Congresso Nazionale S.I.G.G.

29 Novembre 2013

La domotica nella vita dell'anziano come opportunità di incrementare l'autosufficienza al proprio domicilio

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Definizioni

La domotica è l'applicazione di tecnologia informatica e robotica alla casa col fine di migliorare il comfort, la quantità di servizi disponibili e la sicurezza.

DOMOTICA DI SUPPORTO (Assistive Domotic)

Rappresenta l'applicazione della tecnologia domotica all'assistenza di anziani e disabili con l'obiettivo di renderle più autonome, sicure, migliorando la qualità di vita e prolungando il più possibile la permanenza a domicilio riducendone l'istituzionalizzazione.

GERONTOTECNOLOGIA:

Campo interdisciplinare di ricerca di applicazioni tecnologiche orientate alle aspirazioni e opportunità delle persone anziane.

The number and percentages of people in need of advanced assistive technology are increasing every year.

About 3 million of Italians have a disability that affects one or more of their major life activities.

In 2025, over 26% of the Italian population will be over 65 years of age, with one in two working adults serving as informal caregivers.

Basic Technologies Used

Sensors

A **sensor** is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.

Use

Evaluate temperature, dryness, fire or gas detector,Loss of water, trouble in the electric system, detect intruders.

Tracking position. Health parameter monitoring Identify dangerous behaviour and falls

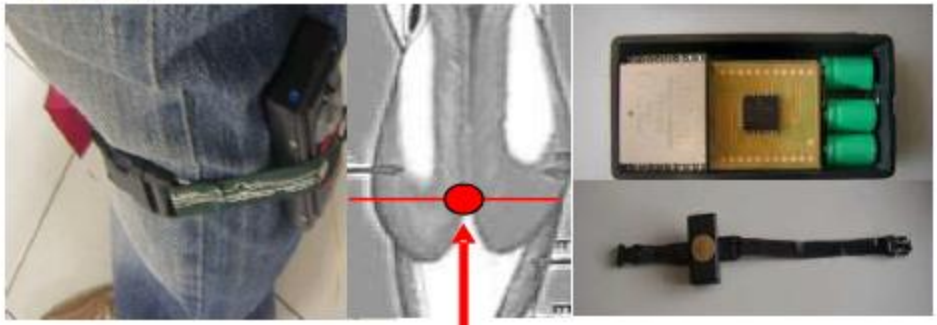
Certification through iPad

Diagnosis of cataract

Sistemi di monitoraggio indossabili

Activity monitor

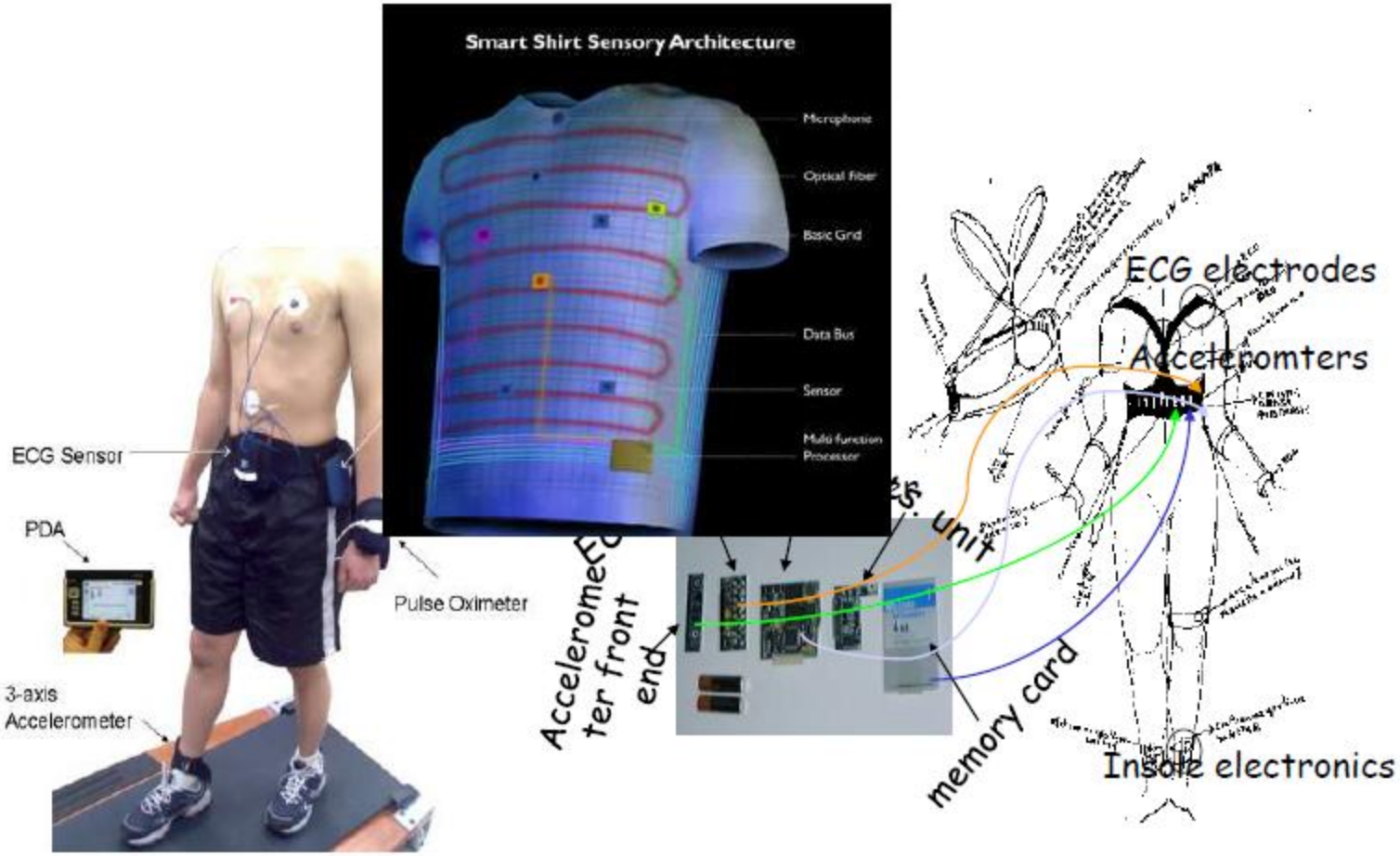
STEP COUNTERS FOR DISABLE PEOPLE (gastroctemius expansion)



Angular velocity and acceletrometer
To detect falling in e.g. Parkinson pt

Sensorized Codivilla Spring

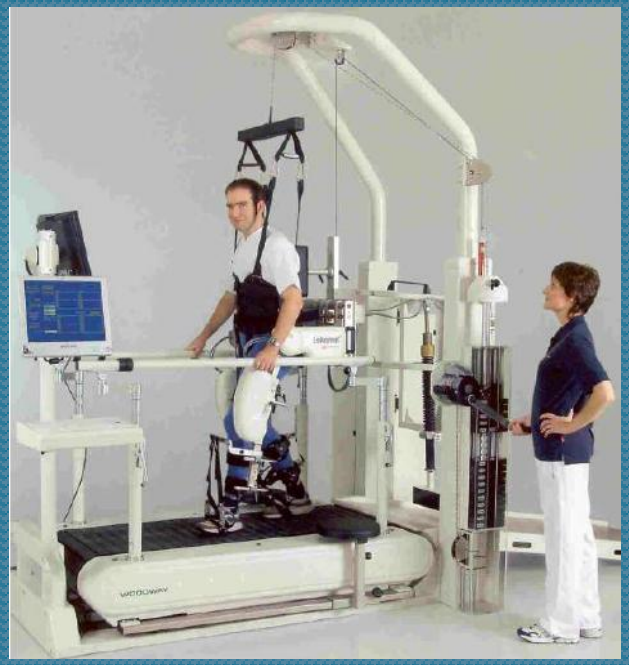
Sistemi di monitoraggio indossabili



Rilevazione ECG a distanza tramite radar UWB

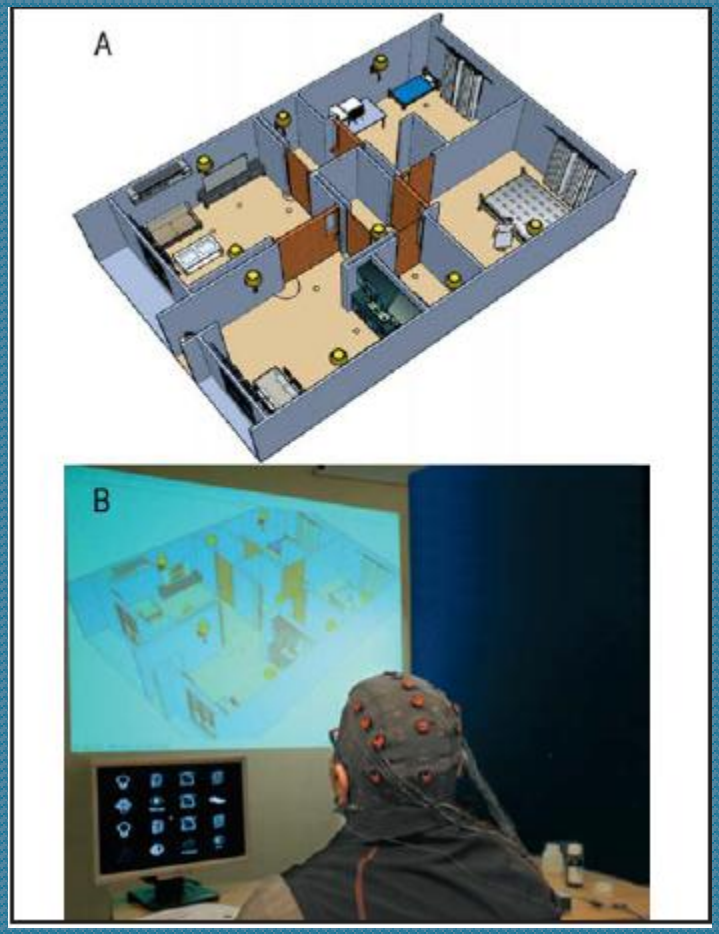
Fig. 11. Kai Sensors' technology platform enables wireless monitoring of vital signs (left); Wireless2000 (center), Microimpulse's VSM (right).

Ausili robotici



ASIMO
HONDA

Asynchronous P300-Based Brain-Computer Interface



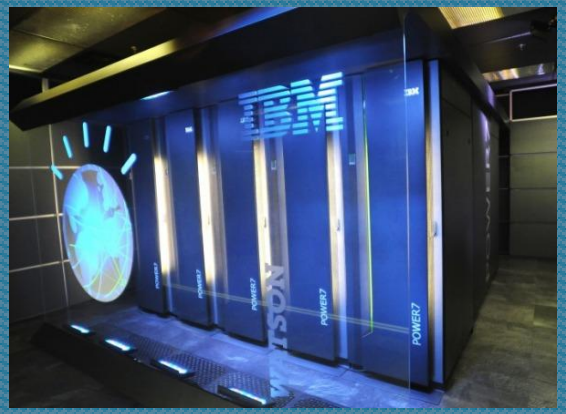
Intelligenza Artificiale

Watson represents a first step into cognitive systems, a new era of computing. Watson builds on the current era of programmatic computing but also differs in significant ways. The combination of three capabilities make Watson unique:

Natural language processing - to help understand the complexities of unstructured data which makes up as much as 90% of the data in the world today

Hypothesis generation and evaluation - by applying advanced analytics to weight and evaluate a panel of responses based on only relevant evidence

Evidence-based learning - to improve based on outcomes to get smarter with each iteration and interaction



SMART HOME TECHNOLOGIES FOR HEALTH AND SOCIAL CARE SUPPORT (REVIEW)

Main results

No studies were identified which met the inclusion criteria

Authors' conclusions

This review highlights the current lack of empirical evidence to support or refute the use of smart home technologies within health and social care, which is significant for practitioners and healthcare consumers.

Evidenze

Reeder B. Framing the evidence for health smart homes and home-based consumer health technologies as a public health intervention for independent aging: A systematic review. internationaljournalofmedicalinformatics 82(2013)565–579.

This review identified and characterized three studies as effective (first tier) evidence for support of aging in place. One reason for the small number of included studies may be a gap in communication between technology and health sciences researchers in the area of health smart homes and home-based consumer health technology research. Another reason may be that research often fails to translate into practice because study designs do not address real-world context and what researchers consider to be evidence is often limited. Transferring technology into the home from organizational settings to support independent living in older adults presents contextual challenges due to the less controlled nature of the home setting.

Evidenze

Steventon A. Effect of telecare on use of health and social care services: findings from the Whole Systems Demonstrator cluster randomised trial. Age Ageing.2013

2,600 people with social care needs were recruited from 217 general practices in three areas in England.

Telecare as implemented in the Whole Systems Demonstrator trial did not lead to significant reductions in service use, at least in terms of results assessed over 12 months.

The QALY gain by patients using telehealth in addition to usual care was similar to that by patients receiving usual care only, and total costs associated with the telehealth intervention were higher. Telehealth does not seem to be a cost effective addition to standard support and treatment.

Evidenze

Klersky A meta-analysis of remote monitoring of heart failure patients. *JAm Coll Cardiol 2009; 54:1683-94.*

6258 patients enrolled in 20 randomized controlled trials and 2354 patients from 12 cohort studies. Based on the meta-analysis, remote patient monitoring was associated with a significantly lower rate of deaths (-17%, P=0.006) and hospitalizations for any reasons (-7%, P = 0.030). The strongest protective effect of remote patient telemonitoring was found when only hospitalizations for HF were considered: -29%,P<0.001.

Inglis Structured telephone support of telemonitoring programmes for patients with chronic heart failure. *Cochrane Database Syst Rev. 2010; 8: CD007228*

Telemonitoring was effective in reducing the risk of all-cause mortality in patients with HF by 34% (P< 0.0001). The effect of these interventions was more pronounced with HF-related hospitalizations, showing a reduction of-21 % *(P=0.008)* .

Evidenze

Olivier GURNÉ. **A critical review on telemonitoring in heart failure.** Acta Carciiol 2012; 67(4): 439-444

Chaudhry SI. Telemonitoring in patients with heart failure. *NEJM 2010;* ***363:*** 2301-9

The Tele-HF trial': 1653 patients who bad recently been bospitalized for HF.

Readmission for any reason or death from any cause within 180 days after enrollment was not statistically different

Koehler F,. Telemedical Interventional Monitoring in Heart Failure Investigators. Impact of remote telemedical management on mortality and hospitalizations in ambulatory patients with chronic heart failure: the telemedical interventional monitoring in heart failure study. *Circulation 2011;* ***123:1873-80.*** TIM-HF trial : 710 patients with stable cbronic HF witb systolic dysfunction and a bistory of decompensated HF witbin tbe 2 previous years . No significant effect (-3%, P=0.87) on all-cause mortali primary end point, cardio-vascular death or HF hospitalization (-11%, P=0.44).

Anand ISP; MUSIC investigators. Design of the Multi-Sensor Monitoring in Congestive Heart

Failure (MUSIC) study: prospective trial to assess the utility of continuous wireless physiologic monitoring in heart failure. JCord/acfo(72011;17:11-6.

Evidenze

Home Telehealth for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis. J. Franek. Ontario Health Technology Assessment Series; Vol. 12: No. 11, pp. 1–58, March 2012

No significantly reduction of outcomes considered. Trend show a reduction of hospitalization.

Evidence-Based Strategies for the Optimization of Pharmacotherapy in Older People. E. Topinkova Drugs Aging 2012; 29 (6): 477-494

There is sufficient evidence that implementation of computerized decision-making support programs can significantly but modestly reduce prescribing errors across multiple healthcare settings.

An Electronic System to Document Reasons for Medication Discontinuation and to Flag Unwanted Represcriptions in Geriatric Patients. Carolien M. J. Drugs Aging DOI 10.1007/s40266-012-0035-y

Encouraging data about automatic signalation of ADR and motivations.

Effect of a centralized prescription network on inappropriate prescriptions for opioid analgesics and benzodiazepines. Colin R. CMAJ November 6, 2012 vol. 184 no. 16 First published September 4, 2012, doi: 10.1503/cmaj.120465

40.1% and 42.4% relative reduction respectively in inappropriate prescriptions for opioids and benzodiazepines after PharmaNet was implemented

Evidenze

Use of accelerometry to measure physical activity in adults and the elderly Bento T. Rev Saúde Pública. 2011.

Smart Home Technologies for health and social care support. Martin et al, The Cochrane Collaboration 2009

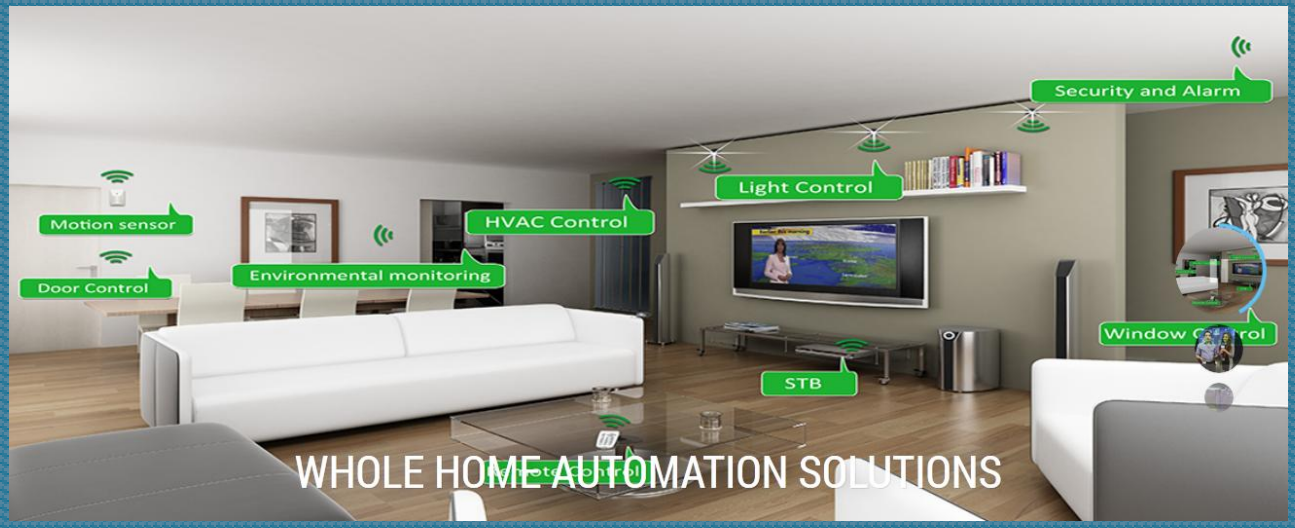
Technology to enhance physical rehabilitation of critically ill patients.Needham DM. Crit Care Med. 2009 Oct;37(10 Suppl):S436-41.

Robot-assisted practice of gait and stair climbing in nonambulatory stroke patients. Hesse S, J Rehabil Res Dev. 2012;49(4):613-22.

Telehealth for persons with severe functional disabilities and their caregivers: facilitating self-care management in the home setting. Forducey PG. Psychol Serv. 2012 May;9(2):144-62.

Soluzioni commerciali

Savant Smart Home Automation



Smart Home for Elderly People (HOPE)

Smart Home for Elderly People (HOPE) è un progetto finanziato dalla comunità europea che ha come obiettivo il miglioramento della qualità della vita, incrementare l'indipendenza, monitorare la salute e rendere più facile la comunicazione alle persone anziane malate di Alzheimer utilizzando una piattaforma "intelligente" che permette di utilizzare sistemi tecnologici innovativi.

HOPE is funded by the European Commission and the Ambient Assisted Living Joint Programme with the AAL-2008-1-099 contact

HOPE PARTNERS: RTeL Forus CETEMMSA TECHNOLOGICAL CENTRE

tracs kmop [i2S] CITIC Casa Sollievo della Sofferenza IRCCS U.O. Geriatria San Giovanni Rotondo - ITALY

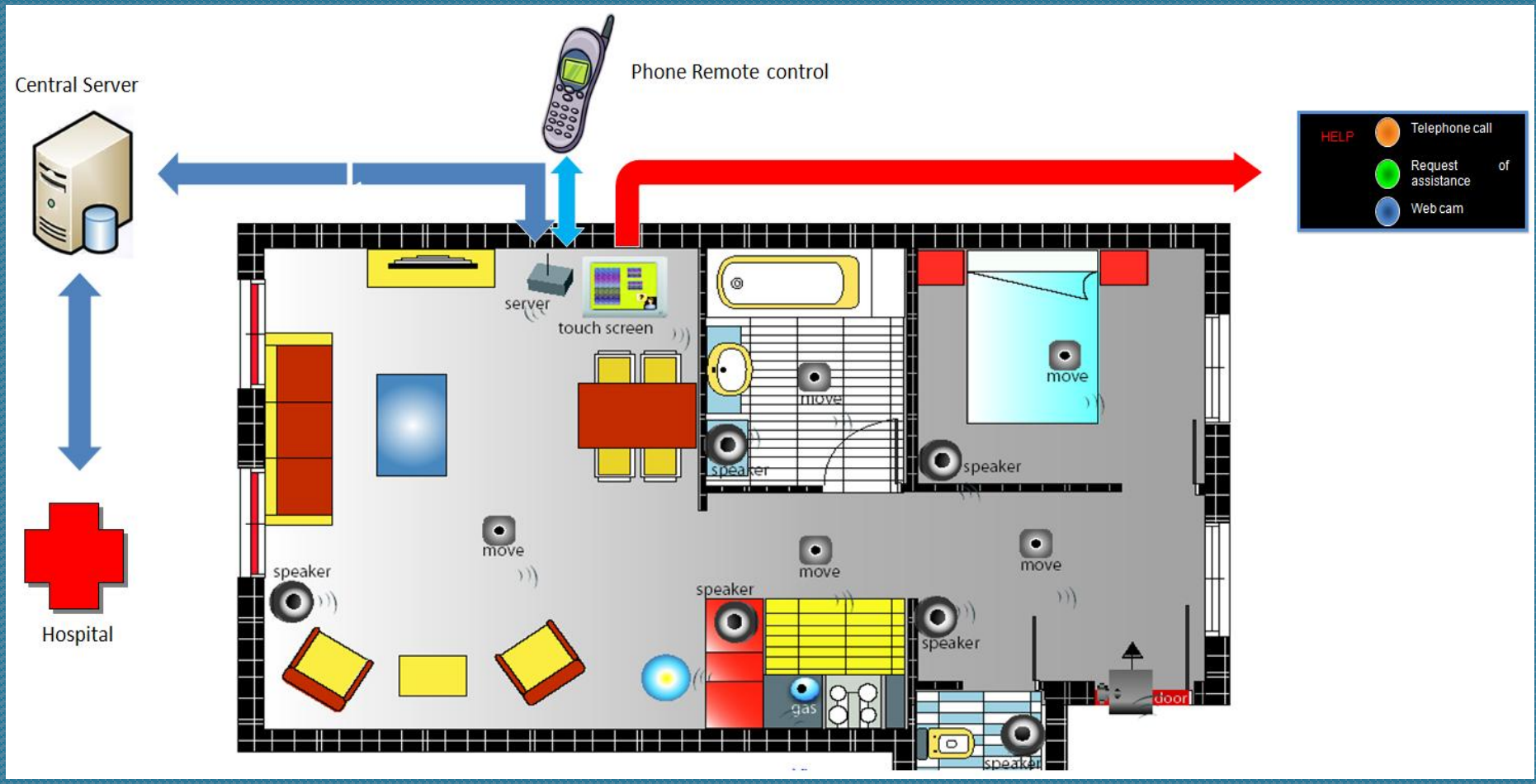
Installazioni dei prototipi

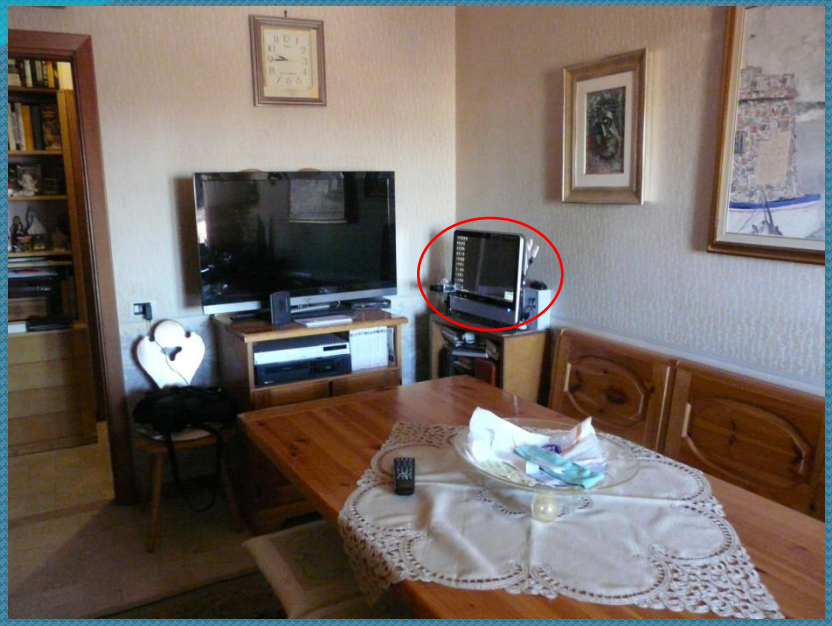
ITALY 2 installations, 1 in a private home and 1 in a geriatric residence in San Giovanni Rotondo (1 man and 1 woman)

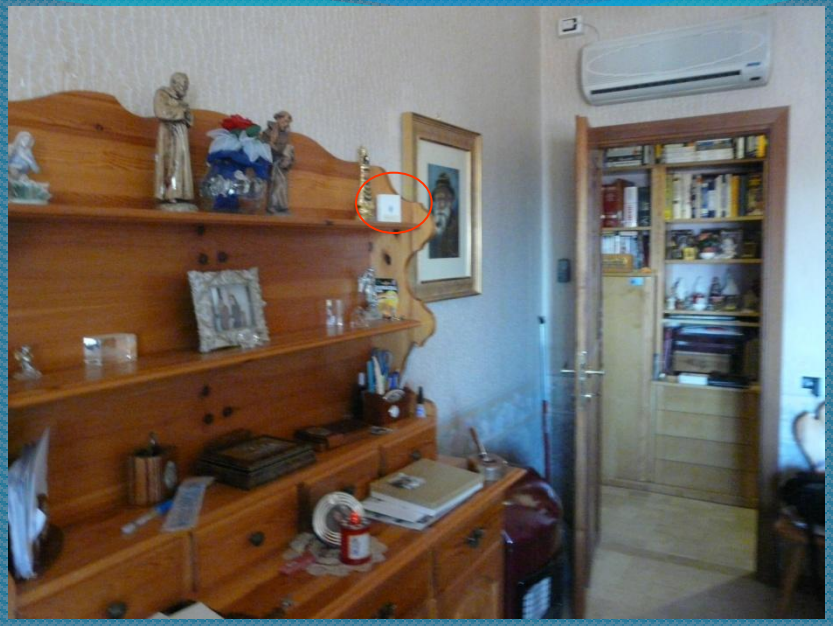
GREECE 1 installation completed and 2 installations in December all in private houses in Athens (1 man and 2 woman)

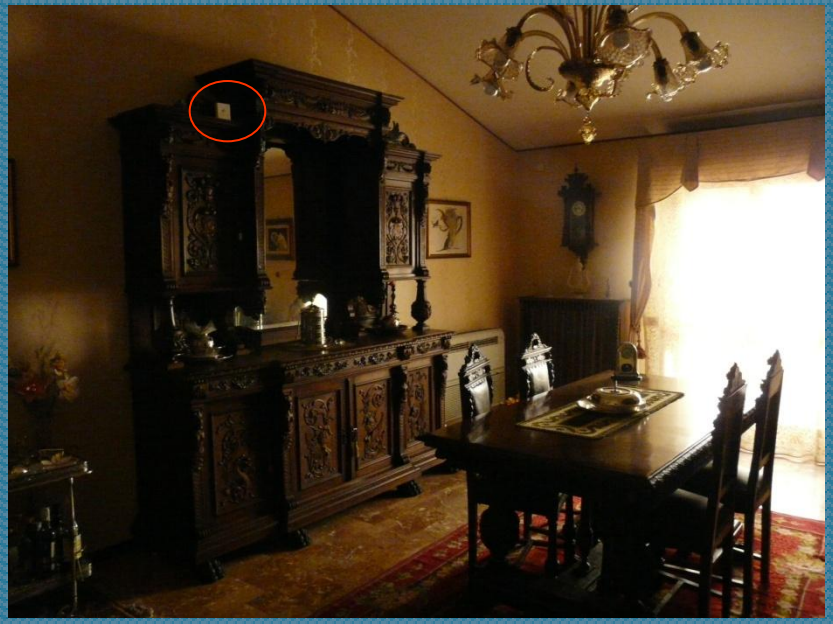
SPAIN 1 installation in the common rooms of a geriatric residence in Malaga (multiple users)

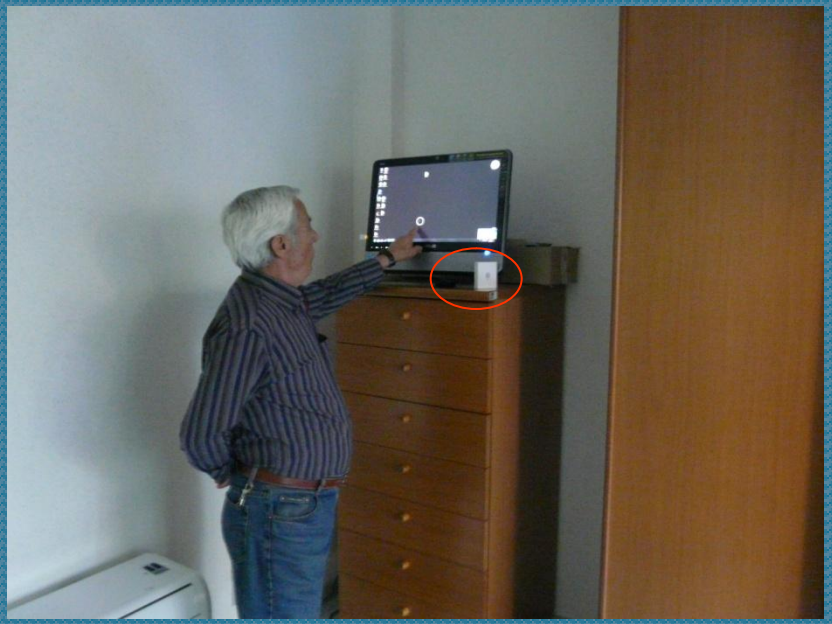
HOPE: pianta della casa e device implementati

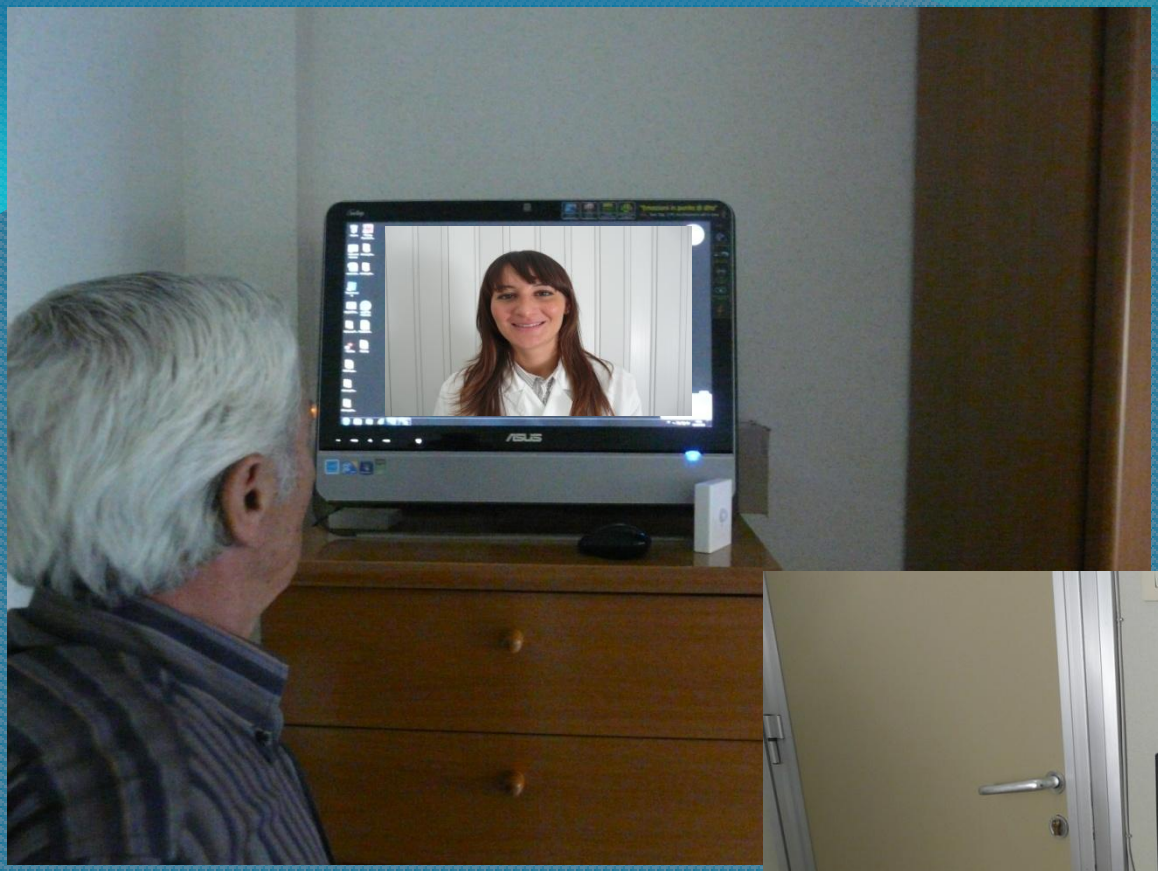


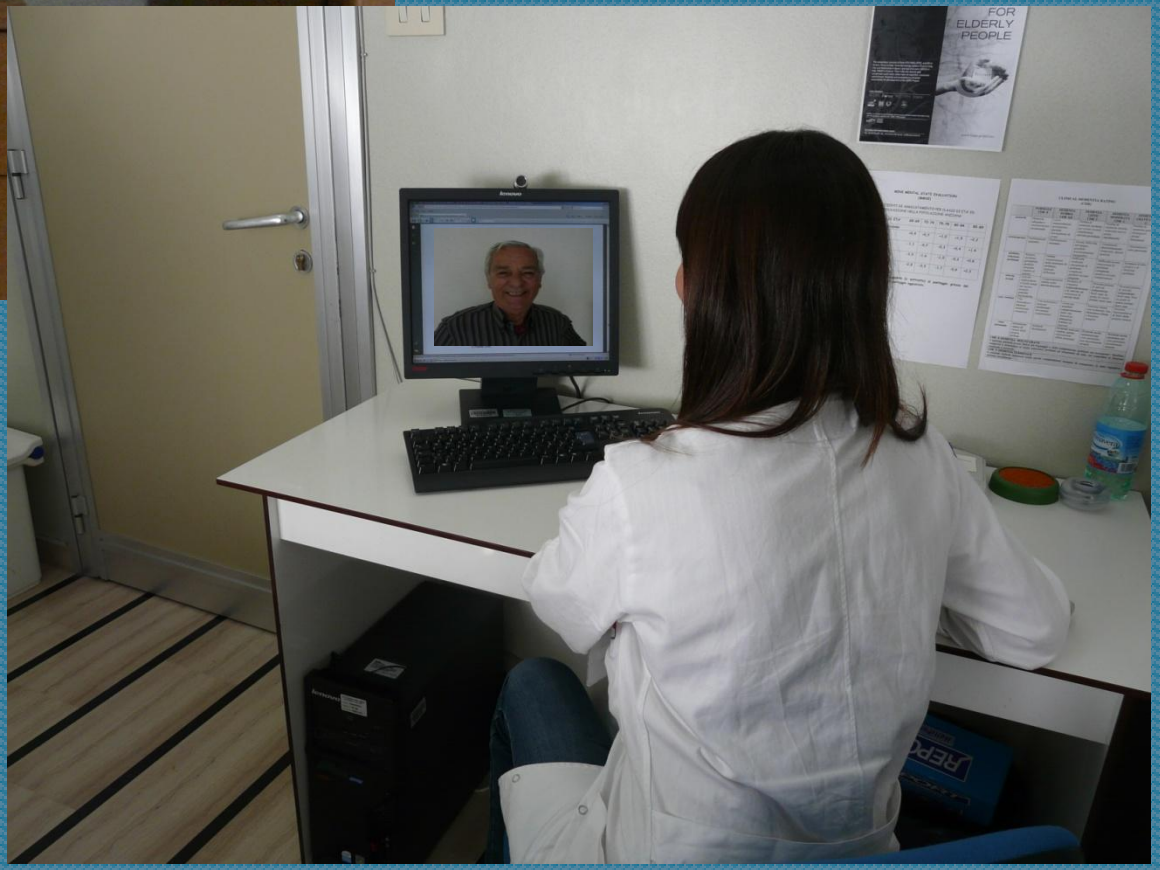









ASUS


FOR
ELDERLY
PEOPLE

Final consideration by the End Users

- The HOPE system is not invasive
- The system appears to be user-friendly
- They feel themself more safe at home
- They appreciate especially the videocall system

- Information on how monitoring the activities of the sensors are working or not
- They have high expectatives (but they are not sure) that the HOPE system will improve their quality of life

Il progetto ALTRUISM (ALzheimer patient's home rehabilitation by a Virtual Personal TRainer-based UNique INformation System Monitoring), finanziato dalla Regione Puglia nell'ambito del bando di promozione dei partenariati regionali per l'innovazione nasce dall'esigenza di permettere ai pazienti affetti da Malattia di Alzheimer di essere curati attraverso la riabilitazione cognitiva anche in ambito domiciliare.

Risultato del questionario

46.9% presentava un lieve deficit della cura della persona

37.5% una lieve disabilità motoria

Il 92.2% dei pazienti è in grado si accendere e spegnere la TV, l'85.9% è in grado di scegliere i programmi autonomamente ed usare il telecomando, il 67.2% è in grado di mantenere un livello di attenzione dall'inizio alla fine del programma televisivo.

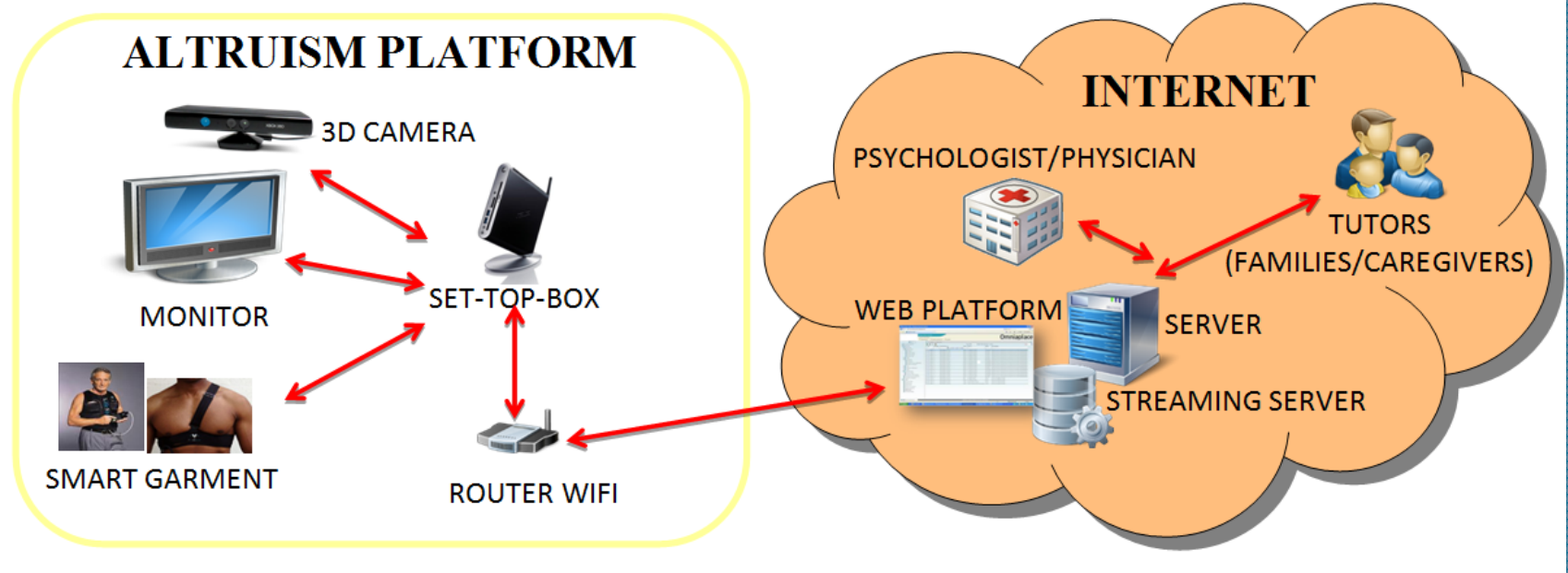
Il 45.3% dei pazienti riesce a telefonare solo ai numeri già programmati nel telefono.

Il 51.6% dei pazienti riesce a riconoscere qualsiasi sistema d'allarme.

Il 79.7% dei pazienti può utilizzare un PC solo se aiutato ed il 50% non riesce ad utilizzare la tastiera del PC.

Inoltre i familiari ritengono che il sistema potrebbe essere molto utile a migliorare la qualità di vita (73.4%), alcune abilità nelle attività basali e strumentali (73.4%), la qualità di cura e di assistenza (73.4%).

AL.TR.U.I.S.M. – Platform Architecture



Platform achieved by the following low-cost commercial component

SET TOP-BOX

(Embedded PC)

3D SENSOR

(Microsoft Kinect©)

BIOMEDICAL SENSOR

(Smartex WWS e-shirt)

Cognitive Rehabilitation Practices

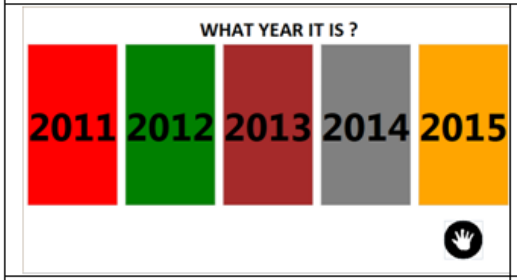
INDIVIDUALIZED REHABILITATION PROGRAM SET-UP

- ✓ The physician defines the list of exercises for a rehabilitation session according to the end user characteristics.
- ✓ The SET TOP-BOX downloads automatically sequences of exercises from the remote server
- ✓ Input parameters are defined a-priori for a customized version and to make the system compliant the MMSE (Mini Mental State Examination)

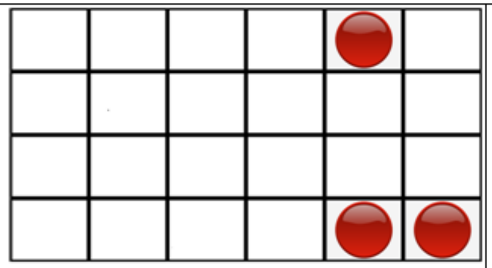
REHABILITATION PRACTICE

- ✓ Sequence of exercises of different categories
- ✓ Performed via a multi-modal contact-less NUI (Natural User Interface)
- ✓ Behavior/Gesture recognition using Microsoft Kinect©
- ✓ Hand tracking algorithms (customized level of movement sensitivity)
- ✓ Human voice synthesis by Microsoft Text-To-Speech engine
- ✓ Visual/Audio link with medical center
- ✓ Clinical Parameters (heart rate, breathe rate, Electrocardiogram…) acquired by Smartex WWS e-shirt

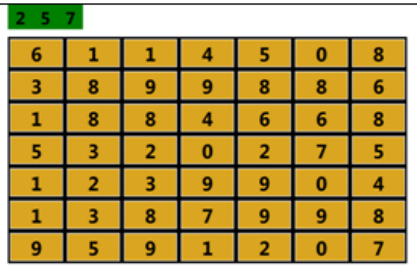
GUI EXAMPLES



Temporal Orientation



Topographical Memory



Visual Memory

Categorization

Visual Attention

Verbal Fluency

Exercise Categories

	SPECIFIC INPUT	HELP ?
Temporal Orientation	Year, month, day, day of the week	✓
Personnel Guidance	Body part target	✓
Topographical Memory	N of answers, N grid rows, N grid columns	✓
Visual Memory	N of images	✓
Hearing Attention	Text/Story, N of words to identify	✗
Visual Attention	N of answers, N grid rows, N grid columns	✗
Categorization	N of images	✓
Verbal Fluency	Target word, synonym/contrary word	✓

Pilot Trial

150 subjects involved

- No rehabilitation treatment
- Traditional rehabilitation treatment
- AL.TR.U.I.S.M treatment

MULTIDIMENSIONAL ASSESSMENT

PSYCHOMETRIC TEST

CARE@HOME

eResult, Sabacom, AserNet, CNR IMM, IRCCS Casa sollievo della sofferenza, Università di Bari, Matrix S.p.a., CETMA

Setting: Casa privata e/o casa di cura.

Soggetti:Verranno considerate due coorti di pazienti anziani ospedalizzatiaffetti
da scompenso cardiaco.

Criteri di inclusione:

1) Pazienti di età superiore a 65 anni ospedalizzati.
2) Diagnosi di scompenso cardiaco NYHA>=2
3)Consenso informato
4) Una completa valutazione multidimensionale.
5) MPI 2 o 3

Numerosità del campione : circa 80 soggetti.

Outcome :

Tecnologici: accettabilità, funzionalità e facilità d'uso dello strumento etc.

Clinici: mortalità a un mese, riospedalizzazione istituzionalizzazione, numero di controlli medici settimanali, qualità della vita, livello dell'umore, alterazioni del profilo di rischio multidimensionale).

Metodi:

Sistema di monitoraggio indossabile come ad es. maglietta Smartex che includa i seguenti parametri vitali: ECG, Frequenza respiratoria, Frequenza cardiaca e Valutazione della motilità.

Peso, valori pressori, diuresi, saturimetria etc.

Parametri ambientali

Il sistema sarà collegato direttamente al centro clinico, e/o al medico di riferimento che ne abbia l'autorizzazione e saranno presenti anche alcuni eventi automatici di allarme per il familiare.

Grazie per l'attenzione