KONDLE VENTURES Ltd.
EDUCATIONAL SYSTEMS

LHP 109
WELDING TRAINER LAB

A 21 is a State of Art **welding simulator** aimed for the vocational training world. Offers a modern teaching trainer that will improve the quality of the welder training process and will reduce the time of training versus a real welding machine.

The A21 simulator offers the following benefits:

1. Not using real power and electrodes or welding gases offer a **risk-accident free environment** for beginners.
2. By not using real consumables is reducing the **cost of training** to **zero**.
3. By statistical performance measurements, **students save time** in learning by even 40% of the time used when training with real equipment for equivalent tasks.
4. Overall, the system will tell you who is to become a welder and who has no capacity˙ after all, is a craftsmanship.

The simulator offers a platform of a **3-Dimensional Real time video**, using Virtual reality technology. **Records and Replays** the welding environment, process and viewing of it realistically, in real time, detailed image and hand motion presentation while accurate records the motion and the process steps during welding from any viewing angle, offering an unlimited viewing perspective of the process assisting the evaluation by the teacher. Additionally the critical performance indices of each student trial are recorded in the Teacher computer database.

A21 offers training in **3 Different types of welding**:

* **SMAW** Shielded Metal Arc Welding
* **GMAW / MIG/MAG** Gas Metal Arc Welding
* **GTAW- TIG** Gas Tungsten Arc Welding

in the same device for the same cost. The equivalent torch replicas for each modules are easily connected to the handheld joystick of the A21 trainer.

RECORD and REPLAY

With its state of art, real-time video technology and real-time motion tracking system, A21 **replicates a real life welding workshop** and process environment.
The real-time motion sensors in the helmet and the torch, allow instant replication of the motion of the user in 3D, real time environment and real time interaction between the user and the A21 system platform.
The 3D, real time video, Virtual reality platform allows the recording from **ALL viewing angles** as in a viewing sphere and not only from the viewing angle of the trainee during the process. That also allows the viewing of the work ,in process or after completion, by the replay feature from any angle ,in the 3D coordinates. All students' 3D video work files are kept in the A21 system for a period pre-defined by the instructor. Statistics and student results can be kept in the teacher workstation for unlimited time.

DIDACTIC PLATFORM

The A21 welding trainer offers to a teacher a **theory and quiz presentation** and welding work process simulation platform. With A21 the instructor has the facility to setup the welding parameters of a selected welding process for each student and the type of exercises. The setup of Exercises for all 3 types of simulated welding are categorized by type of welding joint / welding piece. For each exercise, appropriate variants as welding machine power type (AC or DC), power intensity for all types of welding (SMAW, GMAW, GTAW), electrode size for SMAW, wire speed for GMAW, Filler rod diameters for GTAW and other parameters are easily changeable at setup with the help of the 5 button on the welding torch replica with click-and-select utility before and/or during the welding process. Basic exercises can be altered by the instructor for variations of metal types and other welding scenarios.

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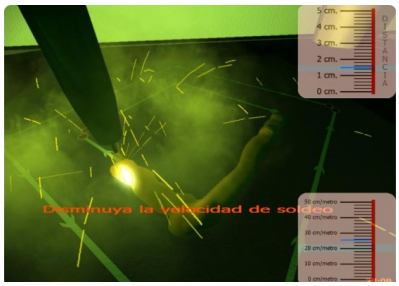

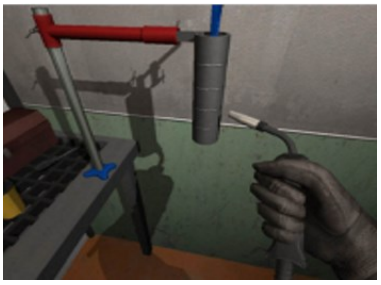

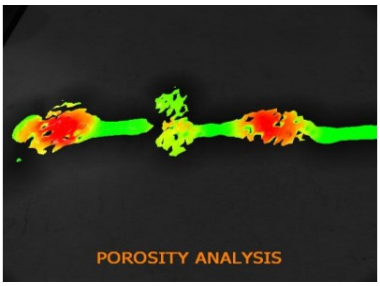

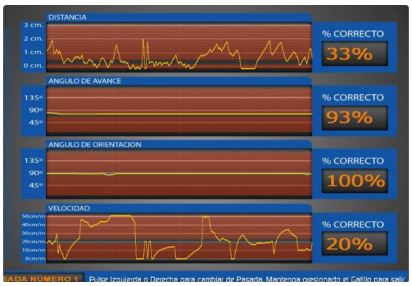

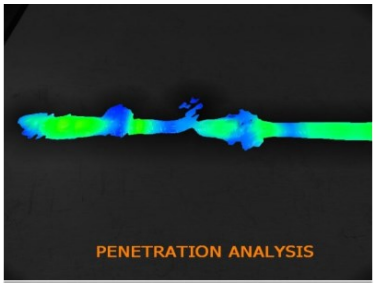

These exercises then can be repeated with any combination of the above parameters or scenarios for 4 different types of welding pieces – Joints, as per **training standards** for welding training:
* EN according to ISO 6947, NENN-EN 287.
* AWS according to ASME section IX.

EXERCISES

The basic system offers **50+ different typical exercises**, preset, for each welding machine type, grouped in **4 modules** for Joint / Piece types of welding simulations, standard welding positions, operators orientation and operators hand selection.

JOINT TYPES

Deposition of weld beads on plates

Plate Fillet welds

Butt welds

Pipe (TEE and Butt) Various Diameters

POSITIONS Per Standards

PA, PC, PF/PG, PE, PH/PJ, H-L045/J-L045, PB, PD, 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 6G

Orientation of welding

The orientation modes provided by the simulator allow to set the motions on:
*__Upward__ welding
*__Downward__ welding
*__Vertical__ piece welding
*__Welders Hand__: Right handed or left handed welder.
The exercises also include scenarios for welding process with various types of metals, Carbon steel, Aluminum, etc.

The menu screen offers the welding parameters exercise control screen. By using the torch base buttons, the user can select for each welding exercise by welding type (SMAW, GMAW, GTAW), Joint type, Position, Orientation of welding and operator. Depending on the selection for exercise when the simulation is launched and a weld bead is started, the system will display a numeric error checking for each one of the telemetric criteria versus the set training parameters for such welding process. Parameters are not disabled and will also display an acceptance range based on the lenient or strict selection.

EVALUATION AND REPORTS

The simulator performs **ON LINE Activity Evaluation**, keeping track of the welding process performance. By using the motion tracking system, the simulator can record in real time and display to the screen Telemetric performance parameters as the **welding distance** between the welding surface and the torch/electrode, the **travelling speed** of the torch, **angle of travel** and **angle of orientation** at any instant versus the preset telemetric criteria for such type of welding as per standards. The instructor has the capacity to set these evaluation criteria versus the performance to be disabled, lenient or strict.

A21 creates a **Welding evaluation report** for each welding trial of the student, with **statistical and graphical presentation** on the deviations of the user performance from the preset settings by the system for the corresponding activity. Additionally, for each trial, creates a realistic **3D image of the welding piece**, a **Porosity scan image** with colors

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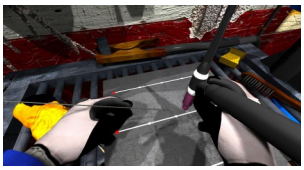

and a **Penetration scanned image** with colors so the instructor can observe the **microscopic result** of the welding result. The reports are stored in the database of the trainer and also on the teacher PC class management database (in case of classroom network) where the teacher has the overall class performance data, per student, day and time of trial, etc. The real time videos are stored on the A21 trainer with the overall reports. The instructor sets the time of keeping the video reports, by default the system keeps them for the length of the academic semester.

WELDING PIECES

The welding pieces for the various Joint types are simulated. **There is no need for hardware pieces or mock-up replicas**. The simulator also has the capability to integrate customer defined pieces additional to the preset ones making the simulator unlimited as far as welding pieces. This practice concerns retraining existing welders into specific industrial welding work pieces training but also allows instructor to expand to more complicated and specialized joint types and expand the training course to specialized industry work pieces.
Customer can supply the Joint /Piece type design in AutoCAD format to KONDLE for transforming them to 3D simulation and for integration to the system at request. The integration transforms the files to connect to the 3D virtual reality real time video platform of the simulator, not as augment video images, but real time 3D images.
KONDLE, at any time, will receive and transform these custom made files to a 3D/A21 item, fully incorporated into the system and at no cost for the period of 3 years from the day of installation.

CLASS NETWORK /FILE MANAGEMENT

The instructor can create locally to A21 **sessions per student,** where each students' welding files, videos and evaluation results can be kept in separate media, USB disk or Flash memory, besides the trainers hard disk.
Many A21 trainers can be interconnected in a classroom via an Ethernet network to the Teacher PC, running Windows 8 or higher, with a class data base management application running on the Teachers personal computer. The **telemetric results** and **statistics** of each student in a class, for all sessions during the period of training are **automatically saved** on the database application files. The application offers all the features a relational database offers in creating data tables, user accounts, data searching, data analysis and reporting as described with any available variant keys i.e. student name, session, date and time, activity name or stage in case of series of interrelated exercises, class, group etc. The data base records are unlimited, subject to the Teacher PC storage capacity only, so number of registered classes or number of students per class have no limitations.

The A21 welding Trainer includes:

1. The A21 trainer **Base workstation.**
2. The **Tracking motion** controller-transceiver.
3. The **welding helmet** with 3D glasses and head motion sensing.
4. The **Torch replica base** with the 5 key controls and interface for interchanging the appropriate SMAW,GMAW and GTAW probes. It includes the hand motion sensing subsystem.
5. A 40 Inch **screen** or larger with HDMI interface.
6. **SMAW** Training Module + SMAW torch probe.
7. **GMAW** Training module + GMAW torch probe.
8. **GTAW** Training module + GTAW torch probe.
9. The A21 Teacher workstation classroom management **application** which runs on all PCs with MS Windows 8.0 or higher.
10. Theory and exercise **electronic handbook**.
11. The training course is fully computer aided and offers theory presentations and questions, prior to the following welding activity for each topic.

Power requirement: 220 VAC.

For technical details, please refer to the technical Data Sheet for A21 Trainer.

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TECHNICAL DATA SHEET

The **A21 welding Trainer workstation** is a computer based system.

The trainers enclosure is a metal cubic box, 47 x 47 x 47 cm, with 4 wheels so it is movable to a convenient space in the classroom, at user's will.
The trainer workstation includes:

* CPU Intel Core i5-4460 3.20GHz
* RAM 16GB DDR3@1600MHz
* VGA IHD Graphics(1920x1200@60Hz)
* HDD 1000GB
* Audio channel, High Definition
* LAN: 100Mb
* PSU 400Watt
* MS Windows 10
* Cable and interface for the Motion tracking controller ,preinstalled.
* Cable and interface for the 3D classes / Helmet, preinstalled.
* Cable installation with cable flex protection, control circuit built-in and interface for the torch replica, preinstalled.
* Optical DVD player with Audio output installed on the front panel.
* Power On/Off switch and System Reset switch with Led indicators on the front panel.
* Cooling fan system, with intake in the front panel and exhaust on the back side.
* Power inlet from 220VAC with cable to connect to a wall outlet on the back side.
* All standard interfaces are on a single panel in the back side of the trainer and include an Ethernet port, a HDMI Port and 3x USB2.0 ports.

Motion tracking Controller. This subsystem includes a Transmitter on a tripod base and motion sensors in the user helmet and the mock up torch base.
The transmitter tracks down the motion sensor positions in real time which are fed in the A21 trainer CPU. The transmitter area covers a sphere of 1.5m radius. The instant positions given by the sensors in the helmet and the torch replica base are fed to the CPU and translated to real time 3D motions within the welding platform and the system interacts with such inputs resulting into a real time simulation.

The Welding helmet with 3D glasses. The helmet is a replica of a welders helmet, made of light plastic and with an adjusting knob in the back for head fitting. Inside the helmet, a set of 3D glasses are installed along with the motion sensor mentioned above. Both interface cables, for the 3D glasses and the motion sensor, are connected to the CPU of the trainer via a secure installation. The system offers a 3D depth image to the simulation environment and makes it even more vivid to the user. This feature creates an effect of volume and depth in the virtual scene.
The 3D glasses have the following specifications:

* 125-inch virtual screen view equivalent from 3 meters.
* 16:9 or 4:3 viewing ration.
* Twin, high-resolution 1280 x 720 LCD displays.
* 60Hz progressive scan update rate.
* 35 to 55 degree diagonal field of view.
* 24-bit true color (16 million colors).
* Independent left and right eye focus adjustment.
* 3D image button for selection of types of 3D video formats (SBS ,OVU, FP).
* Brightness control buttons: allows to adjust the brightness of the image offering 8 different levels of brightness.
* Audio system with volume control buttons: allows to increase or reduce the sound volume which is emitted through the headset integrated in the glasses.

Torch Replica base. A21 is using a handle with controls, as the welding torch base, which accepts the 3 different types of torch probes provided with the system. On its handle, it includes a 5 arrow push button key pad. These arrow pushbuttons allow the user to interact with the system with a simple select-and-click on the application menu. Each welding probe replica, GMAW / MIGMAG, SMAW and GTAW / TIG, is connected to the torch base and according to the simulation module the user is running. Probes are easily plugged in or out of the torch base to perform the appropriate welding session.
The software application simulation modules come preinstalled in the A21 trainer as follows:

40'' TV screen
Screen Size: 40 inches
Display resolution (H x V, pixels): Full HD (1920x1080)
Refresh Rate: 120 Hz
Clear Action motion processing: 240Hz
Aspect Ratio: 16:9
Interface: HDMI
Power input: 220V

ACADEMUS EDUCATIONAL LABORATORIES

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TECHNICAL DATA SHEET

THE WELDING SIMULATIONS

SMAW simulation

The SMAW application simulates **Shielded Metal Arc Welding** using electrodes. The simulation allows the selection of parameters as:
A. Type of electrodes from standard industry used, 4mm, 3.25mm and 2.5 mm. Electrodes are selected by a single click on the selection menu, using the torch buttons. Additionally, when an electrode is finished, is replaced automatically by a single click on the torch selection key.
B. Power intensity can be set in real time at any instant prior or during the welding process.
C. Type of experimental setup i.e by working piece joint type (i.e pipe), by type of metal, position, etc.
The application uses a SMAW replica torch probe.

JOINT TYPES	
Deposition of weld beads on plates	
Plate Fillet welds	
Butt welds	
Pipe (TEE and Butt) Various Diameters	
ELECTRODE	Rutile
Diameter selection	2,5 mm
	3,25 mm
	4.0 mm
POSITIONS	Per Standards
PA, PC, PF/PG, PE, PH/PJ, H-L045/J-L045, PB, PD, 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 6G	
POWER	INTENSITY VARIATION
Up to160 Amperes	

GMAW simulation

When using the A21 Welding Trainer with the GMAW application in a welding training course, the trainer simulates a **Gas Metal Arc Welding (MIG-MAG).**
The simulation in GMAW welding simulates a welding machine with variable intensity and a variable wire speed control.
In GMAW Welding machine, intensity and wire speed are modified in real time at any instant during the exercise. Experiments can vary as to Joint type, metal type, position type, again as per SMAW. The application uses a GMAW replica torch probe.

JOINT TYPES	
Deposition of weld beads on plates	
Plate Fillet welds	
Butt welds	
Pipe (TEE and Butt) Various Diameters	
POSITIONS	Per Standards
PA, PC, PF/PG, PE, PH/PJ, H-L045/J-L045, PB, PD, 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 6G	
POWER	INTENSITY VARIATION
Up to 370 Amperes	

GTAW simulation

This application module in the A21 Welding training course can simulate a **TIG - Gas Tungsten Arc Welding** system. The simulation in TIG welding simulates a welding machine with variable intensity and variable filler rod diameters.
Welding machine intensity and filler rod diameter rod is modified in real time at any instant during the exercises.
The application uses a GTAW replica torch probe.

JOINT TYPES	
Deposition of weld beads on plates	
Plate Fillet welds	
Butt welds	
Pipe (TEE and Butt) Various Diameters	
POSITIONS	Per Standards
PA, PC, PF/PG, PE, PH/PJ, H-L045/J-L045, PB, PD, 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 6G	
POWER	INTENSITY VARIATION
Up to 250 Amperes	
FILLER ROD	
Diameter selection	2,0 mm / 2,4 mm