

A Multi-Modal Human-Machine-Interface for Accelerator Operation and Maintenance Applications



R. Bacher, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

Supported Modalities

1D / 2D Flat Gestures

Single-finger actions (**mouse**)
Single- and multi-finger gestures (**touch-sensitive display**)



2D / 3D Spatial Gestures

Hand-gestures (**Leap Motion controller**)
Hand- and arm-gestures (**Myo gesture control armband**)

Leap Motion Controller



Spoken Commands

English (**Sphinx speech recognition**)

Myo Gesture Control Armband

OS (most recent version)	Mouse	Touch	Leap	Myo	Speech
Windows	yes	yes	yes	yes	yes
Linux	yes	yes	yes	no	yes
MacOS	yes	yes	yes	yes	yes
Android	no	yes	no	yes	yes
iOS	no	yes	no	yes	yes

Applies to

Desktop / Notebook computers with passive or touch-sensitive display
Tablet computers / Smartphones with touch-sensitive display
See-Through Augmented Reality glasses

Web2cToGo / Explorer View HMI

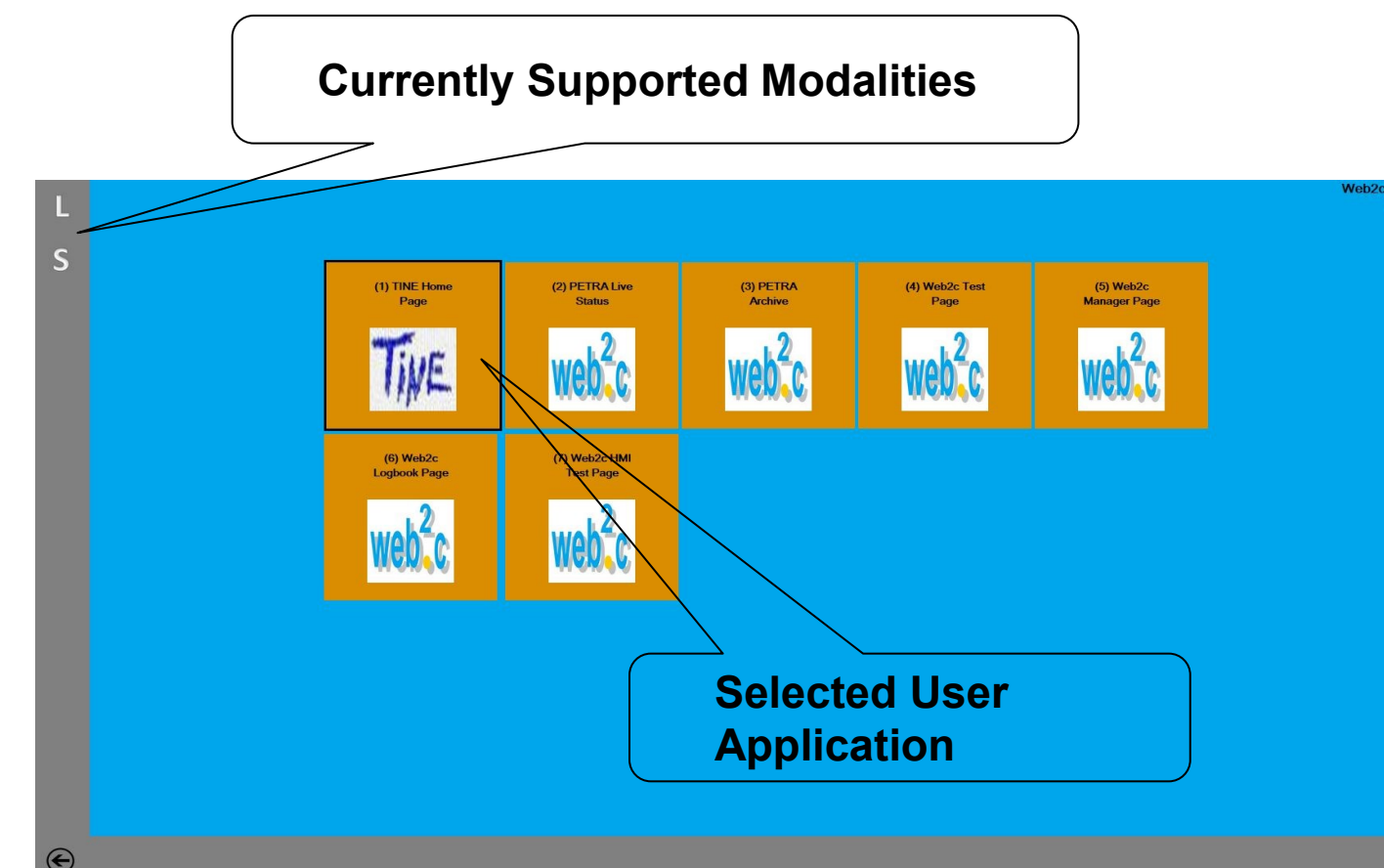
Web2cToGo Web service

Implements Web Client / Server architecture
Capable of running simultaneously up to 15 multi-page Web2cToolkit-compliant user applications (e.g. Web2cViewer application)
Supports **Web2cHMI**: multi-modal HMI (primitive and enriched gestures, spoken commands)

Primitive gestures:

Mouse: Click, Move
Touch: Tap, Move / Swipe, Pinch (2 fingers)
Leap: Key-Tap, Swipe, Open-Hand, Closed-Hand, Circle
Myo: Double-Tap, Wave-Out / Wave-In, Fingers-Spread, Fist

Enriched gestures: primitive gestures followed by moves, rotations etc.



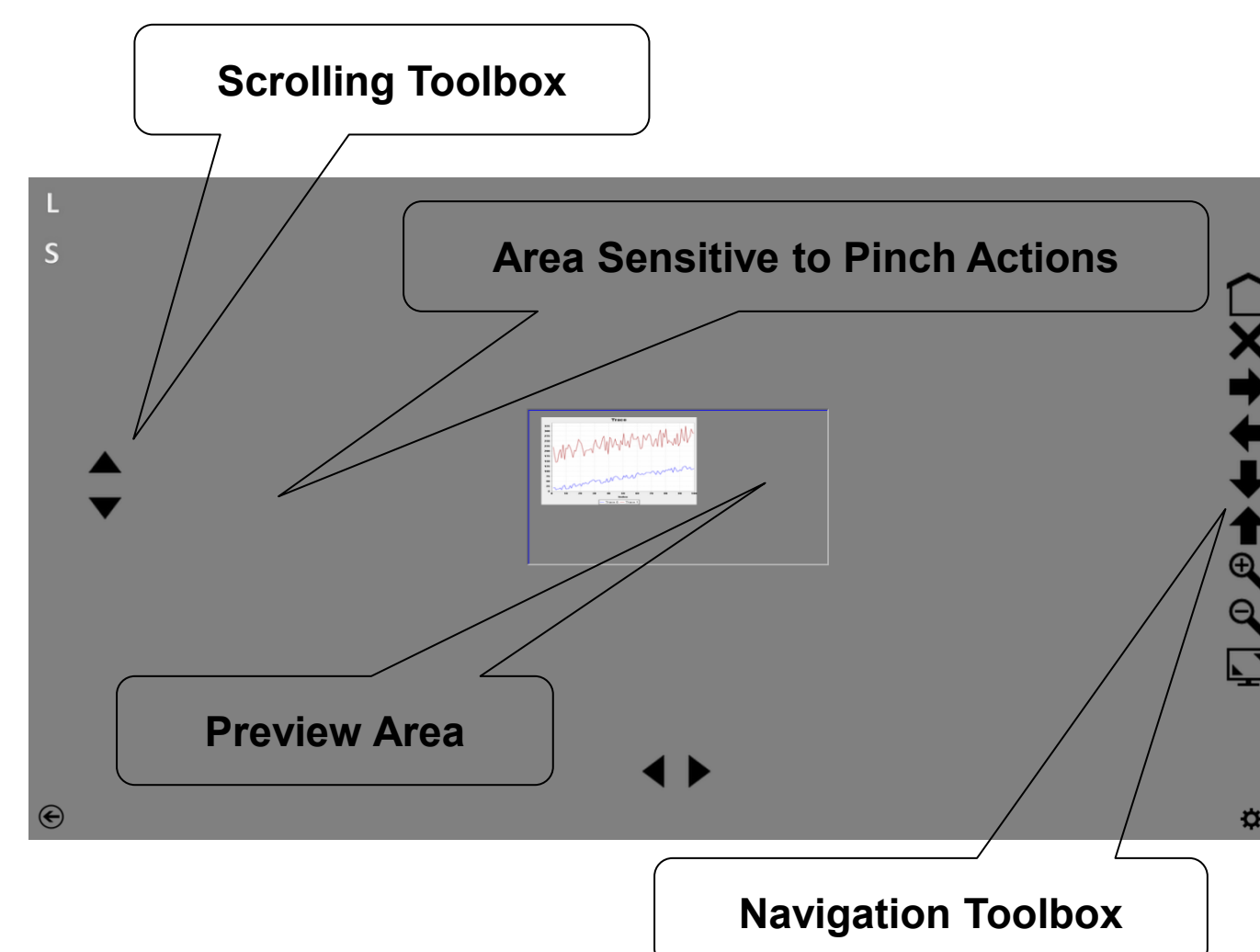
Explorer View

Launching / Displaying of user applications
Indicates the currently supported modalities and corresponding status (armed / disarmed)

Web2cHMI Example

Action	Mouse	Touch	Leap	Myo	Speech
Launch / Display selected application	Click selected application tile	Tap selected application tile (right / left hand)	Open-Hand (right / left hand)	Fingers-Spread (right / left arm)	Say "Display"

Web2cToGo / Navigation View HMI

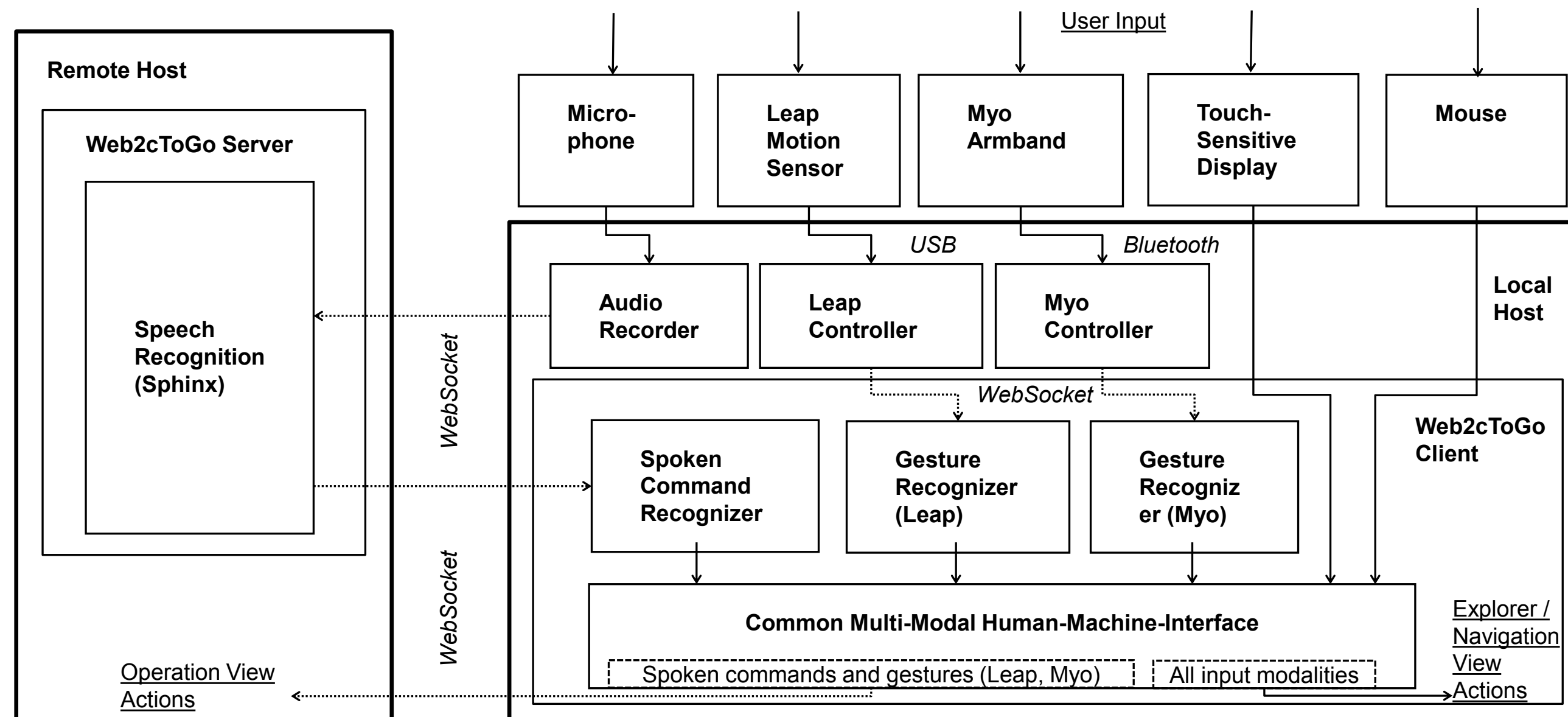


Navigation View

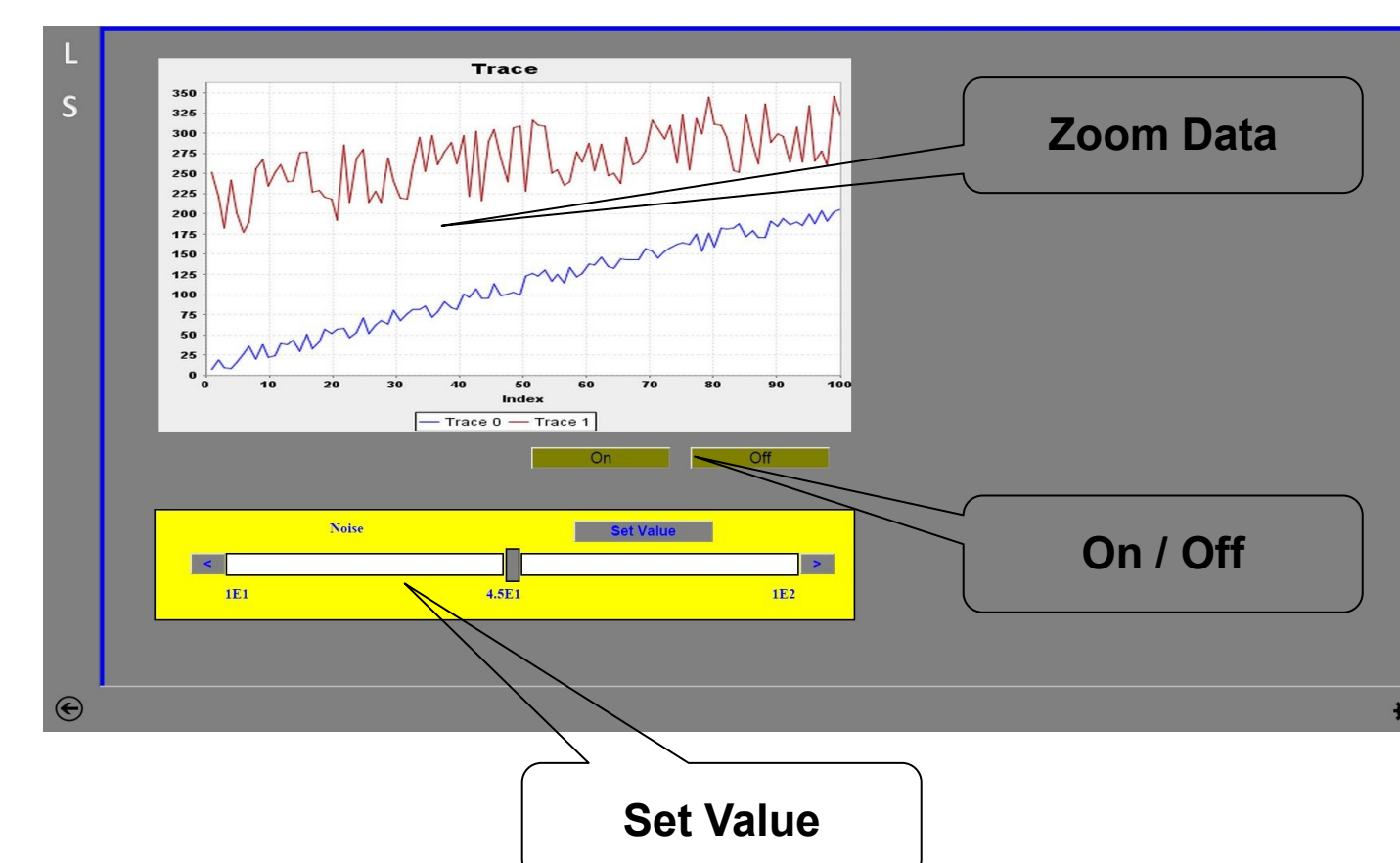
Switching between user applications
Closing user applications
Browsing between pages of user applications
Zooming, resizing and scrolling pages of user applications
Switching to Explorer View or Operation View

Web2cHMI Example

Action	Mouse	Touch	Leap	Myo	Speech
Zoom-in current application page	Click	Tap (right / left hand) Right-Tilted Open Pinch (right hand) Left-Tilted Open Pinch (left hand)	Open-Hand & Clockwise Rotation (right / left hand)	Fingers-Spread & Clockwise Rotation (right / left arm)	Say "Zoom In"



Web2cViewer / Operation View HMI



Operation View

Interacting with interactive widgets
Supported types (1 widget instance of each type per user application page)
"On" - action (On-Button)
"Off" - action (Off-Button)
"Set Value" - action (Slider)
"Zoom Data" - action (Chart)
Switching to Navigation View

Web2cHMI Example

Action	Mouse	Touch	Leap	Myo	Speech
Change Set-Value (small positive step)	Click ">"-Button Click Set-Value Button	Tap ">"-Button Tap Set-Value Button (right / left hand)	Clockwise Circle (right / left hand)	Fist & Clockwise Rotation (right / left arm)	Say "More"

