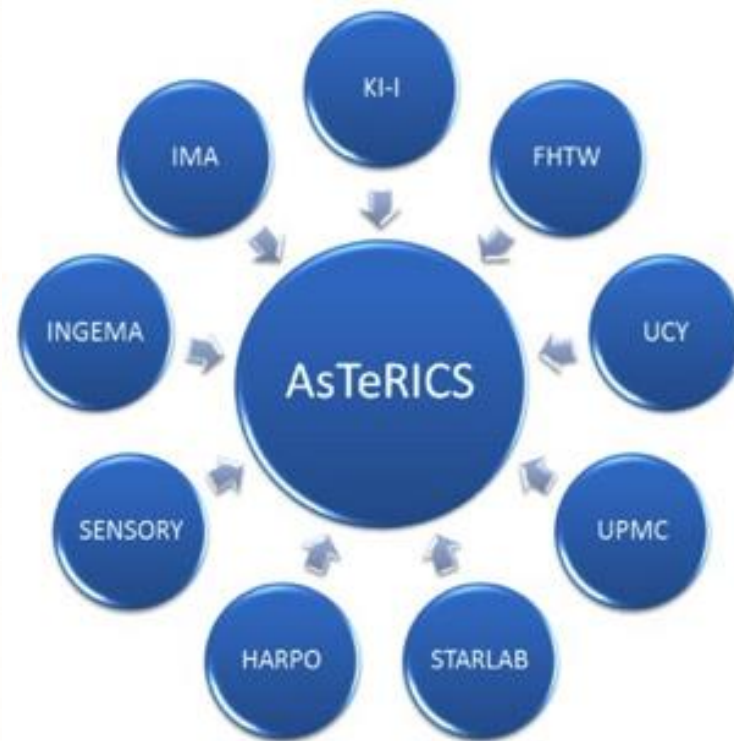


AsTeRICS

Assistive Technology Rapid Integration & Construction Set

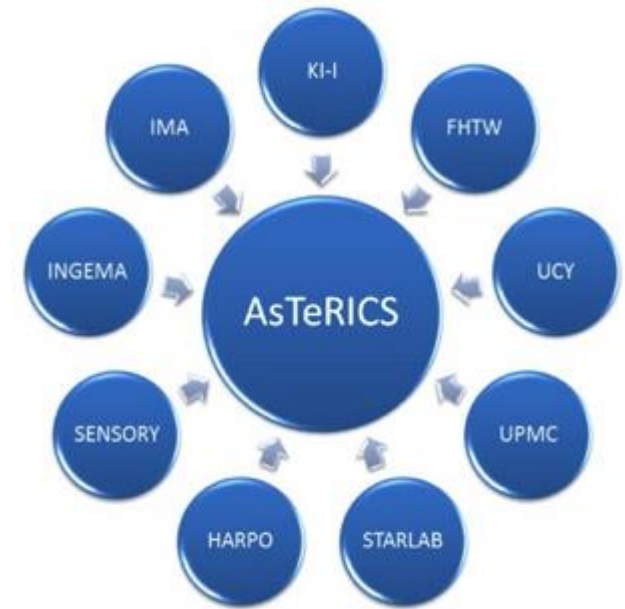
Special Targeted Research Project
(STREP)

7th framework programme of
the European Commission
2010-2013



AsTeRICS – Background

- **2.6 million people** across Europe have problems with their arms or hands (**Eurostat 2005**)
- Several smaller groups with very severe motor conditions:
 - Quadruplegia, Cerebral Palsy, Stroke
 - Amyotrophic lateral sclerosis (ALS)
 - Multiple sclerosis, Muscular Dystrophy
- Flexible Assistive Technologies can increase autonomy and participation in the social life
- AsTeRICS Project with 9 European Partners partially funded by European Commission under the 7th framework programme (ICT, 2010-2013)

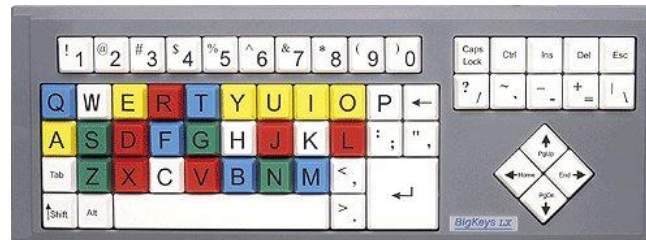


Conventional AT input devices

- Special Buttons, momentary Switches
- Special Input Devices
(Analog Joysticks, Trackballs, Big Keyboards)
- Augmented Alternative Communication Devices (AAC)



<http://www.gokeytech.com/>



BigKeys LX, <http://www.bigkeys.com>



www.infogrip.com

Problems of existing AT-solutions

Common problems of „off-the-shelf“ Assistive Solutions:

- **often optimised for particular application**
and / or small target group, thereby expensive
- **limits of adaptability** or unaffordable costs of the
necessary adaptations

Consequences:

- Some people with disabilities are not as independent
as they could be with **individually tailored**
Assistive Technologies

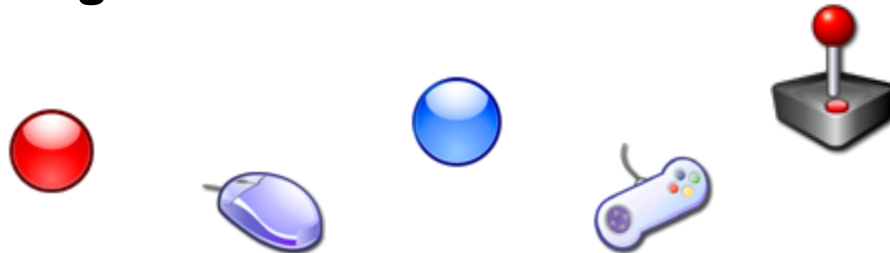
AsTeRICS goals

AsTeRICS provides a **flexible and affordable construction set** for user-driven Assistive Technologies (AT)



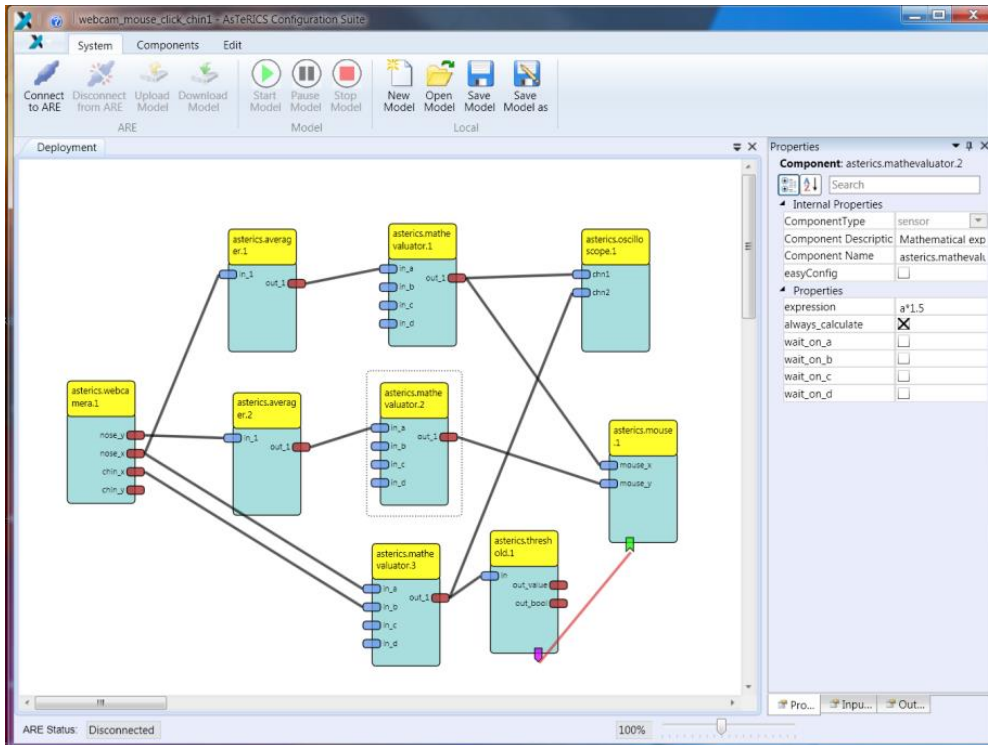
Sensors and actuators can be connected via an embedded computing platform

A software suite offers the interface for **graphical set-up and configuration**



AsTeRICS Configuration Suite

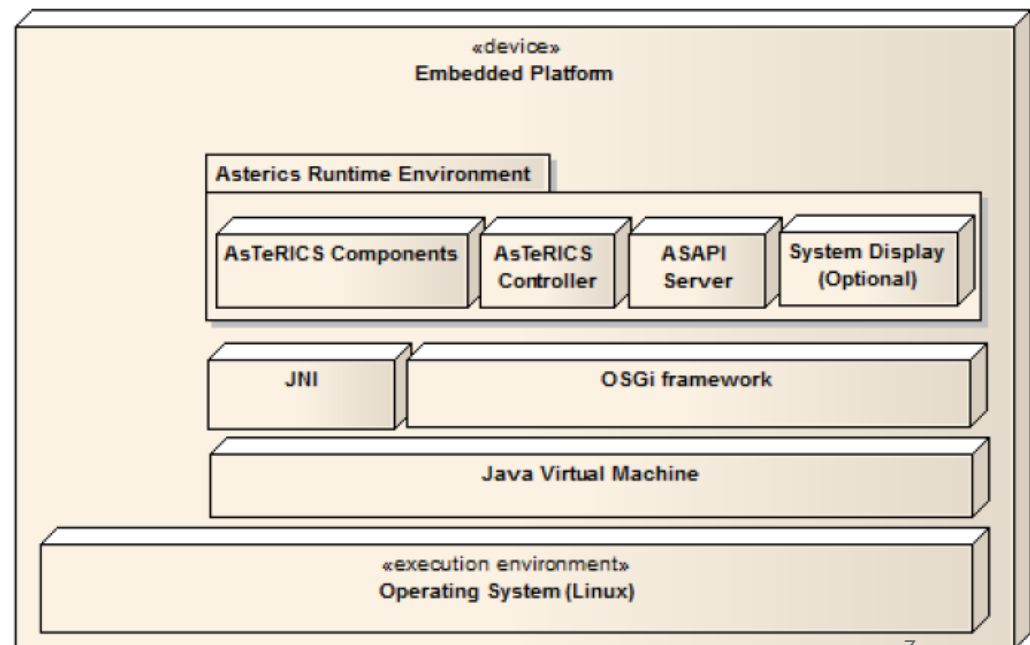
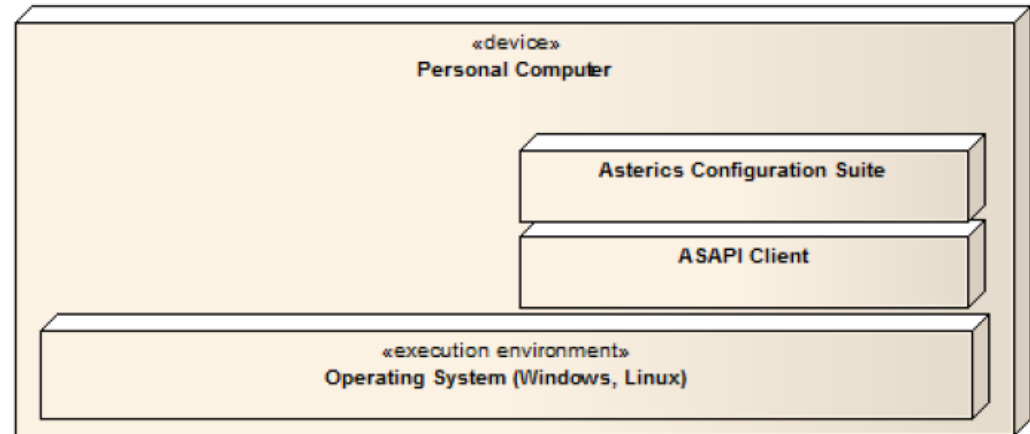
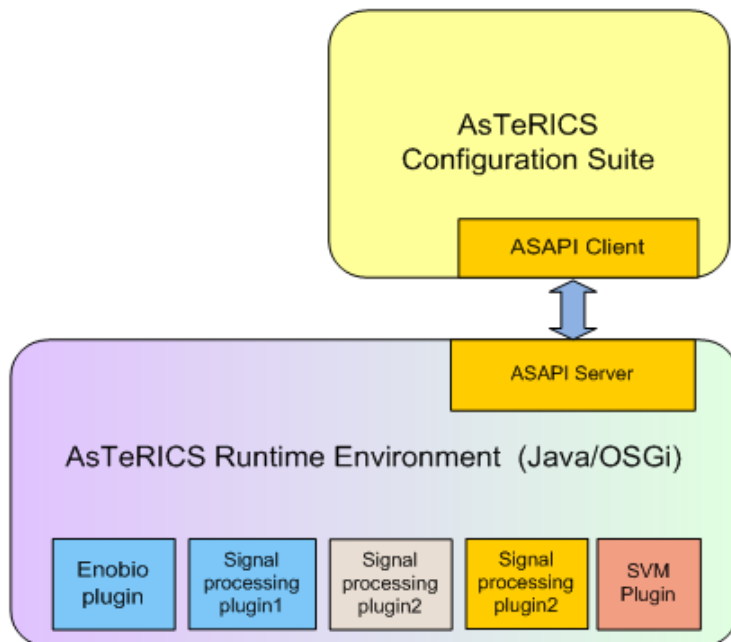
- Connection and Parameterization of plugins
- Upload / Download models to ARE (TCP)



- Cut / Copy / Paste / Group
- Integrated Help System
- GUI designer for GUI plugins

AsTeRICS Architecture

- AsTeRICS Configuration Suite (ACS) is written in C# and runs on Windows PC
- AsTeRICS Runtime Environment (ARE) is written in Java/OSGi, uses JNI / C++ native code for OpenCV, HW access etc.



Hardware modules for input/output:

- Digital input, digital output
- Analog Input
- GPO
 - Open collector outputs
 - Relais switch connectors
- Modules can be connected to any PC/Laptop via USB



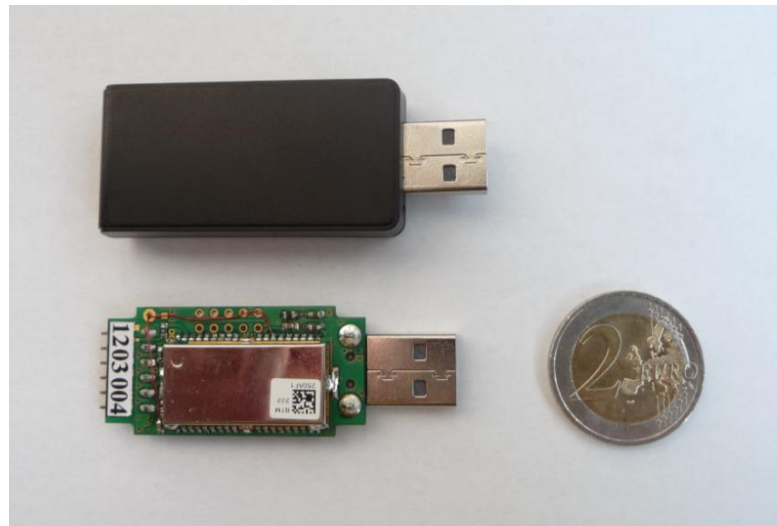
Hardware modules for input/output:

- Wireless 3-axis accelerometer
- ZigBee wireless modules
 - Digital output switch for AC/220V
 - Digital input (binary switches)



Universal HID actuator

- Emulates Mouse, Keyboard and Joystick (USB HID protocol)
- Connects wirelessly to AsTeRICS ARE (via Bluetooth)
- Any input combination can be mapped to the HID device functions
- No SW-installation on target device needed (PC, Mac, Linux, PlayStation..)



On-Screen Keyboard integration: OSKA

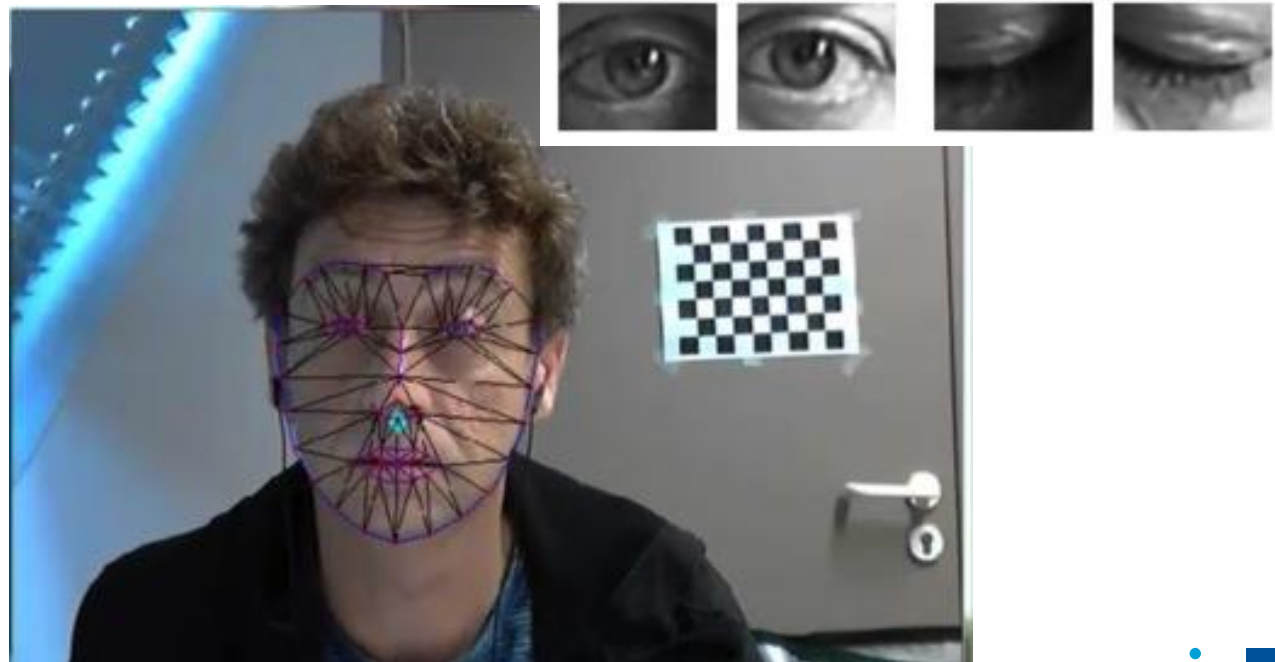


OSKA on-screen keyboard, Scanning; <http://www.oskaworld.com>

- Different Scanning variants (row/col/key)
- Selection controlled by any sensor
- Graphical Grid Editor
- Word prediction, multilingual dictionaries
- Communicator functions
(speech output, mobile phone control)

Remote (webcamera-based) and Head Mounted Feature tracking

- Face detection and feature alignment, EyeState/blink detection
- Facial feature detection (eyebrow movement, mouth open/closed)
- Constrained Local Models + Template Matching for eyestates



Environmental & Smart Home Control

- Abotic Door Opener Integration
- KNX / FS20 standards
- Connected via the GPIO module
- HiFi / Stereo / DVD / TV via Infrared
- Pneumatic Gripper actuator for mouth sticks



- complete input flexibility via desired sensors and on-screen-keyboard grids / scanning

Phone & GSM Integration

- Windows Mobile and Android Smart Phone support
- Make / Accept Calls, Send / Receive SMS
- GSM USB Modem Integration
- Usage of Smart Phone as Sensor (e.g. Accelerometer) or configurable Touch Pad (multitouch / gestures)
- On-Screen-Keyboard with scanning for Android



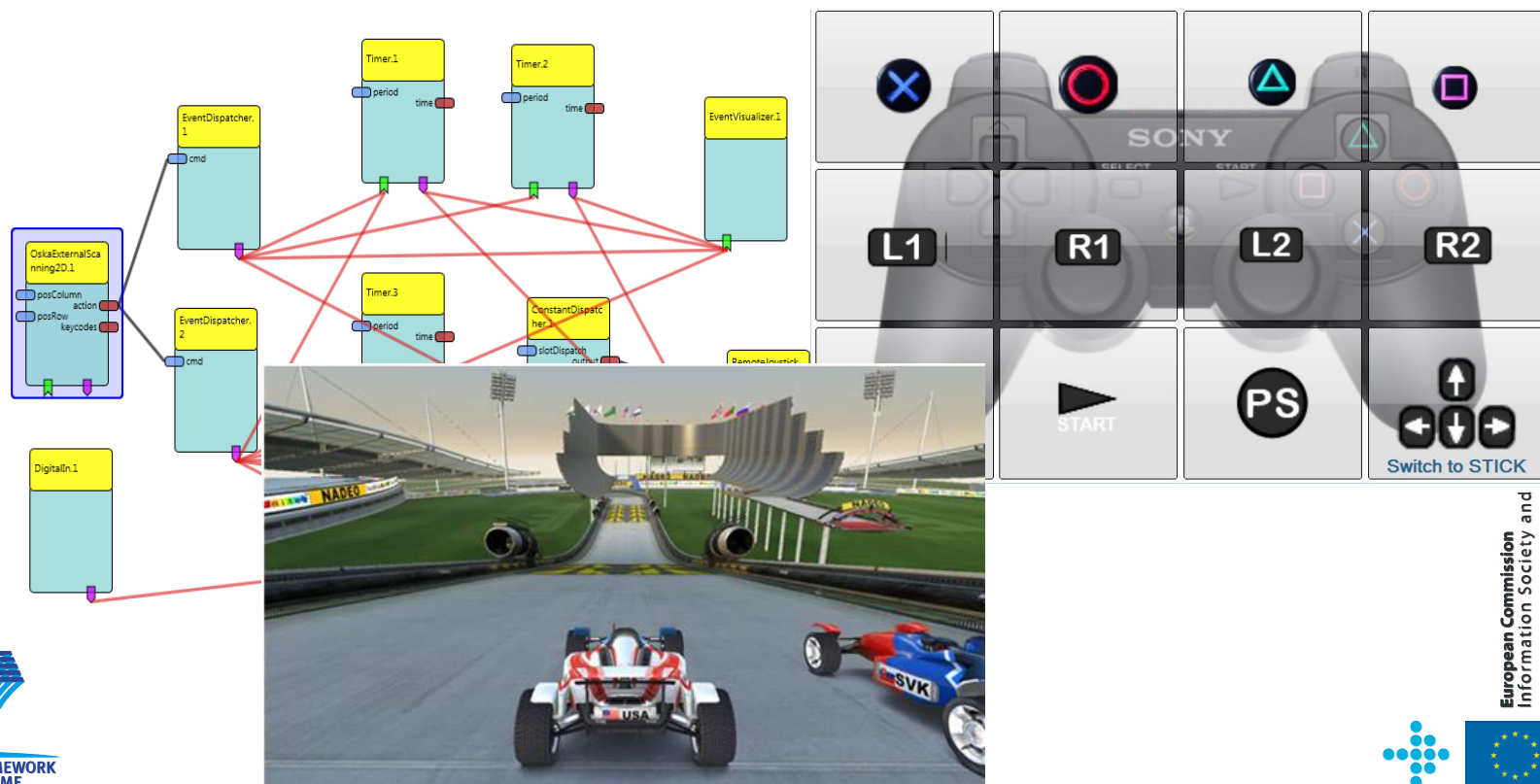
Control of a toy helicopter by a tetraplegic user

- Infrared control command generation by IR-module
- Integration of the wheelchair's bluetooth joystick (via mouse capture plugin)
- EMG or Sip/Puff sensor for controlling up / down
- 4 degrees of freedom



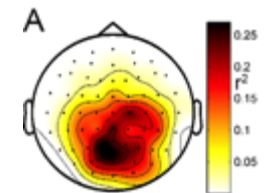
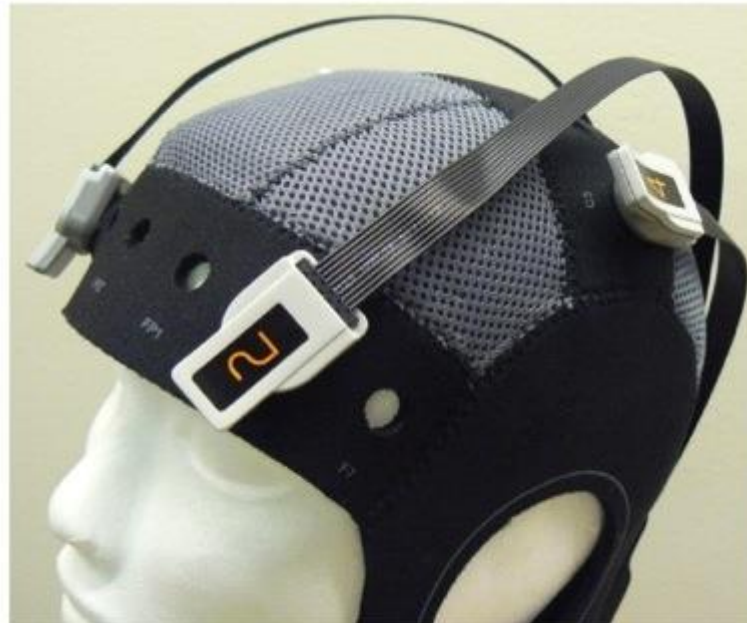
Accessible Toys / Game Control

- HID actuator emulates Playstaion-3 SixAxis controller
- Dedicated models for controlling Racing games or Adventure games using different input modalities and devices



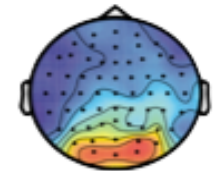
Enobio EEG/EMG

- Wearable, wireless design (ZigBee)
- Active electrodes
- Flexible mounting cap
- Plugins for SSVEP, Eye-blink detection, EMG activity
- BNCI evaluation suite (Matlab, P300 / EPR)



p300

15.00 Hz

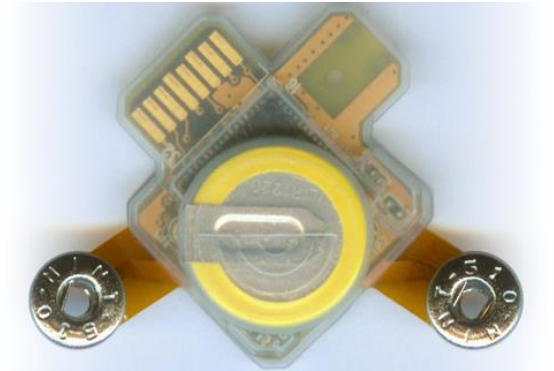


SSVEP



LowCost biosignal acquisition

- OpenEEG / ModularEEG (6 chn)
- Small USB-powered 2 channel version (MonolithEEG)
- EMG / ECG / EOG / EEG
- OPI Innovation TrueSense Exploration Kit
 - wearable ZigBee Sensor
 - EEG, EMG, EOG, ECG
 - accelerometer
 - onboard memory (1 hrs recording)
 - realtime clock



1 cm

2 cm

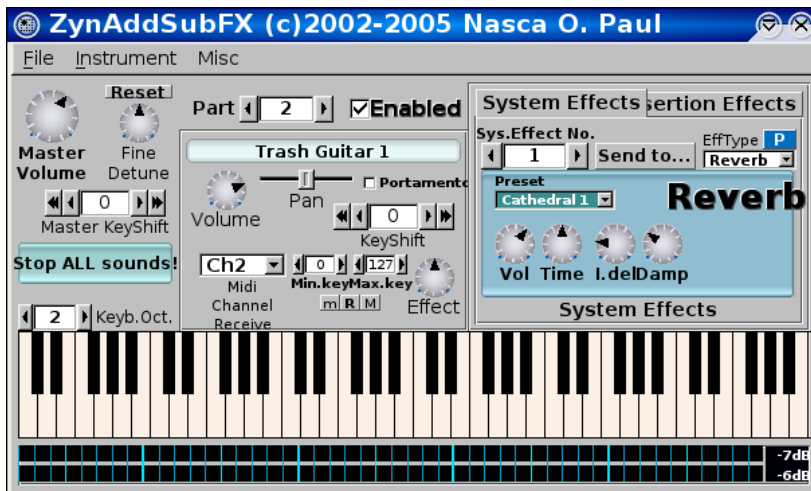
3 cm

4 cm

- Living in Vienna, 35 yrs., Muscular Dystrophy
- Active movement reduced to facial muscles
- Harry uses the lipmouse for computer control: writing emails / gaming / as a musical instrument



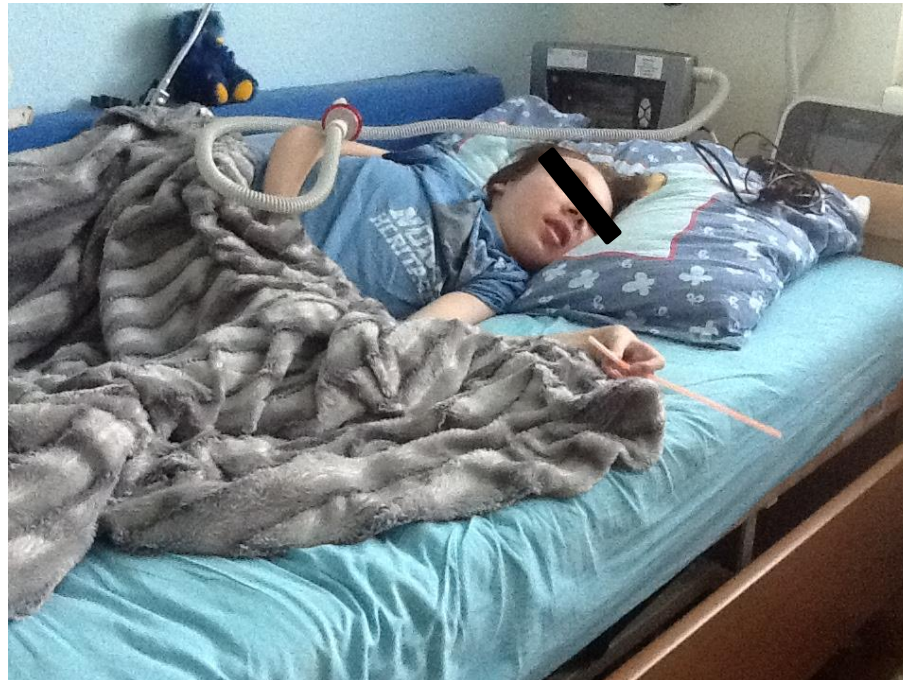
- Musical setup: Lipmouse used together with Tobii eyetracker for chord selection and step sequencer



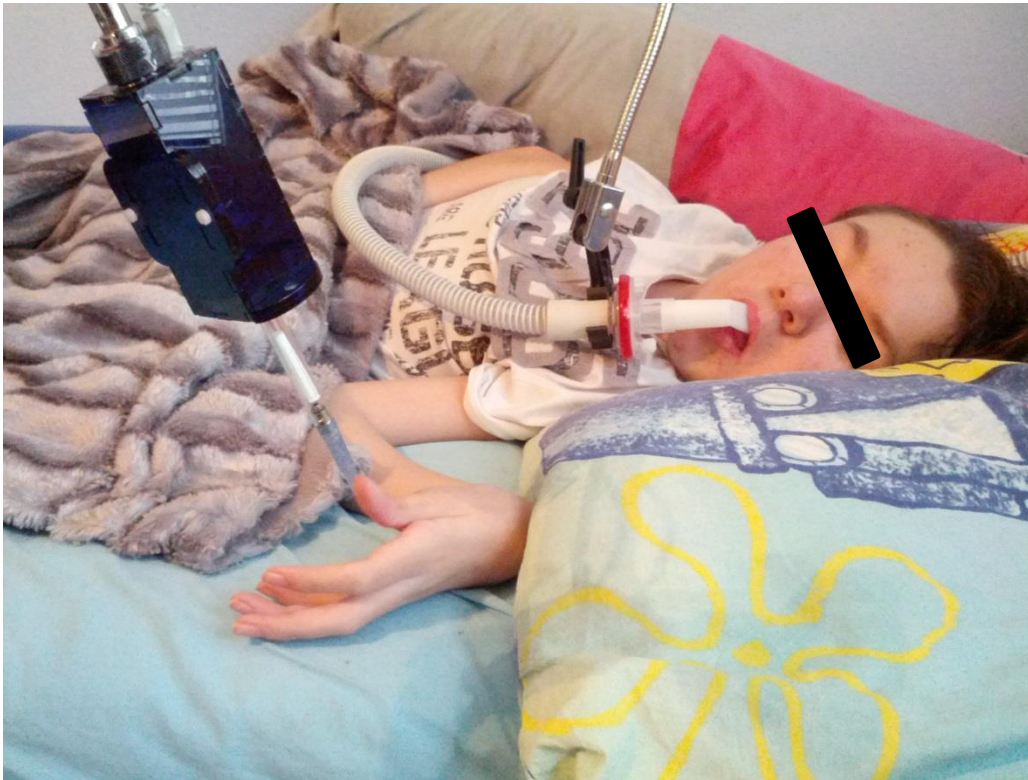
Synthesizer:
ZynAddSubFX

Midi Interface / GUI
PureData

- Living in Vienna, 18 yrs., Muscular Dystrophy
- enjoyed to play PC games, but can not control a PC via usual control devices anymore



- uses the Lipmouse like a joystick and additional buttons to control a PC and play his old PC-games



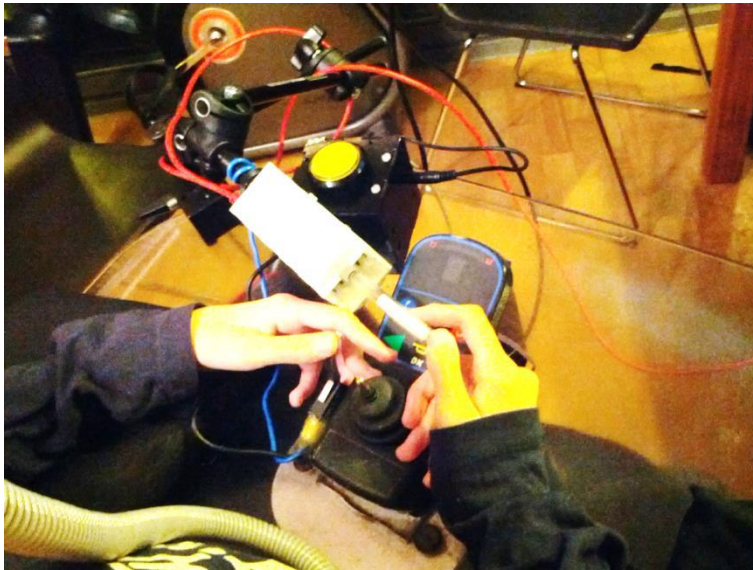
- Planned: using AsTeRICS to control his model railway



- Living in Vienna, 16 yrs., Muscular Dystrophy
- enjoyed to play PC and video games, but cannot use the usual controllers anymore



- uses the Lipmouse like a joystick, additional switches and an eyetracker to control a PC and play his old PC-games



- living in a facility for assisted living, Cerebral palsy
- controls the environment (light, Hifi, TV) with the help of AsTeRICS and an one-button solution



- Tetraplegia (C2) patient
- Uses the lipmouse to control a PC, read ebooks etc.

