CAREN-Extended (plus)

Architectural requirements

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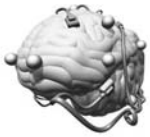

Table of Contents

1 Introduction

CAREN (Computer Assisted Rehabilitation Environment) is a turnkey, customizable visualization application designed for the medical industry. Based on MOTEK's patented D-Flow™ Technology, CAREN allows medical experts to view and analyze balance and coordination strategies in an interactive, controlled environment; enhancing diagnostic and therapeutic activities. Developed by MOTEK under a European Union (EU) funded program, CAREN "immerses" one or more patients in a fully reactive virtual and physical environment to determine, register, standardize, and evaluate human functional performance in a wide range of situations. The combination of the D-Flow feedback loop with a motion platform provides the ability to compensate or adjust the simulated experience by relocating the position of the platform in real-time. CAREN lets therapists introduce dynamic corrections to a patient's virtual and physical realities, creating an interactive relationship that can significantly reduce the rehabilitation and training times for adaptation to a prosthetic device.

2 Architectural requirements

This section provides a description of the architectural requirements for housing the CAREN-Extended and CAREN-Extended(plus) system. Due to the increased height of the entire system, it is preferred to mount the platform in a pit. However, mounting the platform on the floor also is possible. This distinction and its impact on the required ceiling height is provided in section 2.2.

Major structural and electrical requirements for the building will be defined as well.

2.1 CAREN-Extended(plus) configuration

The Caren-Extended set-up being described in this section is based on the next core configuration components:

- √ Platform with a payload of 1000 Kg and a platform top with a diameter of 3 meters having an integrated self-paced instrumented treadmill.
- √ 12 camera optical motion capture system
- √ Flat screen projection (CAREN-Extended)
- √ Up to 180^{o} degrees cylindrical projection (CAREN-Extended(plus))

2.2 Spatial dimensions

The laboratory space can be divided into an area for the system and an area for the operator. The latter one has no very strict limitations and can be arranged quite easily. Minimal space required for the operator and storage of equipment is approximately 12 m^2. The mentioned elements of a Caren-Extended system require a minimum area of 7 x 7 meter with a height of 6 meter. Suitable dimensions for a Caren laboratory can therefore be 7 x 4 x 4 meter. An example of such a laboratory is given in Figure 1.

The minimum height of the room is determined by several cumulative elements. First, a subject (±1.8 meter) is standing on top of the active platform (almost a height of 1.5 meter) reaching already till almost 4 meter high. In addition to this, the best quality motion data is gathered when the Vicon cameras are placed evenly around and above the subject. These elements together result in a minimal ceiling height of 6 meter.

However, when this height of 6 meters is not available, mounting the motion base in a sunken floor can decrease the required height of the room. Figure 2 provides an impression of the same set-up as discussed above, but with the motion base mounted in a pit. Installing the platform in this way decreases the required height of the room from 6 to 4 meters.

2.3 Fundament

Independent of the type of motion base that is being used, the high stress on the fundament due to motions of the motion base need to be kept in mind. For this reason, locating the laboratory on the ground floor may require the least architectural support. This approach also has the benefit of allowing mounting the motion base in a sunken floor (see page 5).

Depending on the equipment mounted in the platform top, overall maximum weight of platform plus equipment can become 1800 kg. Reaction forces of 30 Kn and reaction moments of 60 Knm can be reached.

When using the regular platform, the resonant frequency of the floor shall be above the 10 Hz. and the mounting surface shall be able to withstand a preload on the 9 bolts of 260 Nm.

2.4 Electrical

Both standard single-phase 230V 50 Hz. and 400 V 50 Hz power are required. 3 Phase is necessary for the control center power unit of the motion base while standard power is required for all other appliances like for instance the Caren host computer. When an instrumented treadmill is installed, an additional 3 phase connection is required.

3 Summary

To be able to use a system with high specifications of the CAREN-Extended(plus) system, alterations to regular buildings might be required. Due to the height of the platform and the thickness of the platform top (to house an instrumented treadmill), benefits of mounting the platform in a pit are even bigger.

When you have a space you would like to house a CAREN-Extended or CAREN-extendedPlus system, engineers of Motek are available to discuss the possibilities of installing a CAREN system at your facility.