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

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**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)

Spoken Commands
- English (Sphinx speech recognition)

<table>
<thead>
<tr>
<th>OS (most recent version)</th>
<th>Mouse</th>
<th>Touch</th>
<th>Leap</th>
<th>Mys</th>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Linux</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>MacOS</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Android</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>iOS</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
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</tr>
</tbody>
</table>

**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)

**Native Web2cHMI**
- 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.

**Currently Supported Modalities**

**Web2cToGo / Navigation View HMI**

**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**

<table>
<thead>
<tr>
<th>Action</th>
<th>Mouse</th>
<th>Touch</th>
<th>Leap</th>
<th>Mys</th>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoom in page application</td>
<td>Click</td>
<td>Tap</td>
<td>Right Fingers Pinch (right hand)</td>
<td>Open Hand &amp; Cocked Knuckles (right hand)</td>
<td>Fingers Spread (left hand)</td>
</tr>
<tr>
<td>Switch between applications</td>
<td>Click</td>
<td>Tap</td>
<td>Left Fingers Pinch (left hand)</td>
<td>Open Hand &amp; Cocked Knuckles (left hand)</td>
<td>&quot;Zoom Out&quot;</td>
</tr>
<tr>
<td>Launch / Display application</td>
<td>Click</td>
<td>Slide</td>
<td>Right Hand &amp; Cocked Knuckles (right hand)</td>
<td>Fingers Spread (left hand)</td>
<td>&quot;Zoom Data&quot;</td>
</tr>
</tbody>
</table>

**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)

**Web2cHMI Example**

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<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Set Value</td>
<td>Click</td>
<td>Slide</td>
<td>Right Hand &amp; Cocked Knuckles (right hand)</td>
<td>Fingers Spread (left hand)</td>
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<td>&quot;Zoom Out&quot;</td>
<td></td>
</tr>
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**Spoken commands**
- “Change Set Value”
- “Display”
- “Set Value”
- “Zoom Data”
- "Zoom In" / "Zoom Out"

**Applications Supported**
- Web2cView (Explorer)
- Web2cMotionView (Operation)

**Supported modalities and corresponding status**
- Hand: Circle
- Arm: Open
- Fingers: Pinch
- Leap: Key Tap
- Myo: Double Tap

**Current Status**
- Hand: Circle
- Arm: Open
- Fingers: Pinch
- Leap: Key Tap
- Myo: Double Tap

**Supported Modalities**

- Hand gestures (Leap Motion controller)
- Arm gestures (Myo gesture control armband)
- Touch gestures (mouse, touch, swipe, pinch)

**Applications Supported**
- Web2cView (Explorer)
- Web2cMotionView (Operation)

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