



CONFERENZA GARR 2016

30 NOVEMBRE - 2 DICEMBRE 2016, FIRENZE POLO UNIVERSITARIO DI NOVOLI

THE
CREACTIVE
NETWORK

Un prototipo di applicazione IoT in Sanità: il progetto MARINER

Paolo Meriggi (pmeriggi@dongnocchi.it)
Fondazione Don Carlo Gnocchi Onlus - IRCCS

Fondazione Don Carlo Gnocchi in One Single Slide



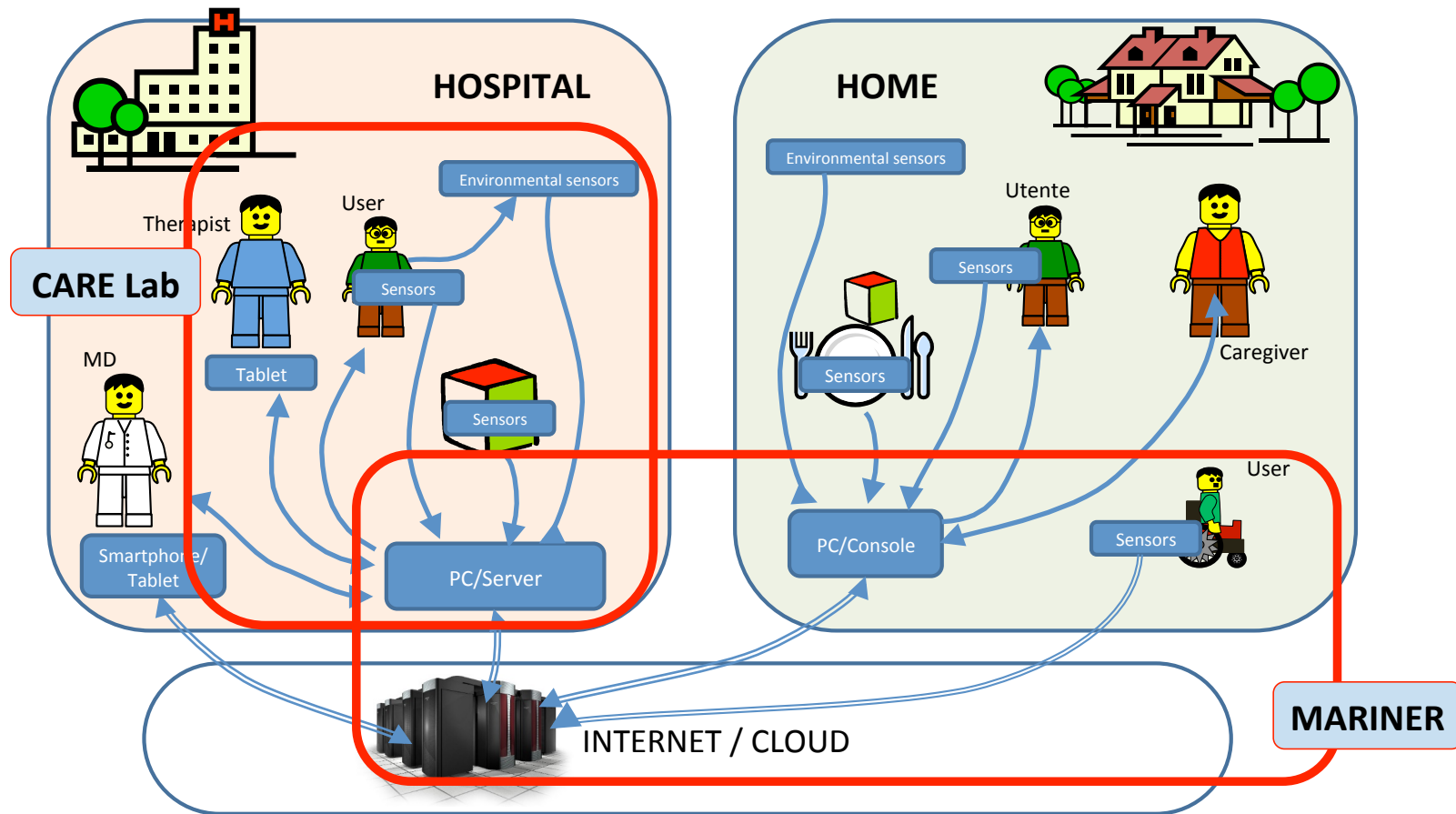
Some Figures

- Non-profit private Foundation
- 5.615 employees and collaborators
- 3.713 hospital beds
- 29 Centers in 9 Regions,
 - **2 Research Hospitals (IRCCS)**
 - 8 Centers for elderly care
 - 23 Rehabilitation Centers in 9 Regions
- 41 Outpatient clinics
- More than **3.3 million patient access/year**

Areas of activity

- Health Care
- Social and training activities for disabled people
- Higher Education
- **Research & innovation (Centro di Bioingegneria)**
- International Aid in Development Countries (NGO)

The Framework: an Innovative Approach in (Pediatric) Rehabilitation



Powered Wheelchair: Some Figures

An Observational Study of Powered Wheelchair Provision in Italy

DOI: 10.1080/10400435.2015.1074631

[Claudia Salatino](#)^{a*}, [Renzo Andrich](#)^a, [R. M. Converti](#)^b & [M. Saruggia](#)^b

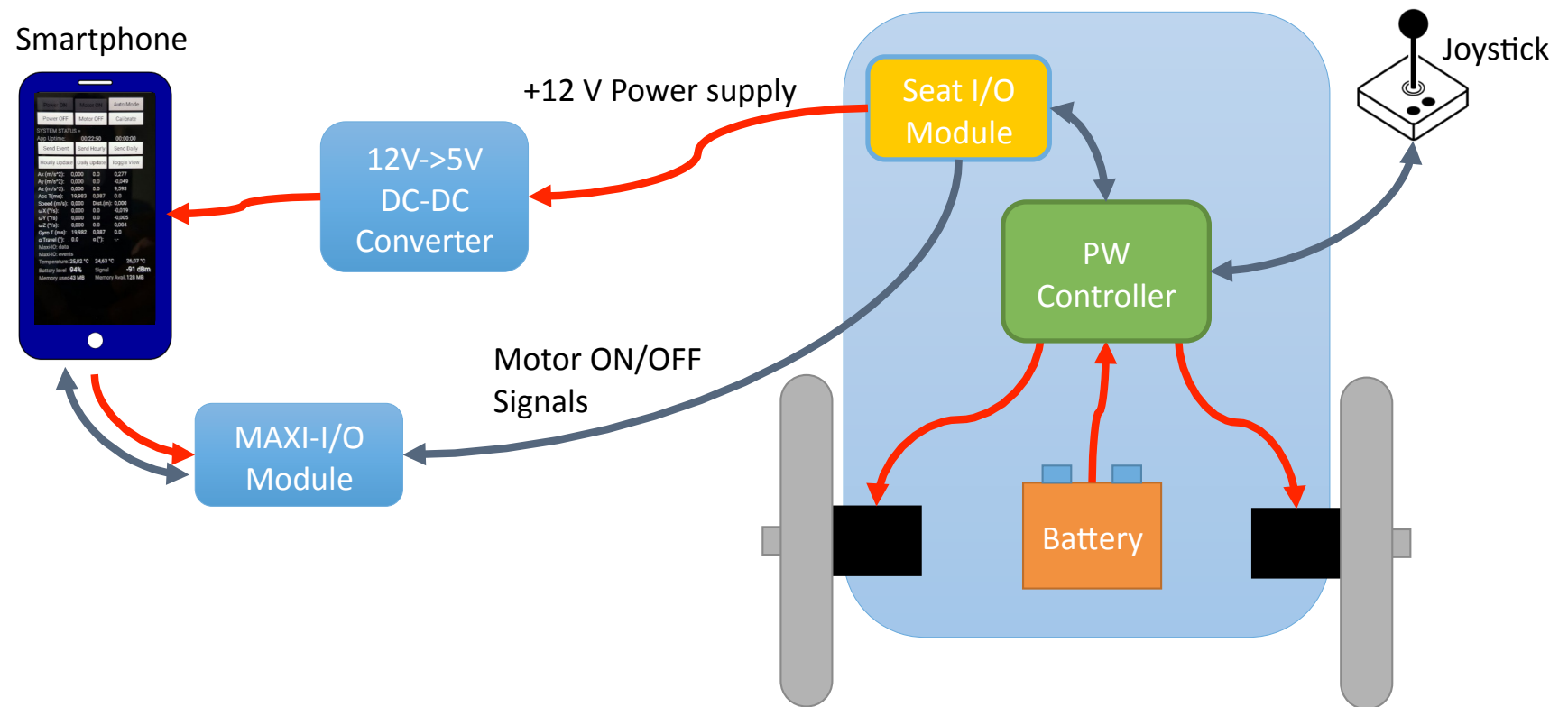
- Around **6250** powered wheelchairs are sold in Italy every year (55% indoor, 45% outdoor use)
- Reimbursement: NHS tariffs for powered wheelchairs \$3,035 for indoor and \$5,157 for outdoor use, plus about >10% for accessories
- Current annual Italian powered wheelchair market is worth at least **\$ 27M**
- From other sources: by 2018 **\$ 2.9B** expected for the manual wheelchair global market and **\$ 3.9B** expected for the power wheelchair market

The percentage of abandonment of all AT solutions (not only PW) during the year following provision range from 25% (Federici & Borsci, 2011) to 40% (Philips & Zhao, 1993) -> There is a growing demand of careful quantitative evaluation and measurements of the outcomes (effectiveness and usefulness)

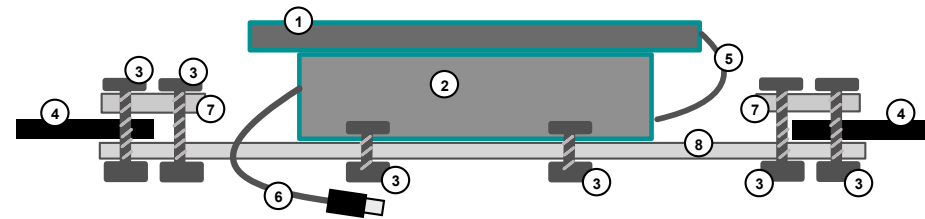
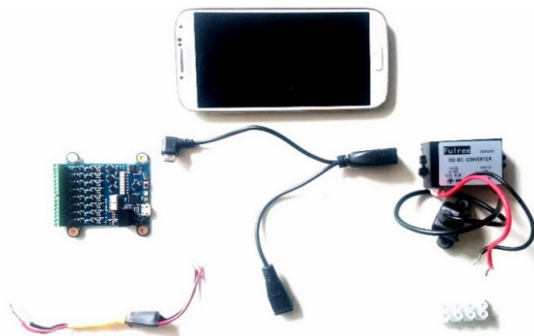
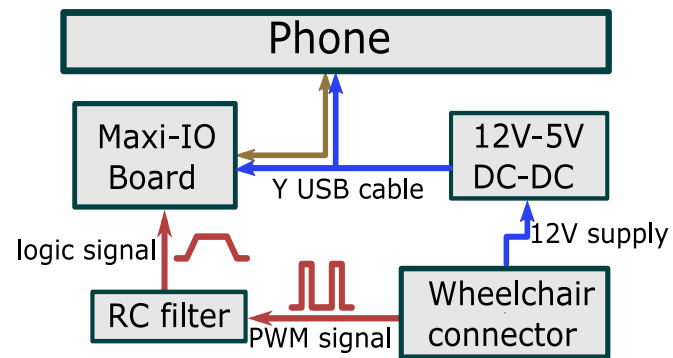
Project MARINER: MonitorAggio Remoto carrozIne ElettRoniche

- Main project goal: to verify that the early adoption of Powered Wheelchair (PW) may contribute to an increase in cognitive functions, through the autonomous exploration of environment
- Secondary project goal: to build and test an appropriate hw/sw architecture to acquire quantitative data about the daily use of PW, storing them locally and in the cloud, where they may be further processed to extract indexes.
- The project (funded by Lombardy Region) started in 2013 and is currently in the final test on-the-field phase.

MARINER - the Overall Scheme



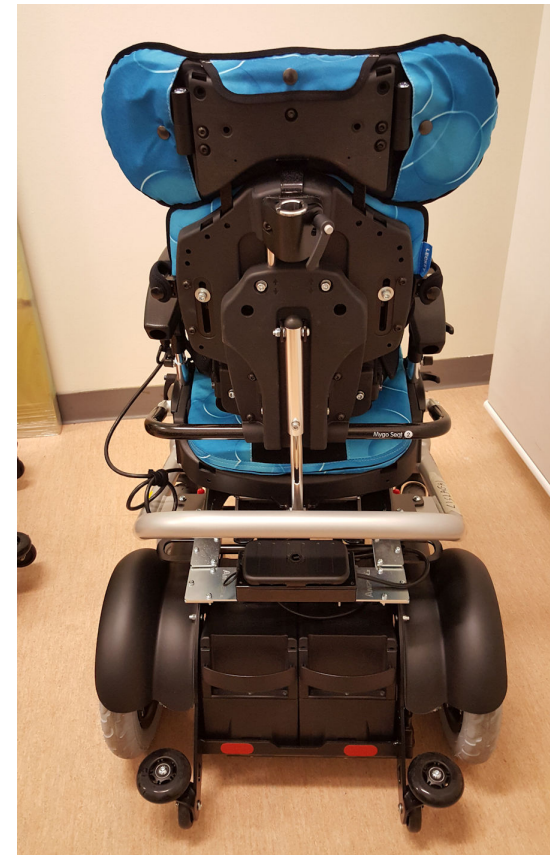
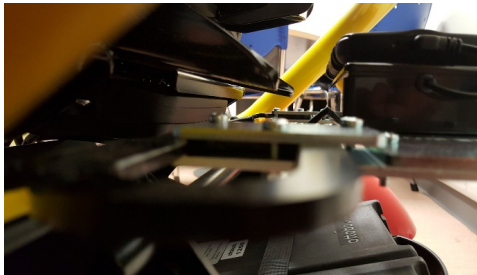
Progetto MARINER: Front-end Assembly scheme



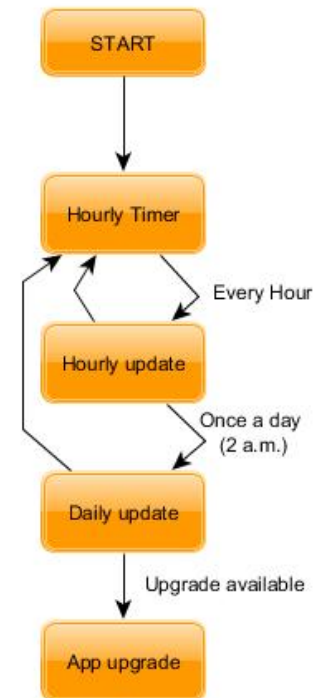
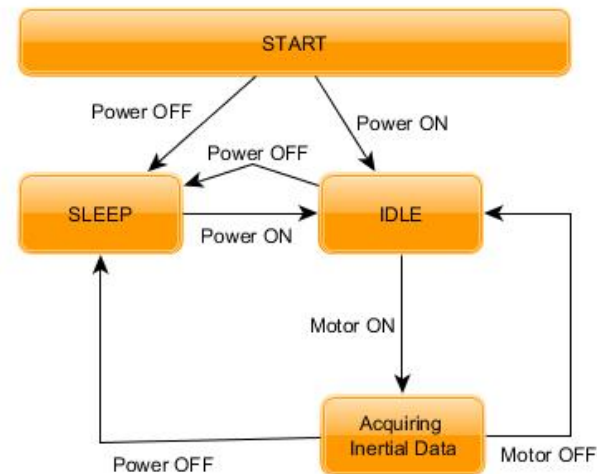
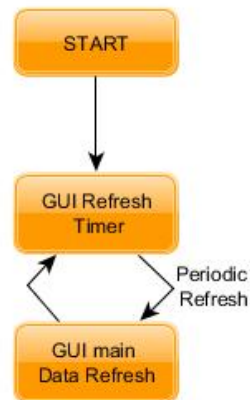
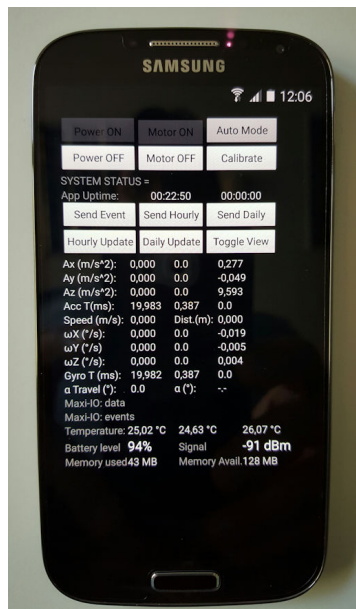
Enclosures and plates. (1) Smartphone (Samsung S4) placed in a rugged plastic case, (2) enclosure containing the Yoctopuce Maxi-IO acquisition module and the DC-DC converter, (3) holding bolts, (4) metal plates on the PW, (5) cable to the cavetto smartphone, (6) cable to the PW, (7) and (8) metal plates for the system's positioning



MARINER: Two Different Setups



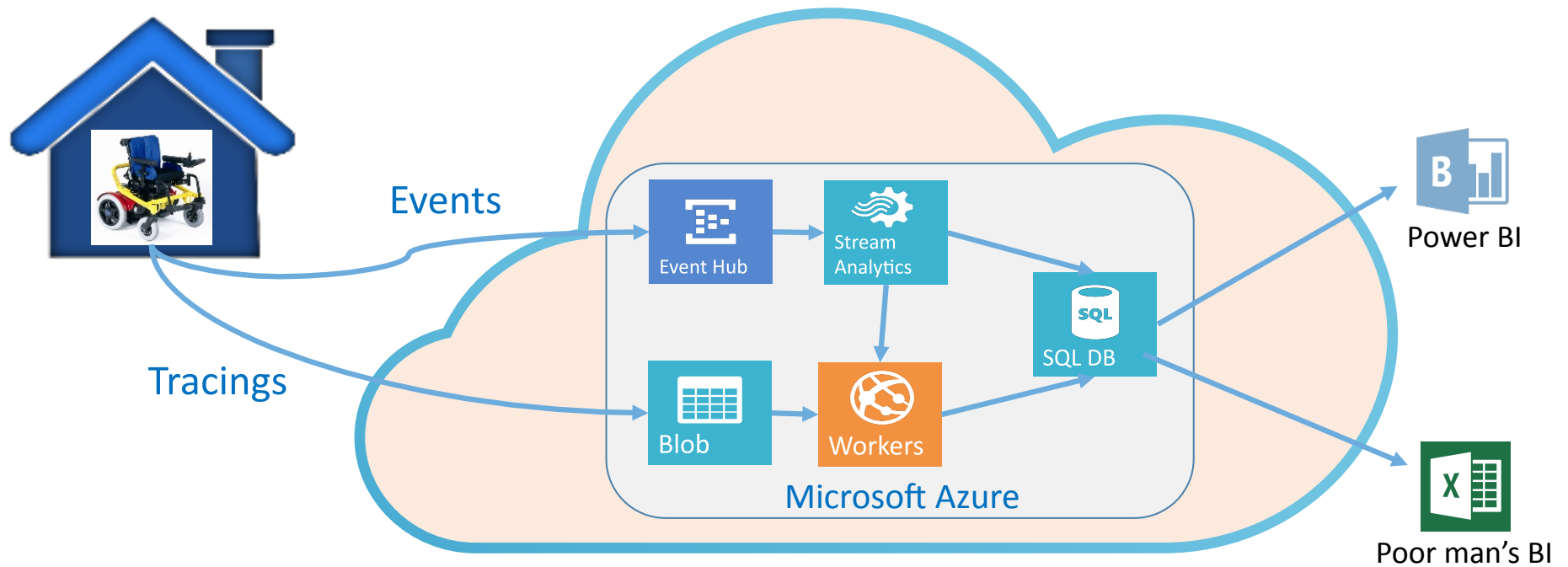
Progetto MARINER: Front End (App) Details



Info acquired and transmitted:

- Phone Temperature every 10s
- Memory and Battery % every minute
- GSM/GPRS Signal level every 6 minutes
- 3D Accelerometer @ 50 Hz (Motor ON)
- 3D Gyroscope @ 50 Hz (Motor ON)
- (opt.) GPS coordinates

Progetto MARINER: Back-end Details



Perspectives and Future work

Current limitations

- We still need real-world long-term validation (currently entering the on-the-field testing phase)
- There is still the need to extract meaningful indexes to describe “how well” the PW are used
- The complete separation from the PW Control Module forces to have indirect measures only
- Limited quality of the data acquired on the smartphone (Android OS based system)
- It is still a pilot project, larger studies are needed

Future perspectives

- The system is “low cost” (< €500) and could become a “black box” to offer a continuous quantitative insight of the PW’s use (not only in the pediatric field)
- Most of the back-end part could be re-used to remotely monitor other types of biomedical relevant signals from ambulatory or home-settings (i.e. smartwatch, IoT solutions)



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Grazie per l'attenzione!

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