AutoMated Vessels and Supply Chain Optimisation for Sustainable Short SEa Shipping

D.7.2: Pilot Demonstration 1 - AutoDock

Document Identification

Status	Final	**Due Date**	30/11/2023
Version	1.0	**Submission Date**	31/12/2023
Related WP	WP7	**Document Reference**	D.7.2
Related Deliverable(s)	D2.4, D4.1, D4.2, D4.3, D4.4, D7.1, D7.5 D8.1, D8.5	**Dissemination Level**	CO
Lead Participant	TUCO	**Document Type:**	R
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 861678. The content of this document reflects only the authors' view and the Agency is not responsible for any use that may be made of the information it contains.

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Document History			
Version	**Date**	**Change editors**	**Changes**
0.10	08/11/2023	Søren Pedersen	ToC draft version
0.15	16/11/2023	E. Kotsidis / S. Pedersen	ToC (feedback from ESI & CORE) + structure of subclauses
0.20	20/11/2023	S. Pedersen	Input to different chapters
0.25	22/11/2023	V. Perales/ I. Benitez	Input from VPF
0.30	01/12/2023	D. Tidy	Input from TRELL
0.35	01/12/2023	M. Koimtzoglou	Input from NTUA Naval
0.40	04/12/2023	A. Mantelos, A. Sakavara	Input from CORE
0.45	04/12/2023	E. Kotsidis	Input from ESI
0.50	07/12/2023	M. Kostovasili	Input from NTUA ECE

Document History			
Version	**Date**	**Change editors**	**Changes**
0.55	07/12/2023	A. Mantelos, A. Sakavara	Input from CORE
0.60	07/12/2023	D. Tidy	Input from TRELL
0.65	12/12/2023	M. Koimtzoglou	Input from NTUA Naval
0.70	13/12/2023	M. Sampedro	Input from AST
0.75	13/12/2023	M. Koimtzoglou	Input from NTUA Naval
0.80	13/12/2023	S. Pedersen	Draft for review
0.85	15/12/2023	D. Tidy	Input from TRELL
0.90	18/12/2023	I. Kotsidis	Input from ESI for the complete deliverable
0.91	19/12/2023	V. Kulkarni	Input from TRELL
0.92	20/12/2023	M. Sampedro	Input from AST
0.93	20/12/2023	P. Papachristou	Input from CORE
0.95	20/12/2023	V. Kulkarni	Input from TRELL
0.99	21/12/2023	I. Kotsidis	Review of the complete deliverable
1.0	28/12/2023	I. Kotsidis	Final version to be submitted

Quality Control		
Role	**Who (Partner short name)**	**Approval Date**
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Project Coordinator	NTUA	30/12/2023

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List of Acronyms

Abbreviation / acronym	Description
AC	Alternating current
AD	Autodock
ADS	Automated docking system
AI	Artificial Intelligence
AIS	Automatic identification systems
AT	Autonomous Tugboats
CAD	Computer Aided Design
CAN	Controller Area Network
CPU	Central processing unit
D1.1	Deliverable number 1 belonging to WP 1
EC	European Commission
GA	Grant Agreement
GPS	Global Positioning System
gRPC	Remote Procedure Call
HW	Hardware
IIoT	Industrial Internet of Things
IMU	Inertial Measurement Unit
IP	Internet protocol
KPI	Key Performance Indicator
LAN	Local Area Network
LiDAR	Light Detection and Ranging
MB	Mega Bytes
ML	Machine Learning
MOSES	Automated Vessels and Supply Chain Optimization for Sustainable Short Sea Shipping
MQTT	Message Queue Telemetry Transport
MS	milliseconds
NMEA	National Marine Electronics Association

Abbreviation / acronym	Description
ONNX	Open Neural Network Exchange
PC	Personal computer
PGN	Parameter Group Number
PI	Performance Indicators
PLC	Programmable Logic Controller
RAMI	Reference Architecture Model for industry 4.0
REST	Representational state transfer
RPM	Revolutions Per Minute
SCC	Shore control Center
SCS	Shore control Station
SI	Success Indicator
SIM	Subscriber Identity Module
SSS	Short Sea Shipping
STCS	Shore Tugboat Control Station
SW	Software
TC	Test Case
T	Tonnes
VPN	Virtual private network
WAN	Wide area Network
WB	Workboat
WLAN	Wireless local area network
WP	Work Package

Executive Summary

This deliverable “D7.2 Pilot Demonstration 1 - Autodock” is the outcome of Task 7.2 with the same title and is a part of WP7 of the MOSES project, which is funded by the European Commission’s Innovation and Networks Executive Agency (CINEA) under the Horizon 2020 research and innovation program (H2020). This deliverable is closely connected to deliverable D7.1 “Pilot Demonstrations and Evaluation of MOSES innovations”, where the main task was to plan a successful execution of Pilot Demonstrations 1, 2 and 3 (T7.2, T7.3, and T7.4 respectively). Furthermore D2.4 “Specifications for the MOSES innovations” and D4.1 “Architecture for autonomous tugboat operation” are vital part of the background for D7.2.

In this report the execution of Pilot Demonstration 1 (T7.2) is described. This pilot demonstrated the MOSES AutoDock System for manoeuvring and docking a container ship in a Deep Sea Shipping (DSS) port. The demonstration employed downscaled versions of the components, including a barge with a mounted steel structure instead of a container ship, two workboats instead of tugboats, and a small-scale redesigned AutoMoor unit that was mounted on the jetty for attaching the barge. The workboats were autonomously controlled by an algorithm that calculated the optimal trajectory and controlled swarm operation of the workboats for pushing the barge to the AutoMoor unit. The control system on the workboats also communicated with the AutoMoor unit to automatically trigger the mooring process.

This deliverable describes the testing platform on an individual component level (as built) with the different constraints and how implementation challenges were overcome. In addition, the testing scenarios defined in D2.4 and D7.1 and the respective outcomes are presented. It should be noted that due to a storm arriving unexpectedly during the testing period, certain of the planned testing scenarios were not executed. However, the testing scenarios that were implemented fully covered the scope of the demonstration and therefore its objectives were achieved.

Pilot Demonstration 1 proved the functionality of the sensors and other supporting electronic devices, the autonomous operation of the workboats, where one was autonomously driven and one was manually driven, and the automated docking by the AutoMoor unit. Out of the total 51 performance evaluations that corresponded to the testing scenarios executed during the demonstration, 57% were evaluated with “Excellent” validation. Based on the results of the demonstration, several lessons learned were identified and significant conclusions were drawn that indicated the next steps for future research.