La Tecnologia al Servizio dell’Anziano
Which technologies?

1. **Information and communication technologies (ICT)**
   - internet systems, telephone-based, webcams, videosys
   - online services and electronic medical-health records

2. **Assistive technologies (AT)**
   - sensors and warning systems
   - smart homes tools
   - telehealth or telemedicine tools
   - video systems to interact with other people

3. **Human–computer interaction technologies (HCIT)**
   - assistive robotics, service robots
   - humanoid robots, companion-type robots
   - exoskeletons, rehabilitation robots
   - robots for cognitive activities and rehabilitation
Clinical applications

1. ICT for Multidimensional Assessment
   MPI_AGE, EUROSAF, SELFY-MPI

2. AT for housing and safety
   Mo.Di.Pro. Project

3. HCIT for mobility and rehabilitation
   Hunova Project
   RO.SA Project
Necessità di assistenza sanitaria
- Assistenza infermieristica (VIP): 35
- Prevenzione - Trattamento Decubiti (VPIA): 10

Profilo dell'autonomia
- Situazione cognitiva (VCOG): 5
- Mobilità (VMOB): 11
- Situazione funzionale (Attività di base - ADL): 29
- Supporto della rete sociale (YSOC): 100

Patologie prevalenti
- Demenza

Calcola MPI
- MPI = 0.81 (Rischio severo)
Integrated Geriatric Clinical Record for physicians and nurses
La fragilità multidimensionale dell’anziano ambulatoriale: Progetto Selfy_MPI SIGOT

Approvato CER 20.05.2019
Development of a smart post-hospitalization facility for older people by using domotics, robotics, and automated tele-monitoring

**AIMS**

1. To develop a prototype of a smart technology-based facility for older patients who need a transitional care period after discharge from the hospital
2. To evaluate the usefulness of technologies for an automatic monitoring of motility, functional and clinical conditions in older subjects

Figure 1 - The layout of the prototype apartment, where the environment sensors have been highlighted. Blue: RGBD sensors; green circles: localization tags; purple: FIR; red: video cameras.

- RGBD sensors
- Cameras
- Passive Infra-Red
- Central Server

Patrone et al. Geriatric Care 2019; 5:8122
Equipment

1. An indoor localization system (Eliko KIO RTLS6) for continuous and unambiguous tracking of persons

2. Passive Infra-Red (PIR) Sensors detecting whether there is movement in the sensed area

3. Cabinet doors’ sensors (SparkFun7 Luminosity Sensor) for the detection of cooking and eating activities

4. Chair occupancy sensors (SparkFun Force Sensitive Resistor) positioned on chairs and the sofa

5. Sensors distributed in the environment with measurements obtained by wearable accelerometers (LG G Watch R5 equipped with a triaxial accelerometer)

6. A set of vital parameters (blood pressure, heart rate, oxygen saturation, glucose) are collected daily through wearable and non-invasive devices
A continuous monitoring of patients’ location and activities was given by analysing the measurements obtained from ambient and wearable sensors by means of appropriately designed signal processing and machine learning algorithms.
Data collected by two environment sensors (trajectories coded in blue and green). Red area indicated the person when sitting. Pie charts summarize the statistics of the amount of time spent on different conditions.
Data-Driven Continuous Assessment Of Frailty in Older People

Chiara Martini*, Annalisa Barla*, Francesca Odone*, Alessandro Verri*, Alberto Cella^, Gian Andrea Rollandi^ and Alberto Pilotto^
Data-Driven Continuous Assessment Of Frailty in Older People

Estimated Motility Index (MI) on 10 active and healthy volunteers
yellow bars = 5 young, green bars = 5 older subjects

Clinical and Functional Assessment

Short Physical Performance Battery (SPPB)
3 tests: balance, gait speed, sit-to-stand 5x

Hand Grip: strength of the upper arm

Multidimensional Prognostic Index (MPI)
8 domains: ADL, IADL, SPMSQ, EES, MNA, CIRS, Drugs, co-habitation

Conclusions

In clinical practice functions and activities are usually estimated through medical tests and questionnaires performed sporadically. Continuous automatic assessment may help physicians in evaluating functions and health status by complementing their assessments with quantitative and non sporadic measurements.

Martini et al, Frontiers Dig Human 2018; doi: 10.3389/fdigh.2018.00006
Hunova robot and fall prevention in older people
# Risk Factors for Falls in Older Adults

<table>
<thead>
<tr>
<th>Domain</th>
<th>Risk Factor</th>
<th>Association</th>
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<tbody>
<tr>
<td><strong>Psychosocial and demographic</strong></td>
<td>Advanced age</td>
<td>+++</td>
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<tr>
<td></td>
<td>Female gender</td>
<td>++</td>
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<tr>
<td></td>
<td>Living alone</td>
<td>++</td>
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<tr>
<td></td>
<td>History of falls</td>
<td>+++</td>
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<tr>
<td></td>
<td>ADL limitations</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Medical</strong></td>
<td>Stroke</td>
<td>+++</td>
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<td></td>
<td>Parkinson disease</td>
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<td></td>
<td>Incontinence</td>
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<td>Acute illness</td>
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<td>Arthritis</td>
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<td></td>
<td>Dizziness</td>
<td>++</td>
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<tr>
<td><strong>Medications</strong></td>
<td>Psychoactive medication</td>
<td>+++</td>
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<tr>
<td></td>
<td>Antihypertensive</td>
<td>+</td>
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<tr>
<td></td>
<td>Polypharmacy (&gt; 4 medications)</td>
<td>+++</td>
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## Risk Factors for Falls in Older Adults

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<tbody>
<tr>
<td>Balance and mobility</td>
<td>Impaired stability when standing</td>
<td>++</td>
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<tr>
<td></td>
<td>Impaired stability when leaning</td>
<td>+++</td>
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<tr>
<td></td>
<td>Inadequate response to ext. perturbation</td>
<td>+</td>
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<tr>
<td></td>
<td>Impaired gait and mobility</td>
<td>++</td>
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<td></td>
<td>Impaired ability in standing up</td>
<td>++</td>
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<td></td>
<td>Impaired ability with transfers</td>
<td>++</td>
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<tr>
<td>Sensory and neuromuscular</td>
<td>Visual acuity, visual field loss</td>
<td>++</td>
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<td></td>
<td>Visual contrast sensitivity</td>
<td>+++</td>
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<td></td>
<td>Reduced periphereal sensation</td>
<td>+++</td>
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<td></td>
<td>Muscle weakness</td>
<td>+++</td>
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<td></td>
<td>Poor reaction time</td>
<td>+++</td>
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<tr>
<td>Neuropsychological</td>
<td>Impaired cognition, depression</td>
<td>+++</td>
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<tr>
<td>Environmetal</td>
<td>Poor footwear, ambient barriers</td>
<td>+</td>
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Conclusions: Standardized balance measures provide only partial information on postural control and omits important components of balance related to avoiding falls.

Hunova combines 2 sensorized mechatronic platforms, under the seat and the platform, and a wearable sensor for full body mobilization.

By using the robotic platforms, hunova evaluates patients’ functions in **seated** and **standing** positions as well as in **static**, **dynamic** and **perturbating** conditions providing biofeedback in real time in order to develop a tailored sensori-motor rehabilitation program.
Study Population
150 subjects aged ≥65 years consecutively admitted to the Frailty Center of the CUROGE Department, Galliera H, Genoa, IT

Study Protocol

- **CGA-based MPI:** ADL, IADL, SPMSQ, MNA, EES, CIRS, Drugs, Co-hab.
- **Physical performance tests:** Gait Speed, Hand Grip, SPPB, TUG, PASE
- **Laboratory tests**
- **Body-comp (DEXA)**
- **Robotic balance evaluation**

12-month follow-up

**Primary outcome:** Falls
**Secondary outcomes:** hospital admission, NH admission, death
To validate an “integrated” intervention program “tailored” on the basis of the clinical, functional and robotic parameters
RO.SA Project: Physical activity by using «humanoid» robot in subjects with Sarcopenia

**Inclusion Criteria**
Subjects aged ≥ 75 years with sarcopenia or pre-sarcopenia

**Basal Assessment**
BIA, HandGrip, SPPB, CGA-based MPI

**Group 1: 20 subjects**
2 sessions /week for 8 weeks
Protocol of Group Exercises
TUTOR: Physioterapist

**Group 2: 20 subjects**
2 sessions/week for 8 weeks
Protocol of Group Exercises
TUTOR: «PEPPER ROBOT»

**Assessment After Intervention**
BIA, HandGrip, SPPB, CGA-based MPI, QOL, Human-Computer Interaction Questionnaire
Key points

• ICTs, ATs and HCITs provide innovative solutions to improve housing, communication, personal safety, mobility and rehabilitation of older subjects

• Psychosocial and ethical issues, acceptance by end-users, costs and the time of intervention may impair a broad use of these technologies in older age

• A great effort in interdisciplinary collaboration is necessary to integrate technology into existing health and social service systems
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<tr>
<td><strong>Titolo</strong></td>
<td>Development and implementation of common strategy for the management of community-dwelling older subjects with multimorbidity and polypharmacy: integration with a multicomponent intervention platform by using domotic, robotic and telecare systems (MULTIPLAT-AGE)</td>
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<tr>
<td>Centro Coordinatore italiano della Rete</td>
<td>E.O. Ospedali Galliera, Dipartimento CUROGE – Genova</td>
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<tr>
<td>Principal Investigator</td>
<td>Alberto Pilotto</td>
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<td>5</td>
<td>Calabria</td>
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Grazie per l’ attenzione