



Privacy concerns in a remote monitoring and social networking platform for assisted living

PrimeLife/IFIP Summer School 2010

Privacy and Identity Management for Life

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Overview

- Motivation
- SmartAssist
 - Overview
 - Concept
 - System components
- Privacy/Security
 - Sensitive Information
 - Concerns/Issues
 - Future Work

More questions than answers in this talk!

Motivation

- Population ageing
 - Demographics of **Germany**
 - Increasing Life expectancy & Declining birth rate (~1.4 children born / woman)
 - Next **50 years**: Increase of people aged over 65 from 19% to over 30% [1]
 - Next **20 years**: Increase of people in need of medical care by 58% [1]
 - Not limited to Germany, e.g. Japan, Italy, Spain
- Increase in healthcare cost and annuity
- More people in need for medical care, less people to provide medical care

Ambient Assisted Living (AAL)

- Increase quality of life, safety and social integration of elderly people
- Technologies for providing unobtrusive support in everyday life situations
- Reduce cost of health care

[1] Statistisches Bundesamt (2006): "11. Koordinierte Bevölkerungsvorausberechnung – Annahmen und Ereignisse" <https://www-ec.destatis.de/csp/shop/sfg/vollanzeige.csp?ID=1019439>

SmartAssist Project

- Started in late 2009, duration: 3 years (2012)
- Funded by the Federal Ministry of Education and Research (BMBF support code: 16KT0942)
- Partners
 - Lübecker Wachunternehmen (Security company)
 - Vorwerker Diakonie (Charitable organization of the Protestant church)
 - coalesenses GmbH (Hardware company)
 - University of Lübeck
 - Institute of Telematics
 - Institute for Signal Processing
 - Centre for Social Medicine and Health Services Research

SmartAssist Service Platform

- Platform to support a self-determined and safe life for **elderly people / Seniors**
- Needs-based care in their own home through personal **Patrons**
- **Instead** of (early) submission to a nursing home

Basic Idea

- Social Network
- Remote monitoring through in-home wireless sensor network

Seniors

- Age: 65 years+ and retired
- Spend large amount of time in their own apartment
- Mentally fit
- (Still) Capable of independent and self-determined living

Two groups (taken from [5])

- People interested in preventive care (Group 1.1.3 in [5])
 - Early detection & diagnosis of diseases and disabilities
- People in need of assistance (Group 1.2 in [5])
 - Use of third party services

[5] Birgid Eberhardt, 2009: Zielgruppen für AAL-Technologien und Dienstleistungen, AAL Kongress- und Fachbeiträge, BMBF/VDE Innovationspartnerschaft AAL

Patrons

- Care for **Seniors** provided through personal **Patrons**
 - Relatives
 - Friends
 - Medical Personnel (Doctors, Ambulances)
 - Third Party Service Providers

Three groups (taken from [5])

- Caregivers or Healthcare assistants (Group 2.1.1 in [5])
 - Children, grandchildren, siblings, close friends and neighbours
- Medical personnel (Group 2.2 in [5])
 - Doctors, Physicians, Paramedics
- Third Party Service Providers (Group 2.4 and 3.8 in [5])
 - Security companies, home care providers, ambulance services

[5] Birgid Eberhardt, 2009: Zielgruppen für AAL-Technologien und Dienstleistungen, AAL Kongress- und Fachbeiträge, BMBF/VDE Innovationspartnerschaft AAL

Existing Health Websites

- Eons.com
 - Social Network for elderly people: Photo and Video sharing
 - Interviews and Articles on Topics like Health, Relationships, Fitness, Dept, Retirement, Insurance, ...

- PatientsLikeMe.com / DailyStrength.com
 - User ↔ User: Emotional Support & Strategies
 - Sharing same diseases / disabilities / problems in life
 - Symptoms & Experiences with Treatments

- MedHelp.org
 - Discussion board on health related topics
 - Cooperates with Doctors
 - Visited by 10 million people each month (self proclaimed)

- ...

SmartAssist Platform Components

Monitoring

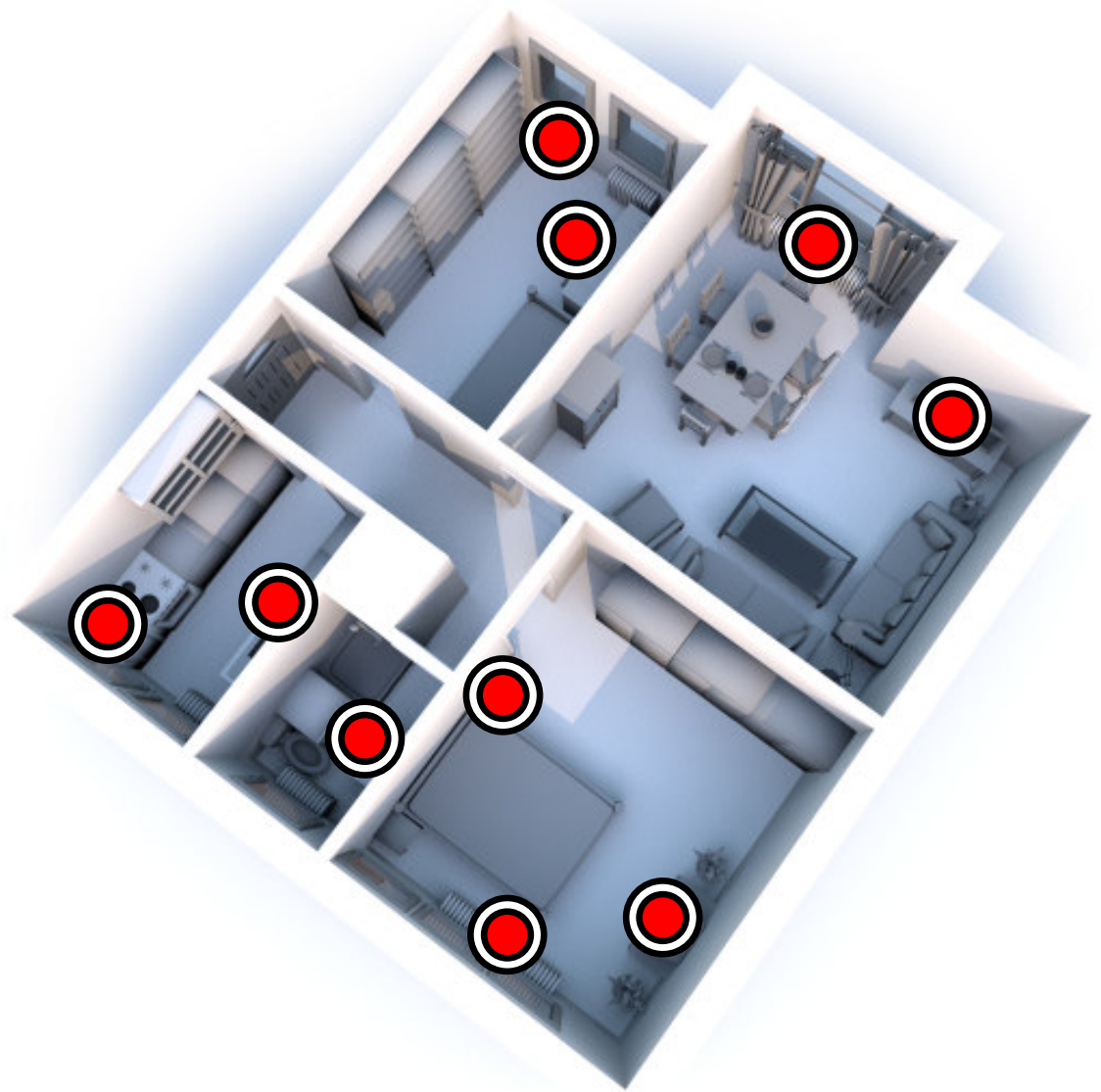
- Unobtrusive environmental/ambient sensors
- Sensor readings forwarded to a central server
- Signal processing and pattern recognition: Daily routine and activities

Social Network

- Communication between the users and their patrons
- Stronger social integration (across distances)
- Knowledge transfer between seniors (Interest groups, local community events, ...)
- Social data used to augment sensor data for medical (e.g. Status messages about feelings, stress, tiredness, headache, ...)

Services

- Extensions to the platform through „Plugins“
- Comparable to “Android Market” / “App Store” for mobile phones



Power consumption

- Coffee machine
- TV
- Computer
- Reading lamp

Water consumption

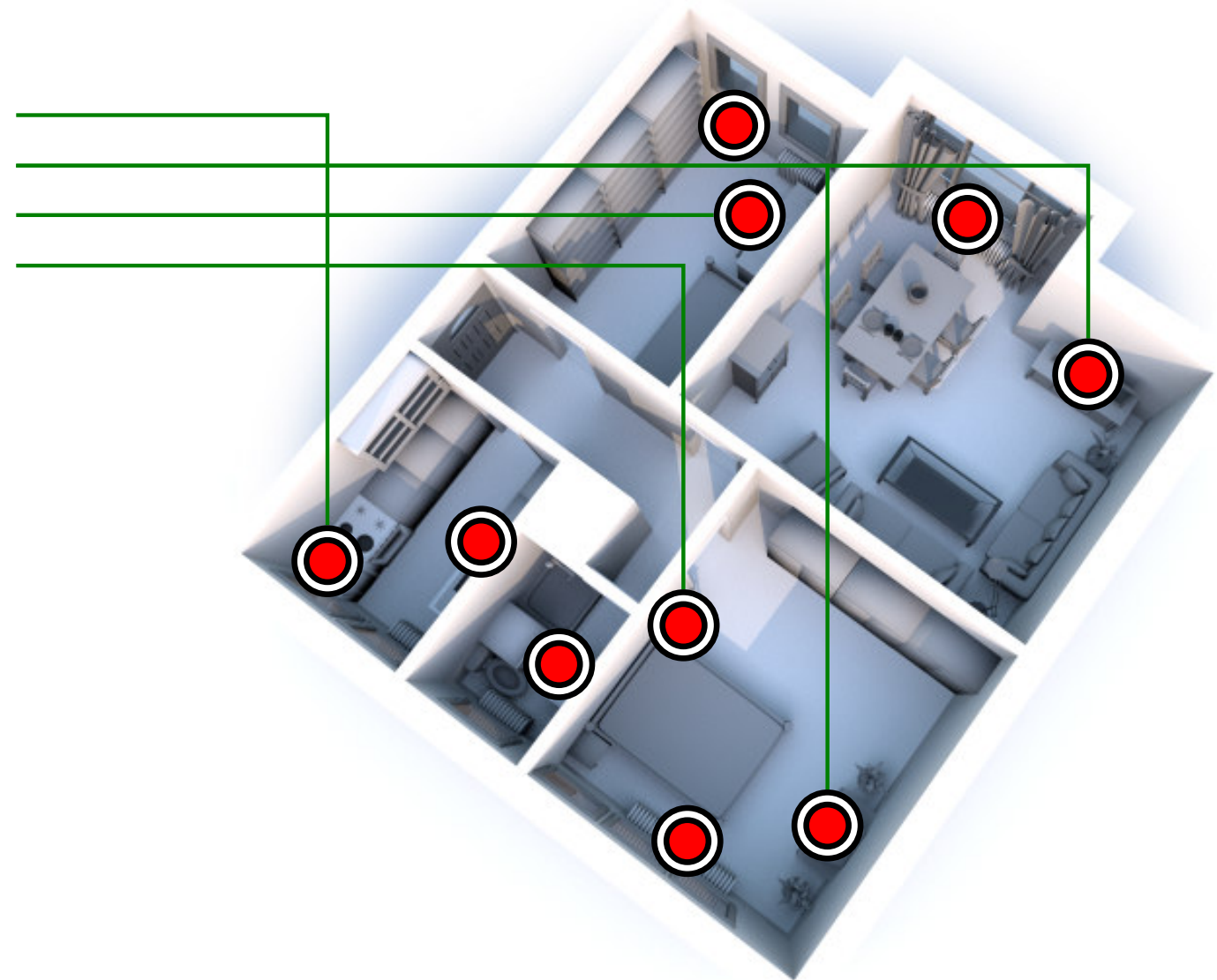
- Bathroom
- Kitchen

Temperature & Humidity

- Living Room
- Study
- Bathroom
- Bedroom

Tracking

- Motion detectors
- Door ajar sensors



Power consumption

- Coffee machine
- TV
- Computer
- Reading lamp

Water consumption

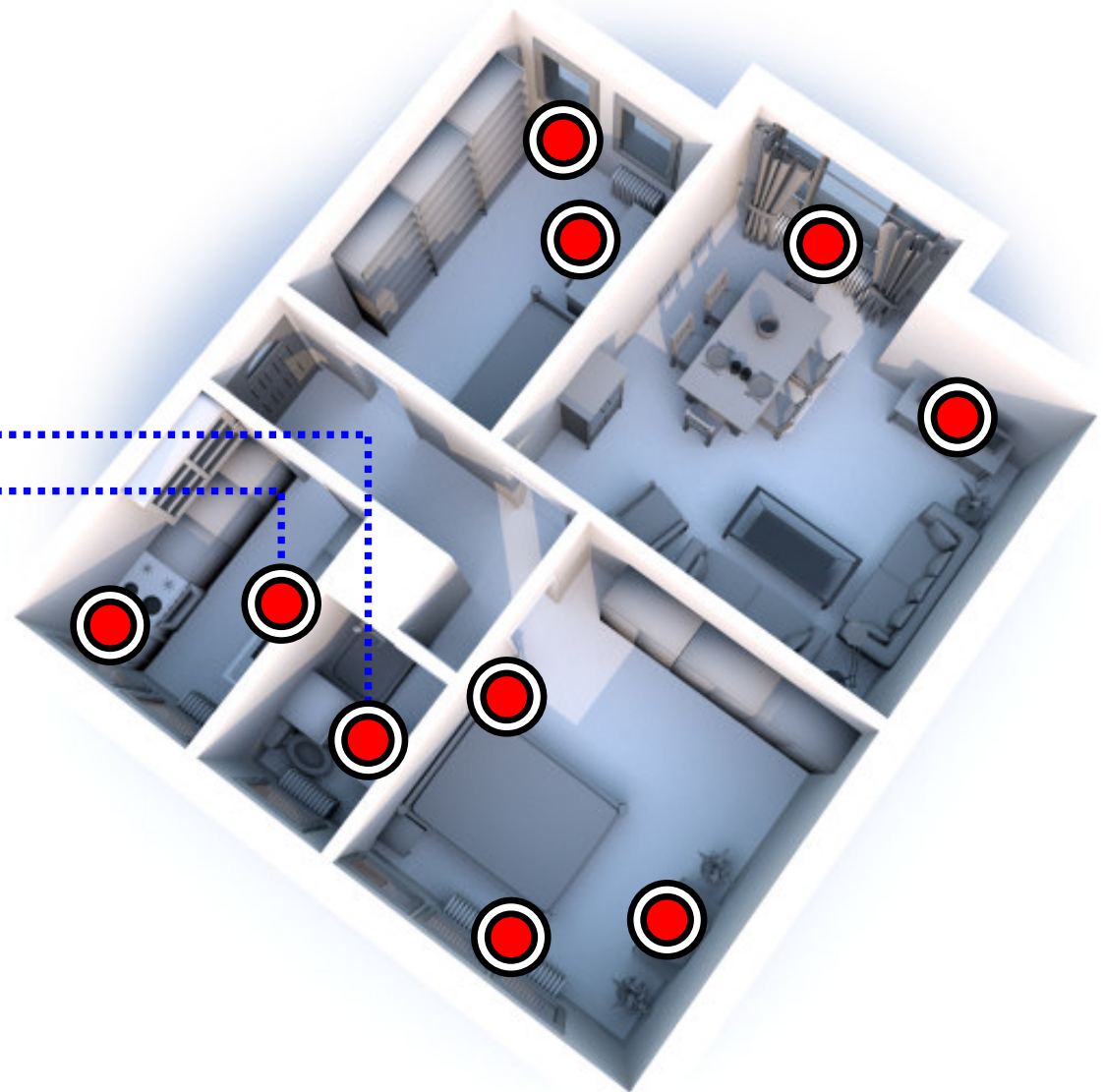
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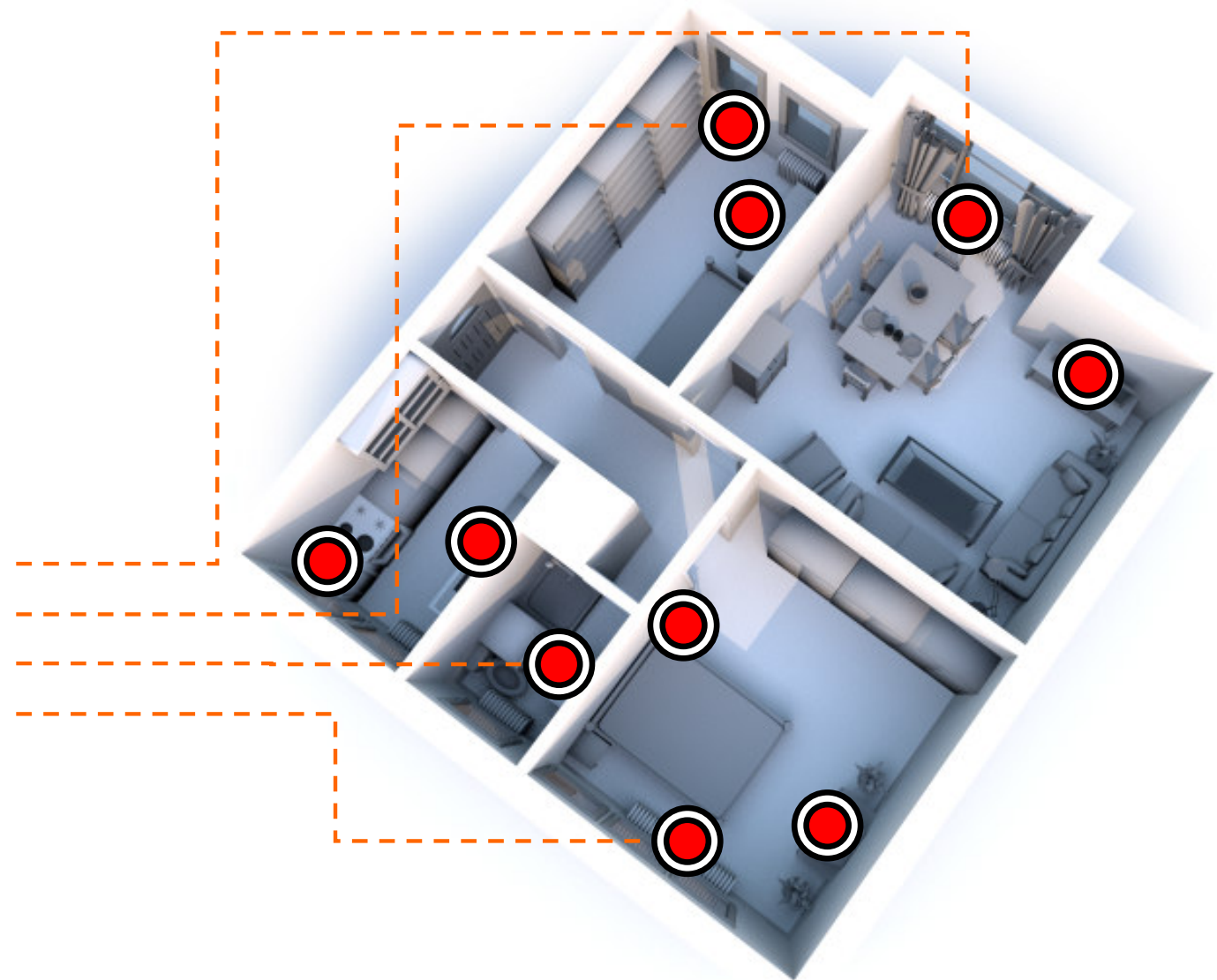
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Examples (from sensor readings)

- Low room temperature in Winter: Is the Senior feeling hot? (Fever, Shivering)
- How much time does the Senior spend in the bedroom? Is he very sleepy?
- Does the Senior forget to turn off the lights? The coffee machine?
- How often does he use the bathroom?
- Does he wash his hands after using the toilet?
(Lowered personal hygiene can be an indicator for Alzheimer Disease)

What we try to do

- Combine Social and Sensor information
- Monitor and analyse the daily routine
- Help Patrons watch over Seniors
- Help diagnose subtle changes in behaviour
- Try to detect dangerous/emergency situations and send help (Third Party/Patrons)

What we can't do

- Prevent the user from admission to a nursing home
- Guarantee for Emergency assistance

Lots of Sensitive Information

Generation

- Seniors enter private information in the social networking component
- Sensors automatically generate private information
- Signal processing generates sensitive information (e.g. activities)

Transmission

- All information needs to be transferred using encryption
- Protection against eavesdropping and man-in-the-middle attacks
- Integrity and Authenticity protection

Storage & Access

- Availability
- Integrity and Authenticity
- Access Control
- Logging

Issues to deal with

- The Senior is in control of all of his information
 - View all data, Edit and Delete all data
 - Sensors can be switched on and off at any time (and scheduled)
- Seniors need to be in control who has access to their data (restrictive by default)
 - Controllable on user and patron/group level
 - Accessible and understandable
 - Possibility to provide different and even forged information
 - “Who has accessed my information?”
- Sharing of information needs to be voluntary
 - No monetary or legal force
 - No disadvantages for insurances
- Information Sparseness
 - Only necessary information needs to be collected and stored
 - Resolution, sample rate, Fuzziness
 - Similar to “Selective Availability” in GPS (Global Positioning System)

Future Work

- Illegal access to sensor data
 - Analyse when the user is not at home, plan a burglary accordingly (www.pleaserobme.com)
 - Identity Theft: Taking names, addresses, photos
 - Sensor Data Theft: Pretend to be a healthy senior and commit insurance fraud
- The right of Not-Knowing / nescience
 - Given: Diagnosis of a serious disease
 - Should the Senior be informed?
 - Should the patrons (a doctor) inform the Senior?
 - Make information unavailable to insurance companies
- Alteration / Deletion of data
 - Interfere in the detection of a disease (Inheritance / Life insurance)
 - Protection against physical tampering
 - Maintain the right for virtual tampering (fuzziness), but detectable



Thank you for your attention!

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