System Overview

The system consists of the following parts:
1. The robot arm, type Adapt Viper S850 with power supply unit and remote control.
2. The control unit and the software for the robot arm, optical tracking system and the TMS device.
3. NDI Spectra® optical tracking system.

Software Specifications

The robot arm, the optical tracking system and the TMS device are operated by the control unit. The software module allows to plan the stimulation treatment, by defining the stimulation targets and the desired coil orientations. The defined target positions for magnetic stimulation are then forwarded to the robotic arm. During the session, any movement of the subject is monitored with the optical tracking system and compensated for. This guarantees optimal positioning of the TMS coil over the pre-defined target. Magnetic stimulation is done when the TMS coil reaches the pre-defined target location.

| MRI Import | • DICOM, Nifti |
| Targets Definition | • Single Targets:  
  - Based on real scalp surface, by pointing at scalp with the pointer tool  
  - Based on computer rendered surface of subject and mouse clicks  
  - Based on MRI / CT data and mouse clicks  
  • Automatically generated target grids, width adjustable height, width and target spacing starting from a previously defined single target |
| Subject Registration | Anatomical landmarks based and/or ICP based. The ICP is based on surface points automatically collected while moving the pointer over the scalp. |
| Targeting Mode | • Static (without movement compensation)  
  • Dynamic (with movement compensation) |
| Stimulation Mode | • Manual. Upon target selection, the robot arm places the coil at the defined position.  
  • Automatic. The robot arm places the coil at all defined target positions:  
  - In the specified order  
  - Randomly |

Export of stimulated positions As text file
Dynamic response latency < 50 ms
Relative accuracy (static target) < 0.05 mm
In-session-repeatability (static target) 0.03 mm
Inter-session-repeatability (static target) • 0.03 mm (same fixation)  
  • 1.0 mm (new subject / new chair-robot-arrangement / new coil attachment)
# Hardware Specifications

## Robotic Arm

The Adept Viper arm is a 6-axis robot designed for a multitude of applications. The precision and physical range of the robot makes it ideal for medical applications requiring flexible and accurate positioning and complete control.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reach</td>
<td>854 mm</td>
</tr>
<tr>
<td>Payload max</td>
<td>2.5 kg (rated)</td>
</tr>
<tr>
<td></td>
<td>5.0 kg (max)</td>
</tr>
<tr>
<td>Repeatability (XYZ)</td>
<td>± 0.030 mm</td>
</tr>
<tr>
<td>Mounting</td>
<td>Floor / Table / Ceiling</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>29 kg</td>
</tr>
<tr>
<td>Environmental Requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient temperature 5 - 40 °C</td>
</tr>
<tr>
<td></td>
<td>Humidity range 5 - 90 %</td>
</tr>
<tr>
<td>Power Requirements for Smart Controller</td>
<td>24VDC (+/- 10%), 120W (5A)</td>
</tr>
<tr>
<td>Power Requirements for MotionBlox-60R</td>
<td>24VDC (+ 10%), 150W (6A)</td>
</tr>
<tr>
<td></td>
<td>200V to 240V AC, 1-phase, 50/60Hz</td>
</tr>
</tbody>
</table>

## Camera System

SmartMove is based on the NDI Spectra™ camera system. This tracking hardware uses infrared light to track the position of the pointer or other tools. Each tool is equipped with multiple passive markers. The position and the orientation of the tools are inferred from the infrared light reflected back to the position sensor. Accuracy is guaranteed to be in the sub-mm range.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Pyramid: 0.25 mm RMS</td>
</tr>
<tr>
<td></td>
<td>AAK 0.35 mm RMS</td>
</tr>
<tr>
<td>95% Confidence Interval</td>
<td>Pyramid: 0.5 mm</td>
</tr>
<tr>
<td>Maximum Update Rate</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>10°C to 40°C</td>
</tr>
<tr>
<td>Measurement Volume</td>
<td>Pyramid</td>
</tr>
<tr>
<td>Data Communication Interface</td>
<td>USB</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>100/120/220/240 V AC, 50/60 Hz, 0.5 A</td>
</tr>
<tr>
<td>Mounting</td>
<td>Tripod, wall or ceiling</td>
</tr>
</tbody>
</table>

## Control Unit

The control unit operates the robot arm, the optical tracking system and runs the software module.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>External start / stop / pause control</td>
<td>TCP/IP (Ethernet-switch or 2nd Ethernet card required)</td>
</tr>
<tr>
<td>Computer</td>
<td>High performance PC with 2GB RAM, fast graphics card, 2x Ethernet card, COM-Port, USB2-Port</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows XP or Linux (Ubuntu)</td>
</tr>
<tr>
<td>Additional requirements</td>
<td>Java JRE 1.6, VTK 5.0.4</td>
</tr>
</tbody>
</table>

SmartMove is intended to be used for research applications only. This product is not sold as a Medical Device as defined in EU Directive 93/42/EEC. The product is not designed or intended to be used for diagnosis or treatment of disease.