Service-Robots as Daily Helpers

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A Thesis about Service-Robots and Ehtics

Open issue for fostering discussion

„Service-Robots are ethically not problematic because they only do what a human operator wants them to do“

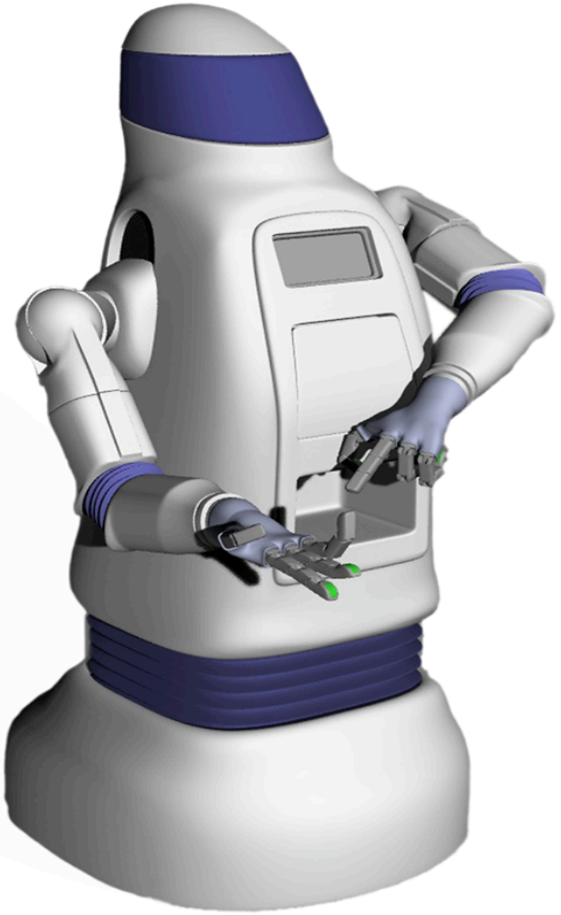
-...

My presentation: What does this mean more precisely?

Deutsche Servicerobotik-Initiative - DESIRE

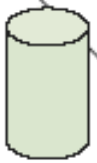
DESIRE-Alltag
- ❑ Technologieplattform
- ❑ Anwendungen

Technologieplattformen als Katalysator für die Konvergenz der Technologien



Anwendungen Alltag

- Indoor-/Outdoor-Wachroboter
- Transportroboter für Krankenhäuser
- Reinigungsroboter für professionelles Reinigen
- Outdoor-Personentransport
- Komponente: Personenerkennung
- Komponente: RFID-Navigation



Alltagstaugliche Wahrnehmung
- Erkennen > 100 Objekte unter unkontrollierten Be
- Sichere Detektion und Modellierung von Hindernis
- 3D-Kartographierung sehr großer Umgebungen
- Erkennen von Objektfunktionen

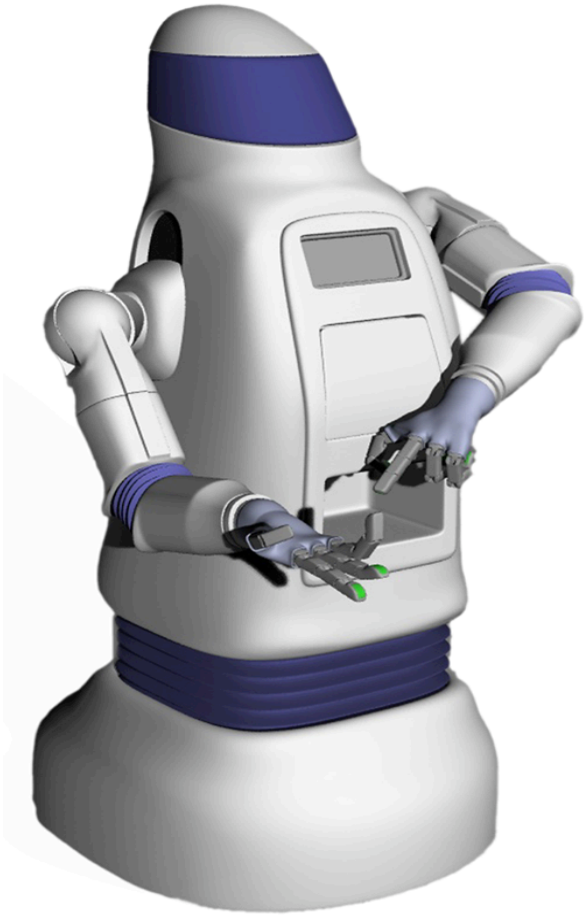
Alltagstaugliche Manipulation
- Integriertes Hand-Arm-System
- Bewegungsführung komplexer Kinematiken
- Sicheres Greifen von einigen Dutzend Objektformen
- Lernen und Adaption bei Manipulationsaufgaben (PdV)

Alltagstaugliche Interaktion und Kommunikation
- Robuste Zeigegesten
- Klassifizierung von Interaktionssituationen, Erkennung von Partnern

DESIRE-Grundlagen
- ❑ Referenzarchitektur
- ❑ Funktionalitäten
- ❑ Komponenten

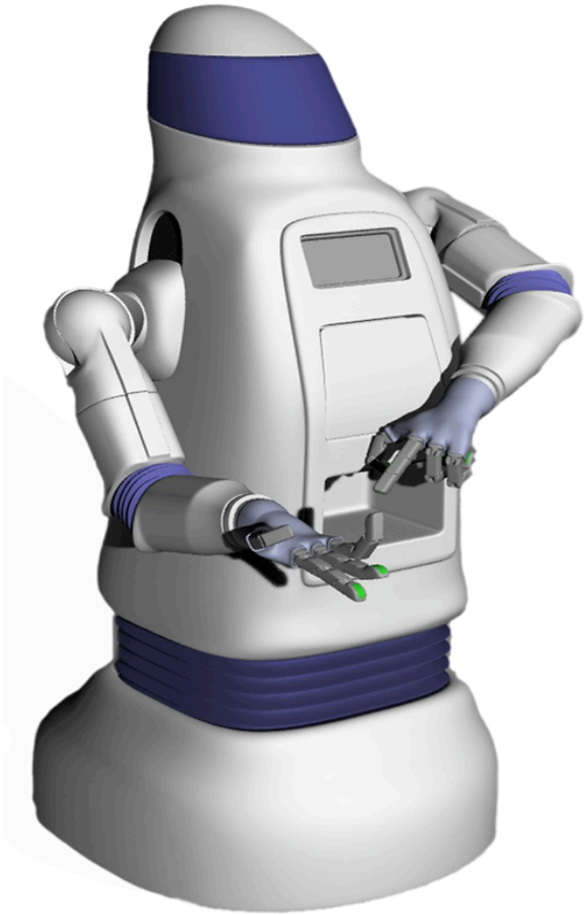
Grundlagen

The German Service Robotic Initiative



- A project funded by the German ministery of research
- Headed by Fraunhofer (IPA), with leading German robotic/electronic industry (KUKA, Siemens)
- Start 1.10.05, 3 Years duration
- Goals
  - Integrate leading edge technology
  - Provide functionality that works in daily life
  - Offer an open, extensible system architecture

Application Scenarios

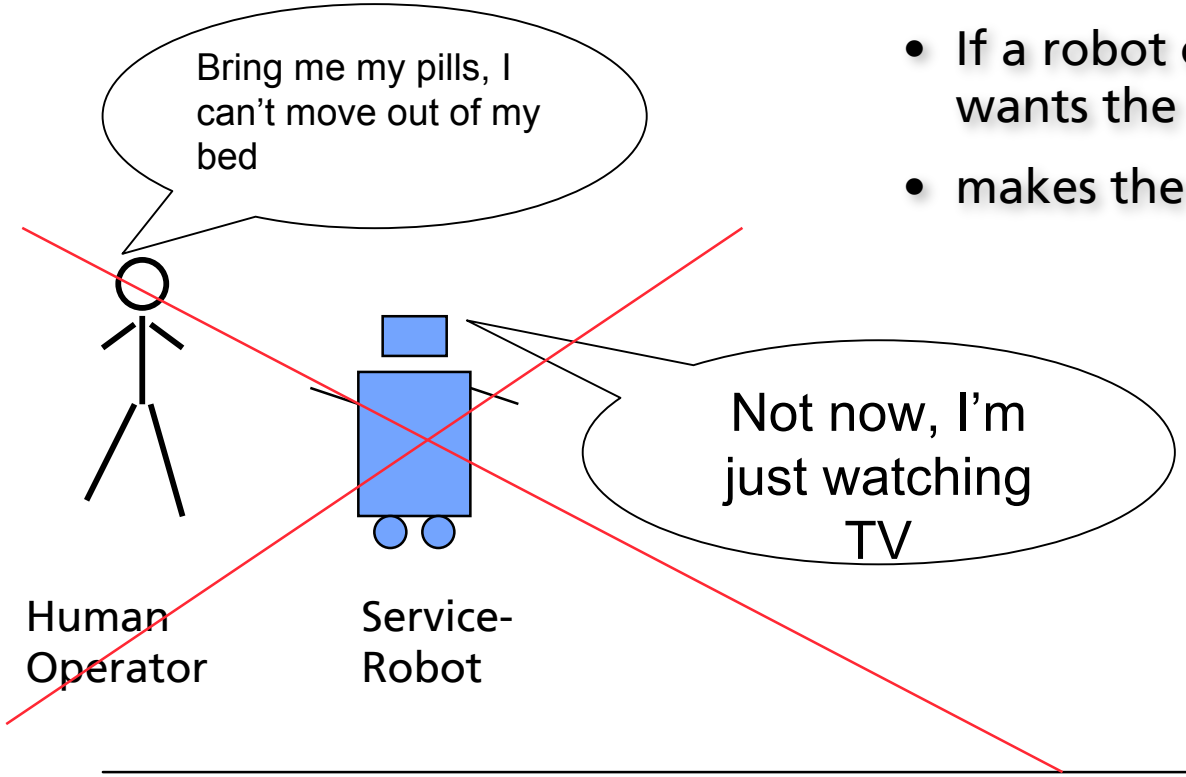


- "Clear-up the kitchen table"
  - all objects on top the kitchen table will be moved to where they belong
- "Fill the dish washer"

  the dirty dishes will the sorted correctly into the dish washer
- "Clear-up this room"
  - all objects that are not at their place will be moved to where they belong

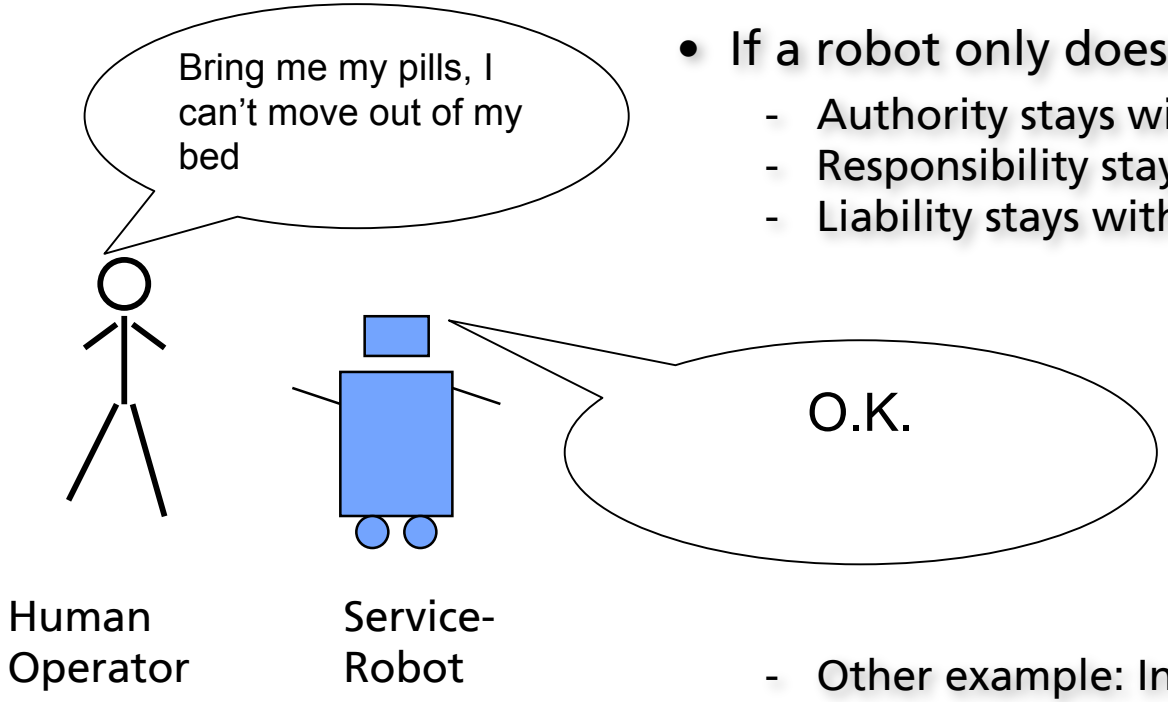
Fraunhofer Institut Autonome Intelligente Systeme

Service-Robots and Human Operators



- If a robot only does what a human operator wants the robot to do
- makes the robot useful

Advantages of the Human Operator Concept



- If a robot only does what the humans wants it to do
  - Authority stays with the human operator
  - Responsibility stays with the human operator
  - Liability stays with the human operator

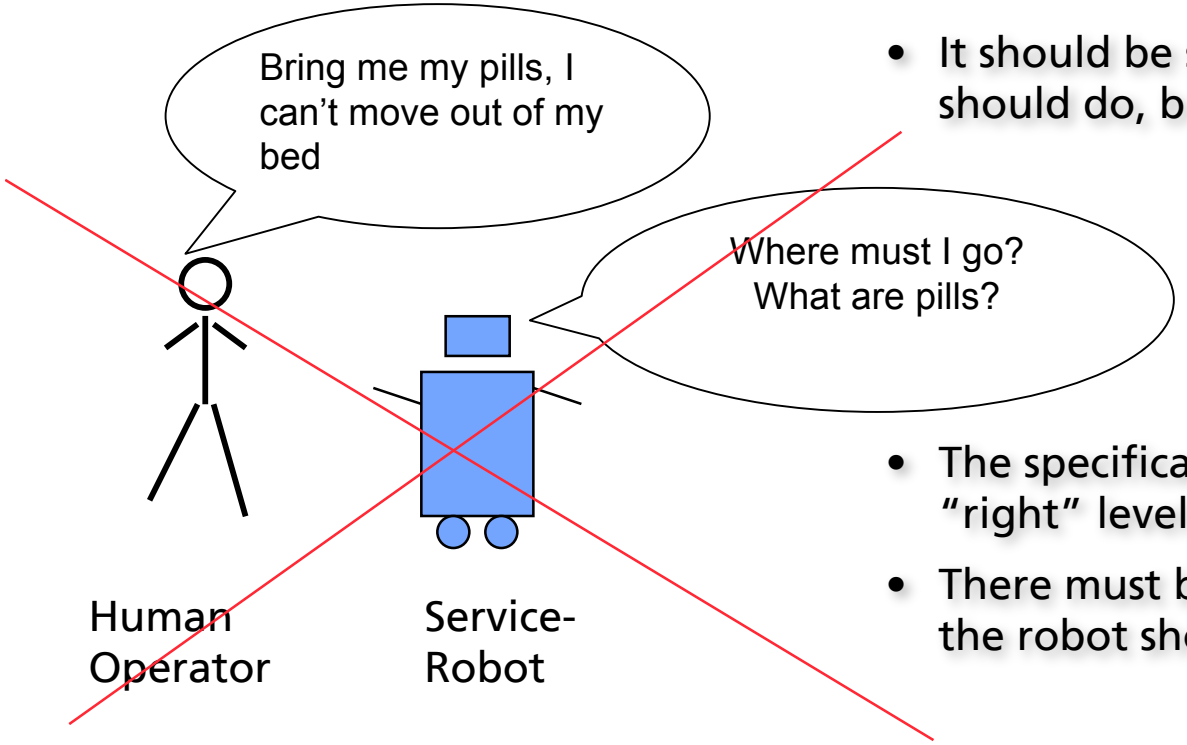
- Other example: Intelligent driving assistants in cars
- Other example: space robotics / mission on mars

Predictability: An industrial proven concept

- A system/machine/robot is predictable if it delivers correct functionality according within a specified time.

- Well known concept from real-time systems and industrial robots
- Sometimes also called deterministic

Predictability and Autonomy



- It should be sufficient to specifiy "what" the robot should do, but not "how"

robot selects autonomously how to do it

- The specification of "what to do" must be at the "right" level of abstraction
- There must be a model that allows to specify what the robot should do

Examples of Models (at different layers)

well established model

new, but understood

lots of research needed here

Layer	Abstraction „what to do“	Model
Drives	Drive at speed s	Control loop that regulates output voltage (differential equation model)
Navigation	Move to position (x,y) without hitting any obstacle	Navigation algorithm with in-built obstacle avoidance (model combining a map and sensor input)
Service-Robot	„clear up room“	Room model (non movable objects) Object model - picture of object - where to put it normally - how to grab it - … Non-identifiable objects are just obstacles …

Fault Tolerance

- A model must include the possibility that something goes wrong
  - robot does not recognize objects correctly
  - robot tries to grab an object, but looses it
  - robot has wrong estimation about ist position in the room
  - ...
- A robot should recognize these faults and
  - try some recovery
  - or inform the human operator

Summary

- Authority for Service-Robots stays with the human operator
- Predictability: Operator specifies what the robot does
- Autonomy: Robot selects how to do it
- Combining predictability and autonomy requires expressive models at reasonable abstraction levels.

Discussion

„Service-Robots are ethically not problematic because they only do what a human operator wants them to do“

Open issue. please discuss:

-what is the model for “take care of my child while I am away”

- can we leave a patient who needs pills alone with a service robot to bring those pills if needed?

-...

I hope to have made this part of the statement a bit clear

BMBF Projekt - Start 11/2005 - 3 + 1 Jahr

1. Fraunhofer-Institut Produktionstechnik und Automatisierung (IPA)
2. Fraunhofer-Institut Autonome Intelligente Systeme (AIS) ← ARCHITEKTUR

(3. Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR))

4. Siemens AG (Siemens)
5. Forschungszentrum Informatik Karlsruhe (FZI)
6. Albert-Ludwigs-Universität Freiburg (ALU)
7. Ruhr-Universität Bochum (RUB)
8. KUKA Roboter GmbH (KUKA)
9. Schunk Gmbh & Co. KG (Schunk)
10. InMach Intelligente Maschinen GmbH (InMach)
11. Viisage Technology AG (Viisage)
12. Gesellschaft für Produktionssysteme GmbH/Neobotix (GPS/Neobotix)
13. Gesellschaft für Produktionssysteme GmbH/Projektmanagement (GPS)

Koordination von Subsystemen