CITADELS

TESTBED DESCRIPTION

Cultivating Industry 5.0 Talents: Academia-industry collaboration and empowerment through accessible DEep technoLogieS

Project acronym:	CITADELS
Project topic:	HORIZON-WIDERA-2024-TALENTS-03-01
Project number:	101217281
Type of action:	HORIZON-CSA
Project starting date:	1 September 2025
Project duration:	48 months
Dissemination level	PU

1 Soldamatic AR Welding Simulator

TestBed title	Soldamatic AR Welding Simulator

1.1 Short summary

The Soldamatic AR Welding Simulator is an augmented-reality training system designed to support experimentation, validation, and deployment of digital welding training processes in a safe and controlled environment. It replicates real welding equipment, including the torch, helmet, and workpiece, within a simulated environment, enabling realistic training without the need for physical consumables. The system provides real-time feedback and supports the development of welding skills and muscle memory through interactive training scenarios. It enables efficient and cost-effective training while reducing material usage and operational risks. The TestBed offers an accessible environment for training, performance assessment, and Proof-of-Concept activities in digital welding and immersive learning technologies. It supports DeepTech applications in augmented reality and digital manufacturing, and aligns with Industry 5.0 principles by enabling safe, human-centred skill development.	
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Position / institutional role	Director, ABICOR BINZEL Varilna Tehnika d.o.o.
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Phone No.	+386 51 208 118
ORCID persistent identifier (PID)	N/A
TestBed Responsible Name (if different from PI)	N/A
Funding source(s) for TestBed's acquisition	ABICOR BINZEL Varilna Tehnika d.o.o.
Relevant Keywords	Collaborative robotics, robotic welding, human–robot collaboration, welding automation, digital manufacturing, smart manufacturing systems

1.2 Hosting Institution

Name of Host Organization	ABICOR BINZEL Varilna tehnika d.o.o.
Department or Lab	N/A
Name of Building	Pomurje Technology Park
Physical Address	Plese 9 A 9000 Murska Sobota
Website Links	https://binzel-abicor.com/SI/slv/
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1.3 Photos/videos

Main photo:

1.4 DeepTech Area and Application Domain

DeepTech Area	Check all that apply	Check ONE main area
Extended Reality	✓	✓
Robotics	☐	
Artificial Intelligence	☐	
Human Machine Interfaces	☐	
Biotechnology	☐	
Other	☐	

The TestBed focuses on digital training and skill development through augmented-reality simulation of welding processes. It enables immersive learning environments where users interact with virtual representations of real industrial tasks. The system supports structured training workflows, performance monitoring, and data-driven assessment of user progress. It allows safe and repeatable practice without the need for physical consumables. The TestBed contributes to the digitalisation of vocational education and training by providing scalable and efficient training solutions aligned with modern industrial requirements.

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Application Domain	Check all that apply
Manufacturing 	✓
Healthcare 	☐
Logistics 	☐
Agriculture 	☐
Maintenance & inspection 	☐
Other: Digital Education and Training	✓

1.5 Potential Stakeholders and Exploitation Scenarios

Non-academic stakeholders	
Industrial Partners	✓
SMEs	✓
Startups	✓
Government Bodies	☐
Professional Associations	✓
Community	☐
Others 1 (comma-separated)	☐
Academic stakeholders	
Undergraduate students	✓
MSc students	✓
PhD students	✓
Researchers	✓
Others 2 (comma-separated)	
Other types of stakeholders	

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Others 3 (comma-separated)	

	Check all that apply	Short notes (optional)
Internal academic research	☐	
Collaborative research with external academic partners	✓	
Contract research / Proof-of-Concept for industry	✓	
Pilot / DeepTech Deployment in operational environment	✓	
Training services (courses, workshops, certification)	✓	
Service provision (testing, benchmarking, validation)	✓	
Open access for walk-in users (e.g. open days / hackathons)	☐	
Other (specify): _____	☐	

1.6 Formal Access Conditions

Type of partner asking for access	Type of contractual relationship	Check all that apply
Academic partners	No contract (direct access)	☐
	Direct contract between parties (e.g., research agreement)	✓
	Indirect contract between parties (e.g., project framework)	✓
	Other / Describe	☐
Industrial	No contract (direct access)	☐
	Direct contract between parties (e.g., research agreement)	✓
	Indirect contract between parties (e.g., project framework)	✓
	Other / Describe	☐

Type of prerequisites	Description of prerequisites	Check all that apply
Agreements	Confidentiality agreement for proprietary algorithms	☐
	Data sharing agreement for datasets generated	✓
	IP agreements	✓
	Other / Describe	☐
Insurance	Users must have appropriate liability coverage through their home institution	✓
	Other / Describe	☐

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1.7 Training and Safety

Mandatory technical training	Safety is a key component of the TestBed, as the system is designed to simulate welding processes without generating real heat, gas, or fumes, enabling safe training conditions. Users are required to follow basic operational guidelines and use standard personal protective equipment (PPE), such as a welding helmet and gloves, to support realistic and ergonomic training.
Recommended technical training	N/A
Mandatory safety requirements	Safety is a key component of the TestBed, as the system is designed to simulate welding processes without generating real heat, gas, or fumes, enabling safe training conditions. Users are required to follow basic operational guidelines and use standard personal protective equipment (PPE), such as a welding helmet and gloves, to support realistic and ergonomic training. The system is designed in accordance with applicable safety requirements, including CE machinery standards.

1.8 Technical description

Hardware	• AR welding helmet: Headset and HD display integrated into a real welding helmet, enabling augmented-reality visualisation during training.
	• Physical welding torch: Equipped with haptic sensors and multi-axis tracking for realistic interaction and motion capture.
	• Workpiece models: Physical components with marker recognition enabling precise positioning and tracking within the AR environment.
	• Computer unit: High-performance system with GPU supporting real-time rendering and simulation of welding processes.
Software needed to run the TestBed	• Soldamatic simulation software: Provides real-time augmented-reality visualisation and simulation of welding processes, including MIG/MAG, TIG/GTAW, FCAW, and SMAW.
	• Learning management system (LMS): Supports course management, performance tracking, and analytics for training activities.
Standards that apply	• The system is designed in accordance with applicable safety standards, including ISO 12100, as well as relevant CE machinery requirements. In addition, the TestBed follows ISO 9606 as a reference for welding process qualification in training scenarios and aligns with applicable UNE standards supporting welding training and certification frameworks. These standards ensure safe operation and consistency with recognised industrial training practices.

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1.9 Existing Software Assets (i.e. in GitHub)

Link:	Short description:
N/A	N/A

1.10 TestBed documentation

Type	Short description:	Name and source (link):
Further information, documentation	Official product page	Soldamatic, https://seaberyat.com/en/soldamatic/

1.11 Application cases

Application case:	Short description:	Photo of the Application case
Welding skill training and certification	Use of the system for training, assessment, and certification of welders through realistic simulated welding tasks.	N/A
Proof-of-Concept for AR-based manufacturing training	Validation of augmented-reality technologies in industrial training environments and digital manufacturing education.	N/A
Ergonomic research and simulation	Use of the TestBed for studying operator behaviour, ergonomics, and process efficiency in simulated welding environments.	N/A
Remote AR-based learning	Application of the system in remote and distributed training programmes for geographically dispersed training centres.	N/A
Educational and industrial deployment	Use of the TestBed in vocational schools, industry academies, and R&D environments. The system is deployed in over 80 countries, supporting global training initiatives.	N/A

Possible TRL application range	TRL4	☐
	TRL5	☐
	TRL6	☐
	TRL7	☐
	TRL8	✓

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1.12 Funding source

Funding source acknowledgements
ABICOR BINZEL Varilna Tehnika d.o.o.

1.13 Ethical and societal aspects

Ethical and societal aspect:	Short description:
Societal aspect	From a societal perspective, the TestBed supports safer training by reducing exposure to hazards associated with real welding processes. It enables skill development in a controlled and supervised environment.
Ethical aspect	From an ethical perspective, the system processes limited user data related to training performance. Such data are handled in accordance with applicable data protection principles, including GDPR, and are used for training evaluation and learning improvement.

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