Centre for Healthcare Robotics

The University of Auckland-ETRI Joint Laboratory for u-Healthcare Robotics

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UniServices
Auckland UniServices Limited

THE UNIVERSITY OF AUCKLAND
FACULTY OF ENGINEERING

August 2008

Robotics and Intelligent Systems Laboratory

Department of Electrical and Computer Engineering

http://robotics.ece.auckland.ac.nz

Outline

- Robotics in aged care
  - Increase in the aged population
  - Increasing capabilities and market for service robots
  - Benefits of robots in health care
- University of Auckland Robotics Group
- Joint NZ-Korea project

Aged population growth (1)

- Dramatic growth in aged numbers in NZ
- One in 8 people are over 65, one in 5 by 2025
- One in 4 >85's are in residential care, one in 3 by 2021

- Already staffing and quality are challenges in aged care
- Each year 50% of residents have falls
- Care staff turnover is high
- It is a challenge for staff because of staff shortages

Aged Population Growth (2)

- Situation is worldwide, NZ, Korea, Japan, US, etc

- Increased funding cannot solve it: GDP per capita for aged care is increasing rapidly
- Robotics is one of the potential technology solutions

Market potential

- Personal robot growth from US$40b to US$50b by 2025

- Healthcare and medical robot market of US$2.7b by 2015

- Medical devices market US$80b in US, US$75b in Asia-Pacific, growing 12.5% pa

- Japanese service robot industry could grow from $5.2b in 2006 to $26b in 2010 and nearly $70b by 2025.

Personal robots

South Korea Microrobot, Dasarobot, Yujin Robot, and others

Pet Robot GENIBO

Public Robot FRIDA

Public Robot DOOLY

Cleaning Robot ZACSEN

iRobot.com: Vacuuming, cleaning, connecting

RobotCAM

Hanson Robotics, USA

The news is variable …

- Japanese seniors prefer teddies to robots *(Stuff, Sep07)*

- Lonely robots ignored by elderly luddites *(Herald, Sep07)*

- Bill Gates predicts "the future is robots", and introduces iMS Robotics Studio *(Scientific American, Jan07)*

- Robotic Dog Makes Nursing Home Residents Less Lonely *(Saint Louis University study, Jan08)*

Healthcare robots

Surgery robots already
established

Remote doctor

(InTouch, Santa Barbara)

Nursebot Florence (CMU, U Pitt)

IWARD (EU project): *It may not be long before tiny mobile robots will be giving a hand to the nurses and medical orderlies in hospitals.*

Paro the therapeutic baby
seal robot companion

Robot walkers

University of Virginia

Stanford

Veterans Affairs

Benefits of robots in aged care

- Vacuuming
- Delivery of food and laundry
- Vital signs monitoring: frequent, accurate, recorded
- Intelligent walkers extend the ability to walk independently
- Medication reminding, compliance checking, and perhaps administering, e.g. to improve outcomes for diabetics
- Physio, rehab, behaviour coach and reminder
- Companionship
- Video and audio service link to family and carers
- Remote telemedicine in rural areas, communities, prisons
- Support and relief for care staff (lifting, moving patients)

Extend older peoples' time at home and lower levels of care

Benefits of robots in aged care

- Vacuuming

- Delivery of food and laundry

- Vital signs monitoring

- Intelligent walkers

- Medication reminders, checks, and perhaps administering

- Behaviour coach

- Companionship

- Link to family and carers

- Remote telemedicine

- Support for carers

Extend older peoples' time at home and lower levels of care

Who will benefit?

- Aged
- Families
  - With older family living in the home
  - Remote family contact
- Care staff
  - Laundry and kitchen staff
  - Nurses
  - Doctors
- Insurers and funders

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Multidisciplinary team

Bruce MacDonald,ECE	Robotics and Intelligent Systems
George Coghill,ECE	Artificial neural networks
Catherine Watson,ECE	Robotic Speech
Waleed Abdulla,ECE	Speech recognition
Michael Neve,ECE	Wireless propagation
Karl Stol,Mech	Robot Navigation
Burkhard Wuensche,CS	Graphics and Visualisation

Liz Broadbent,Psych Med	Psychology in healthcare
Jim Warren,NIHI	Health Informatics
Karen Day,NIHI	Health Informatics
Martin Orr,NIHI	Health Informatics
Martin Connolly,Ger Med	Gerontology
Ngaire Kerse,Gen Practice	Gerontology
Mark Fisher,Middlemore	Geriatric Psychology

Gary Putt,UniServices	Business development
Andrew Palairet,UniServices	Business development
Malcolm Pollock,NIHI	Business development

Jim McMillan,Research Office	Grant applications

Healthcare Robotics Project (Tony Kuo)

- With Dr Liz Broadbent in Psychological Medicine

- Human reactions to good/bad robots: IROS 2007

- Student project in 2007, now a new PhD project

- Initially:

  - Taking blood pressure
  - Taking pulse
  - Taking temperature
  - Reminder service for medication
  - Networked communications to health services
- Shortly: blood samples, psychological evaluation

The University of Auckland-ETRI Joint laboratory for u-Healthcare Robotics

Project outline

- 3/4 year project, up to US $5.5M, start July '08
- Between 2 research organizations – ETRI and UoA
- Research components
  - Robot Programming tools, Wifi propagation, speech, vital signs, clinical practice guidelines
- Commercialisation components
  - Health Informatics – data, integration
  - Healthcare expertise – medical, lifestyle, entertainment, psychological, evaluation of robots in healthcare
- Has a range of support: NZ Health IT companies, NZ and Korean Governments, Korean Robotics companies, NZ aged care facilities

Status (1)

- **Market and legal analyses** completed (good results)
- Main **funding** proposal approved by NZ government (IIOF, NZ$1.8M + NZ$3.7M ETRI funding, over three years)
- UoA **study of human reactions** to good and bad robot presented at IROS in Oct/Nov, San Diego
- UoA project to **take blood pressure with a robot**; initial study completed
- UoA **focus group with nurses** completed

Status (2)

- Planned study: **acceptability of robots** to older people
- **Korean companion robot technologies** already established over four years, trialled in homes
- NZ/Korean **negotiations** since 2006
- **NZ health IT companies** engaged.
- Two **Korean robots** and software acquired
- **Korean Robotic Companies**: we are having discussions

Events (1)

- Mid 06 *ETRI visits NZ*; general seminar by John Grundy
- Aug 06 *NZ Delegation to Korea* (FRST, UniServices)
- Oct 06 *ETRI submits a Korean proposal* for joint work
- Nov 06 We submit *IIOF concept* (Human-robot interaction)
- Dec 06 *ETRI application declined; our IIOF withdrawn*
- Dec 06 *ETRI delegation to NZ* (FRST, ETRI) New topic: aged care
- Mar 07 *NZ Delegation to Korea* (FRST, UniServices) Agreed to form joint robotics centre for aged care
- Apr/May 07 *Build team at UA*: engineering, medicine & psychology, health IT (CSI, NIHI)
- Apr/May *Engage NZ health IT companies* (UniServices)
- Jun 07 *IIOF concept submitted* on aged care
- Jul 07 *IIOF concept approved*
- Aug 07 *Gary, Bruce visit ETRI & Govt in Korea* (UniServices)
- Sep/Oct 07 *Legal Analysis* by Buddle Findlay (UniServices)
- Oct 07 *Voice of Market analysis* by Paragon (UniServices)

Events (2)

- Nov 07 *IIOF application submitted*
- Nov 07 *ETRI delegation on robotics to NZ* (UniServices, FRST) incl NZ companies, Buddle Findlay, aged care facilities
- Dec 07 *IIOF funding approved*, conditional on ETRI funding
- Dec 07 *NERF concept approved*
- Jan 08 *ETRI researchers visit UA* to scope project
- Feb 08 *Two Korean robots and software purchased* (UniServices)
- Feb 08 *NERF proposal submitted*
- Mar 08 *ETRI vitals signs monitor project* favoured in Korea
- Apr 08 *Nurses focus group* Karen Day (NIHI)
- Apr 08 *Bruce, Gary visit ETRI and Korean robotic companies* (UniServices)
- *Jun 08 KANZ broadband summit in Korea*
- *Jun 08 ETRI funding contract signed*
- *Jul 08 IIOF contract approved*
- *Aug 08 Agreement for UniServices and ETRI*
- *19 Aug 08 Launch*
- *(plus several meetings/workshops with NZ companies)*

Events

- Started in mid 2006
- Many visits by us to Korea
- Many visits to NZ by ETRI
- Ministerial broadband summit in Seoul
- Several company workshops
- Market analysis in Boston
- Several grant applications

- *Launch: 19 August 5:30pm*

Legal analysis

Dr Marie Bismark & Dr Jonathan Coates, Buddle Findlay

- ***No significant impediments to our research plans***
- Patients must be fully informed and have choice
- Research staff, nurses, doctors must be trained and meet responsibilities to patients
- Commercial robots must be notified as medical devices. The new Trans-Tasman Joint Therapeutics Agency may be more stringent.
- Medicines: administering can use technology, prescribing can be done remotely (after face-to-face)
- Ethics approvals are required
- Needs of Maori must be considered
- Health information must be managed properly
- Trials for commercial companies must have professional indemnity insurance
- Plan to see MoH Compliance Team and Medicines Control Team

Voice of Market analysis

- **One day Expert Forum (Boston, October 2007)**
- Funded by UniServices with support from a TEC GIPI
- 8 commercial and academic US experts in robotics, aged & healthcare
- To provide market information and potential applications
- Results:
  - No direct competition
  - Appeal to 3rd party funders (insurers, agencies, families)
  - Potential use of robots for care in correctional facilities
  - Supported robots for: nurse's assistant, rehabilitation, entertainment & companionship, vital signs & behaviour monitoring, mobility, ageing in place

Nurse focus group results
Summary of identified uses for robots

- Home assistant, falls monitoring, companionship, communication, meals, hydration, medication, pain management, vital signs monitoring
- Remote access to help district nurse
- Hospital robot: wound care assistant, watch duty, track/escort patients, isolation assistant, identity management

Reasons why robots may fail in nursing

- Inadequate *funding*
- *Culture* and change management
- Disparate health *information systems*
- *Security* issues
  - Theft of robots
  - Patient information security (via robots)
- Protocols and guidelines must be *up to date* and relevant
- "*Big brother*" issues (watching nurses)
- Patients must *see the value* of a robot

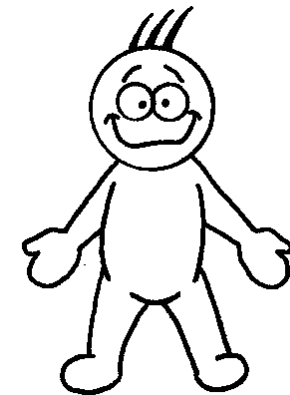 *Our plans mitigate all the issues, especially by acceptability studies*
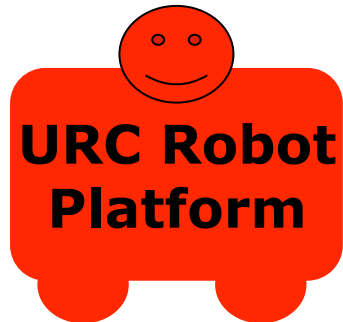
Project outline

ETRI
www.etri.re.kr

- Korean Gov.
- NZ Gov.

- Korean Companies
- NZ Companies

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Support

Commercialize

- URC infra system
- HRI components
- Health Care Robotic Space
- Standard

Testbed in NZ

- Robotic programming
- Healthcare Informatics
- Healthcare robotic service
- Environment optimization

Elderly Care

by ETRI

Vision for Centre for Healthcare Robotics

by Phil Shepherd, Medialab
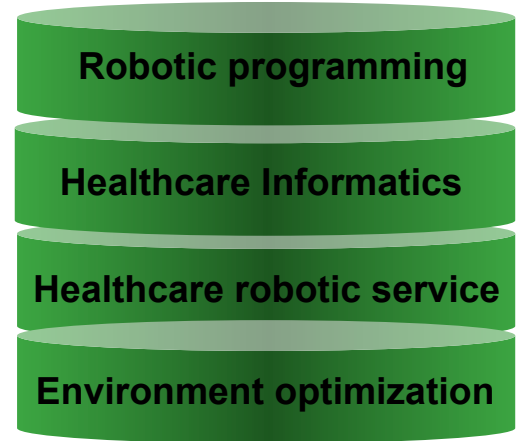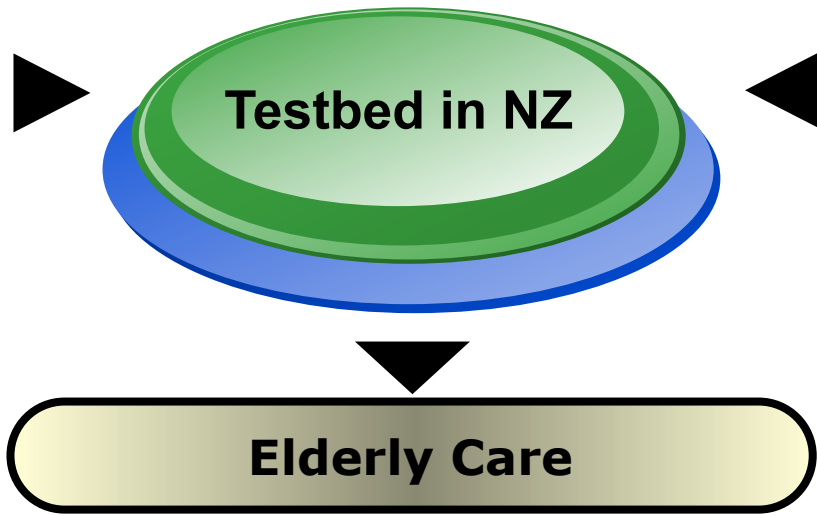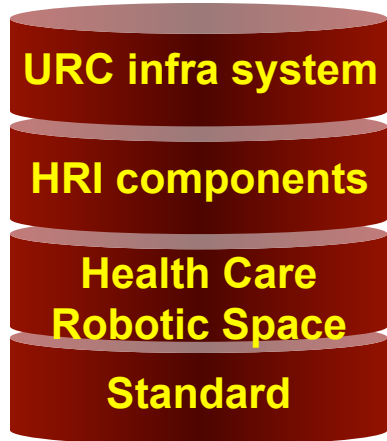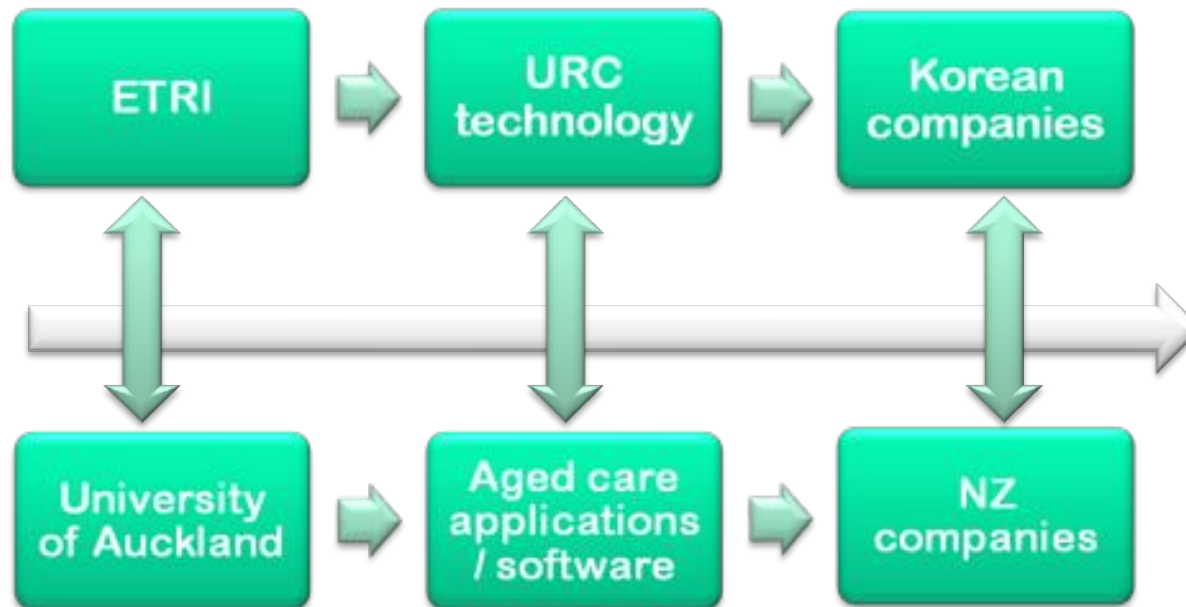
Vision for Centre for Healthcare Robotics

Korea robotics companies (3)

•US (2)
•European robot companies?

NZ health IT companies (7)
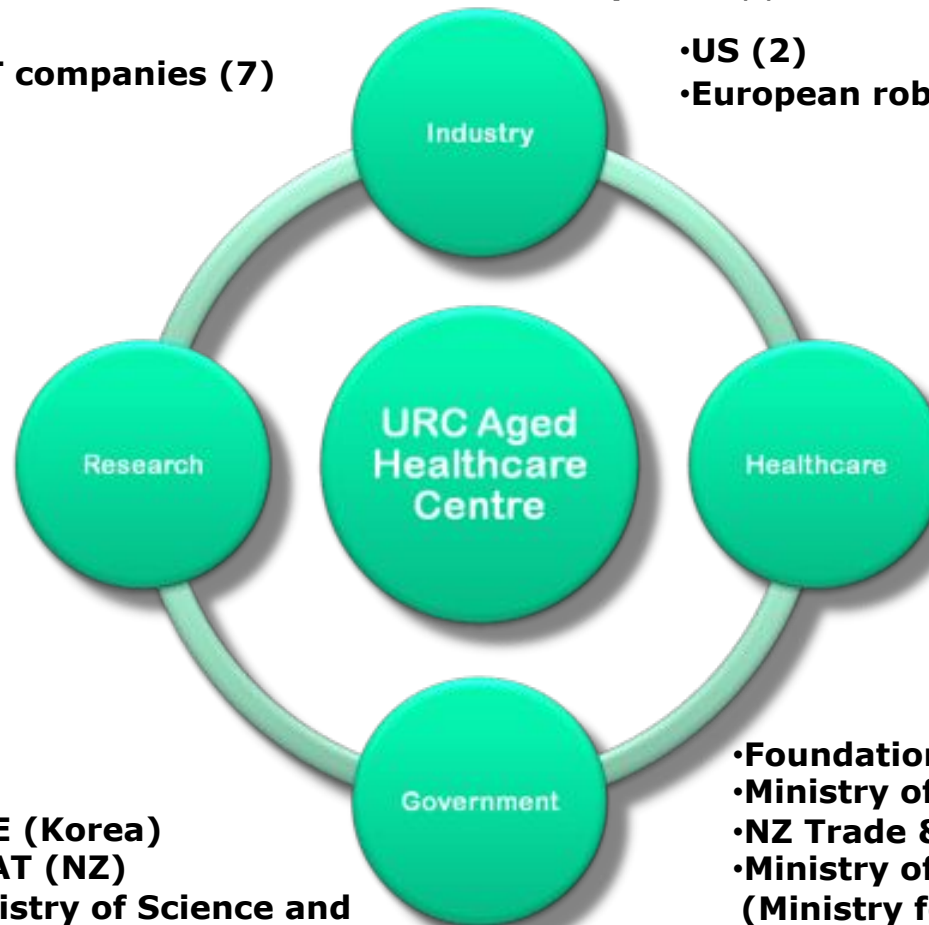
•ETRI
•University of Auckland
•NZ govt research lab

•Two aged care
 organisations

•MKE (Korea)
•MFAT (NZ)
•Ministry of Science and
 Technology (NZ)

•Foundation for RS&T (NZ)
•Ministry of Health (NZ)
•NZ Trade & Enterprise
•Ministry of Economic Dev (NZ)
 (Ministry for ICT)

by Phil Shepherd, Medialab

NZ company interests

- Health IT software
- Eg: healthcare services, telemedicine, companionship and networking
- Delivered on networked robot clients
- Can be sold after the robot is purchased
  - Downloaded from the server
- Opportunities for telcos to deliver content and services via robots
- NZ companies will work together with Korean robot companies to export health IT software on robotic platforms
- Aged care facilities: evaluation

Economic Development and Research Science and Technology Minister, Pete Hodgson, and Communications and Information Technology Minister, David Cunliffe, have announced a major research programme into personalised robotics in the aged health sector which has the potential to place New Zealand in the export market of the growing global robotics industry.

» Press statement, 20 June 2008

Summary

- Robotics in aged care
  - Significant increase in the aged population
  - Increasing capabilities and market for service robots
  - Benefits of robots in health care
- University of Auckland Robotics Group
- Collaboration with South Korea's ETRI
- Potential for high growth based on the aged care robot platform

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- ETRI, including: Dr Cho YoungJo, Dr Sohn Joochan, Dr Chi SuYoung, Dr Yoon HoSub, Mr Lee Ickchan

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