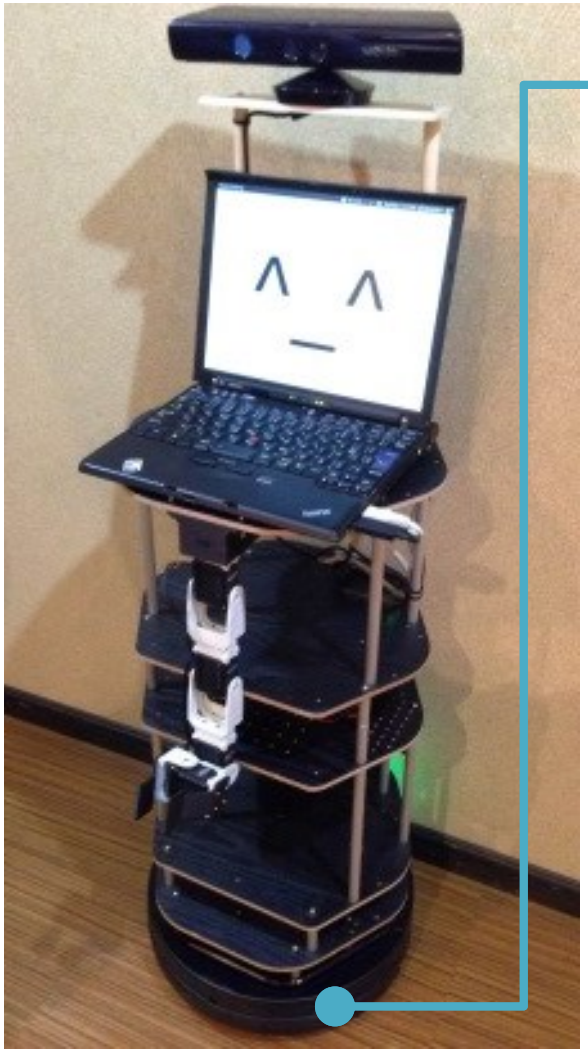
b. 机器人的**眼**
   - 机器人视觉，物件识别

c. 机器人的**手**
   - 机械手臂，抓取物件

d. 机器人的**嘴**
   - 语音识别，人机交互

e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

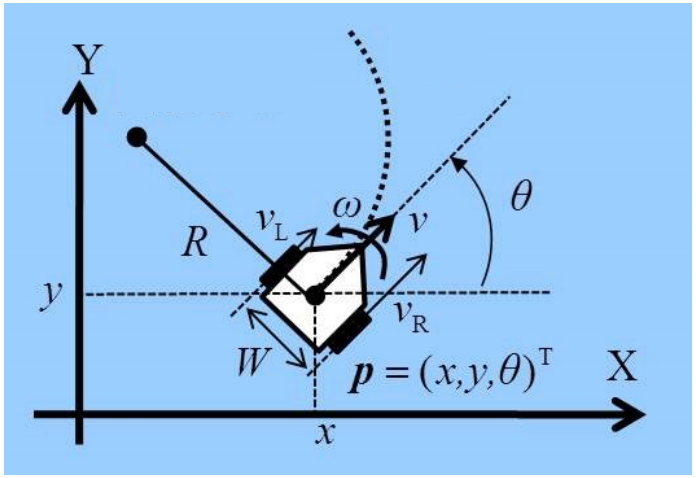
# 家庭服务机器人DIY，你我都做得到

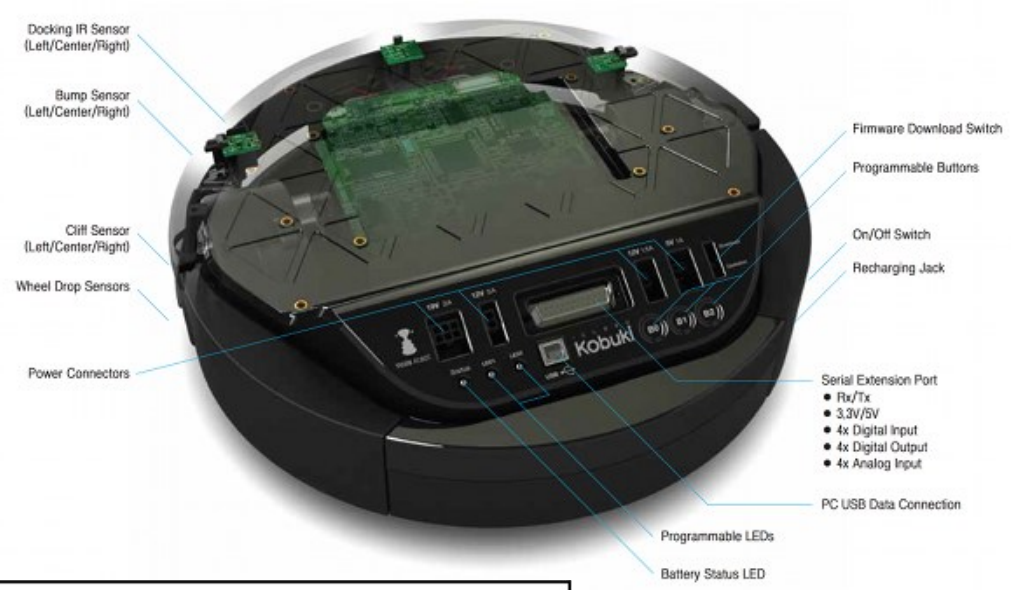


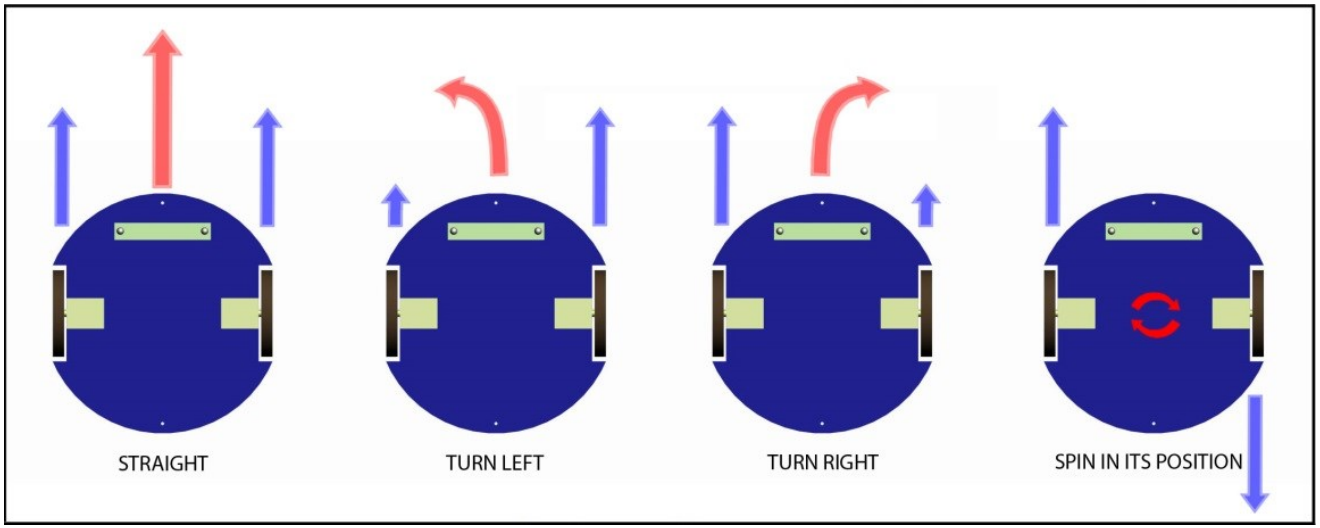
a. 机器人的**腿**
   - 移动平台，室内导航
b. 机器人的**眼**
   - 机器人视觉，物件识别
c. 机器人的**手**
   - 机械手臂，抓取物件
d. 机器人的**嘴**
   - 语音识别，人机交互
e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

# 2a. 机器人的腿: 移动平台，室内导航

- 相对双轮移动平台

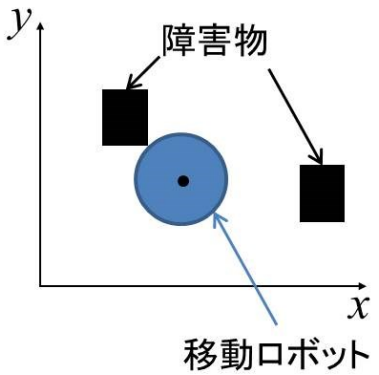


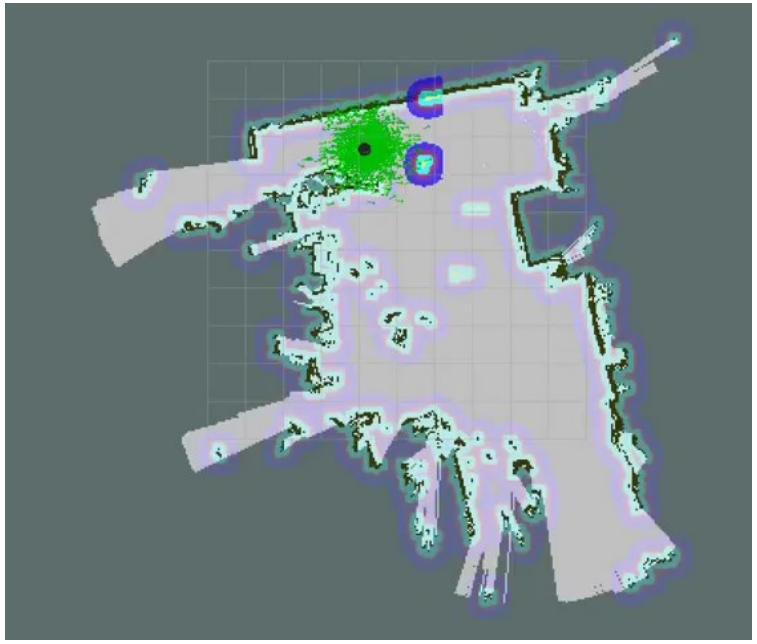



# 2a. 机器人的腿: 移动平台，室内导航

- 室内导航
  - 机器人定位Adaptive Monte Carlo Localization (AMCL)
  - Simultaneous Localization and Mapping (SLAM)地图建筑
  - 回避静动态障碍物

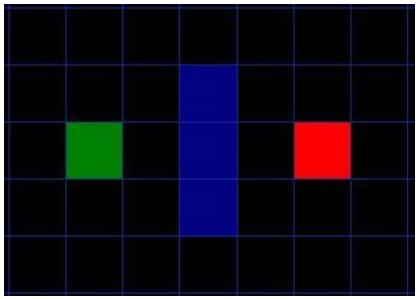


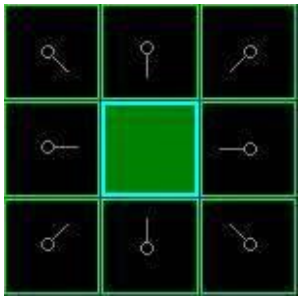



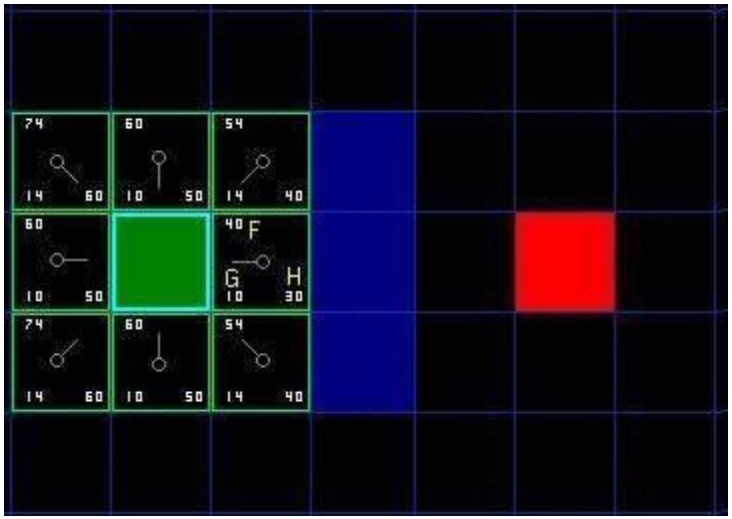
# 2a. 机器人的腿: 移动平台，室内导航

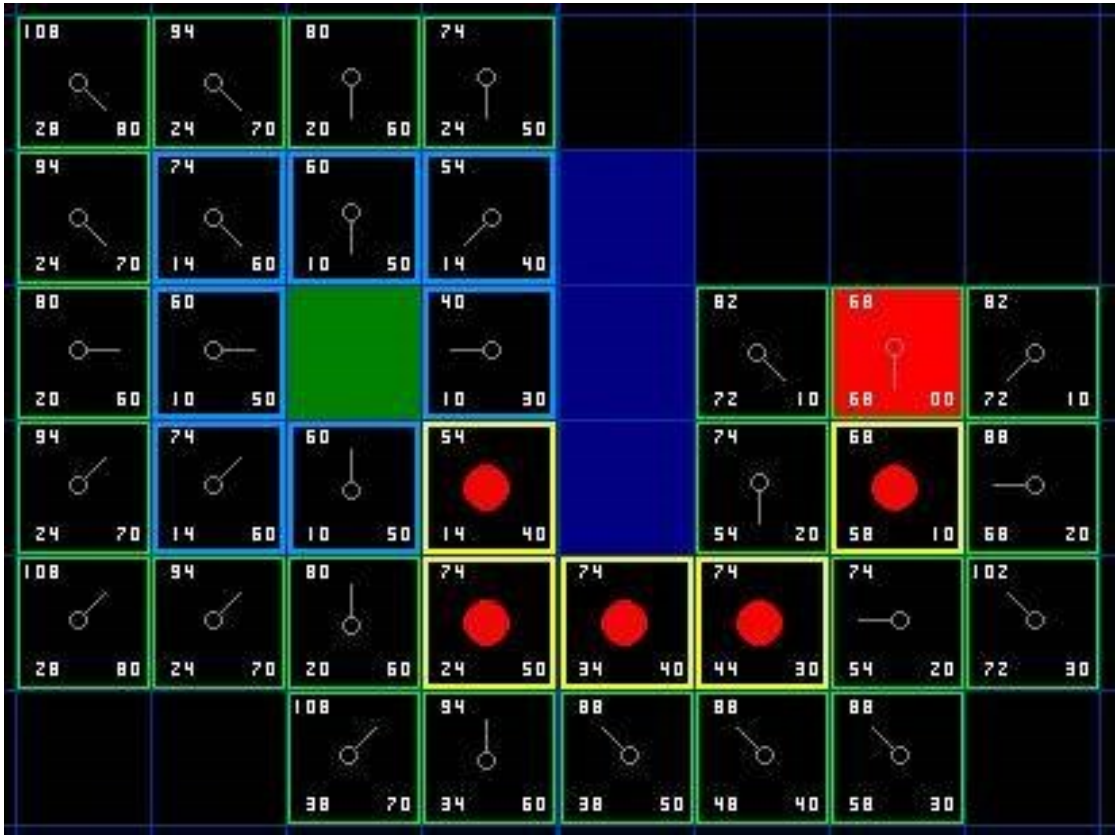
- 室内导航
  - 路径规划
  - 例如:A*算法(路径最短成本) $f(n) = g(n) + h(n)$ ($start \to n$, $n \to goal$)

[http://www.policyalmanac.org/games/aStarTutorial.htm]





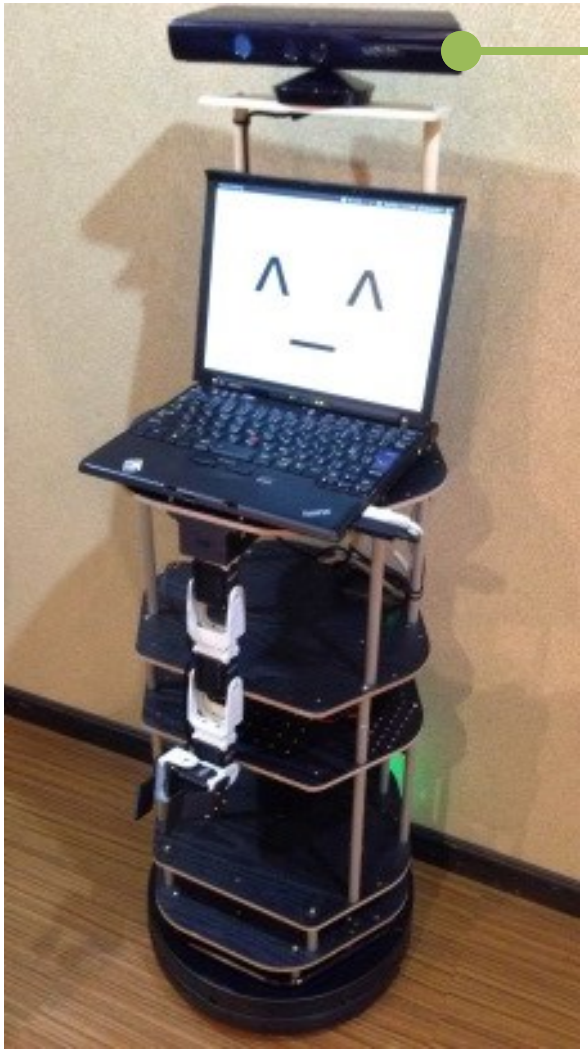


# Robot Navigation
# Autonomous Vehicle


[https://www.youtube.com/watch?v=tiwVMrTLUWg]

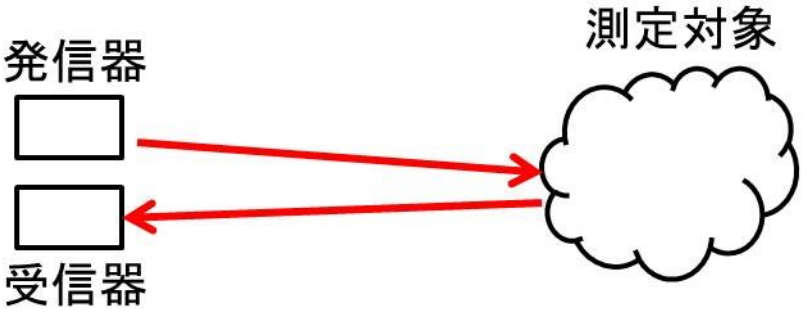
# 家庭服务机器人DIY，你我都做得到



a. 机器人的**腿**
   - 移动平台，室内导航
b. 机器人的**眼**
   - 机器人视觉，物件识别
c. 机器人的**手**
   - 机械手臂，抓取物件
d. 机器人的**嘴**
   - 语音识别，人机交互
e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

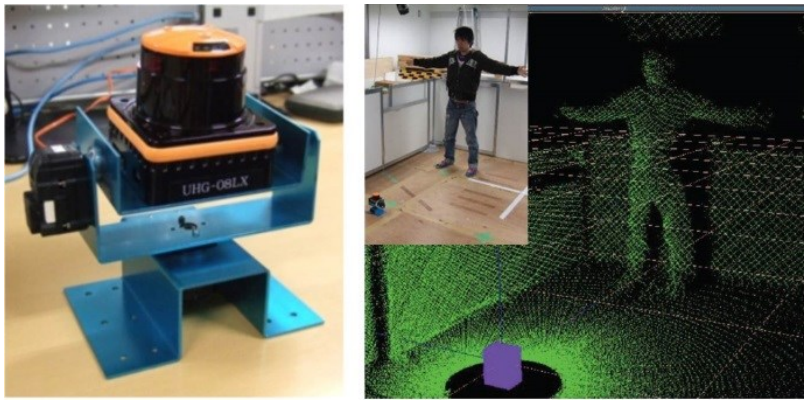
# 2b. 机器人的眼: 机器人视觉，物件识别

- 机器人视觉
  - 激光距离传感器，
    超声波距离传感器，
    红外线3D距离图像
    摄像头等等

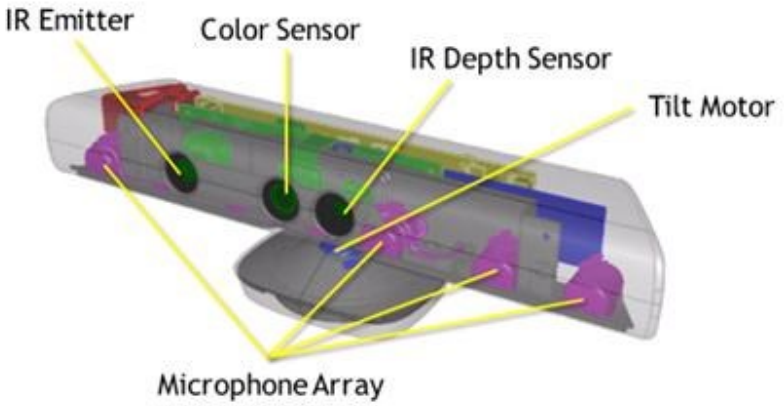




2D激光距离传感器

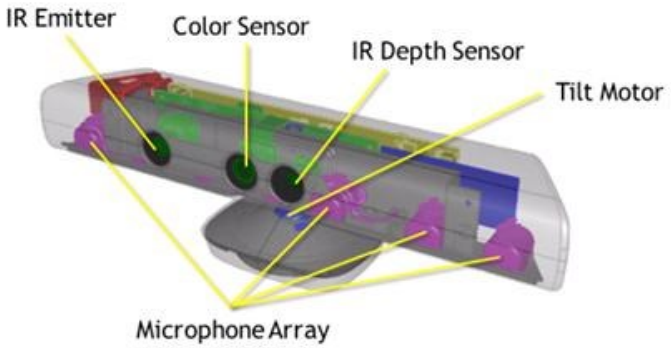


3D激光距离传感器

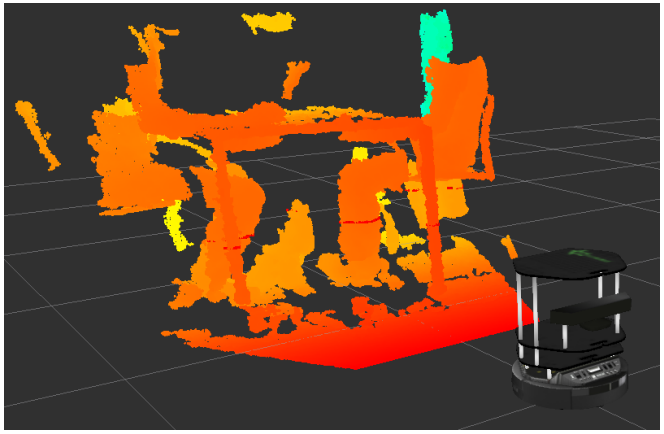


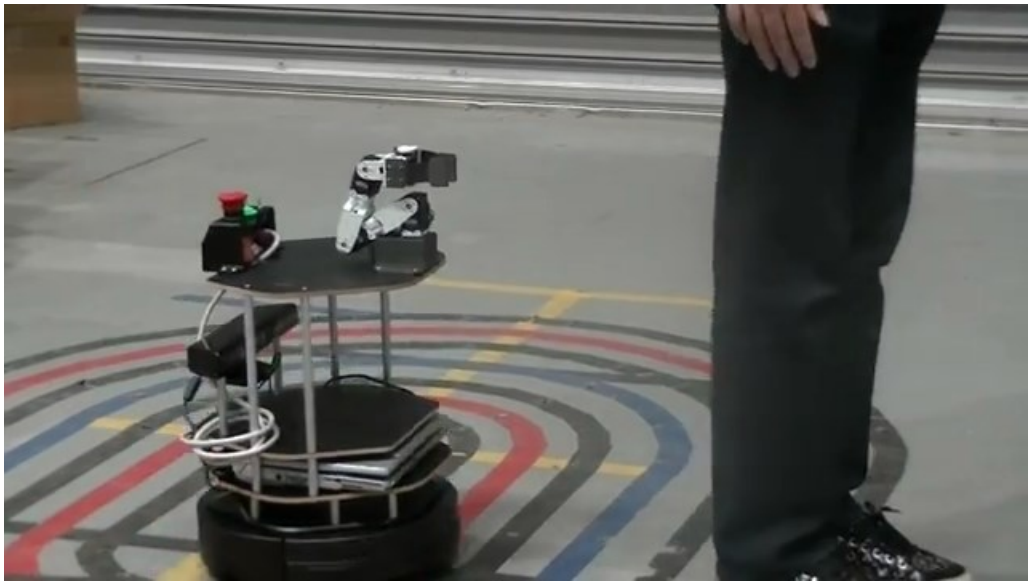
# 2b. 机器人的眼: 机器人视觉，物件识别

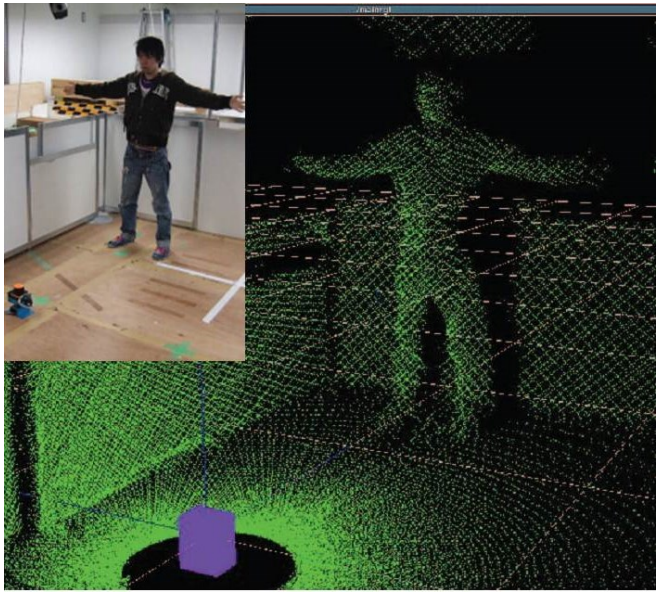
- 机器人视觉
  - 使用RGB-D传感器环境识别




[https://msdn.microsoft.com/en-us/library/jj131033.aspx]



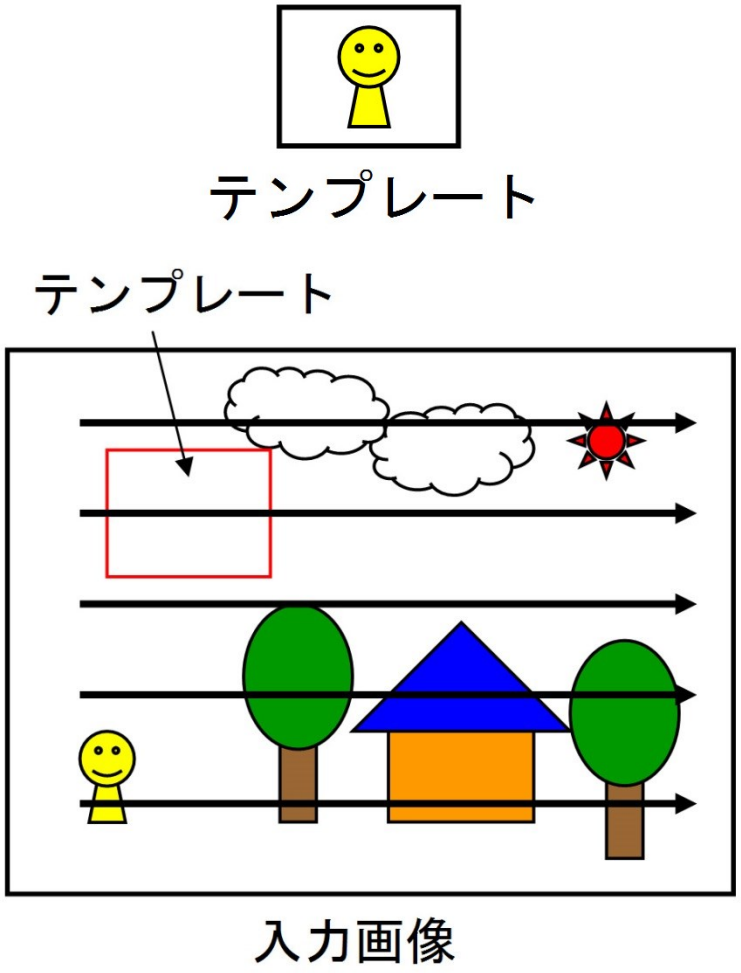




# 2b. 机器人的眼: 机器人视觉，物件识别

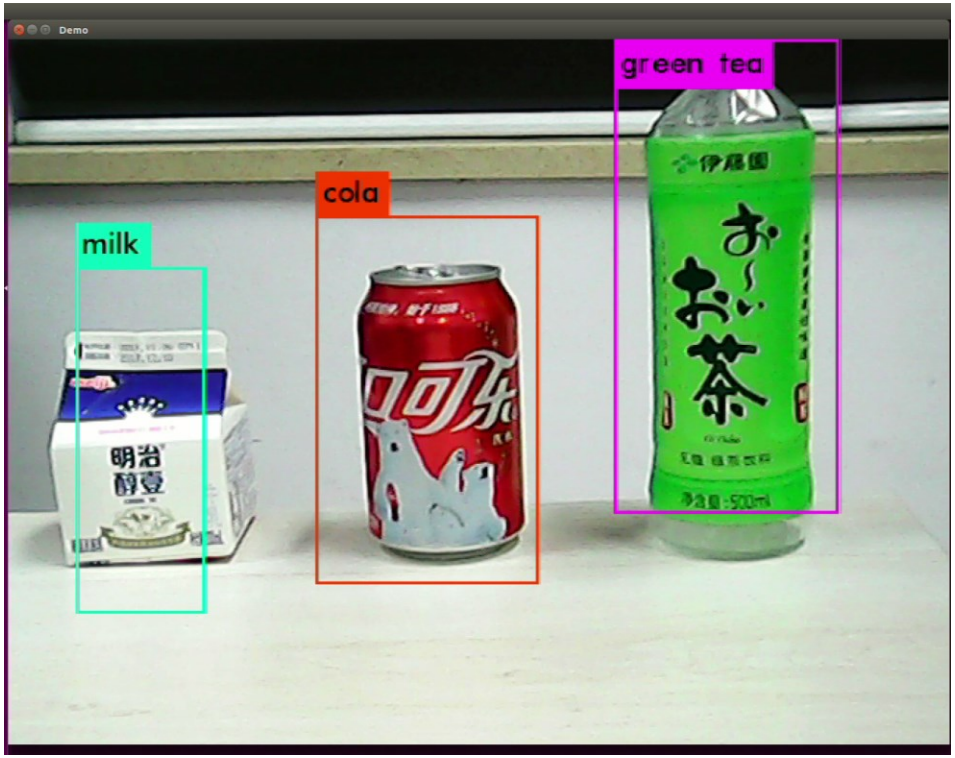
图像处理，模式匹配

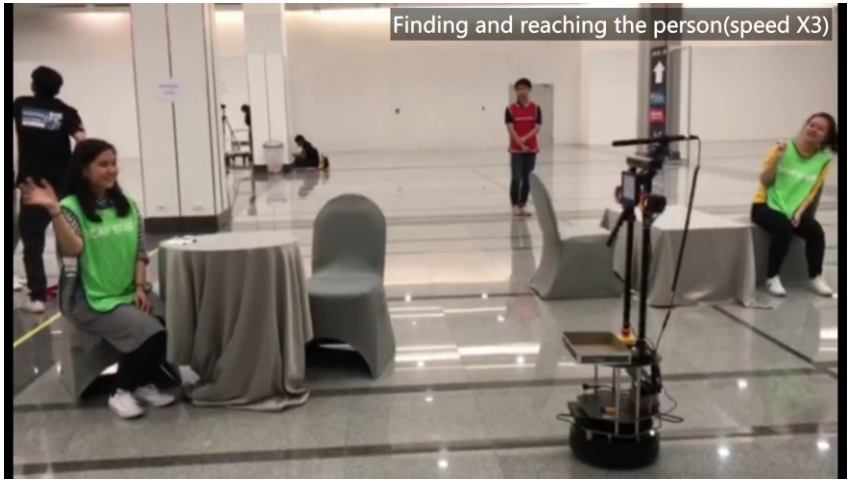
- 图案: 图像特征和像素值
- 模板匹配
- 相异的计算
  - SAD (Sum of Absolute Difference)
  - SSD (Sum of Squared Difference)
- 相似程度的计算
  - NCC (Normalized Cross Correlation)



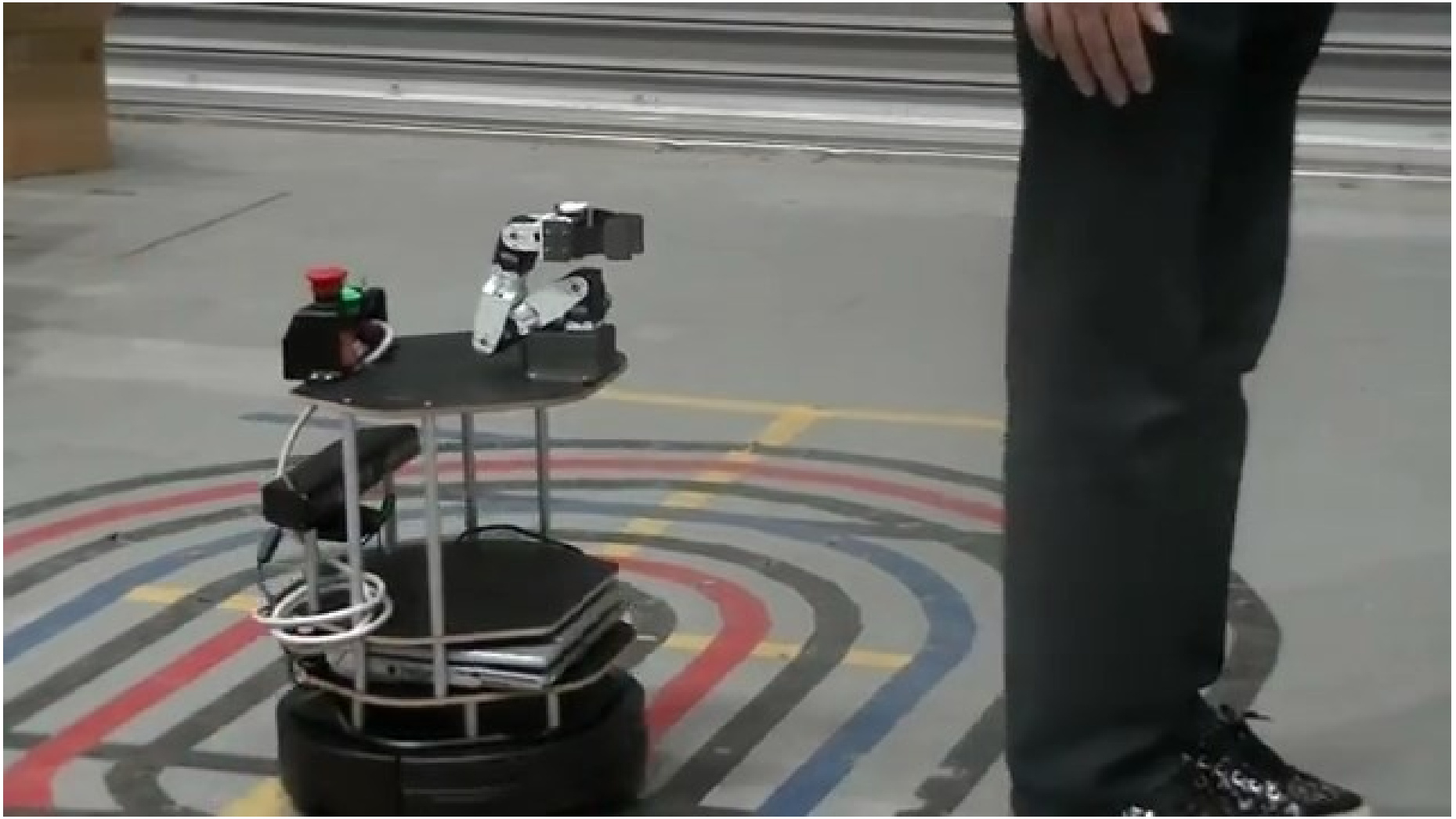

模板匹配

# 2b. 机器人的眼: 机器人视觉，物件识别



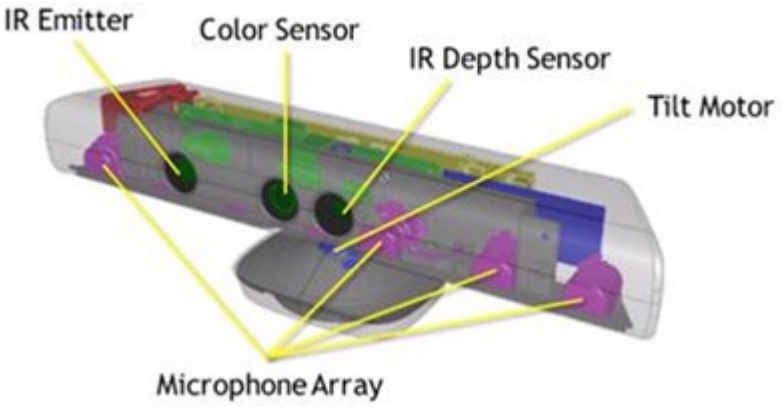
# People Tracking (Follow Me)

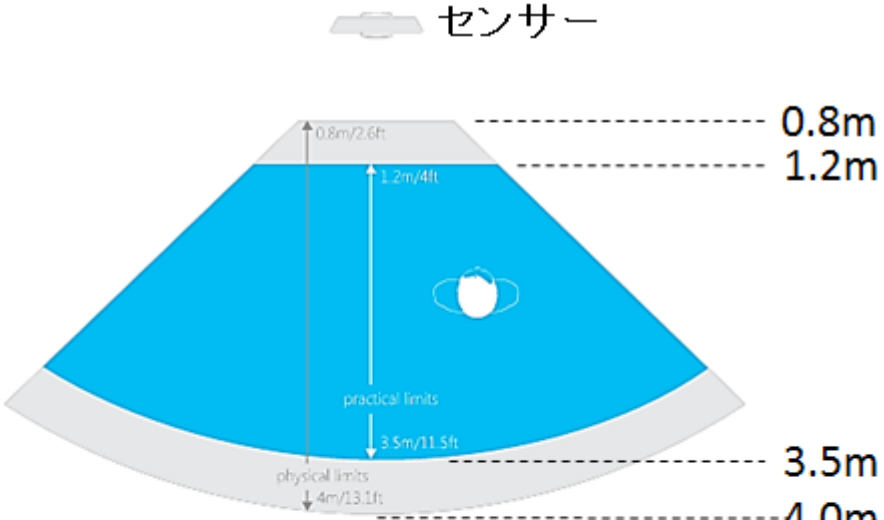


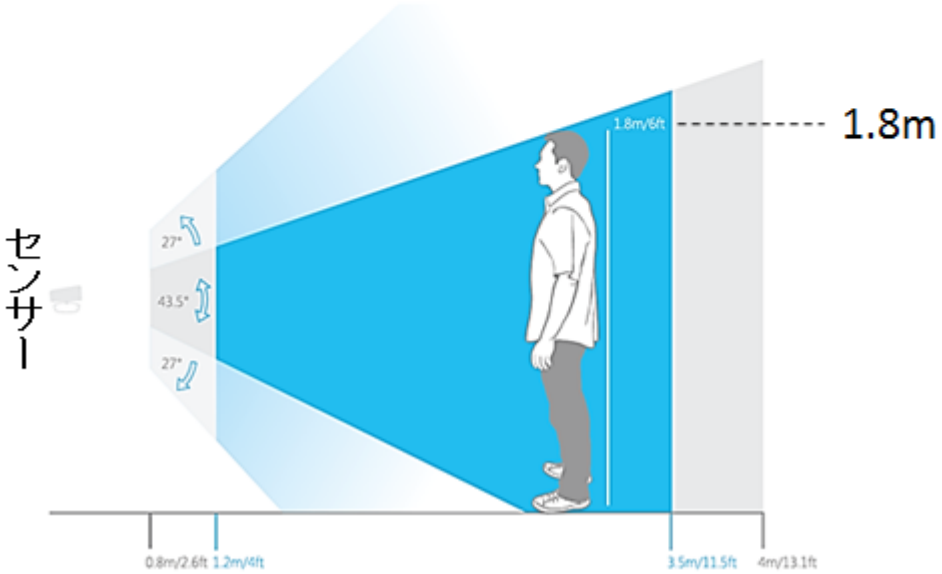
# RGB-D Sensor

3D MS Kinect sensor

- RGB Color VGA Video camera
- Depth sensor
  - Infrared projector
  - Monochrome CMOS sensor
- Resolution 640 x 480 pixel
- 30 FPS

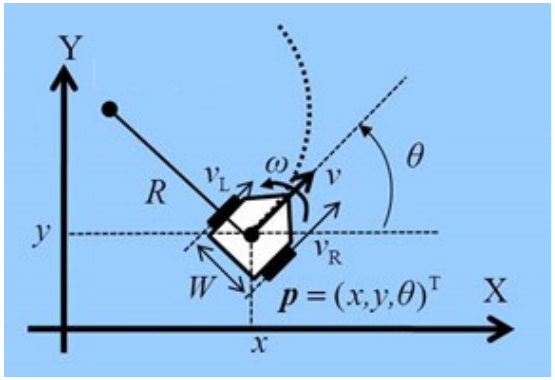


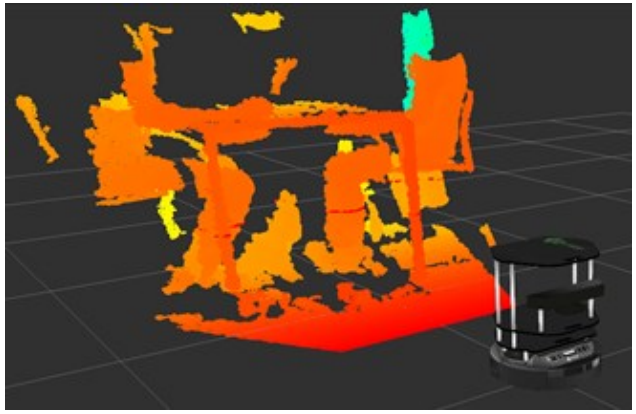



# People Tracking (Follow Me)

- Parallel Two-Wheel Vehicle (Mobile Robot)



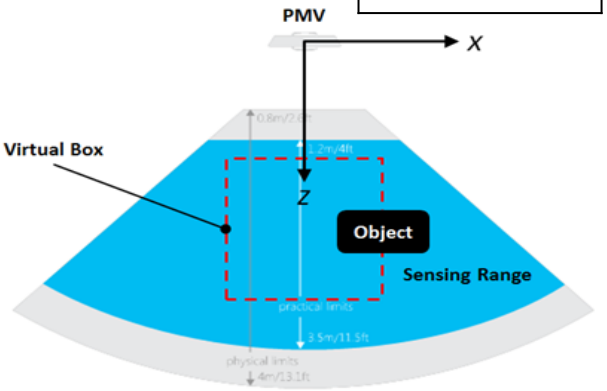



Data Point Cloud

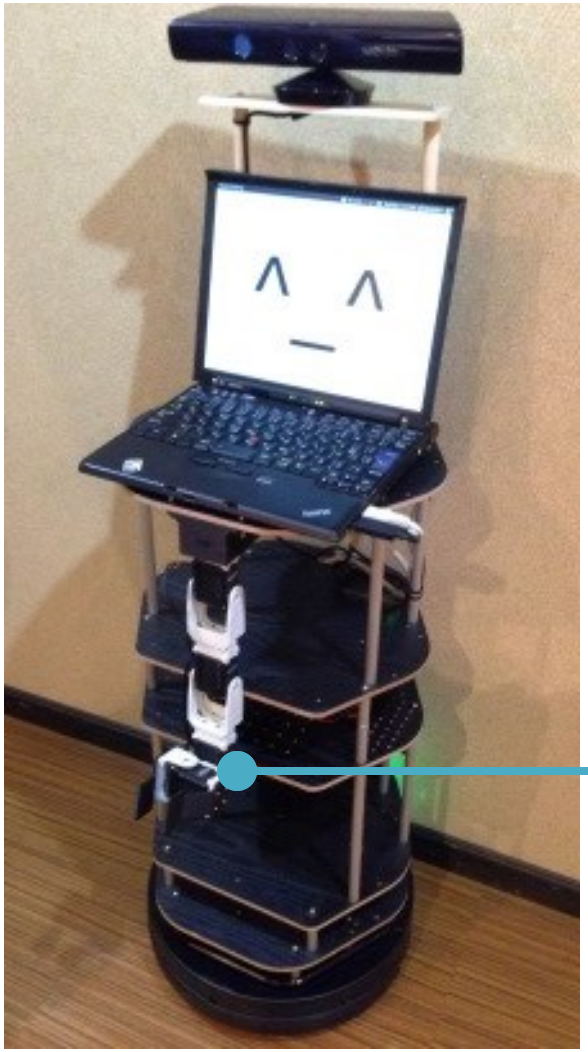
Control Parameters

| Parameter |
|---|
| *min_y* |
| *max_y* |
| *min_x* |
| *max_x* |
| *max_z* |
| *goal_z* |
| *x_scale* |
| *z_scale* |

- Vehicle Following Control
  - Lateral, $X_{centroid} = \frac{\sum_{i=1}^{n} x_i}{n}$
  - Longitudinal, $Z_{centroid} = \frac{\sum_{i=1}^{n} z_i}{n}$
  - Rotation, $\omega_{PMV} = -X_{centroid} \times x\_scale$
  - Speed, $v_{PMV} = (Z_{centroid} - goal\_z) \times z\_scale$



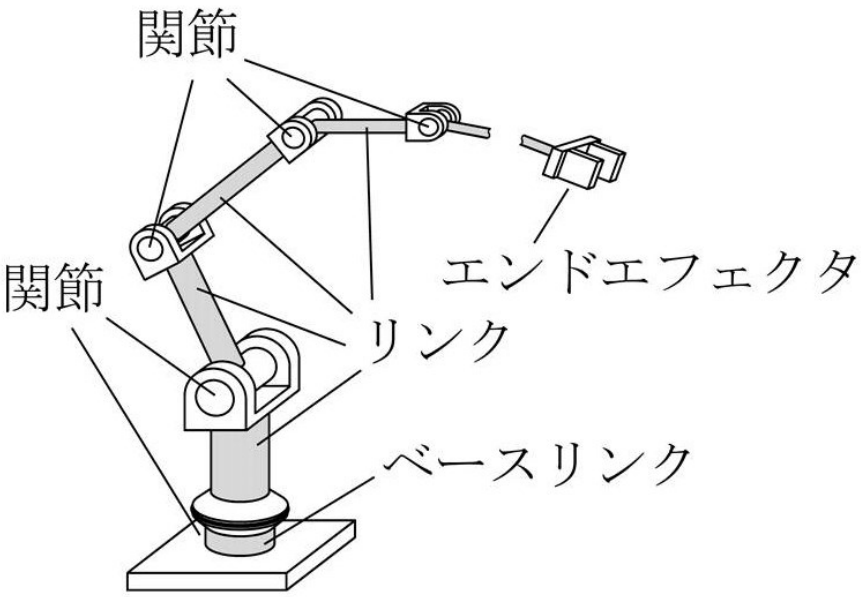
# 家庭服务机器人DIY，你我都做得到

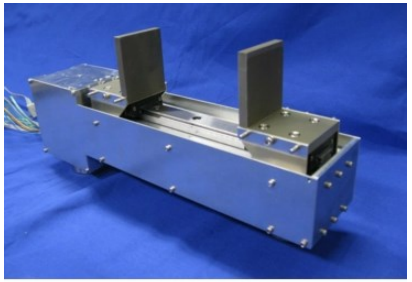


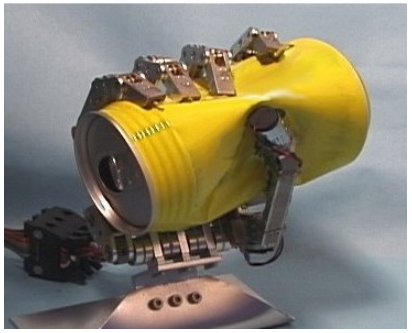
a. 机器人的**腿**
   - 移动平台，室内导航
b. 机器人的**眼**
   - 机器人视觉，物件识别
c. 机器人的**手**
   - 机械手臂，抓取物件
d. 机器人的**嘴**
   - 语音识别，人机交互
e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

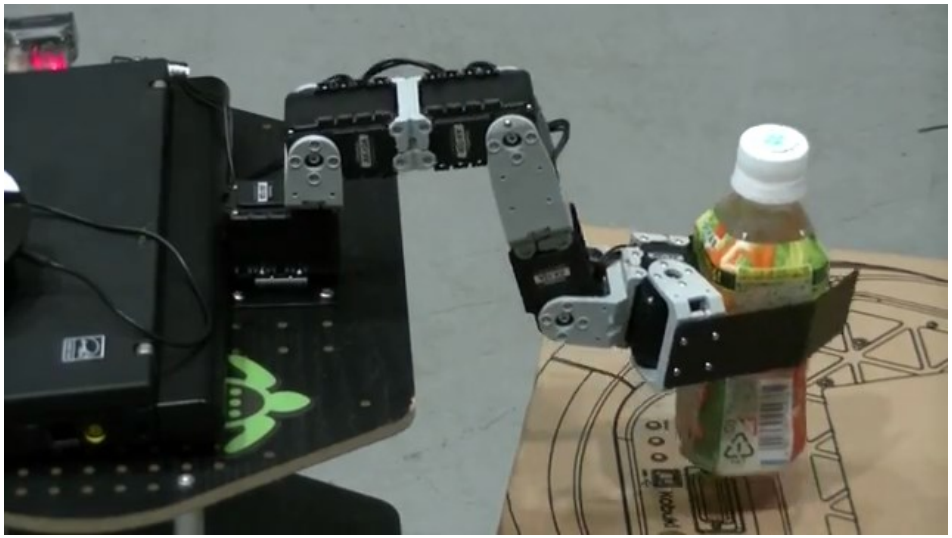
# 2c. 机器人的手: 机械手臂，抓取物件

- 链接
- 联合
- 基本链接
- 末端执行器
- 自由度
- 有效载荷
- 驱动系统



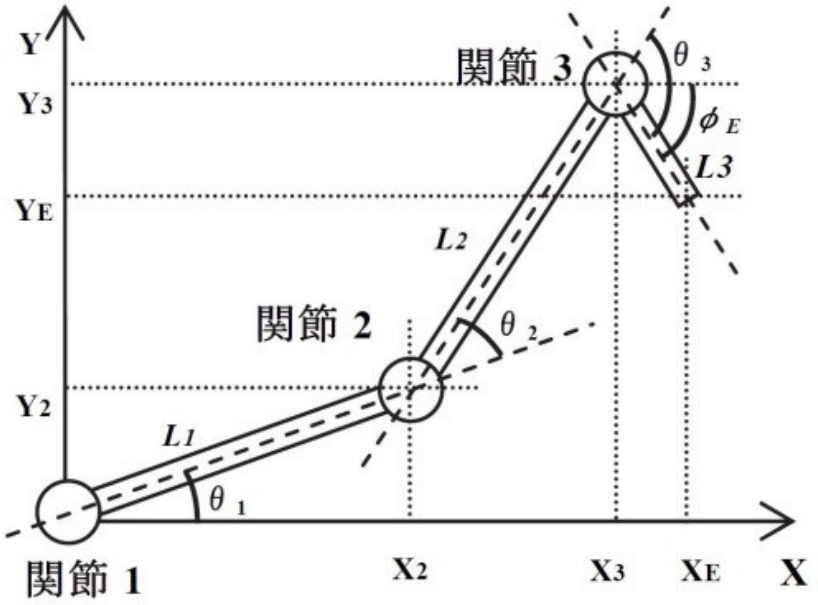




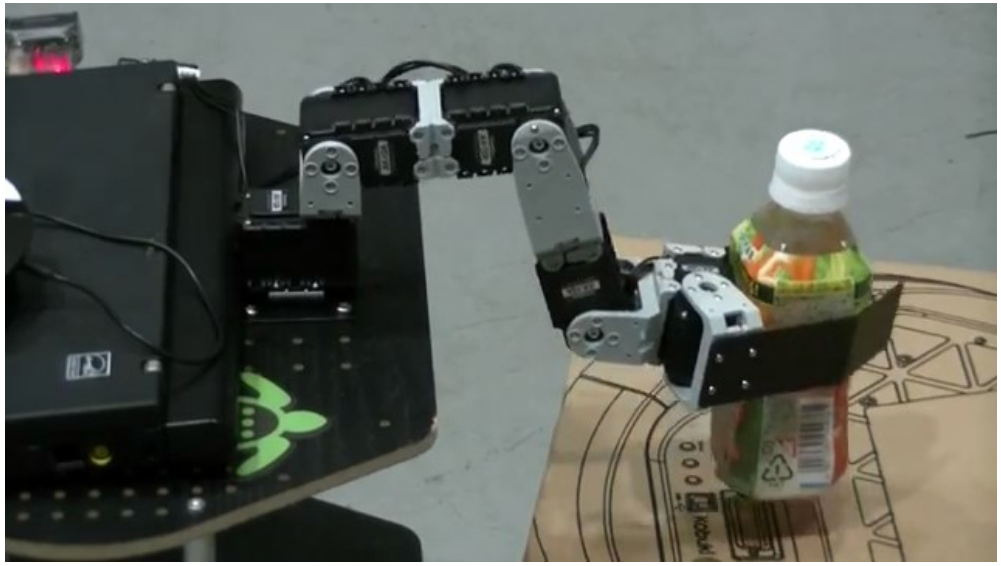
# 2c. 机器人的手: 机械手臂，抓取物件

- 正向运动学(Forward Kinematics):
  关节位移（旋转，线性运动）→手的位置和姿势
- 反向运动学(Inverse Kinematics):
  手的位置和姿势→关节位移（旋转，线性运动）

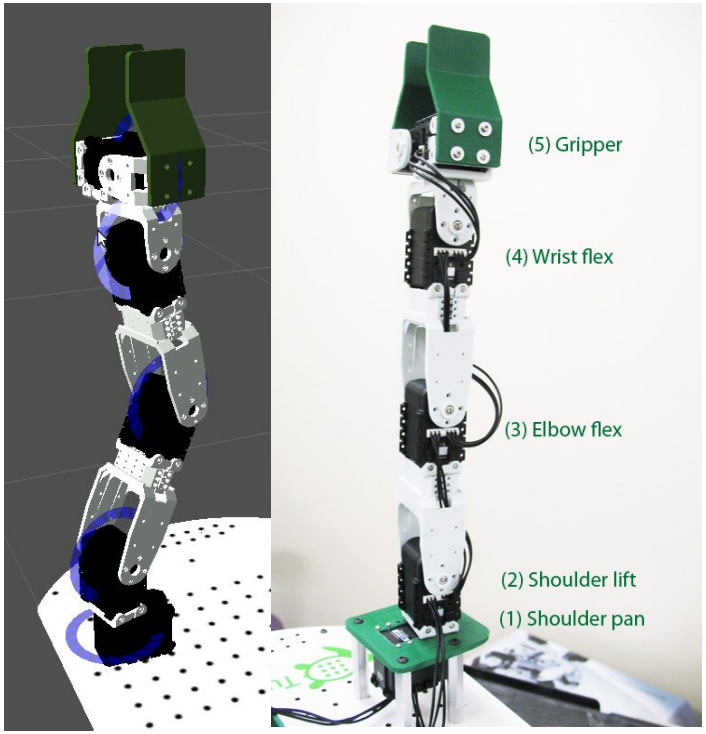
- $X_2 = L_1 \cos\theta_1$
- $Y_2 = L_1 \sin\theta_1$
- $X_3 = X_2 + L_2 \cos(\theta_1 + \theta_2)$
- $Y_3 = Y_2 + L_2 \sin(\theta_1 + \theta_2)$
- $X_E = X_3 + L_3 \cos(\theta_1 + \theta_2 + \theta_3)$
- $Y_E = Y_3 + L_3 \sin(\theta_1 + \theta_2 + \theta_3)$
- $\emptyset_E = \theta_1 + \theta_2 + \theta_3$

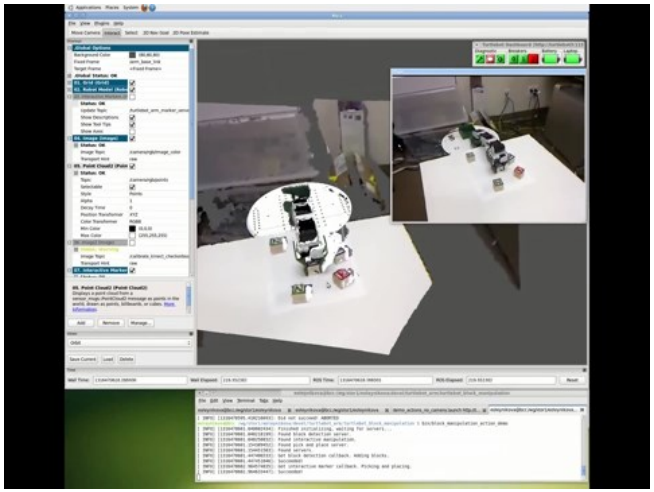


# 2c. 机器人的手: 机械手臂，抓取物件

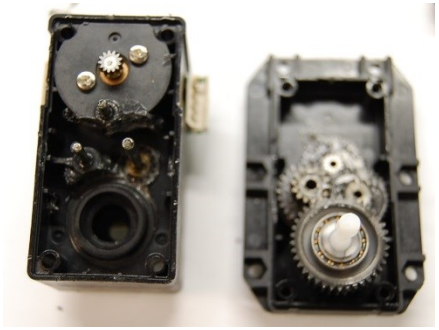


抓取物件



http://wiki.ros.org/turtlebot_block_manipulation



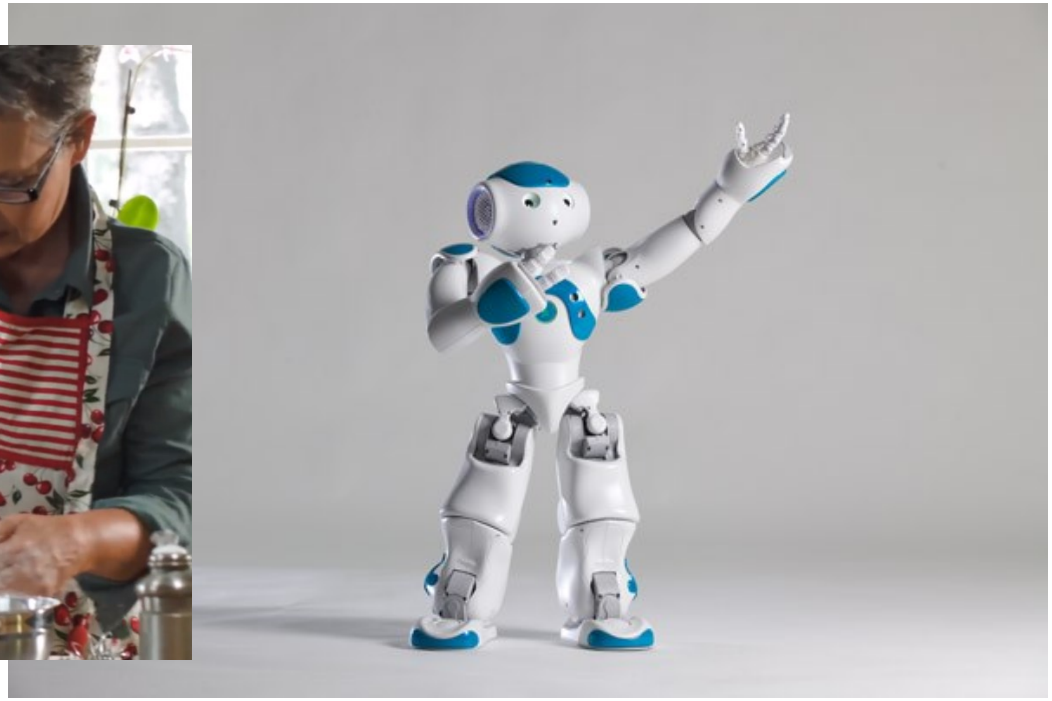
# 家庭服务机器人DIY，你我都做得到

a. 机器人的**腿**
   - 移动平台，室内导航
b. 机器人的**眼**
   - 机器人视觉，物件识别
c. 机器人的**手**
   - 机械手臂，抓取物件
d. 机器人的**嘴**
   - 语音识别，人机交互
e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

# 2d. 机器人的嘴: 语音识别，人机交互

- 语音识别，会话（通信）
  - 言语和非言语

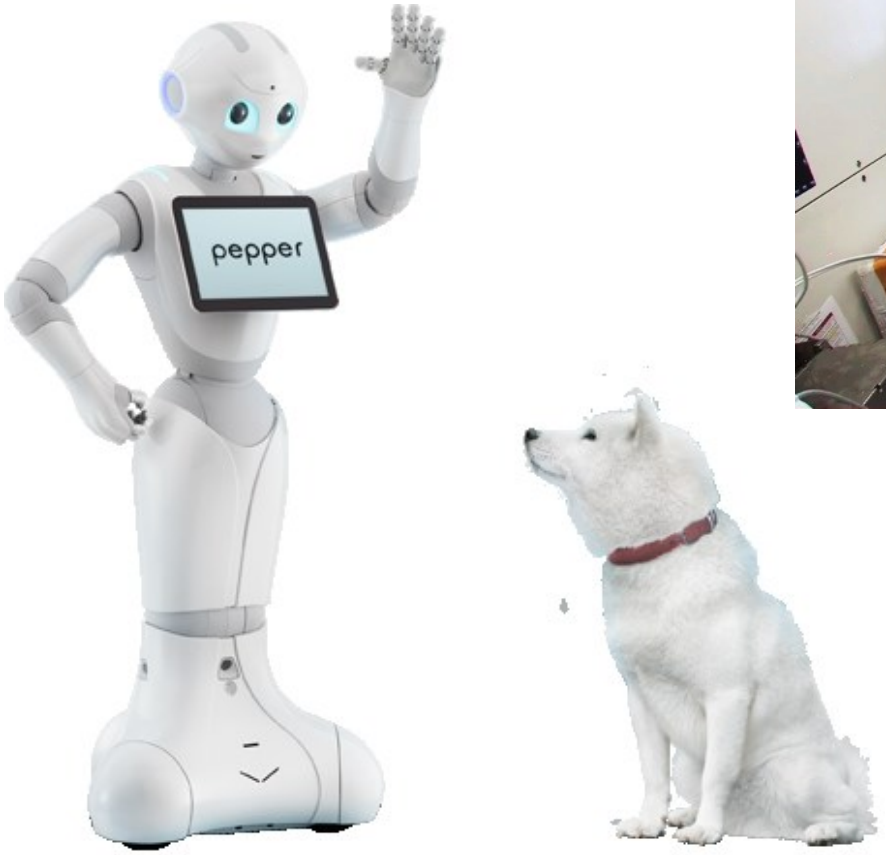
[http://growthhackjapan.com/2014-08-22-jibo/] Video



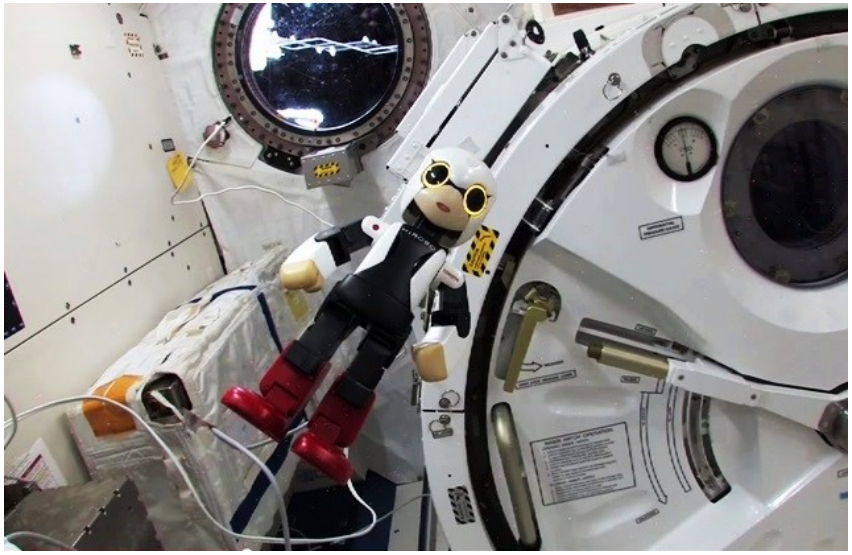
[http://blogs.solidworks.com/teacher/2012/05/educator-events-for-a-solidworks-summer.html]

# 2d. 机器人的嘴: 语音识别，人机交互

- 認知，社会性



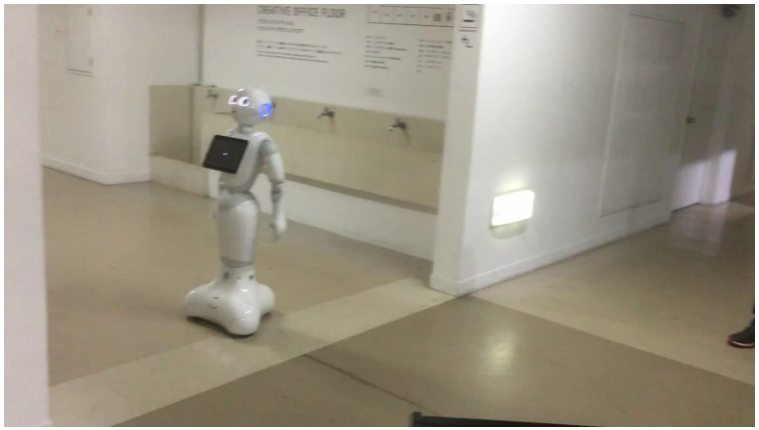

有感情的个人机器人”Pepper”
[http://www.softbank.jp/robot/] Video



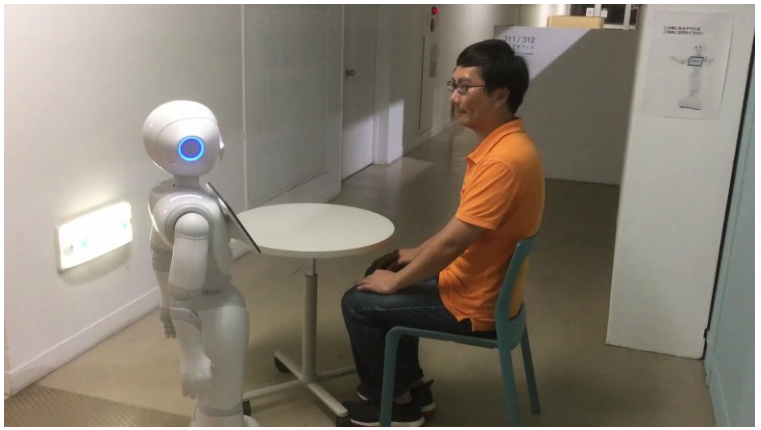
宇航员机器人”KIROBO”
[http://kibo-robo.jp/]

心理治疗机器人”Paro”
[http://www.daiwahouse.co.jp/robot/paro/]

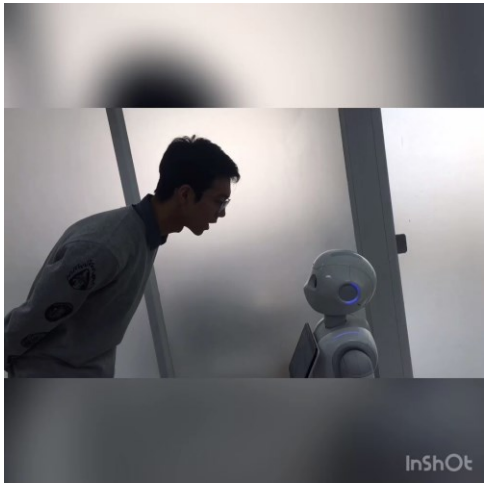
# 2d. 机器人的嘴: 语音识别，人机交互



Tour Guide



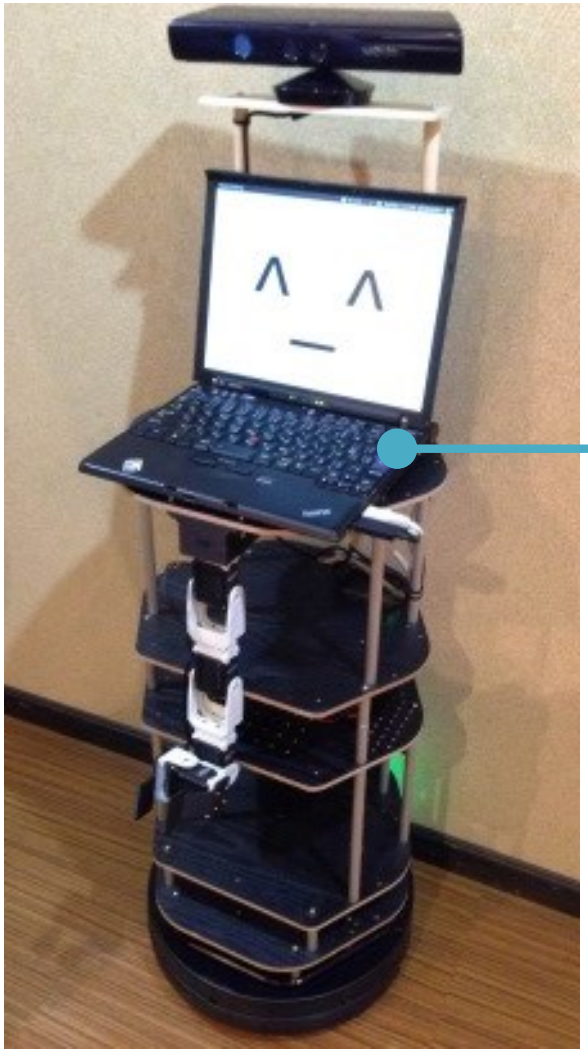
Restaurant Waiter




Convenience Store Staff


Telepresence

# 家庭服务机器人DIY，你我都做得到

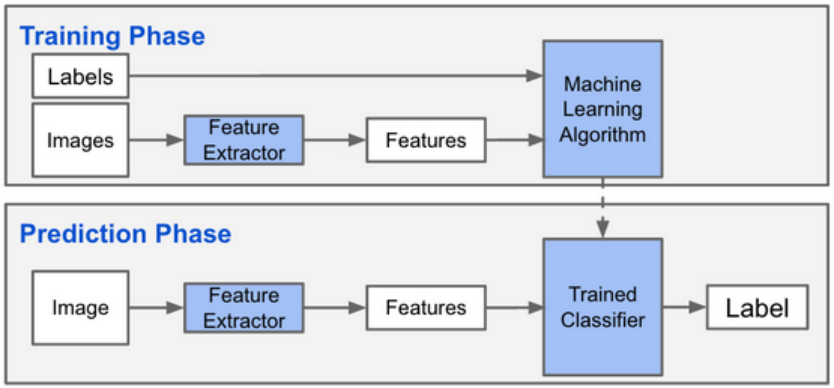


a. 机器人的**腿**
   - 移动平台，室内导航
b. 机器人的**眼**
   - 机器人视觉，物件识别
c. 机器人的**手**
   - 机械手臂，抓取物件
d. 机器人的**嘴**
   - 语音识别，人机交互
e. 机器人的**脑**
   - 人工智能，机械学习，云计算与大数据

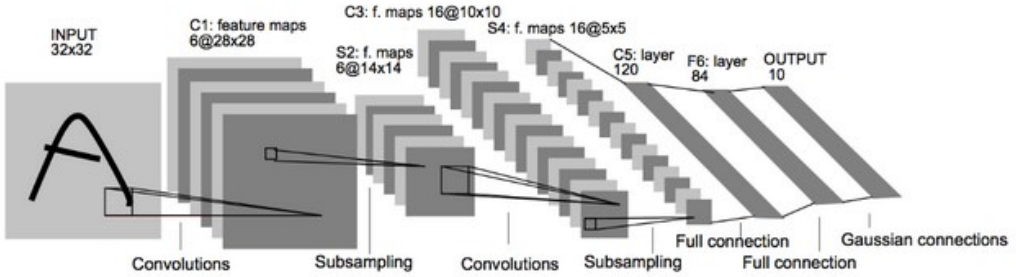
# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

- 深入学习与Caffe面部和性别认知


Sample of cats & dogs images from Kaggle Dataset




Machine Learning Phases




CNN called LeNet by Yann LeCun (1998)

[http://adilmoujahid.com/posts/2016/06/introduction-deep-learning-python-caffe/]

# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

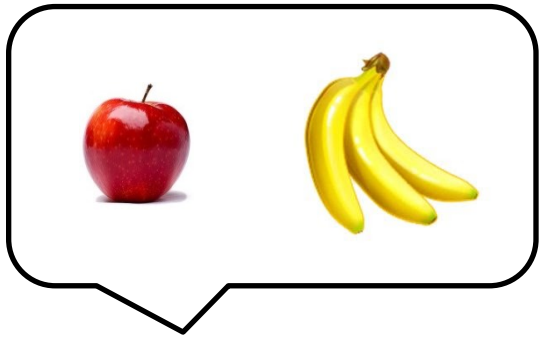
- 在RoboCup 2016中实施人物识别任务的结果

# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

- Processing Servers
- Databases

Cloud System

Client Systems

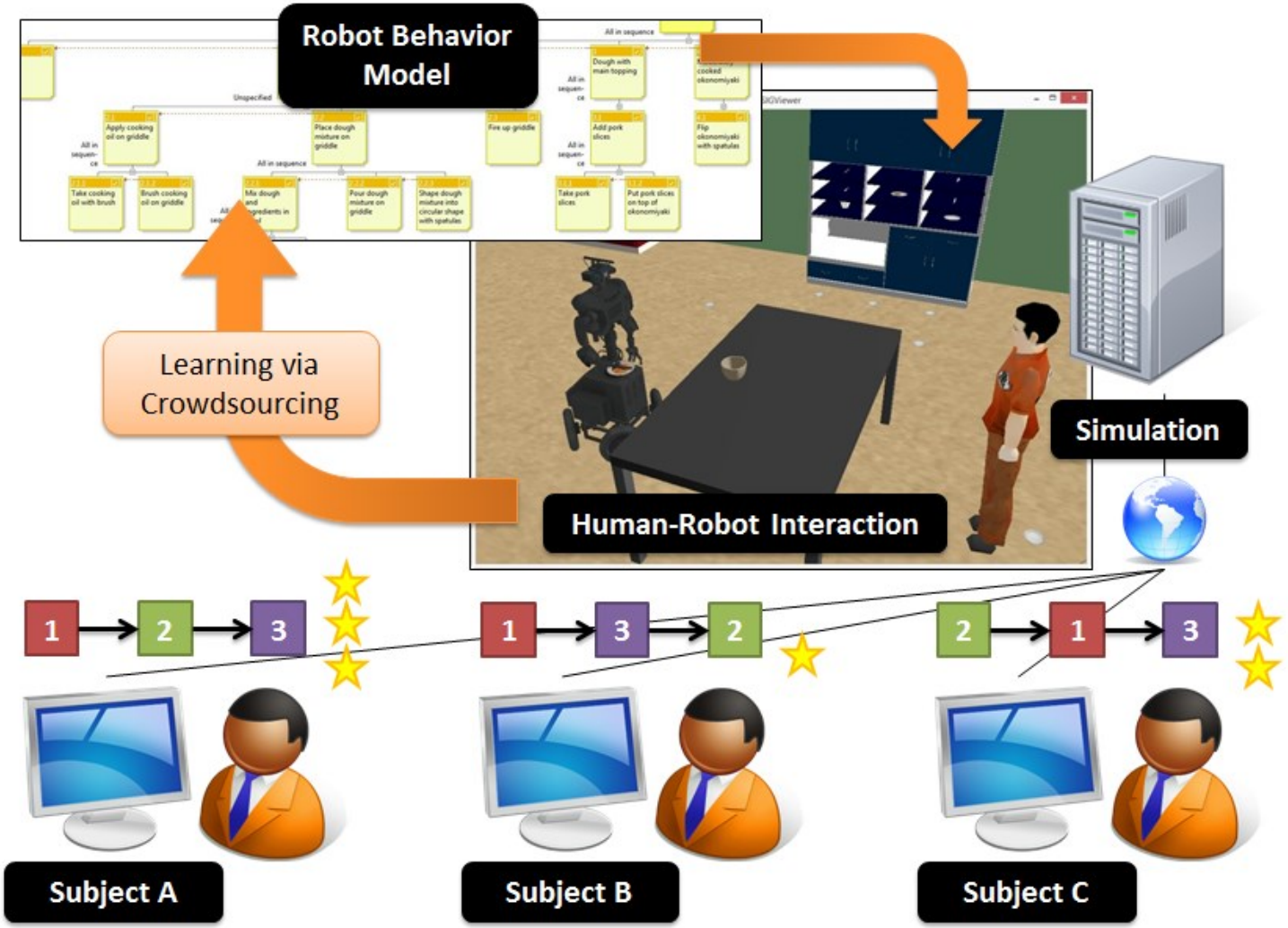


Robot Learning

Knowledge Transfer

# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

- 云端众包大量虚拟人机交互实验，用于协作策略学习




[J. T. C. Tan, Y. Hagiwara, T. Inamura, "Robot Learning Framework via Crowdsourcing of Human-Robot Interaction for Collaborative Strategy Learning," in *Proc. of the 24th IEEE RO-MAN (Interactive Session)*, IS04, 2015]

# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

- 云端众包大量虚拟人机交互实验，用于协作策略学习


Learning from the database of 4 experiments:
did nothing at all

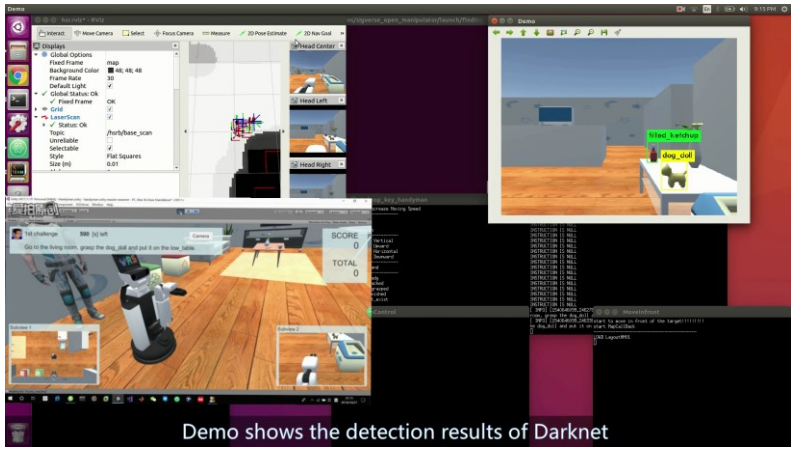

Learning from the database of 16 experiments:
took two actions and put one thing


Learning from the database of 64 experiments:
took six actions and put three things

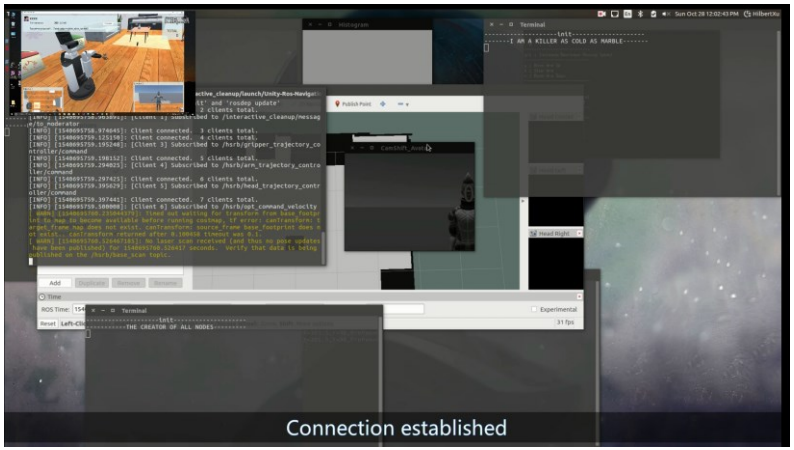

Learning from the database of 128 experiments:
took eight actions and put four things

# 2e. 机器人的脑: 人工智能，机械学习，云计算与大数据

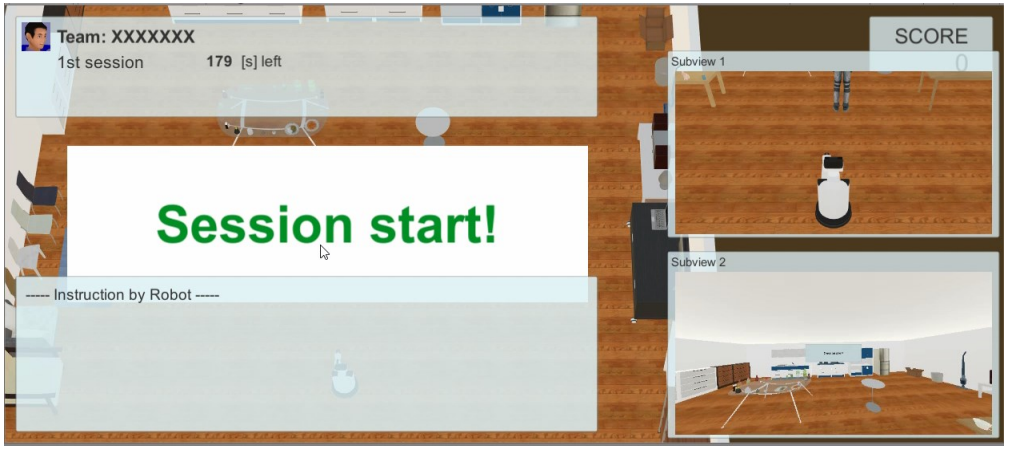
- 虚拟现实人机交互实验，提高机器人学习效率



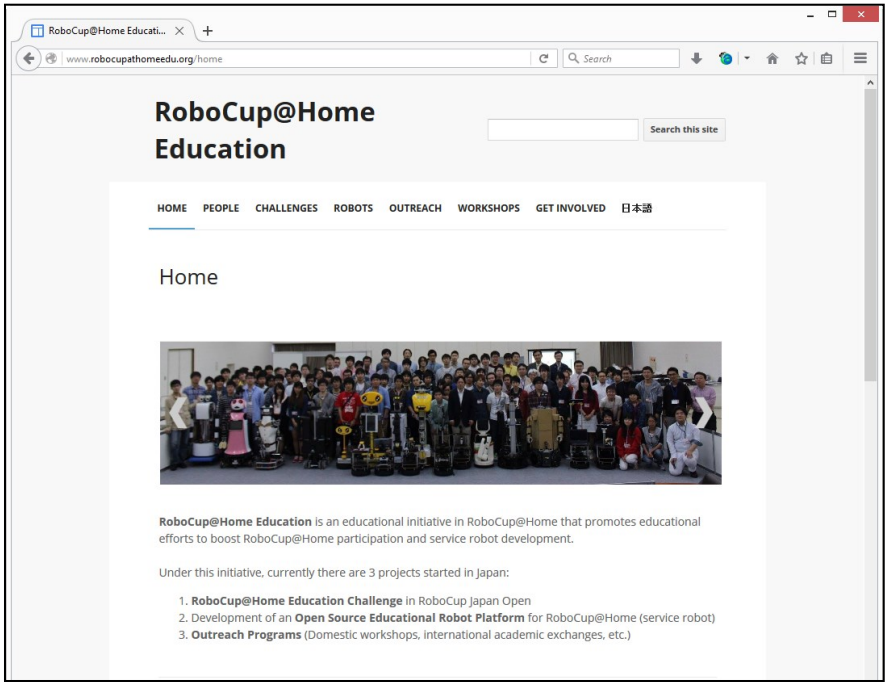

**Handyman (GPSR)**




**Interactive Clean Up**




**Human Navigation**




http://www.robocupathomeedu.org/

# 3. ROBOCUP@HOME EDUCATION INITIATIVE

# RoboCup@Home Education

**RoboCup@Home Education**促进RoboCup@Home的教育工作，以推动RoboCup@Home的参与和家庭服务机器人的开发。目前的活动：

1. 创办RoboCup@Home Education Challenge
2. 推动家庭服务机器人的开源教育平台
3. 推广活动（国内培训营，国际学术交流项目等）

http://www.robocupathomeedu.org/

https://www.facebook.com/robocupathomeedu/

Universities & Research Community

*Join RoboCup*

RoboCup Japan Open


iHR Challenge

Robots in RoboCup Japan Open 2016

Workshop

Exchange Program

*Outreach to Public*

Invited Lecture

RC@Home Education Challenge

*Evaluate the learning*

Evolution by New Contribution

RoboCup Community

*Promote New Entry*

*Improve Service Robot Development*

RC@Home Education

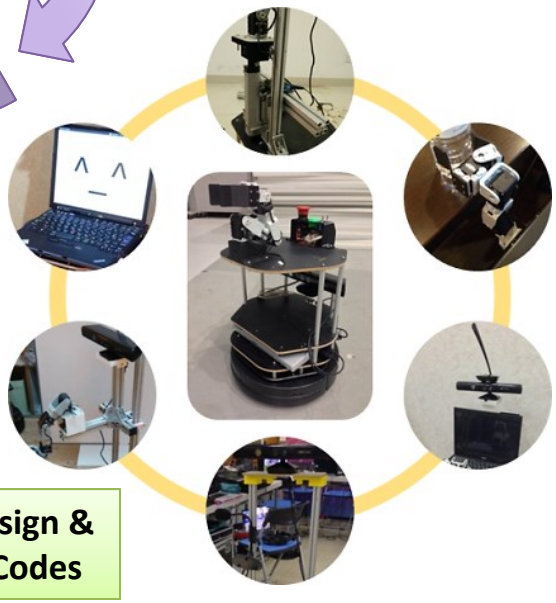
Outreach

Open Robot Platform

RoboCup Committee

Open Courseware

Open Design & Source Codes



Core Robot Platform with Modular Add-ons

# 合作成员

[ 日本 ]
- Organizer: RoboCup Japan Committee
- Coordinator:
  - Hiroyuki OKADA (Tamagawa University)
  - Yoshinobu HAGIWARA (Ritsumeikan University)
  - Jeffrey Too Chuan TAN (Nankai University, China)
- Supporter:
  - Yasuhiro MASUTANI (Osaka Electro-Communication University)
  - Kosei DEMURA (Kanazawa Institute of Technology)
  - Yuki INOUE (Osaka Institute of Technology)
  - Kenichi OHARA (Meijo University)

[ 意大利 ]
- Organizer: Italian RoboCup Regional Committee
- Coordinator:
  - Luca Iocchi (Sapienza University of Rome)
  - Paola Ferrarelli (Sapienza University of Rome)

[ 美国 ]
- Collaborator: Amy EGUCHI (Bloomfield College), M. Q. Azhar (BMCC.CUNY)

[ 加拿大 ]
- Collaborator: Sara Iatauro (English Montreal School Board)

[ 中国 ]
- Collaborator: 李实 (中科院自动化所)

[ 泰国 ]
- Collaborator: Kanjanapan SUKVICHAI (Kasetsart University)

[ 马来西亚 ]
- Collaborator: Zool Hilmi Ismail (Universiti Teknologi Malaysia), Kwan Ban Hoe (University Tunku Abdul Rahman), Danny Ng Wee Kiat (University Tunku Abdul Rahman), Hafiz Rashidi Harun (Universiti Putra Malaysia)

[ 伊朗 ]
- Collaborator: Reza Javanmard (University of Science and Technology of Mazandaran)

# RoboCup@Home Education Challenge竞赛活动

- RoboCup@Home主竞赛
  - Since 2006
- RoboCup@Home Education Challenge
  - RoboCup Japan Open 2015, Fukui (SPL Beta), 日本
  - RoboCup Japan Open 2016, Aichi, 日本
  - RoboCup Japan Open 2017, Nagoya, 日本
  - RoboCup Asia-Pacific 2017 Bangkok, 泰国
  - RoboCup Japan Open 2018, Ogaki, 日本
  - European RoboCupJunior Championship (EURCJ) 2018, Montesilvano,意大利
  - RoboCup 2018 Montreal, 加拿大
- Upcoming events
  - RoboCup中国赛 2019
  - RoboCup 2019 Sydney, 澳大利亚
  - RoboCup Japan Open 2019, 日本

# RoboCup@Home Education Challenge
# RoboCup Japan Open 2015, 2016, 2017, 2018

RoboCup Japan Open 2015, Fukui (SPL Beta)

RoboCup Japan Open 2016, Aichi

# RoboCup@Home Education
# RoboCup Japan Open 2015, Fukui (SPL Beta)

- Date: 2015 May 1 (Fri) - 4 (Mon)
- Participated Teams
  1. AHP-1 eR@sers (Tamagawa University)
  2. AHP-2 OIT Kitayama (Osaka Institute of Technology)
  3. AHP-3 KameRider (The University of Tokyo, Nankai University (China), Universiti Teknologi Malaysia (Malaysia))
  4. AHP-4 SOBITS (Soka University)
  5. AHP-5 D.K.T. IcARus (Kanagawa Institute of Technology)
  6. AHP-6 TanichuCluster (Ritsumeikan University)

| Ranking | No. | Team | Basic Functionalities | Restaurant | Sub-Total (5/2) | Follow Me | Sub-Total (5/3) | 5/2+5/3 | Normalization | Technical Challenge | (Internal Judges) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st | AHP-3 | KameRider | 400 | 750 | 1150 | 300 | 300 | 1450 | 100 | 40 | 46 | 38 | 91.33 |
| 2nd | AHP-6 | TanichuCluster | 150 | 250 | 400 | 50 | 50 | 450 | 31 | 33 | 41 | 40 | 53.52 |
| 3rd | AHP-1 | eR@sers | 150 | 0 | 150 | 560 | 560 | 710 | 49 | 18 | 35 | 16 | 47.48 |
| 4th | AHP-2 | OIT Kitayama | 400 | 0 | 400 | 250 | 250 | 650 | 45 | 19 | 30 | 12 | 42.75 |
| 5th | AHP-5 | D.K.T. IcARus | 0 | 0 | 0 | 181 | 181 | 181 | 12 | 23 | 26 | 34 | 33.91 |
| 6th | AHP-4 | SOBITS | 0 | 0 | 0 | 221 | 221 | 221 | 15 | 15 | 31 | 20 | 29.62 |

# RoboCup@Home Education
# RoboCup Japan Open 2015, Fukui (SPL Beta)

The RoboCup@Home rulebook of **2014** is based and 4 tests are selected as follows:

**1. Basic Functionalities**

- The description in section 5.2 Basic Functionalities (pg. 40-42) is referred.
- In section 5.2.1, 1. Pick and Place (pg. 40), the objects for the robot to pick up will be located within the reach of the working envelope of the robot arm.

**2. Follow Me**

- The description in section 5.3 Follow Me (pg. 43-47) is referred.
- No change is made on the rules.

**3. Restaurant**

- The description in section 6.3 Restaurant (pg. 64-66) is referred.
- In section 6.3.2, 1. Guide phase (pg. 64) is omitted. The object and delivery locations will be informed before the game.
- In section 6.3.2, 2. Navigation and manipulation phase (pg. 64), the objects for the robot to retrieve will be located within the reach of the working envelope of the robot arm.

**4. Open Challenge**

- The description in section 5.5 Open Challenge (pg. 52-54) is referred.
- No change is made on the rules.

[http://www.robocupathomeedu.org/challenges/robocup-home-education-challenge-2015/rules-2015]

# RoboCup@Home Education
# RoboCup Japan Open 2016, Aichi

- Date:
  - Competition days: 2016 March 25 (Fri) - 27 (Sun)
  - Team setup: 2016 March 24 (Thu)
- Venue:
  - Aichi Institute of Technology, Aichi, Japan
- Participating Teams:
  1. eR@sers (Tamagawa University)
  2. OIT Kitayama (Osaka Institute of Technology)
  3. KameRider (The University of Tokyo, Nankai University (China), Universiti Teknologi Malaysia (Malaysia), Shibaura Institute of Technology)
  4. SOBITS (Soka University)
  5. WinKIT@DKT (Kanagawa Institute of Technology)
  6. TanichuCluster (Ritsumeikan University)
  7. MMR (Meijo University)
  8. ODENS (Osaka Electro-Communication University)
  9. Eruca (Tokyo City University)

# RoboCup@Home Education
# RoboCup Japan Open 2016, Aichi

The RoboCup@Home rulebook of **2015** is based and 4 tests are selected as follows:

**1. Navigation Test**

- The description in section 5.3 Navigation Test (pg. 50-53) is referred.
- No change is made on the rules.

**2. Speech Recognition & Audio Detection Test**

- The description in section 5.6 Speech Recognition & Audio Detection Test (pg. 59-61) is referred.
- No change is made on the rules.

**3. Restaurant**

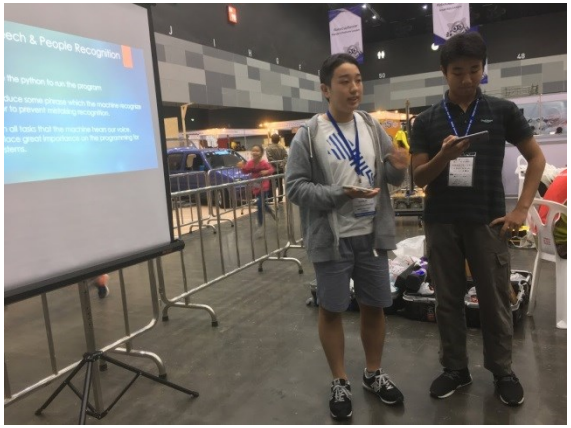
- The description in section 6.3 Restaurant (pg. 66-70) is referred.
- In section 6.3.3, 6. Delivering phase (pg. 67), the objects for the robot to retrieve will be located within the reach of the working envelope of the robot arm (see below).

**4. Finals**

- The description in chapter 7 Finals (pg. 79-80) is referred.
- No change is made on the rules.

[http://www.robocupathomeedu.org/challenges/robocup-home-education-challenge-2016/rules-2016]

# RoboCup@Home Education Challenge 2017
# RoboCup Asia-Pacific (RCAP) 2017 Thailand





https://blogs.mathworks.com/racing-lounge/2018/01/17/robocupathome-education-workshop/

# RoboCup@Home Education Challenge European RoboCupJunior Championship (EURCJ) 2018, Montesilvano, Italy



# RoboCup@Home Education Challenge 2018

## Workshop & Competition

## RoboCup 2018 Montréal


RoboCup 2018 MONTRÉAL · CANADA

MathWorks®

RoboCup@Home EDUCATION
www.RoboCupatHomeEDU.org

**Workshop June 16 (Sat) ~ 18 (Mon), 2018**

- 6/16
  - AM Workshop 1 Hardware and Software Setup
  - PM Workshop 2 Speech, Navigation
- 6/17
  - AM Workshop 3 Vision
  - PM Workshop 4 Arm, System Integration
- 6/18
  - AM Field Testing
  - PM Robot Inspection and Presentation

**Competition June 19 (Tue) ~ 21 (Thu), 2018**

- 6/19
  - AM Team Setup
  - PM Task 1 Speech and Person Recognition
- 6/20
  - AM Task 2 Help-me-carry
  - PM Task 3 Restaurant
- 6/21
  - AM Finals (Demo and Presentation)

***AM 09:00~12:00; PM 13:00~16:00

# RoboCup@Home Education Challenge 2018
# RoboCup 2018, Montreal

# 机器人培训

[ 日本 ]

- Family & Robotics Workshops
  - 2014.08.31 Introduction to ROS and TurtleBot2
  - 2014.09.04 RoboCup@Home Challenge with TurtleBot2
  - 2014.09.28 “Grab a bottle” with TurtleBot2
  - 2014.11.16 “Follow me” with TurtleBot2
- 2016.01.23 RC@HomeEDU Workshop (Kanto)
- 2016.02.20 RC@HomeEDU Workshop (Kansai)
- 2016.12 3rd RC@HomeEDU Workshop (Kansai)
- 2017.02 4th RC@HomeEDU Workshop (Kanto)

[ 马来西亚 ]

- 2017.02 RC@HomeEDU Workshop

[ 意大利 ]

- 2017.03 RC@HomeEDU Workshop @ RomeCup

[ 伊朗 ]

- 2017.04 RC@HomeEDU Workshop @ RoboCup Iran Open 2017

[ 中国 ]

- 2017.08 RC@HomeEDU Seminar @ ROS技术及应用培训，中国机器人大赛2017

[ 美国 ]

- 2017.09 RC@HomeEDU Exhibition @ Maker Faire, New York

[ 泰国 ]

- 2017.12 RC@HomeEDU Workshop @ RoboCup Asia Pacific 2017

# 国内推广活动


tHomeEDU.org
ROBOTIS
CORPORATION
NVIDIA
latte

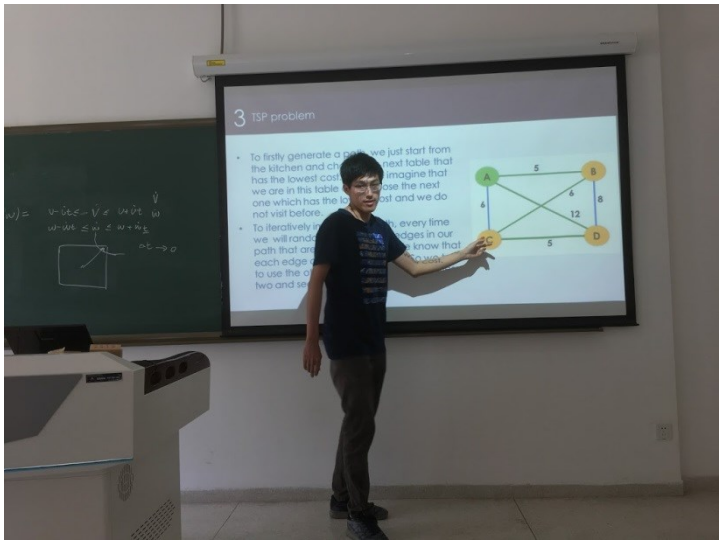

科学大讲堂
家庭服务机器人DIY
南开大学

# 国外推广活动



MathWorks
ROBOTIS
NVIDIA

# 机器人软件工程学
# Robotics Software Engineering




# 国际学术交流

- 2017.01.09-18 SAKURA Science Program @ Japan
  - Host: Tamagawa University (**Japan**)
  - Visitor: 10 students and 1 staff from Kasetsart University (**Thailand**)
- 2016.12-2017.03 RoboCup Internship @ Japan
  - Host: The University of Tokyo (**Japan**)
  - Intern: 1 student from Univerisiti Teknologi Malaysia (**Malaysia**)
- 2016.02.26-03.06 SAKURA Science Program @ Japan
  - Host: The University of Tokyo (**Japan**)
  - Visitor: 10 students and 1 staff from Nankai University (**China**)
- 2016.02.03-19 SAKURA Science Program @ Japan
  - Host: Shibaura Institute of Technology (**Japan**)
  - Visitor: 10 students and 2 staff from Universiti Teknologi Malaysia (**Malaysia**)
- 2014.12.06 Intelligent Home Robotics Challenge 2014 @ Japan
  - Venue: **Tokyo**
  - Participated the challenge and workshop by 3 students from Univerisiti Teknologi Malaysia (**Malaysia**)
- 2014.06-09 RoboCup Internship @ Japan
  - Host: The University of Tokyo (**Japan**)
  - Intern: 1 student from Univerisiti Teknologi Malaysia (**Malaysia**)
- 2014.03-06 Robotics Internship @ Japan
  - Host: Shibaura Institute of Technology (**Japan**)
  - Intern: 1 student from Univerisiti Teknologi Malaysia (**Malaysia**)

UTM raih anugerah di Tokyo

**Pasukan** Universiti Teknologi Malaysia (UTM) merangkul dua anugerah pada International Intelligent Home Robotics Challenge 2014 (iHR2014) di Tokyo, baru-baru ini.

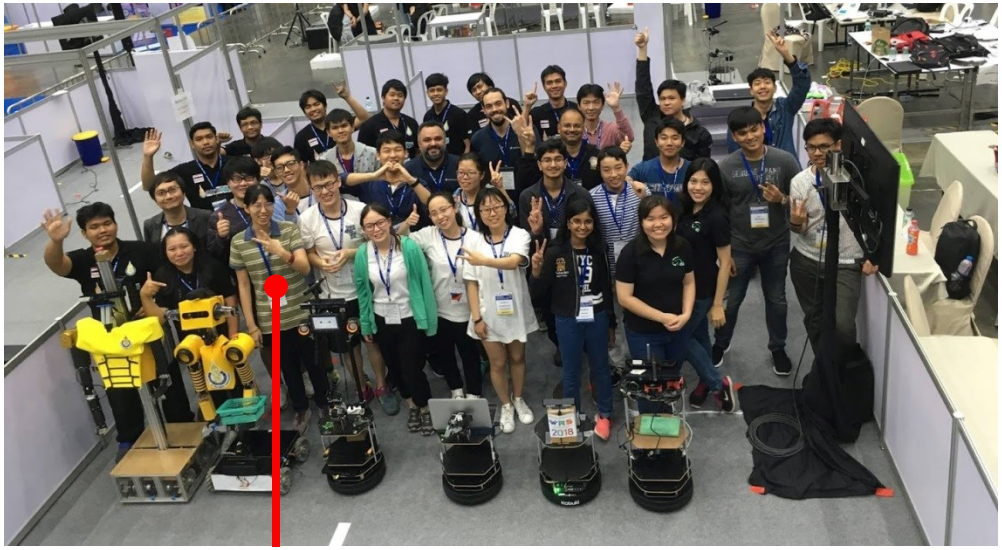
Kedua-dua pasukan berkenaan diwakili tiga siswa sarjana muda dan dua siswa sarjana dari Fakulti Kejuruteraan Elektrik.

SISWA UTM bangga meraikan kemenangan mereka.

# 推广学生的发展

澳大利亚国立大学
博士奖学金

日本东京大学
硕士奖学金

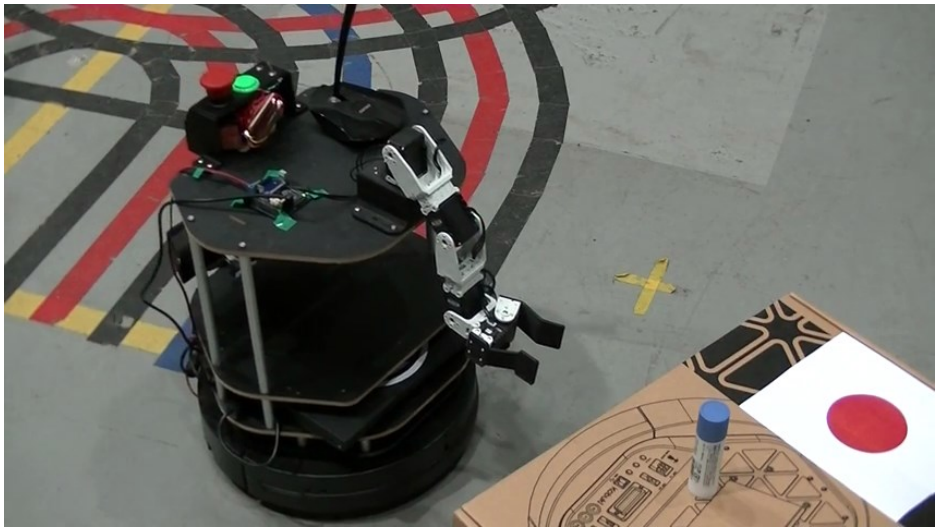


意大利大学实习


日本研究所实习　意大利大学实习

# 近未来计划

- 推广中国与全世界
  - RoboCup@Home Education Community (Challenge, Workshop)
  - 中国RoboCup公开赛，中国机器人大赛
- 与RoboCup Junior（高中生）合作
- 与工业伙伴合作
  - MathWorks, NVIDIA, ROBOTIS等等
- 开放课程教材，开放机器人(硬件/软件) 开发



www.RoboCupatHomeEDU.org

# 谢谢！

*Supported by:*

RoboCup

MathWorks

ROBOTIS

大圣机器人
Tianjin Dason Robotics Technology

WRS
World Robot Summit

RT CORPORATION

NVIDIA.

iHR研究専門委員会

SAKURA SCIENCE
Exchange Program in Science

RoboCup Japan

RoboCup Junior

IEEE Robotics & Automation Society

lattel
::{ROBOTICS}

JST 独立行政法人 科学技術振興機構
Japan Science and Technology Agency