Overview of presentation

- Update on ISO robot standardization activities
- Drivers for the future
  - Industrial robots → service robots
- ISO SC2 work groups
  - WG1: Vocabulary
  - WG3: Industrial robot safety
  - WG7: Personal care robot safety
  - WG8: Service robots
- Conclusions
Prior to 2004 most robot standardization activities focused on industrial environments. ISO and IEC are main international organizations with responsibilities for the standardization.

EC funded Network of Excellence CLAWAR (1998-2005) ⇒ primary aim to widen the application base for robotics. Initiatives in robot modularity and standardisation for mobile service robots.

Formal contacts were made to several national standards bodies to activate the work required:
- BSI (Univ Leeds, UK), AFNOR (Cybernetix, France), SIS (Orebro, Sweden), ONH (Univ Vienna, Austria), IBN, (RMA, Belgium), BIS (BAS, Bulgaria), ESI (HUT, Finland), DIN (T-AFF, Germany), MSZT (Univ Budapest, Hungary), ENIU (UNICT, Italy), NNI (TNO, The Netherlands), PKN (Poznan, Poland), IPQ (ISQ, Portugal), AENOR (CSIC, Spain)

New robot standardization work under with SC2: Robots and robotic systems proposed. ISO Resolution to set up an ISO Advisory Group on “Standards for mobile service robots”, with GS Virk as Chairman.
- Advisory Group setup in June 2005 with GS Virk as Chair with ≈30 nominated experts + Observers for maximising input
- Advisory Group reported results at TC184/SC2 Plenary meeting in Paris on 15-16 June 2006
- Creation of a work group on Personal care robot safety (Prof Gurvinder S Virk, UK as chair)
- Creation of an Work group on Service robots (Prof Seungbin Moon, Korea as chair)
- Creation of a work group on robot vocabulary (Rodolphe Gelin, France as chair; now Prof Moon)

Traditional robot applications

Manufacturing in “Industrial environments”
New service robots

Passenger Robots
- i-Seat (TOYOTA)
- WL-16R8 (Waseda Univ.)

Surgery Robots
- Da Vinci (Intuitive Surgical)

Care Robots
- i-Swing (TOYOTA)
- Regina-JII (Japan Logic Machine)
- CARE-O-BOT (Fraunhofer-IPA)

Domestic Robots
- Roomba (iRobot)
- Automower (Electrolux)

Changing face of ISO robot standardization

TC 184 Industrial Automation Systems and Integration
TC 199 Safety of Machinery
SC2 Robots for industrial environment
- ISO 9946 ... Presentation of Characteristics
- ISO 10218 ... Safety
- ISO 9499-1 ... Mechanical Interfaces

TC 184 Automation Systems and Integration
TC 199 Safety of Machinery
SC2 Robots and Robotic Devices
- ISO 10218 ... Safety of industrial robots
- ISO 8373 ... Updated Vocabulary
- ISO xxxx ... Safety of robots in personal care

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FDA Workshop on Medical care robots
So what is a robot?

- **Robot:** First used by Czech writer Karel Capek in a play entitled Rossum’s Universal Robots in 1921. Capek’s robots were hard-working humanoid machines. The word derives from robota, the Czech word for slave labourer.
- **Robotics:** The term robotics, meaning the technical field encompassing robot technology, was first used by Isaac Asimov in 1942 in a short story entitled Runaround.
- **No “official ISO” definition of robot**
- **Official ISO definition (ISO 8373):** An industrial robot is an automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes which may be either fixed in place or mobile for use in industrial automation applications.
- **Current trends:** term “robot” is now being used for systems that have “motion” and “intelligence” rather than being “multi-purpose” as defined in ISO 8373.

### Industrial/ Service Robots

<table>
<thead>
<tr>
<th></th>
<th>Industrial Robots</th>
<th>Service Robots</th>
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</thead>
<tbody>
<tr>
<td><strong>Working environments</strong></td>
<td>Controlled and defined environments</td>
<td>Information structured/unstructured environments</td>
</tr>
<tr>
<td><strong>Users</strong></td>
<td>Training for specified tasks in defined environments</td>
<td>Training to cover wide range of tasks in info structured/unstructured environments</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>Machine dependant</td>
<td>Dependent on the robot and the user</td>
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<tr>
<td><strong>Working philosophy</strong></td>
<td>To keep robots and humans separated (see ISO10218-1)</td>
<td>Robots and humans must share workspace for providing/receiving the services</td>
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<tr>
<td><strong>Machine design</strong></td>
<td>Flexible on commissioning</td>
<td>Flexible on demand</td>
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FDA Workshop on Medical care robots

Climbing and Walking Robots, 16-18 July 2007, Singapore
Drivers for change?

• Manufacturing robots in industrial environments: The current situation sees robots as very dangerous and
  – Can only be used to do well-defined tasks in well-defined environments
  – Can only be used by specialist and trained operators and users
  – Have ISO rules and regulations that try to largely “separate the robots from the humans” due to the potential hazards

• Services Robotics: The future? Robots need to be
  – Used for a wide range of requirements + environments not easily defined
  – Used by non-specialist users
  – In the same space as the humans; need for regulations especially safety

• How to make the transition?
  – Don’t develop robots but develop reusable robot technologies (Japan)
  – No standards – Safety a big concern
  – Widen acceptability?
  – Ethics becoming important?

New ISO workgroups

• WG1 Vocabulary on robots and robotic devices
• WG3 Industrial robot safety
• WG7 Personal robot safety
  – Non-medical personal care robot safety
  – Medical care robot safety
• WG8: Service robots
• Countries involved: France, Germany, Hungary, Japan, Korea, Sweden, Switzerland, UK, USA
• Liaisons: IEC, IFR, IEEE, DICOM
Latest ISO robot definitions

- **robot**: actuated mechanism programmable in more than one axis with a degree of autonomy, moving within its environment, to perform intended tasks
- **service robot**: robot that performs useful tasks for humans, society or equipment excluding industrial automation applications
- **autonomy**: ability to control movement and communication to perform intended tasks without human intervention
- **personal care robot**: service robot with the purpose of aiding actions or performing actions that contribute directly towards improvement of the quality of life of individuals
- **medical robot**: a robot or a robotic device intended to be used as a medical device

Conclusions

- **Robotics is moving to a new era: Services Robots aimed at mass markets**
- **New technologies need to be developed to meet the requirements of this new sector where close human-robot interaction is needed**
- **Safety standard needed urgently to assist rapid development**
  - **non-medical personal care robot safety standard** due to be published in 2011
  - **medical care robot safety standard**: work started in 2009, due to progress approximately 2 years behind non-medical robot work