A Concept to Cover Assisted Living Key Areas based on Home Automation Sensors

extended Version of a presentation at the
IEEE London Conference on Networking, Sensing and Control in April 2007

Prof. Dr.-Ing. habil. Lothar Litz
Institute of Automatic Control
University of Kaiserslautern

Brasilia, March 16, 2007

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Outline

- Introduction

- Assisted Living Key Areas

- Pilot Project in Kaiserslautern

- Basic Structure of the Solution

- Information Hierarchy and Information Processing

- Outlook

Development in many countries:

- People live longer
  → Less money available for care
- Birth rates decline
  → Less people have to care for more elderly
- More people will live alone
  → Assistance is needed
- More elderly-typical deceases (e.g. dementia)
  → Special Assistance needed

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Population pyramids for Germany

Altersaufbau: 2001 Deutschland

Altersaufbau: 2050* Deutschland
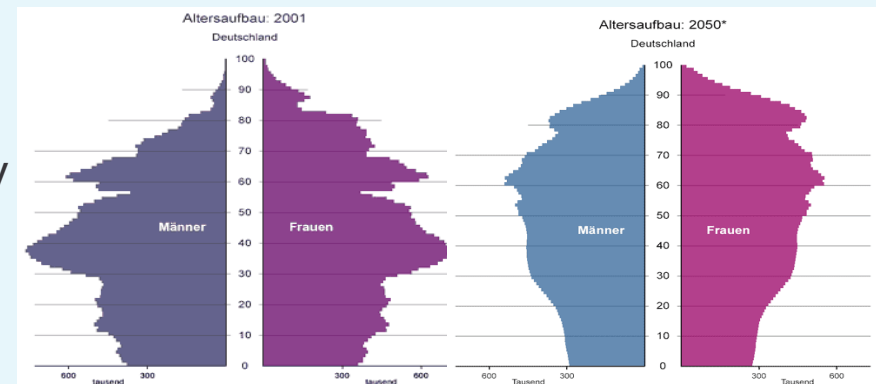
What does Assisted Living mean?

Concept of a technical Equipment to help people to live self-determined as long as possible in their home

Health

- Downfall Detection
- Taking Medicines
- Alarming Emergency situations

Safety

- Watching front door by camera
- Switching off critical loads
- Preventing Water Damage

Comfort

- Electronic latchkey
- Electric shutters
- Automatic lighting
- Dialing by photos

Special Devices
Health

Safety

Home Automation

Comfort

- Downfall Detection
- Taking Medicines
- Alarming Emergency situations

- Watching front door by camera
- Switching off critical loads
- Preventing Water Damage

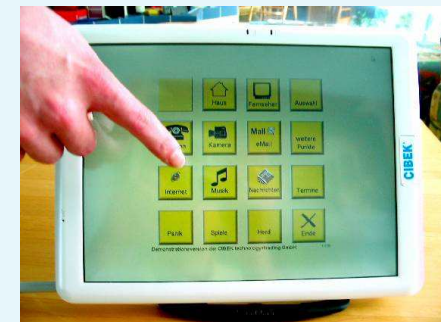- Electronic latchkey
- Electric shutters
- Automatic lighting
- Dialing by photos

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Comfort Examples

- Motion detection to switch on lights

- Remote control of electric shutters

- Opening doors by electronic keys

- audio-visual communication among apartments

Safety Examples

- Camera and microphone at the front door

- Monitoring on the screen: apartment door open/closed
  and locked/unlocked, Windows open/closed

- when leaving the apartment
  - Automatic indication: Windows open/closed
  - Automatic switching off of critical loads

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Home Automation

- Watching the inhabitant's activity

Special Devices

- Emergency-Call wristbands
- Downfall detectors
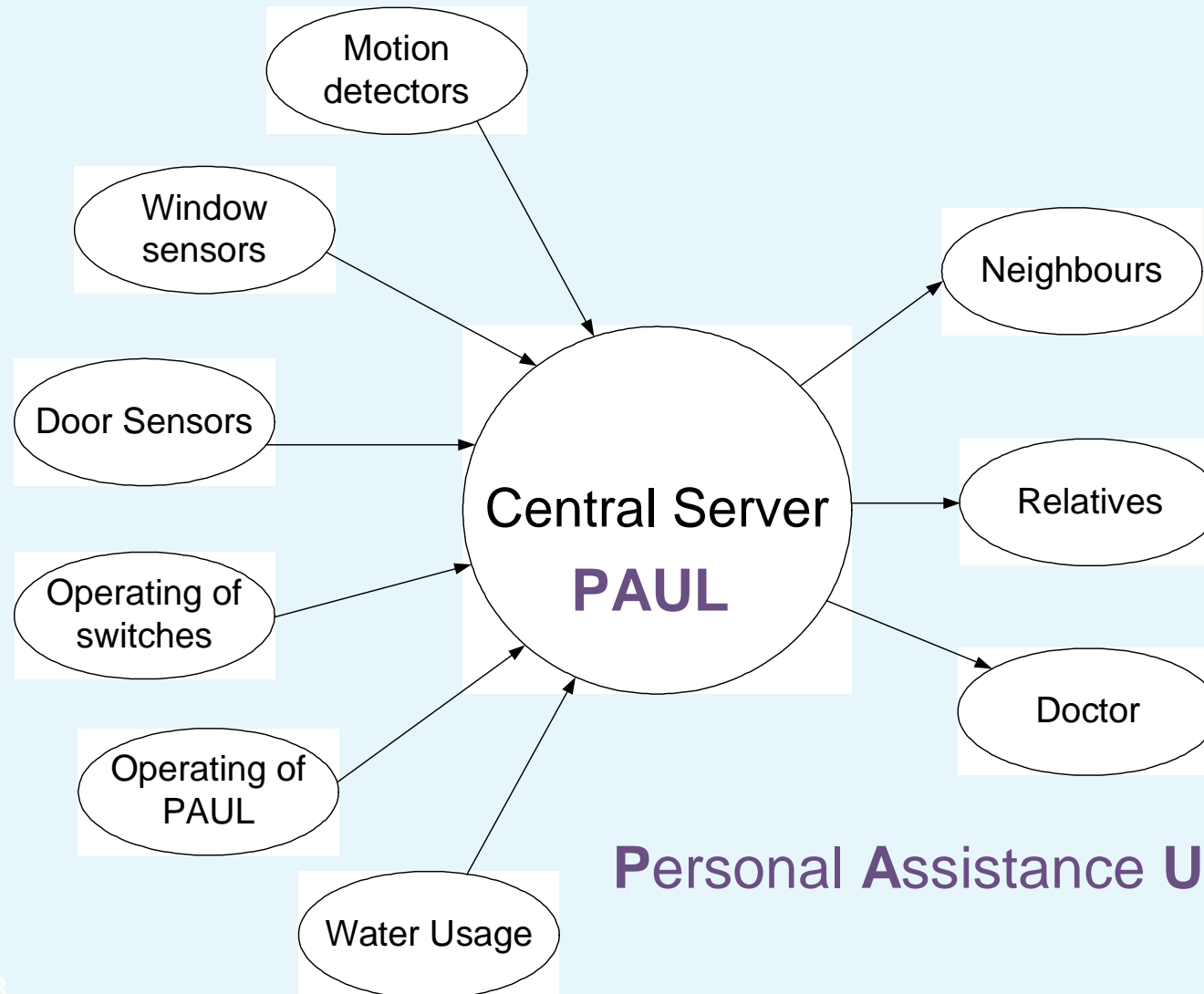- Downfall detection mats

Pilot Project in Kaiserslautern

← last year

this year
↓

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KAISERSLAUTERN

Motion detectors

Window sensors

Door Sensors

Operating of switches

Operating of PAUL

Water Usage

Central Server
PAUL

Neighbours

Relatives

Doctor

Personal **A**ssistance **U**nit for **L**iving
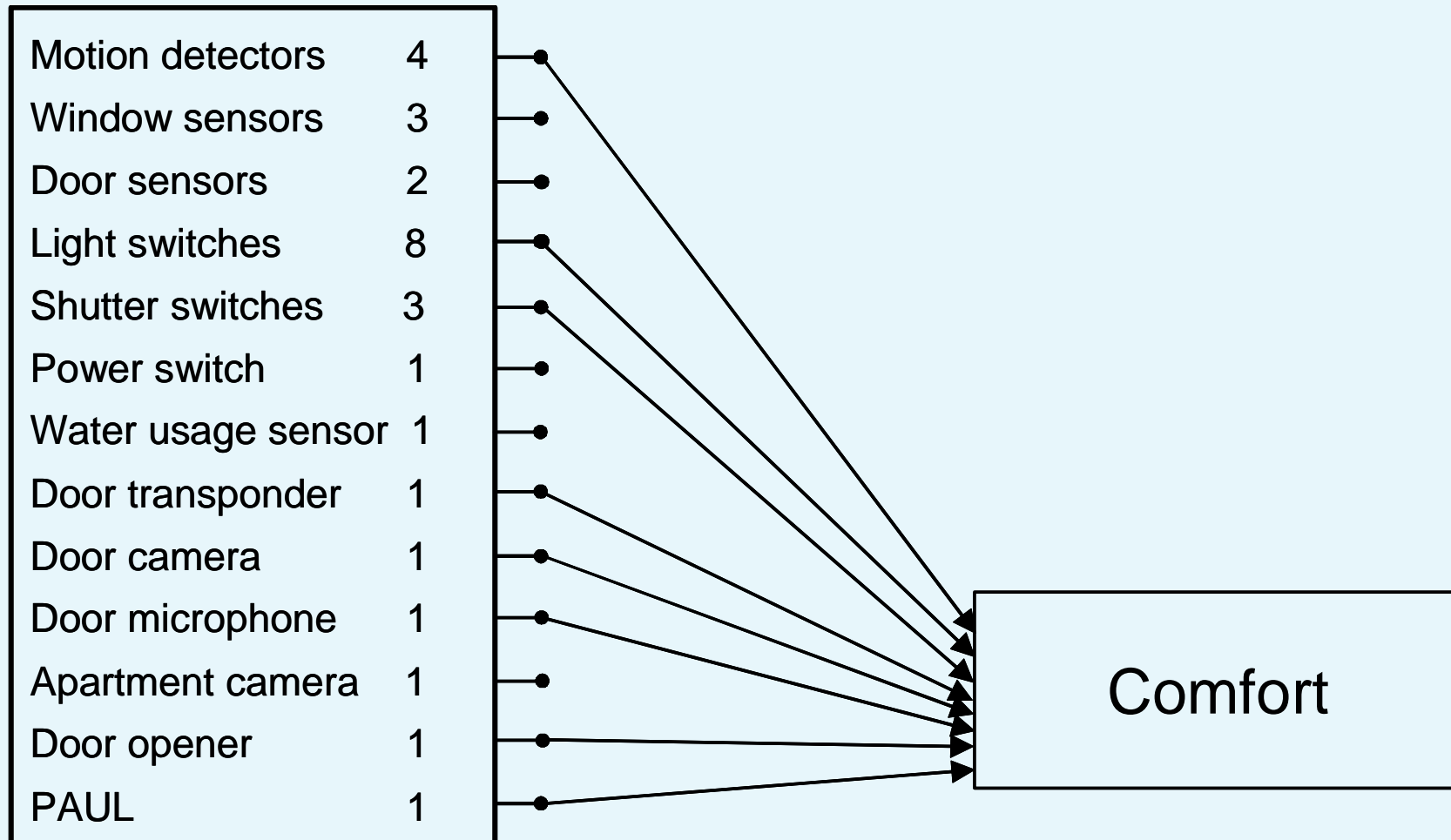
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Tasks of PAUL

HCI

Central
Data
Collector

Intelligent
Monitoring
Unit

Alarm
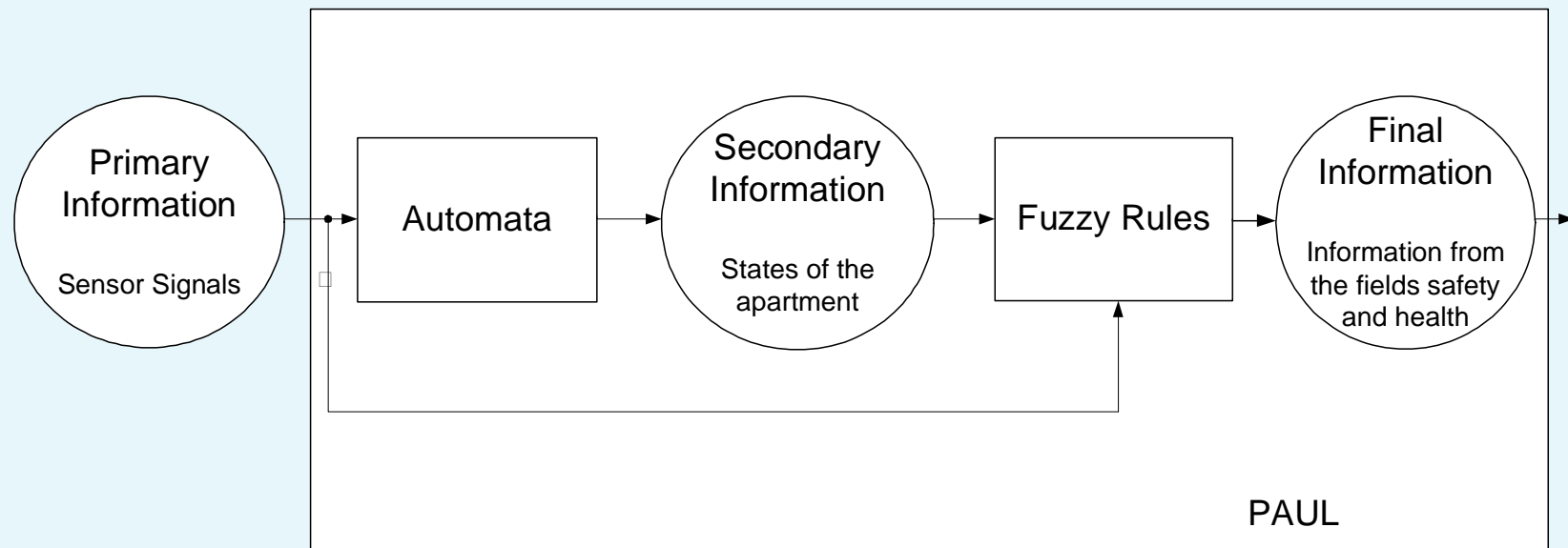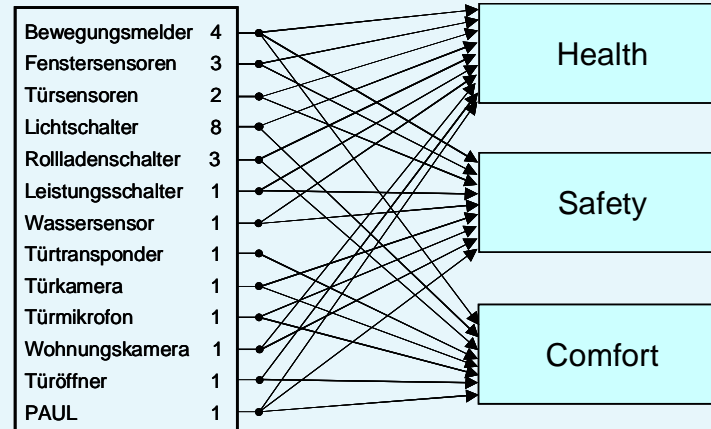Generator

Motion detectors	4
Window sensors	3
Door sensors	2
Light switches	8
Shutter switches	3
Power switch	1
Water usage sensor	1
Door transponder	1
Door camera	1
Door microphone	1
Apartment camera	1
Door opener	1
PAUL	1

TECHNISCHE UNIVERSITÄT
KAISERSLAUTERN

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Health

Bewegungsmelder	4
Fenstersensoren	3
Türsensoren	2
Lichtschalter	8
Rollladenschalter	3
Leistungsschalter	1
Wassersensor	1
Türtransponder	1
Türkamera	1
Türmikrofon	1
Wohnungskamera	1
Türöffner	1
PAUL	1

Health

Safety

Comfort

Primary Information

Sensor Signals

Automata

Secondary Information

States of the apartment

Fuzzy Rules

Final Information

Information from the fields safety and health
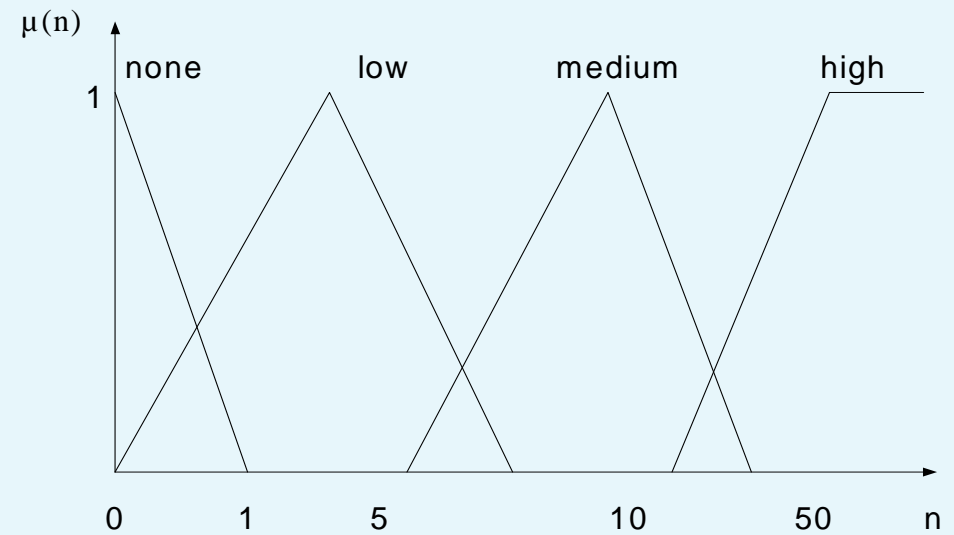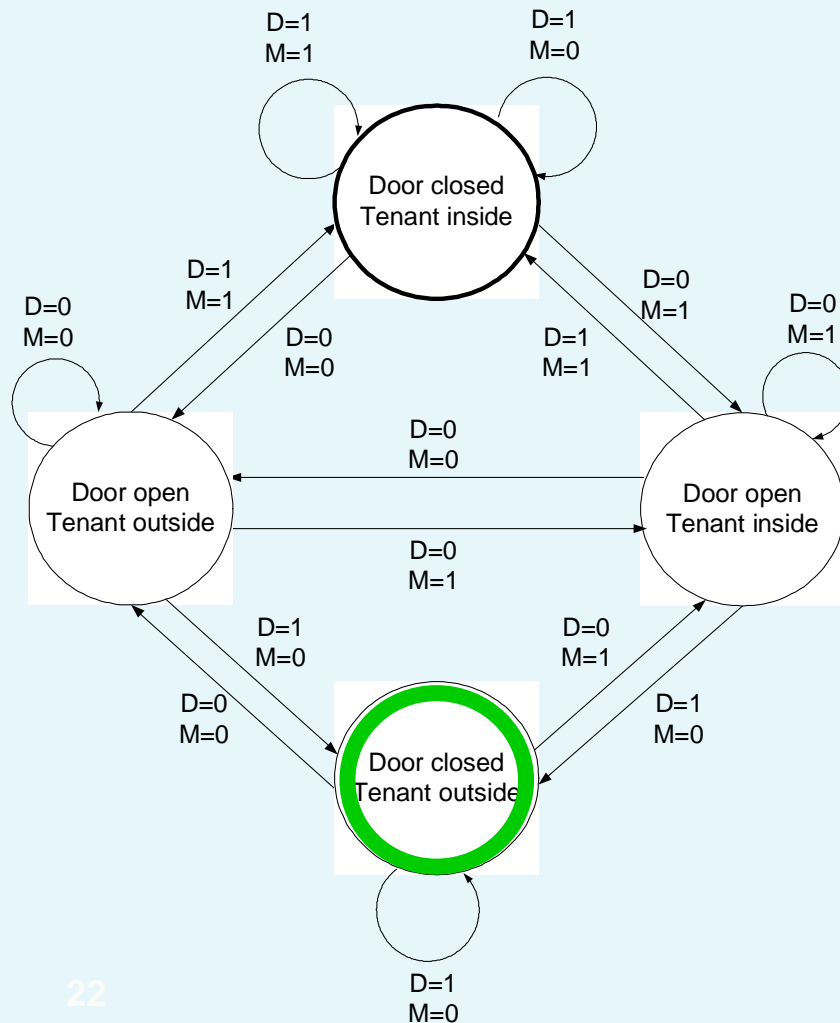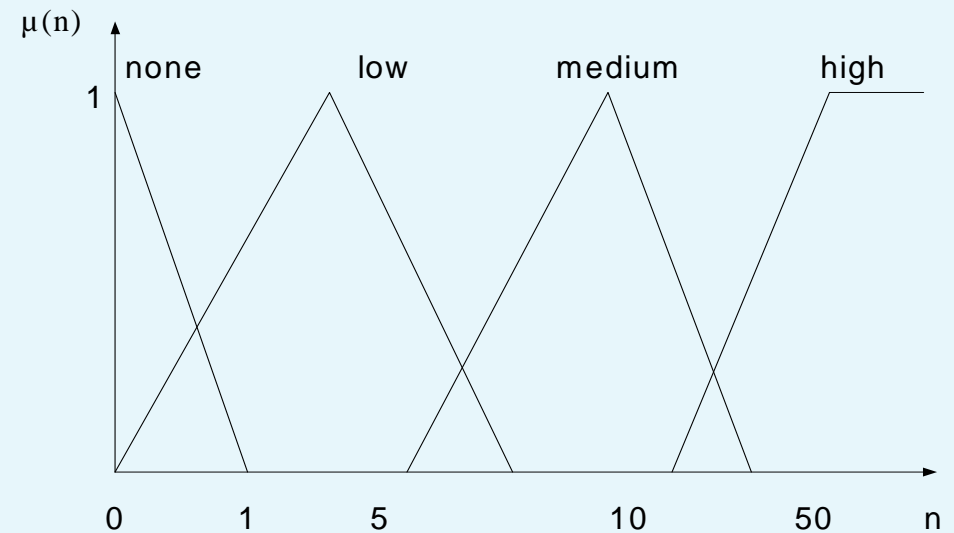
PAUL

Automata

Fuzzy Rules

IF Tenant inside **AND** expected activity high **AND** momentary activity low **THEN** Alarm mean priority
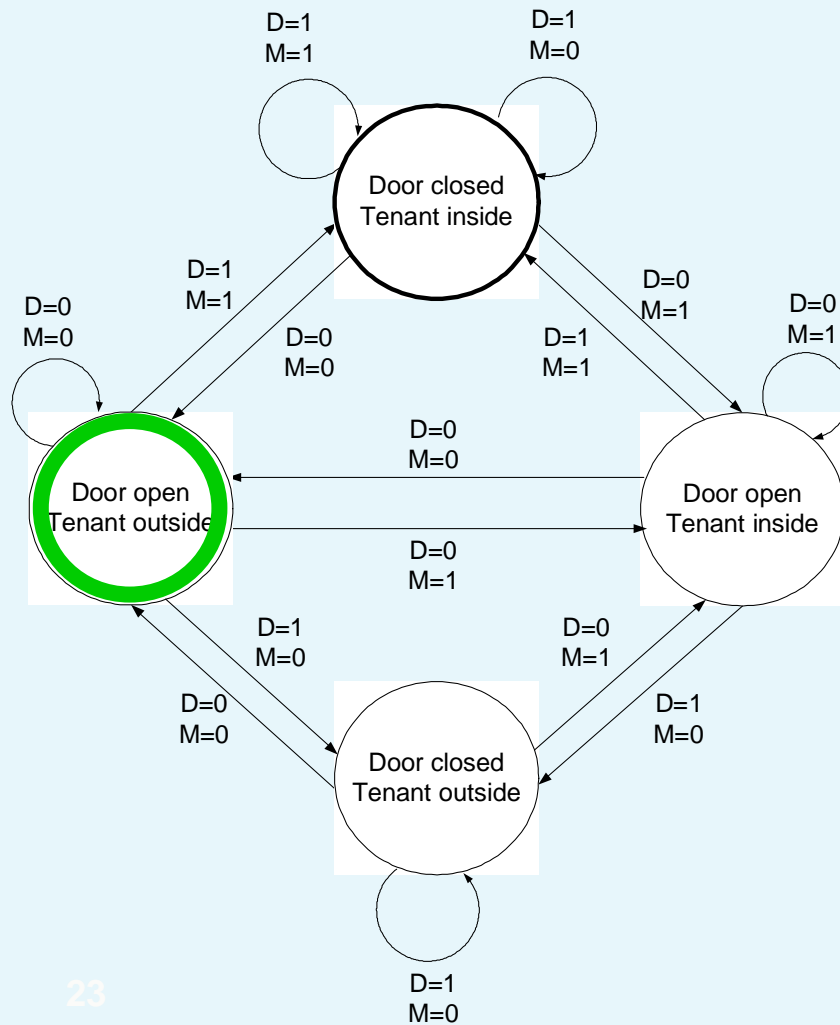

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Automata

D=1
M=1

D=1
M=0

**Door closed
Tenant inside**

D=1
M=1

D=0
M=1

D=0
M=0

D=0
M=0

D=1
M=1

D=0
M=1

**Door open
Tenant outside**

D=0
M=0

**Door open
Tenant inside**

D=0
M=1

D=1
M=0

D=0
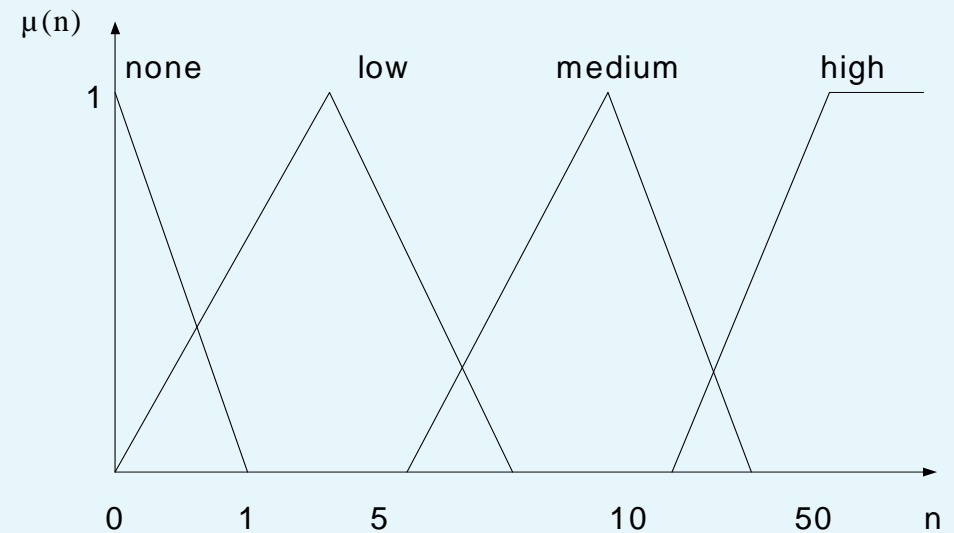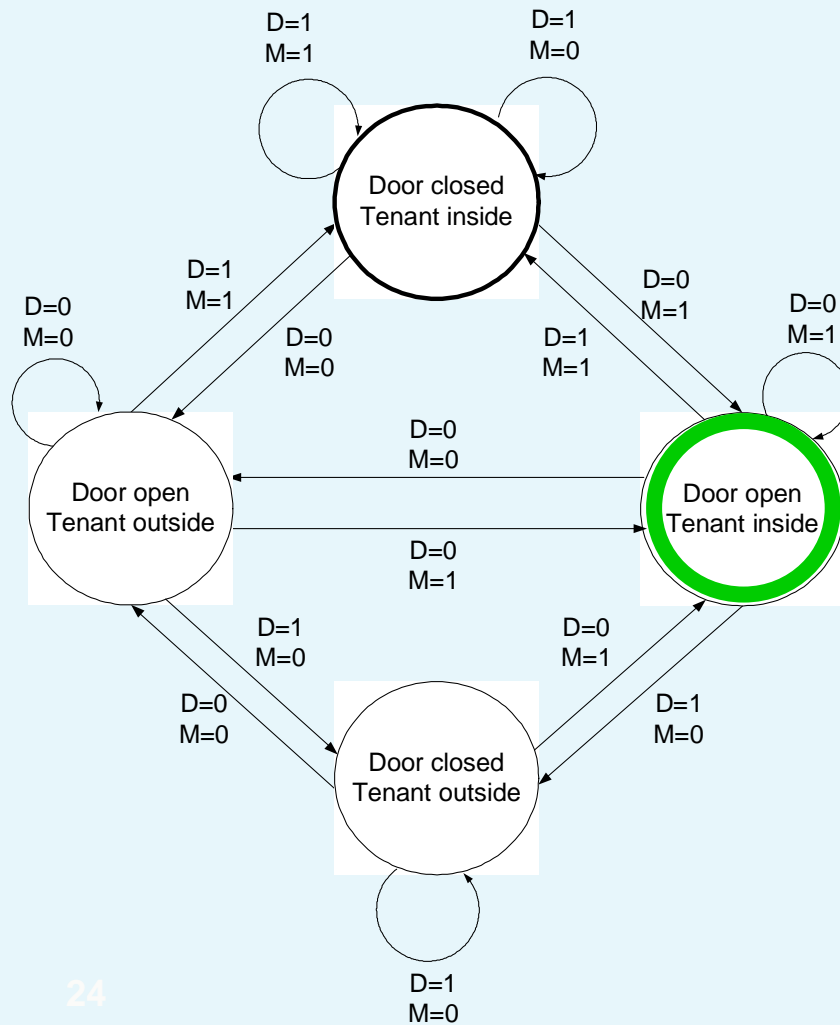M=1

D=0
M=0

D=1
M=0

**Door closed
Tenant outside**

D=1
M=0

Fuzzy Rules

IF Tenant inside **AND** expected activity high **AND** momentary activity low **THEN** Alarm mean priority

$\mu(n)$

none   low   medium   high

1

0   1   5   10   50   n

Automata

D=1
M=1

D=1
M=0

Door closed
Tenant inside

D=1
M=1

D=0
M=1

D=0
M=0

D=0
M=0

D=1
M=1

D=0
M=1

Door open
Tenant outside

D=0
M=0

D=0
M=1

Door open
Tenant inside

D=0
M=1

D=1
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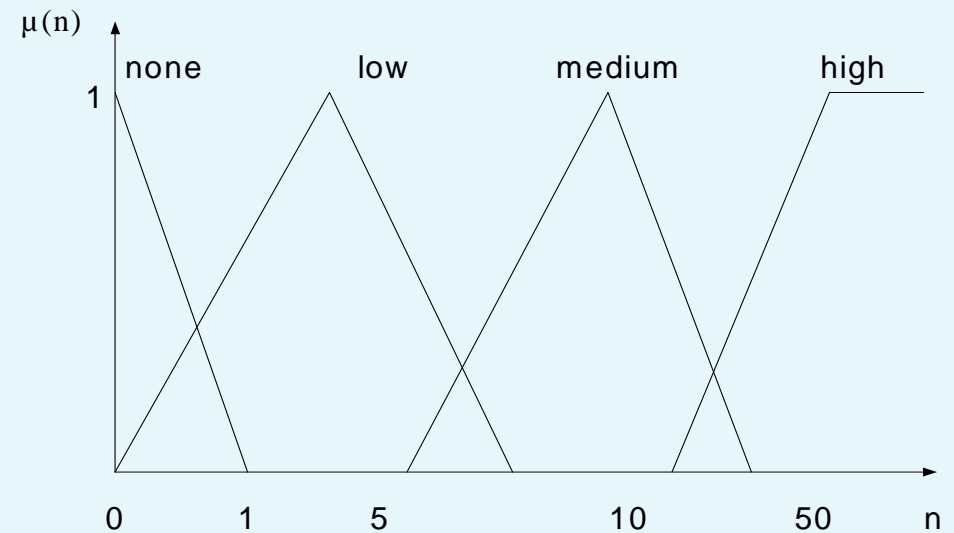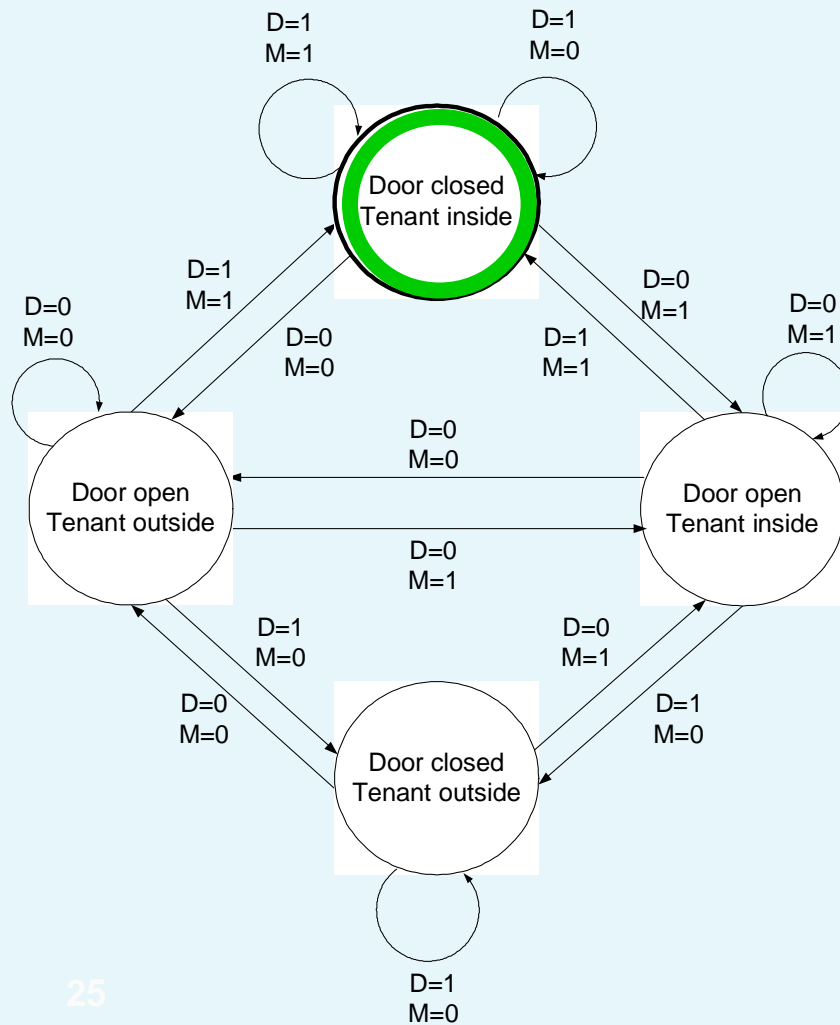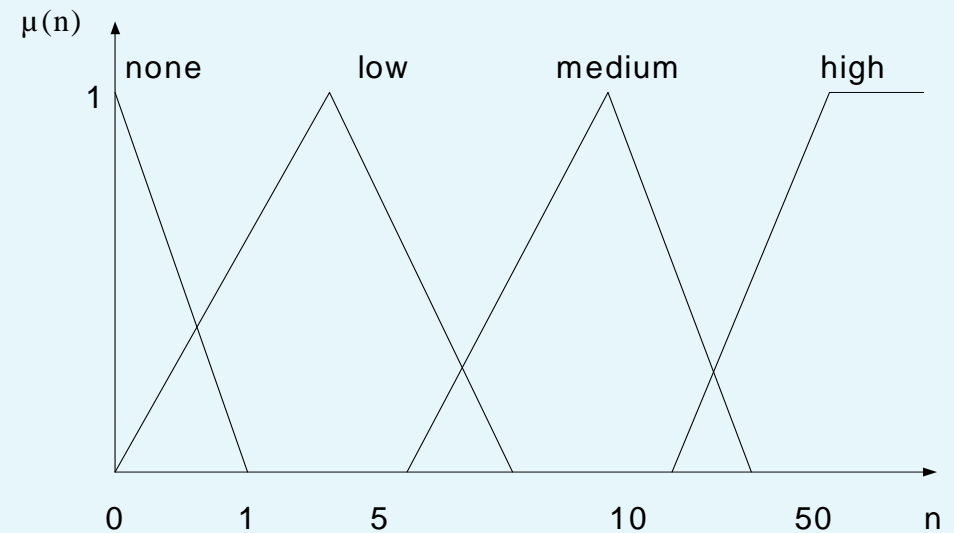
PAUL:

- more intuitive graphical user interface

- interface evaluation with elderly people

- minimization of false alarms

Thank you very much for
your attention