

Specifications

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D I G I N E X T
Simulation & Virtual Reality Systems

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GENERAL OVERVIEW

This system is used to support the training process during the first phases of welding training program. It saves unskilled trainees from using huge amounts of expensive welding consumables during practice sessions in order to acquire the psycho-motor bases of the activity. It also provides trainers with means to closely monitor and assess the gestures of the trainees.

This system demonstrates that VR technologies can help the trainees to assimilate and control body-movements and gestures faster and at a lower cost. In addition, the architecture of the system enables the seamless integration within the existing training process, without disrupting the organization, and while improving the quality of the learning and the educational dialogue.

This system addresses two complex and combined issues: Welding and Training.

The first issue relates to the targeted domain. Postures and kinematics are essential components of this expertise. The system also addresses trainees learning effectively.

2. SYSTEM DESCRIPTION

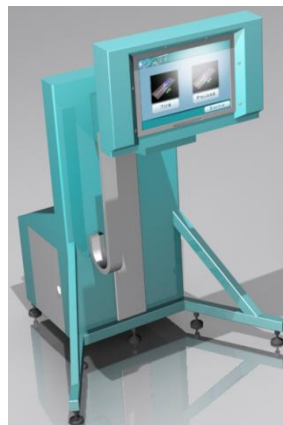
The CS WAVE system has the following modules:

2.1 THE MAIN UNIT: THE WORKBENCH

The welding workbench is the main tool for training those learning welding gestures. It also comprises an error analysis teaching tool.

It is a large metal machine (around 180kg, 110 x 80 x 150 cm) equipped with a mobile 21” TFT screen controlled by a computer.

A workbench can be used by several students per days. All information is distributed over the network so a student can work on any of the workbenches of the training centre. A central server can manage several workbenches.



2.2 THE PORTATIVE UNIT: THE LITE

The portative system is a portable version of the workbench. Mainly dedicated to demonstration, it has exactly the same feature as the workbench and then can be used as a real light training system.

It comes in a flight case (45*140*60 cm, full weight of the equipment around 50 kg). The portative unit is equipped with the same 21” TFT screen and has a full computerized system embedded.

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The portative unit can be installed in the same network architecture as the workbench and can communicate with the same central server.



2.3 THE CONTROL CENTRE

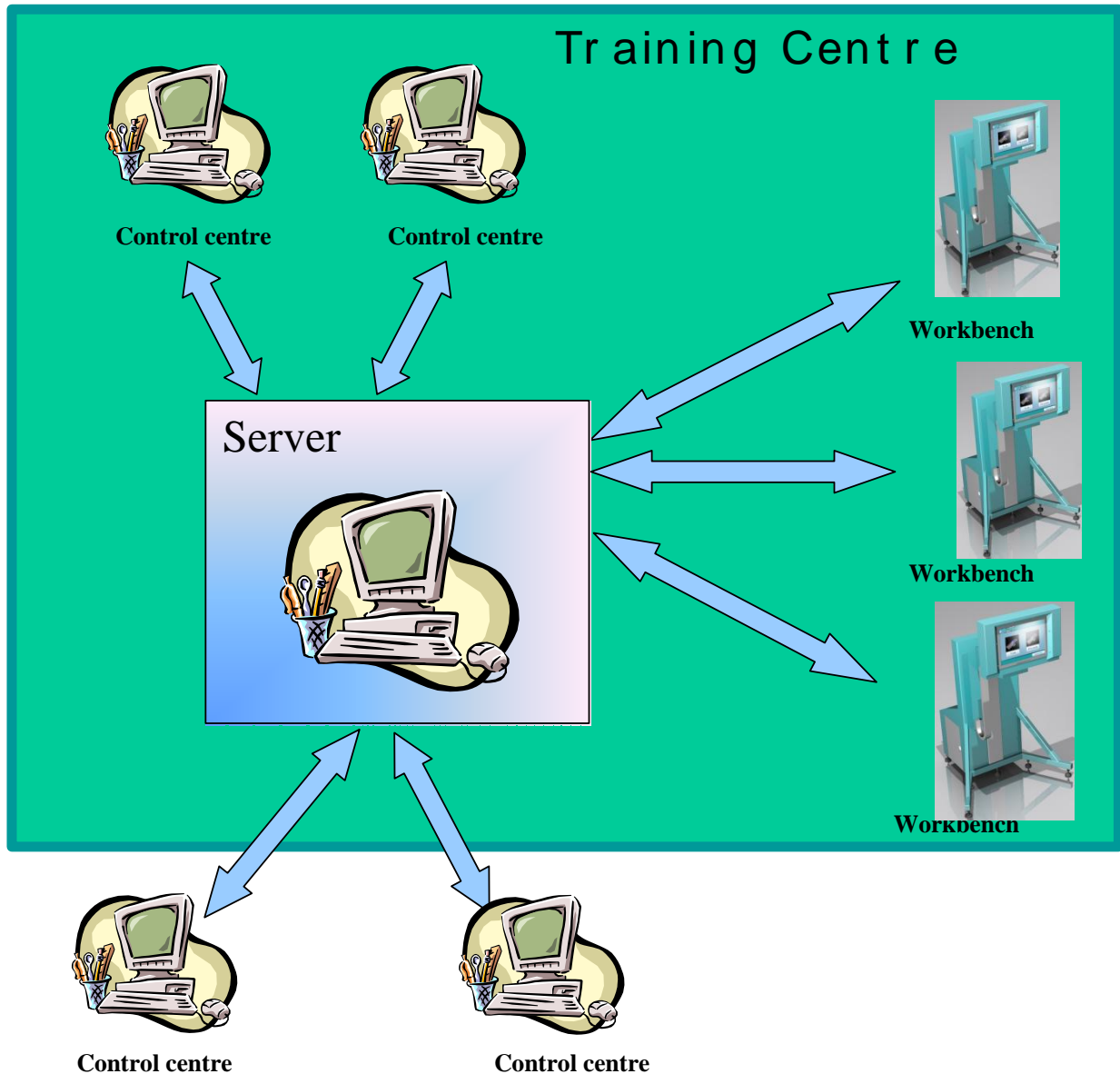
This software is dedicated to the trainer. It is a Windows software that can be run on any computer. There can be as much control centre as necessary (ideally one per trainer). It is permanently connected with the workbenches and uses an internet connection so it can be distant or locally installed.

2.4 THE SERVER:

This windows software is taking care of the network communication and data storage from and to the workbenches and the control centres.

3. ARCHITECTURE

The following diagram describes a typical CS WAVE layout architecture in a training centre.



The control centres can be installed wherever desired inside the training centre (local network) or outside it (global network).

The server and control centres are modules that can be installed on existing workstations. However, it is recommended to install the server on a dedicated machine.

4. WORKBENCH SPECIFICATIONS

The WORKBENCH system has the following features:

- a mobile TFT screen, which automatically positions according to both the user's height and the exercise to perform,
- an embedded PC with an Ethernet port,
- a tangible interface that comes with a welding torch(MAG), an electrode handle(MMA) and a torch combined with the rodbox(TIG).

The screen is embedded into a metal box that moves horizontally along a vertical pole and thanks to an electrical engine controlled by the computer. Limitation sensors detect the top and bottom limits at all time avoiding any overrun issues.

The box itself is equipped with an electric actuator engine that rotate the screen from vertical to horizontal position. This rotation is controlled by the computer and validated thanks to a button on the side of the machine that the user needs to push while the screen is rotating. This is a security control.

The torch, electrode handle, TIG torch and rodbox simulate the real tools of the welder. They are real welding tools equipped with motion tracking system.

The software that tracks six degrees of freedom motion tracking system based on a hybrid technology of inertial and ultrasonic is provided. The position and orientation of the tracking is determined by the output of the accelerometers and gyros. Drift correction is accomplished in a special filter by fusing the output of the inertial sensors with range measurements obtained from the ultrasonic components. The result is a full 6-DOF tracking of the welding tool that is very smooth, precise, and free from jitter. This equipment can only be provided by CS WAVE for the welding training (world exclusive patent).

Inside the machine, located at the back of it, a metal box protects the electronic equipments which are:

- A PC computer with 3D graphics capability
- A control card for the engines (rotation and translation), connected to the PC.
- The HUB that controls the motion tracking system, also connected to the PC
- A UPS that ensure the power supply and save the system from power cuts and variations.

5. LITE SPECIFICATIONS

The PORTATIVE system has the following features:

The portative system has the same features as the WORKBENCH. Especially the motion tracking system is the same. The user is able to turn this mobile unit by himself in a vertical or horizontal position. Tilting sensor will detect the screen position and check it before starting an exercise.

6. WORKBENCH AND LITE COMMON FEATURES:

The system provides motion training for GMAW (MAG), SMAW (MMA) and GTAW (TIG) welding. All training is conducted with a real welding tool equipped with motion tracking system.

The system conducts the following:

- Identification of the user
- Personalized setup of the screen position
- Exercise selection
- Progressive learning (by level of difficulties and separated learning of each motion parameters)
- Exercise performance
- Exercise result analysis
- Contextual help

At the end of the exercise, the system provides a graphical representation of the trainee's performance. The first information is the level of success of the exercise. If positive, the user could automatically validate the level corresponding to the exercise.

Then, detailed results are made available in the form of graphs along the welding cord for each monitored parameter. The analysis of these graphs, usually with the assistance of the trainer, allows the user to better understand his errors and determine how to improve for the next try.

7. THE CONTROL CENTRE

The control centre is the software tool used by the trainers to remotely define, monitor and review exercises. It should also be used by the system administrator to create and manage user profiles for trainers and trainees. In addition, the latter can consult their statistic and progress with the control centre tool.

Control centre could be installed either inside (local area network) or outside (wide area network) the training centre in order to provide remote expertise and monitor trainees activity from distant locations.

The welding workbench is a totally autonomous system only requiring a power socket and a network connection to run, the control centre is a software application requiring a Windows XP/VISTA/7 host.

8. THE SERVER

The server is in charge of the network communications between the different elements of the system network. It is also in charge of the persistence and the consistence of distributed data. The information available within a system network can be either static (GUI skins and configurations, exercise parameters, videos) or dynamic (results of exercises and result syntheses).

Both sorts of information is stored in the server's database and replicated on all the control centres and workbenches. Installed on a PC dedicated to this usage, the server can be controlled by the system administrator through a dedicated interface enabling backup, storage and update procedures. It also provides him with synthetic information on the state of the complete system as well as networking statistics.

9. SERVICES

Installation, commissioning and training by an authorized trainer is provided.