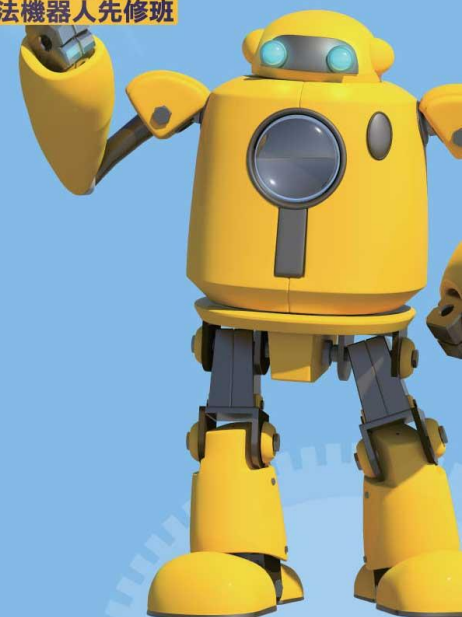


智慧機器人技術發展之機會及挑戰

宋開泰

交通大學電機系

Presented at Faculty Coffee Time
2016/4/ 20





Intelligent **S**ystem **C**ontrol **I**ntegration Laboratory

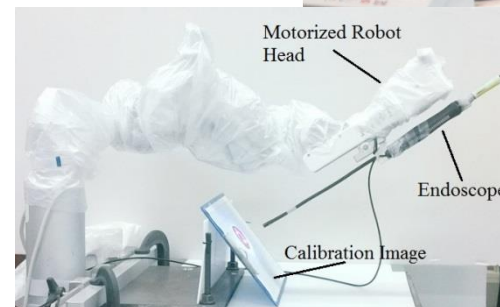
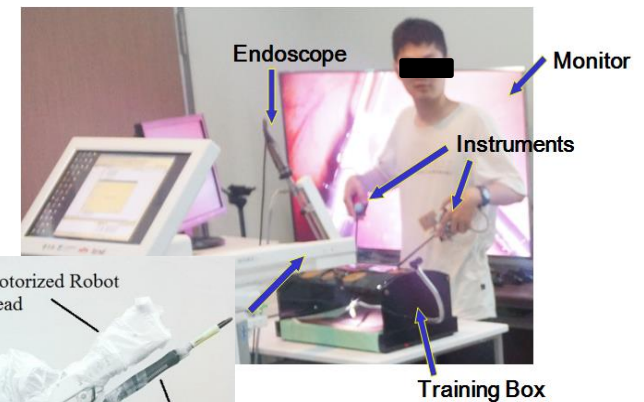
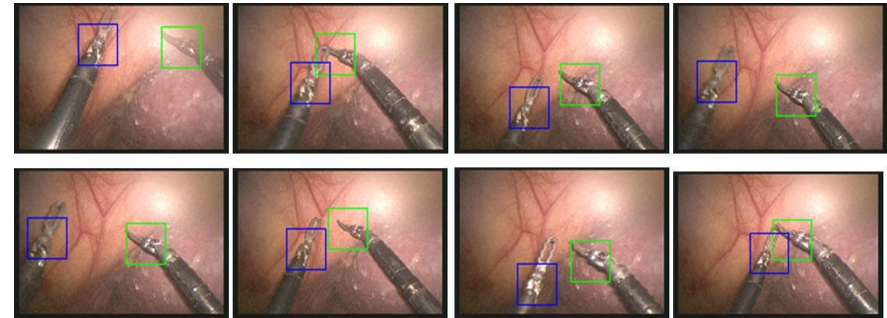
Mobile Robots

- Mobile manipulation
- Walk assistance
- Human-robot shared control

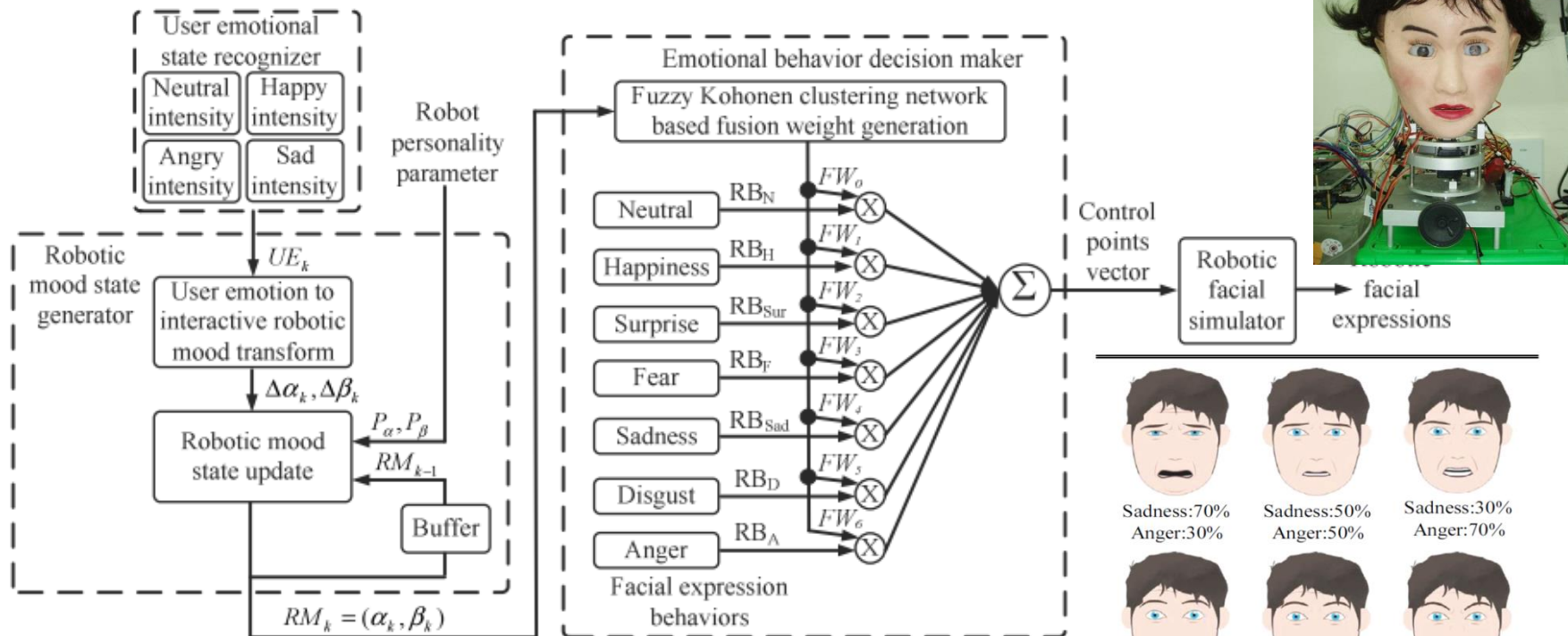


Surgical Robots: Endoscope Camera Holder

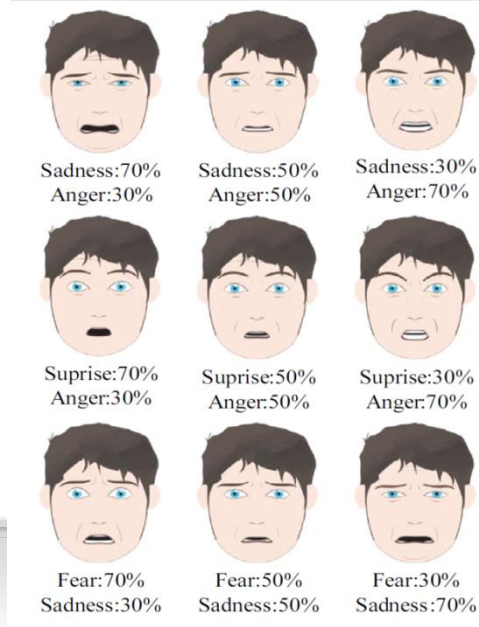
- Instrument detection and tracking by using natural features.
- The robot arm holds and moves the endoscope to provide a suitable field of view.
- The instrument in surgeon's hand is not only the tool for treatment but also the mouse to control the position of endoscope.



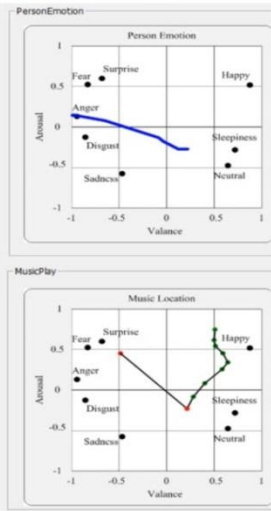
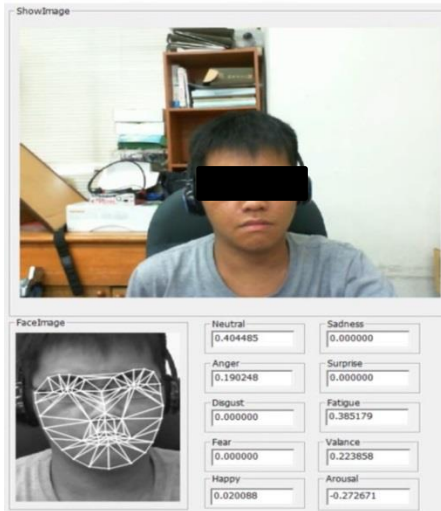
Robotic Emotional Behavior Generation



Robot behaviors are associated with its mood and personality.

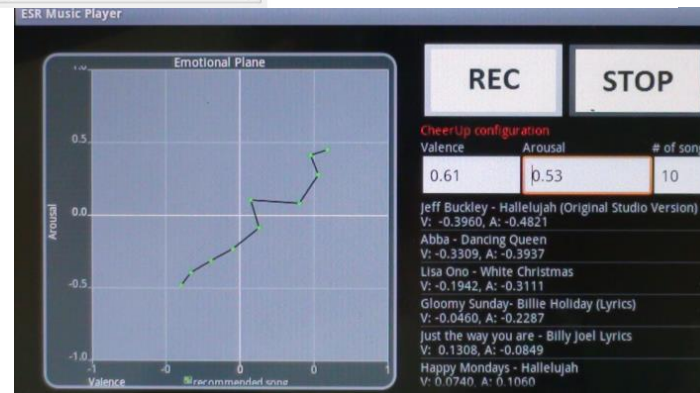
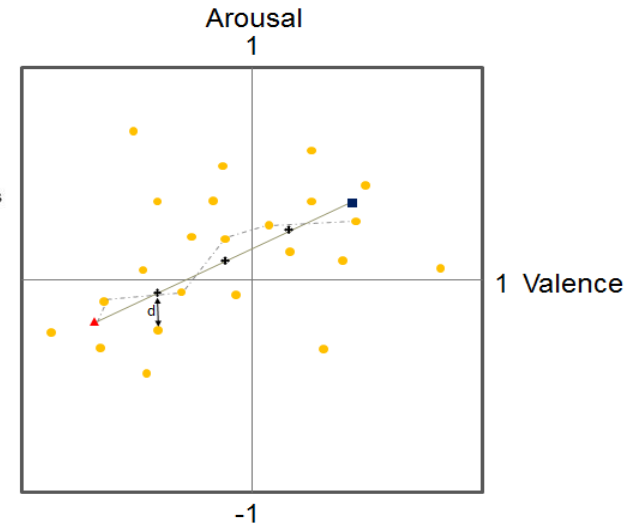


Emotion Recognition



音樂播放清單：

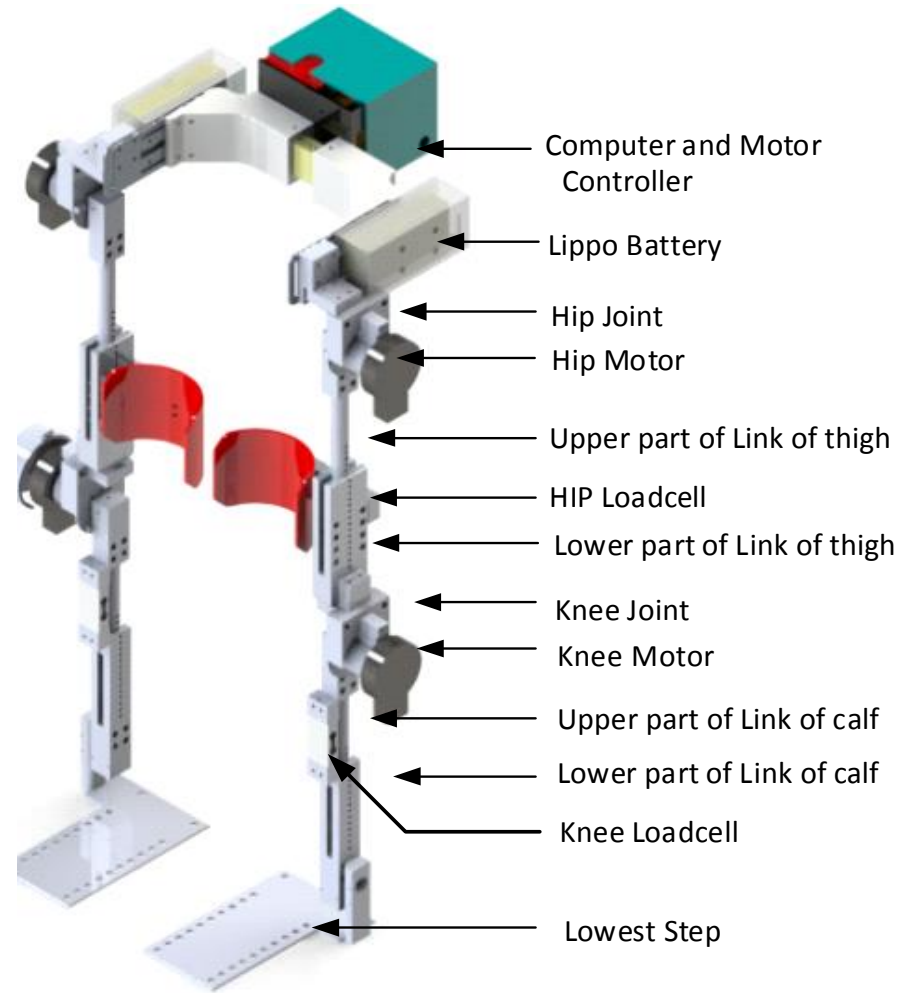
01. (A: 0.45, V: -0.49)
Muse - Take A Bow
02. (A: -0.22, V: 0.20)
Whitney Houston - I Will Always Love You
03. (A: -0.09, V: 0.28)
The Kingstons - Where have all the flowers gone
04. (A: 0.08, V: 0.40)
Castle in the air - Don McLean
05. (A: 0.26, V: 0.58)
Frank Sinatra - Jingle Bells
06. (A: 0.34, V: 0.65)
Marilyn Manson - Sweet Dreams
07. (A: 0.45, V: 0.59)
Oh, Happy Day! Tim Hughes
08. (A: 0.54, V: 0.51)
We Wish You the Merriest
09. (A: 0.62, V: 0.50)
C'est La Vie - B-Witched
10. (A: 0.74, V: 0.51)
The Beatles - I Want



Automatically select a piece of music from a song database and cheer up users.

Lower Limb Exoskeleton

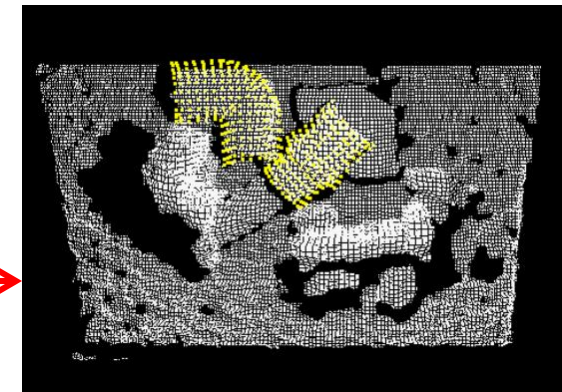
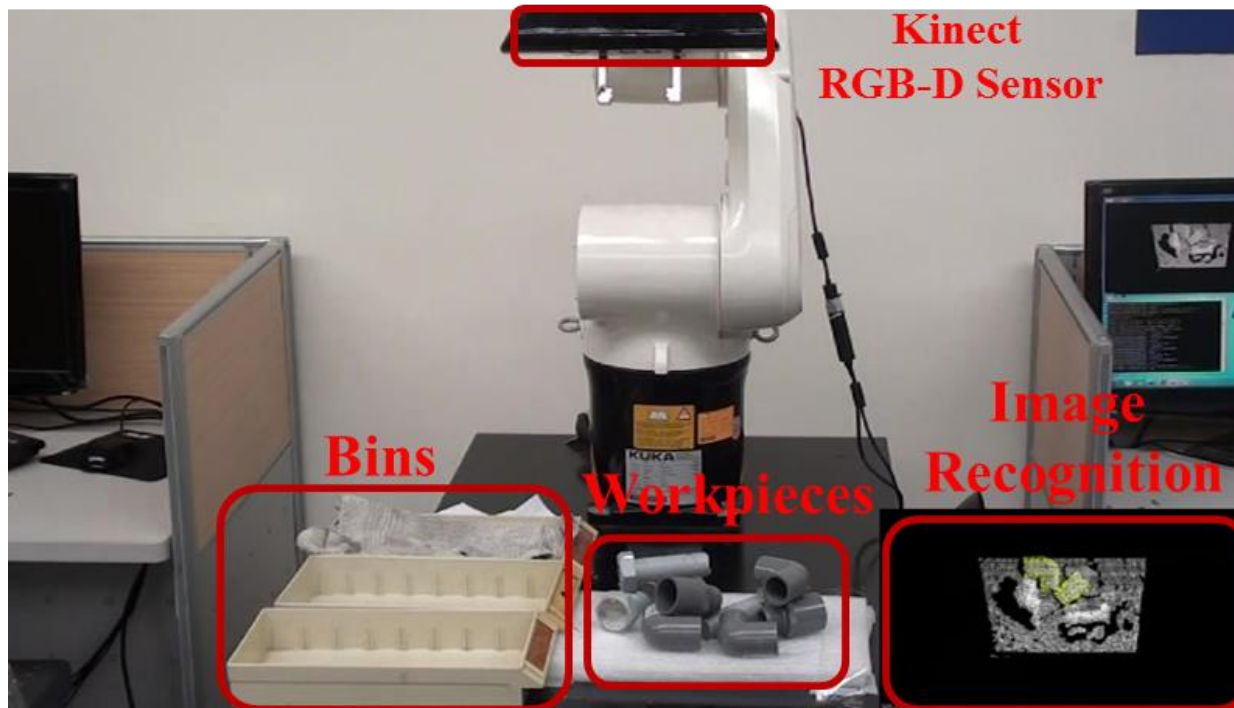
- Assistive force generation
- Gait motion prediction



6-DOF Robot Arm : Random Bin Picking

3D reconstruction

Pose estimation



Robot Technology (RT)

Home Cleaning Robots



Robomower

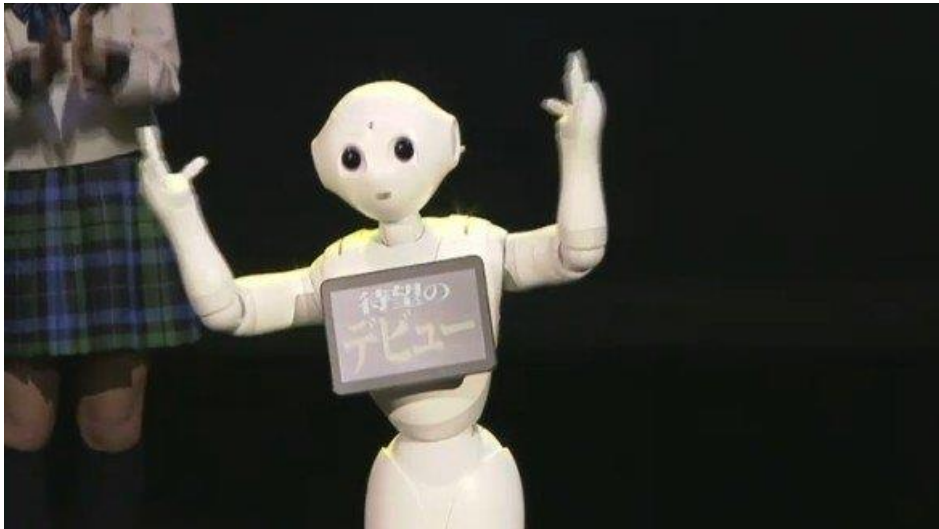


LawnBott



iRobot Scooba

Home Robot

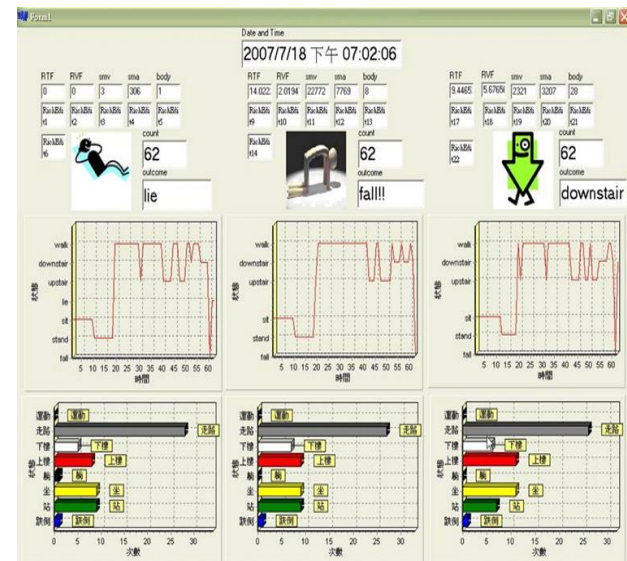
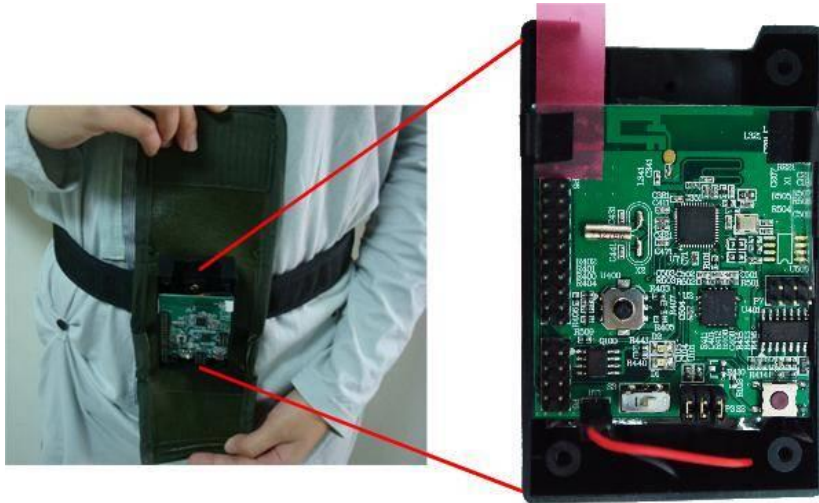


Pepper (軟銀 鴻海 Aldebaran)

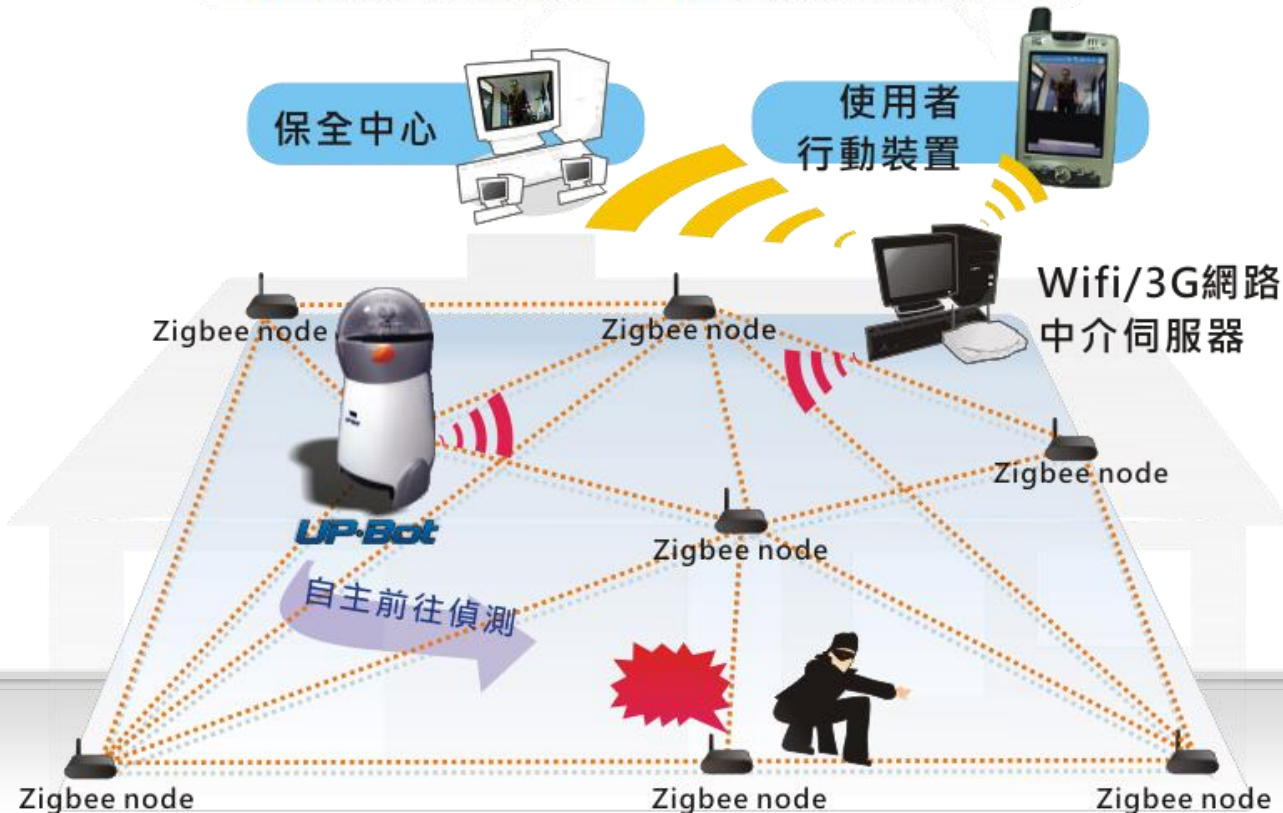
120cm，約台幣6萬，2015/2上市

Human Pose Estimation

- Estimate sit, stand, walking, Climbing up/down stairs, lie down, fall to the ground
- Connected to a wireless sensor network ◦

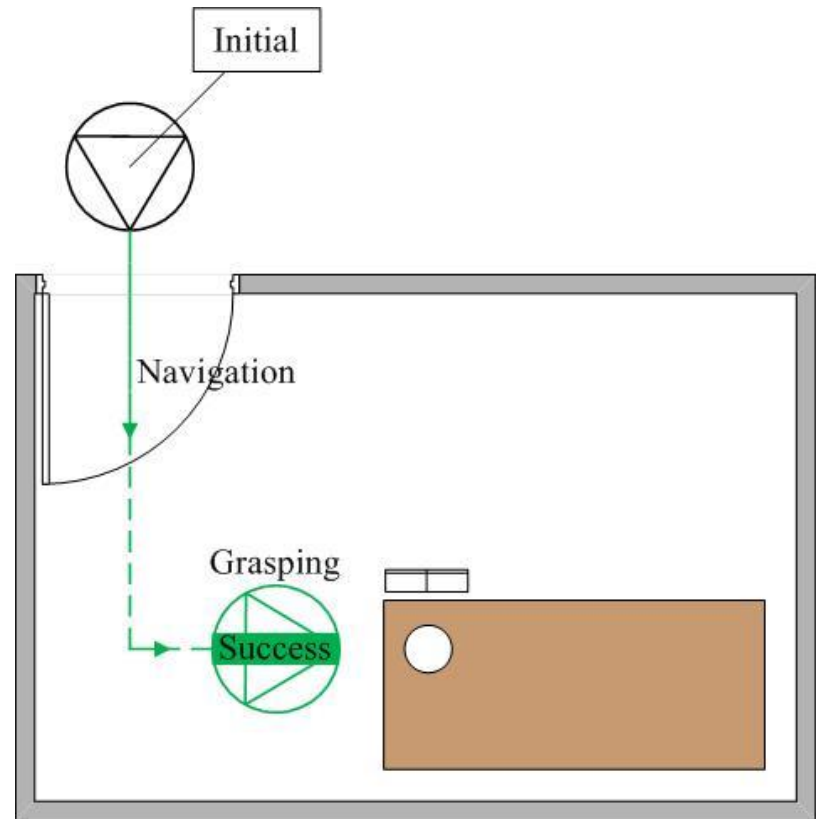


System architecture of Robot on Demand



Place Recognition & Grasp Planning

- To determine the proper position for searching and grasping objects.
- To consider graspability and reachability of robot for mobile manipulation task.

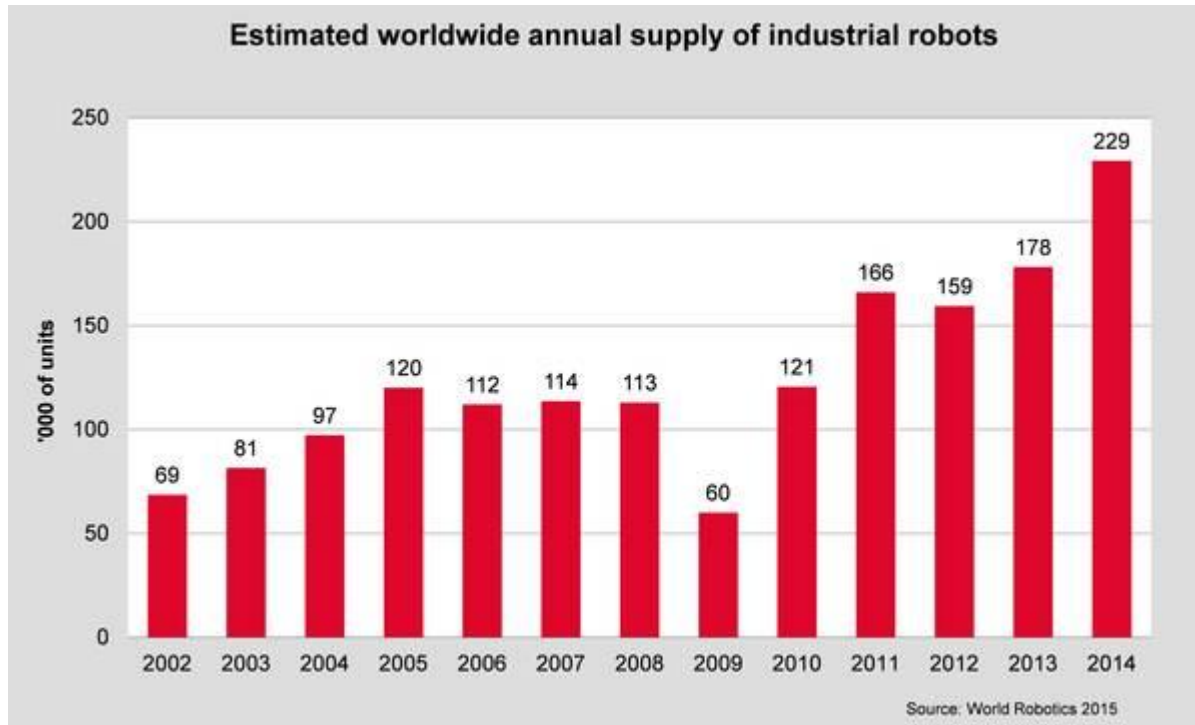


Robot Market

機器人產業動態

- 2010，Willow Garage 推出PR2及ROS。
- 2011，德國提出 Industrial 4.0
- 2012，Amazon買下KIVA 機器人公司。
- 2013，Unbounded Robotics公司發表UBR-1 (Running ROS)個人機器人。
- 2013，Google 買下Boston Dynamics, Schaft, Nest 等9家機器人科技公司。
- 2014，6月5日，日本軟體銀行公開機器人Pepper。2015年6月第二批銷售1000台。
- 2015，6月日5，生產力4.0科技發展策略會議，結合物聯網、巨量資料、智慧機器人推動工業4.0虛實整合網路智慧製造。
- 2015，12月2日，台灣第一台協作機器人: RT-5, Techman Robot

工業機器人年產量

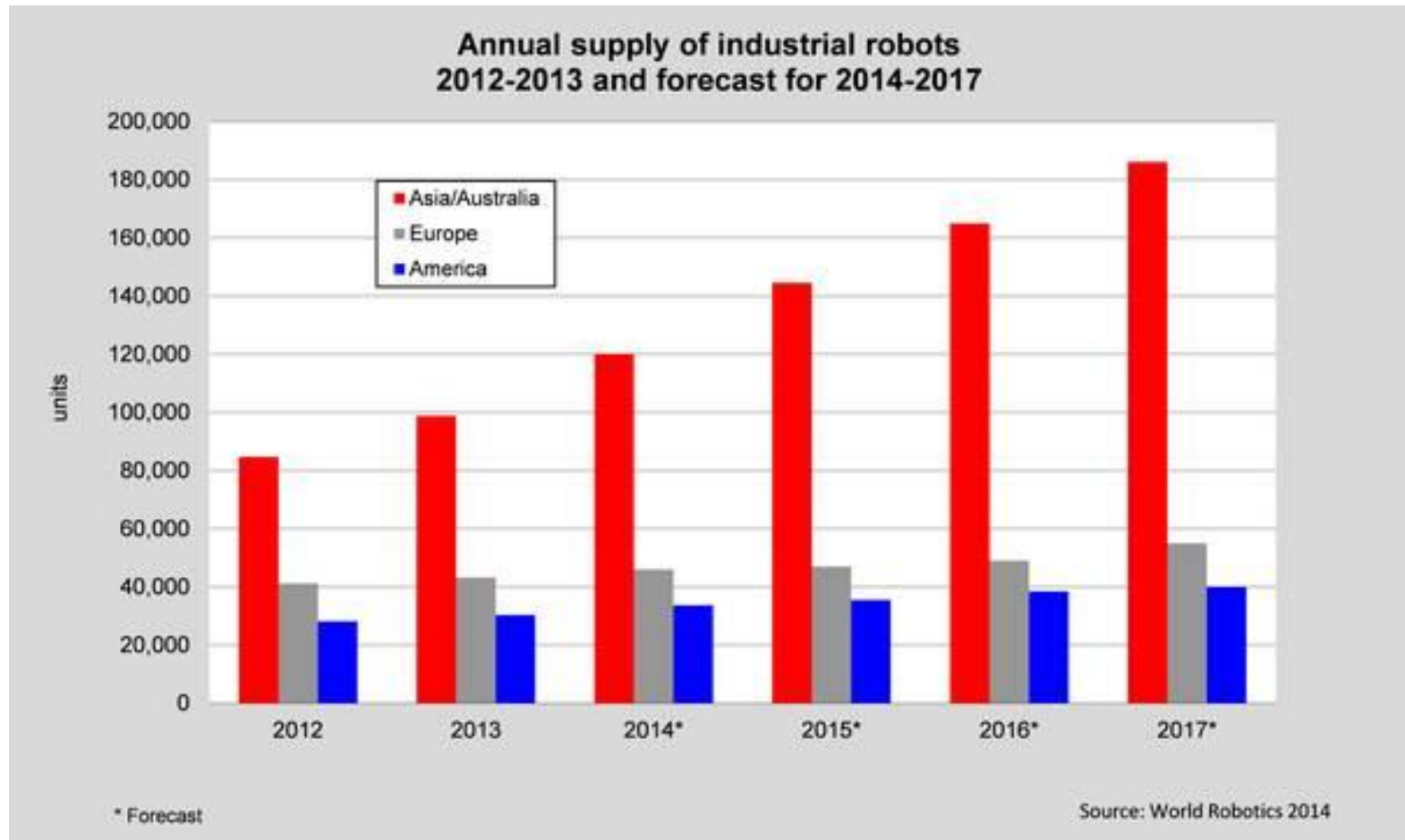


2014: 22.9萬台
2015: 24萬台

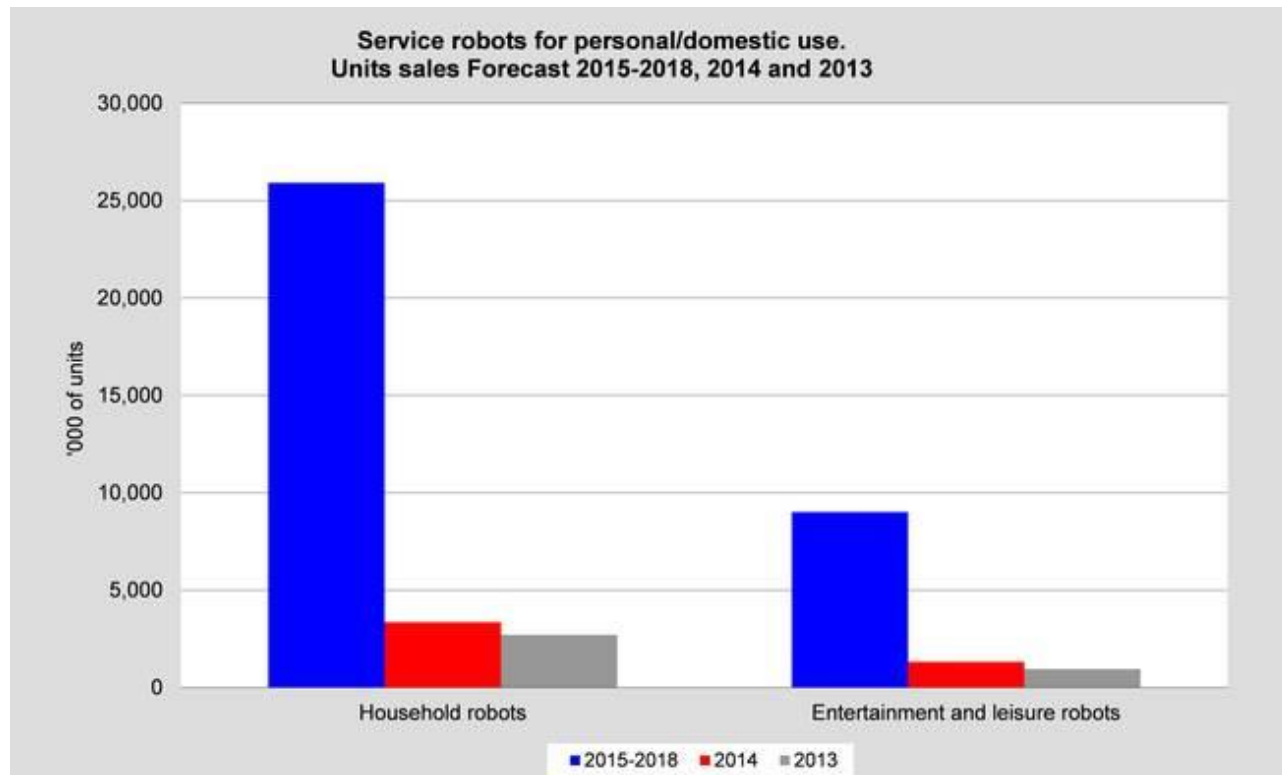
主要廠牌:
Yaskawa
Fanuc
Kuka
ABB

From: IFR

2014-2017工業機器人產量預估



家用(清潔教育娛樂) 機器人年產量



2014: 470萬台
2015-2018:3500萬台

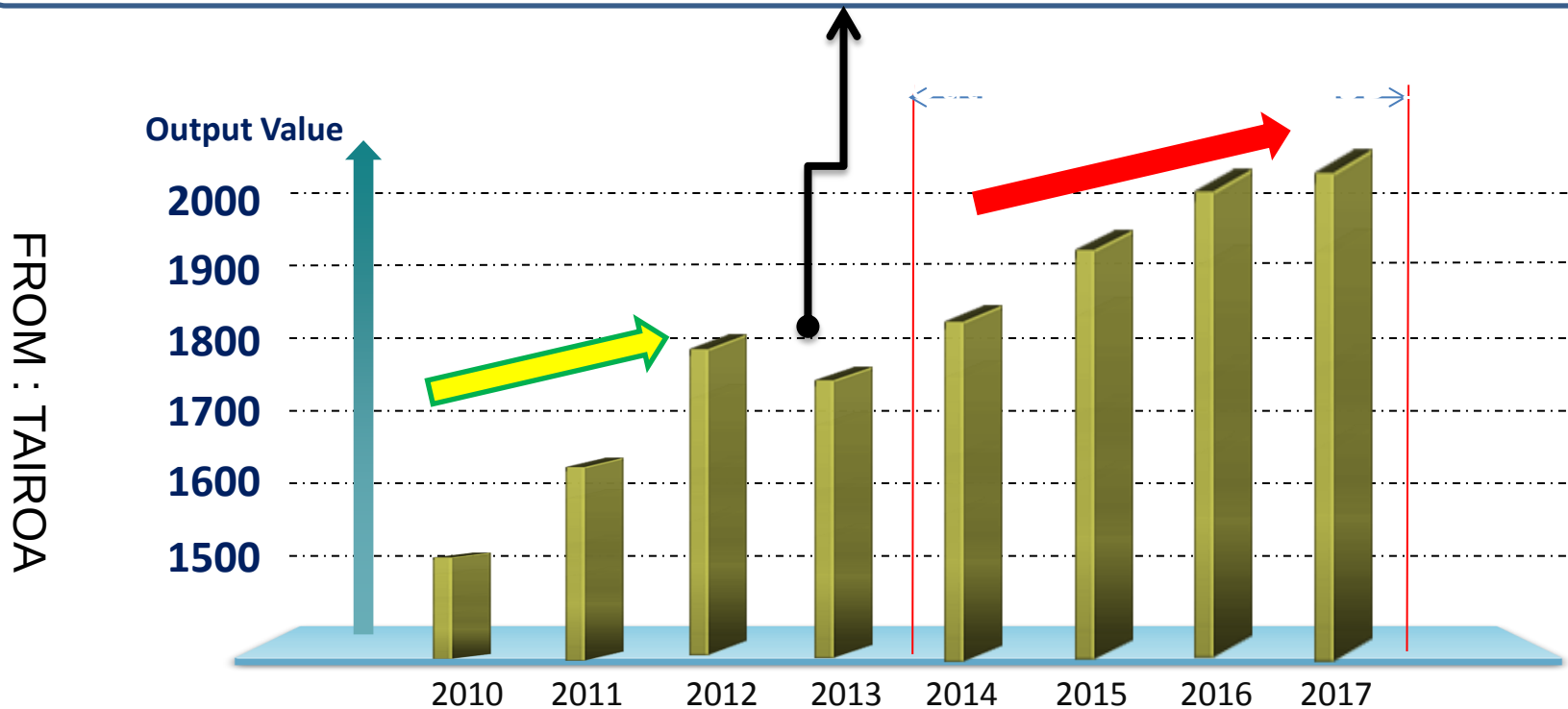
From: IFR

Intelligent Robotics Industry in Taiwan

The output value of intelligent robotics industry in Taiwan has risen from USD\$ 1500 Million from 2010 to USD\$ 1753 million in 2013. The Compound Annual Growth Rate (CAGR) is nearly 5%.

Industrial Robot Company:95
Output value around USD 1563 million

Service Robot Company:25
Output value around USD 190 million



	2010	2011	2012	2013	2014	2015	2016	2017
Output Value	1500	1683	1800	1753	1820(e)	1910(f)	2003(f)	2107(f)

Robot-centric Intelligent Automation Systems in Taiwan

Robot plays a key role in intelligent automation applications. For examples, 3C product manufacturing, metalworking, food processing, and logistics...

Packed box transport



Cake sorting



PCB mainboard assembly



Assembly



Stove parts sand blasting



LED wire welding



Sewing machine metal case deburring

Robotics Beyond Industry 4.0

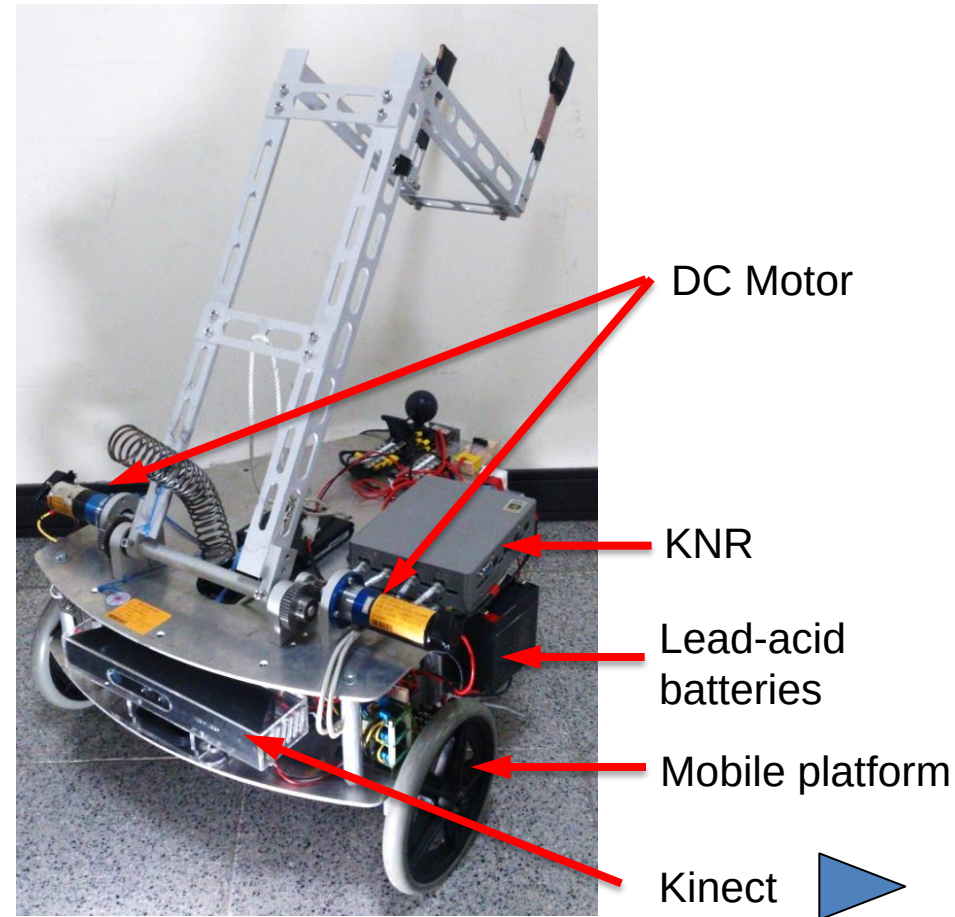
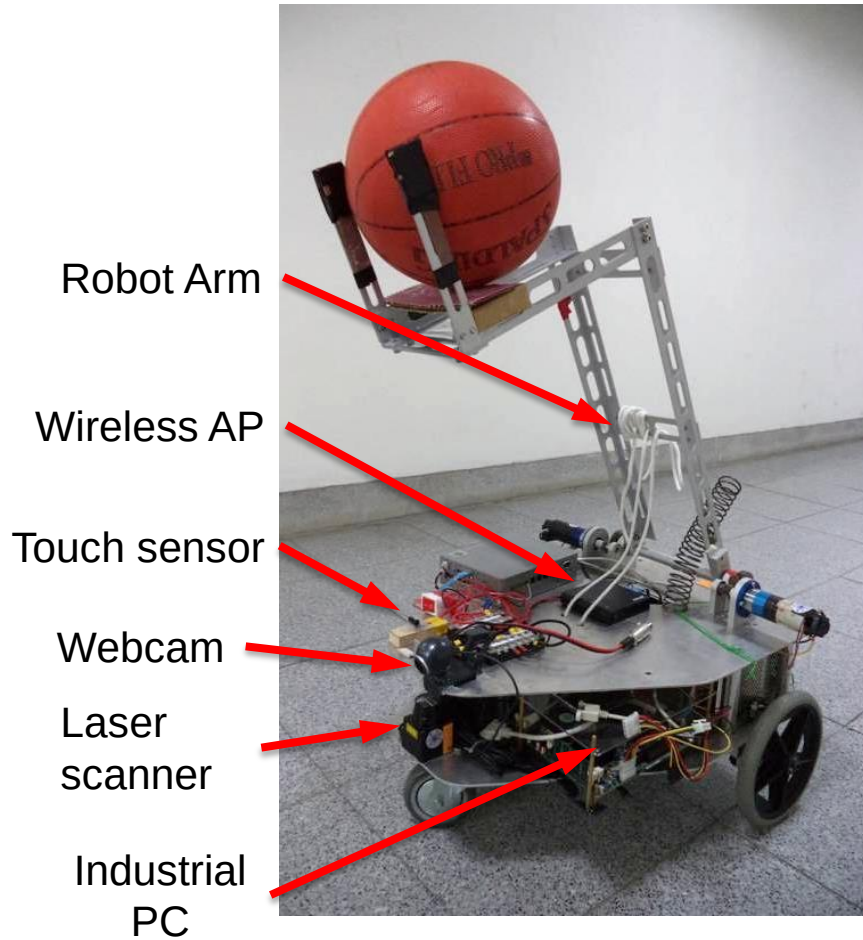
- IoT Robots
- Learning Robots
- Emotional Robots
- Robot Companion
- Ubiquitous Robots
 - Robotized tools, appliance, furniture

Robot Education

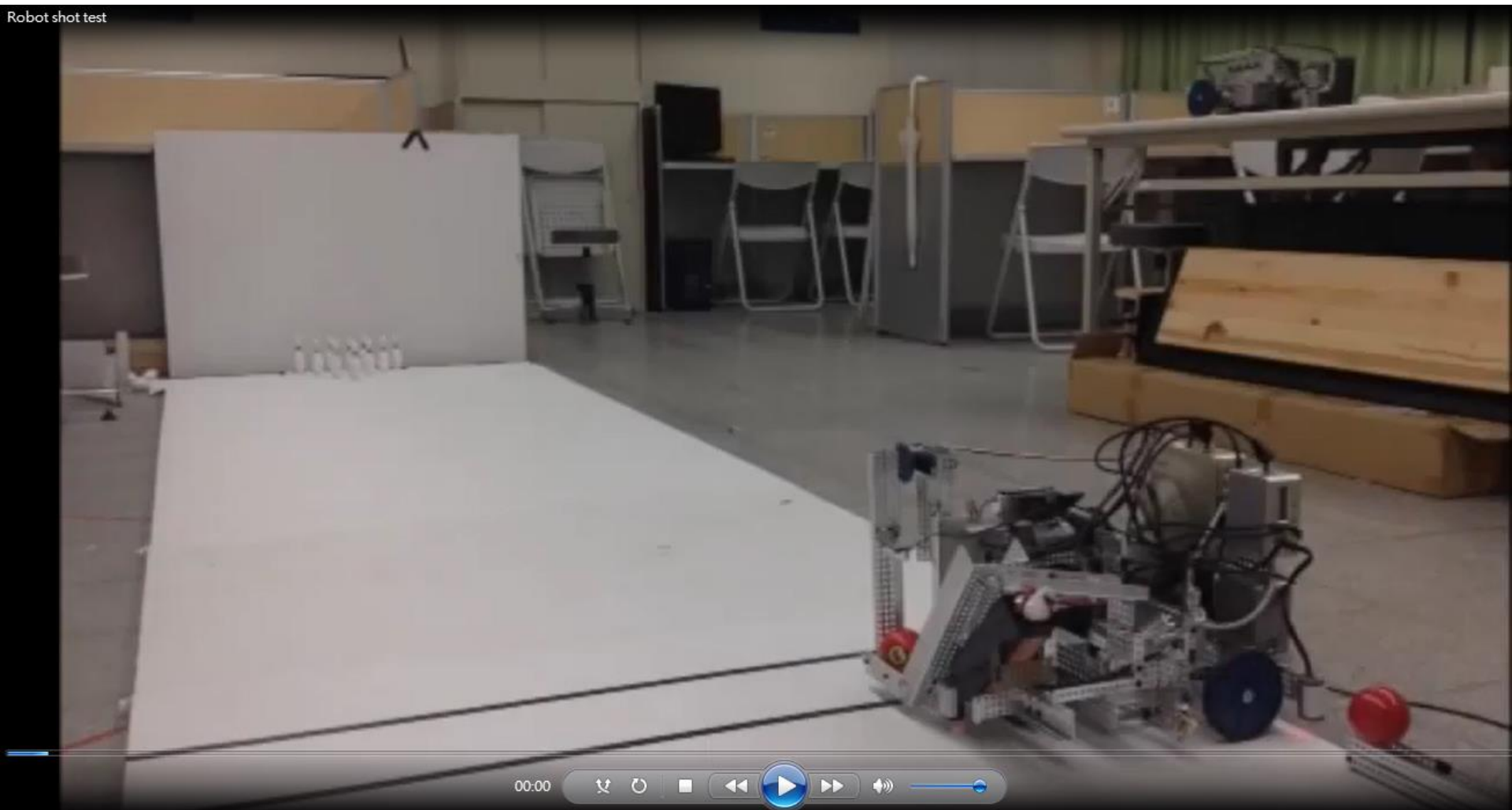


KNR 機器人實驗手冊：KNRm控制器
實驗教材開發（增訂版）

Basketball Robot



Bowling Robot



謝謝聆聽
敬請指教

