DigLogs

Pilot project Plan

Deliverable D5.2.1

5.2.3 Application for data flows management

Responsible partner: Port of Rijeka Authority (PP7) **Involved partners: All**			
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Notes:			

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Introduction: App for data flows management

As a part of DigLogs project, Port of Rijeka Authority has decided to upgrade the existing maritime traffic control system in order to improve information system functionalities related to vessel traffic monitoring. This upgrade refers **both to upgrade of VTS/VTMIS system, and also extends newly derived services towards passengers as end users by means of a novel video feed service**, increasing the level of their satisfaction and passenger traffic safety.

In the following paragraphs, motivation for such a project, functional and technical analysis and their aspects are going to be explained in more details, to create a path towards project analysis and requirements specification later in the document.

1. Pilot project goals

The pilot project goal is to establish a monitoring system using a highly modular, ready to go, compact surveillance solution, consisting of video and fixed lens thermal cameras, which is ideal for short to medium range surveillance applications, capable to exactly pinpoint every small vessel or other vehicle present or approaching the passenger terminal. This underlines the passenger pilot category, where Port of Rijeka Authority's project neatly fits.

Video sensing device, serving output data to a dedicated, custom made Web client application will be connected via a pilot-developed module to existing traffic system and display in real time the inflow of small and large vessels and vehicles moving at the passenger terminal. *All Silent Sentinel Pan* and *Tilt* systems will be designed with absolute positioning feedback as standard. Also, the system will add more resolution by means of an additional informational layer to already existing VTS radar and connected sensing technology, In order to timely identify any threat detected and remain focused on the target as the threat moves, providing live, real-time update, and enabling both better information and decision making.

Gathered visual and numerical data can be displayed in different venues and forms, for example, in the Port control center (Rijeka traffic system), Port of Rijeka Authority main building, or, in a limited scope, publicly available at the passenger terminal or yacht quay or other suitable venue, and the operators could make changes and record the vessels currently covered by the existing maritime surveillance system. The idea behind the pilot is to extend visual representation to end users (passengers), using already existing mapping facilities provided by Rijeka traffic system and appropriate graphic elements.

This way, additional benefits will be reaped both by control authorities overseeing traffic via VTS and end user stakeholders – passengers.

Long term goal of the project is to broaden the technological base of the Port of Rijeka, and create a technological mesh of solutions, adding a new layer of visibility and constantly increasing the security of passenger maritime traffic in the port basin.

Decision on the pilot content was made because existing VTS solution has a pre-set resolution and industry and compliance standard resolution, while Port of Rijeka Authority is aiming to

increase minimal requirements and meet stakeholders' expectations. Furthermore, it wishes to open its operative data towards stakeholders, primarily **passengers.**

The pilot already contains integration with more complex solutions, namely, port VTS/VTMIS system, adding a new visibility layer in poor conditions, depicting vessels of smaller dimensions.

2. Pilot project functions and scope

Main pilot function is provision of additional visibility layer to VTS system operators, increasing boat resolution and visibility, showing port basin situation to end stakeholders and passengers and enhancing safety in the area.

Scope of the pilot is requisitioning and purchase of the envisaged equipment, its installation and functional integration with the existing VTS system already in use in the Port control center of the Port of Rijeka Authority, and the visualization of the port panoramic presentation for the end user group of passengers using already existing visualization using Web page presentation.

Exact technical requirements, connectivity and input-output possibilities are subject to further determination during pilot development and component identification up to its end, as some components might change even during pilot execution. While main components are already identified as a part of analysis and requirements specification, it is possible that some smaller components will be identified later in the pilot execution, so flexibility will be required during later stages.

A required optical system must possess **adequate technical qualities to support envisaged role**. Among **initial and required parameters** that were discussed and considered are:

1. Vehicle (boat/maritime object) detection equal to or larger than length of Rijeka breakwater or other selected installation micro location (for example, passenger yachts quay),
2. Respect of industry Johnson criteria: vehicle size defined as 2,3 m2, detection at 2 pixels,

50% probability subject to environmental conditions,

3. Lens F number equal to 1.2 or better, in order to provide optimal sharpness of the image,
4. Resolution, at least 640x480,
5. Adequate camera controls and presentation mode,
6. FLIR capability, and
7. Pan–Tilt–Zoom controls, adding capability of remote directional and zoom controls.

Also, **connection with the system** using *Rijeka Traffic* application (business information system) already used in Rijeka Port Traffic Control center towering over passenger terminal is a prerequisite for successful pilot execution.

Video camera serving separate visual feed for display with Rijeka traffic business information system needs to have adequate quality, IP protection and to be weather and elements proof.

Pilot project limitations are primarily in form of focus on only passenger area, and not other port areas. Port of Rijeka has a quite diverse port structure, and full coverage would greatly exceed the budget and scope of the proposed pilot project.

Project assumptions are:

1. Time frame dedicated for pilot execution will be adequate,
2. Financial means for pilot requisitioning will suffice,
3. There are suitable locations for uninterrupted installation and operative usage of the video sensing equipment,
4. The stakeholders will be interested in the project deliverables (checked during WP4).

3. Project methodology

Custom project management methodology will be used, based on PMI-PMP methodology. Best practices and concepts from classic project management methodology will be used. It will cover the entire lifecycle of the pilot project implementation. It is best suited to the fast track and relatively short project like this pilot.

In order to manage the project, **standard tools** will be used, like internal business information systems of the Port of Rijeka, document management system Sharepoint, e-mail and office automation tools (Microsoft Word, Excel and Powerpoint). Furthermore, Gantt chart will be used to track the project execution.

Project team will communicate directly (peer to peer), in person and using remote presence tools (WebEx and Skype). Brief weekly coordination meetings will be held in order to inform all project team members with development of the project and to resolve ongoing issues.

Documents used in the project planning and to be used in implementation can be divided into several categories, based on the document type and ownership:

1. DigLogs set of documents, outlined in DigLogs Application Form (includes this pilot work plan),
2. Documents created by the Port of Rijeka Authority and its consultants, and
3. Documents created by the solution vendors, integrators and developers.

Expected output documents that will be produced as a part of the pilot project are:

1. Pilot Work Plan (this document),
2. Functional – technical pilot specification (serves as a basis for tendering documentation),
3. Tendering documentation (used in the public procurement process),
4. Installation and development – sign off logs and related documentation,
5. Equipment delivery and integration (development) services delivery notes,
6. User manuals and additional documentation,
7. Invoicing documentation,
8. Communication archives (emails).

Monitoring of the pilot project execution will be executed using the following milestones, in sequence (check points – check off milestones):

1. Compiled draft of the project work plan – approved by PP7,
2. Completed project work plan, ← **CHECK OFF MILESTONE** 1
3. Written draft of the technical-functional specification,
4. Completed rest of the public procurement (tendering) documentation,
5. Issued requests/invitations for quotations,
6. Received commercial offers,
7. Evaluation of offers completed and best offers selected,
8. Awarded equipment purchase contracts, ← **CHECK OFF MILESTONE 2a**
9. Awarded integration services contracts, ← **CHECK OFF MILESTONE 2b**
10. Equipment delivered and installed,
11. Integration development services delivered and completed,
12. UAT testing, and
13. Full system functional (pilot development completed). ← **CHECK OFF MILESTONE 3**

4. Project preparation

This chapter describes the phases of the Pilot project preparation before the actual development and later phases.

4.1 Project functional requirements

At the moment, traffic oversight in the port area is achieved using standard VTS service that will be upgraded as a consequence of the project.

The technical feasibility of a system does not present a significant risk, as the hardware part of the technology should be readily available, while integration will more of a challenge, and especially in the part of activities related to M2M data exchange with Rijeka Traffic system.

VTS is a service implemented by a Competent Authority, and in this case Port of Rijeka Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service has the capability to interact with the traffic and respond to traffic situations developing in the VTS area, as foreseen by the IMO Resolution A.857(20).

According to IALA VTS Recommendations when, considering the development and implementation of VTS, the Competent / VTS Authority need to decide on the type of service to be provided.

In this sense, VTS can be used as an Information Service, Traffic Organization Service and Navigational Assistance Service. This is shown in the Figure 1 on the next page.

Figure 1: Three modalities of VTS use

Information Service (INS) is a service to ensure that essential information becomes available in time for on board navigational decision-making.

1. The position, identity, intention and destination of vessels
2. Amendments and changes in information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points
3. The mandatory reporting of vessel movements
4. Meteorological and hydrological conditions
5. Manoeuvrability limitations of vessels
6. Any information concerning the safety of navigation

Traffic organization service (TOS) is a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the declared VTS area.

- Planning or prioritizing of vessel movements to prevent congestion or dangerous situations
- Establishing of the system of traffic clearances
- Organizing of the allocation of space
- Following of special routes
- Observing of speed limits
- Observing a developing situation, interacting and coordinating of vessel traffic

NAS is a service that provides essential and timely navigational information to assist in the on board navigational decision-making process and to monitor its effects.

- Risk of grounding
- Risk of collision
- Vessel is deviating from the passage plan
- Vessel is unsure of its position
- Vessel is unsure of the route to its destination
- Assistance to anchoring
- Vessel defects or deficiencies
- Severe meteorological conditions

Objectives and benefits of the VTS system are:

- Vessel traffic management and safety provision in Improved quality of port services and resources utilization
- Greater safety of life and property
- Reduced risk associated with marine operations
- Detection of illegal activity
- Environmental protection
- Distribution of the VTS-related information to interested parties
- Storage of the VTS data for administrative purposes and incident analysis
- Provision of assistance in search and rescue operations and to the coastguard.

Current general configuration of the VTS system is shown in Figure 2 on the next page.

VTS Control Center configuration

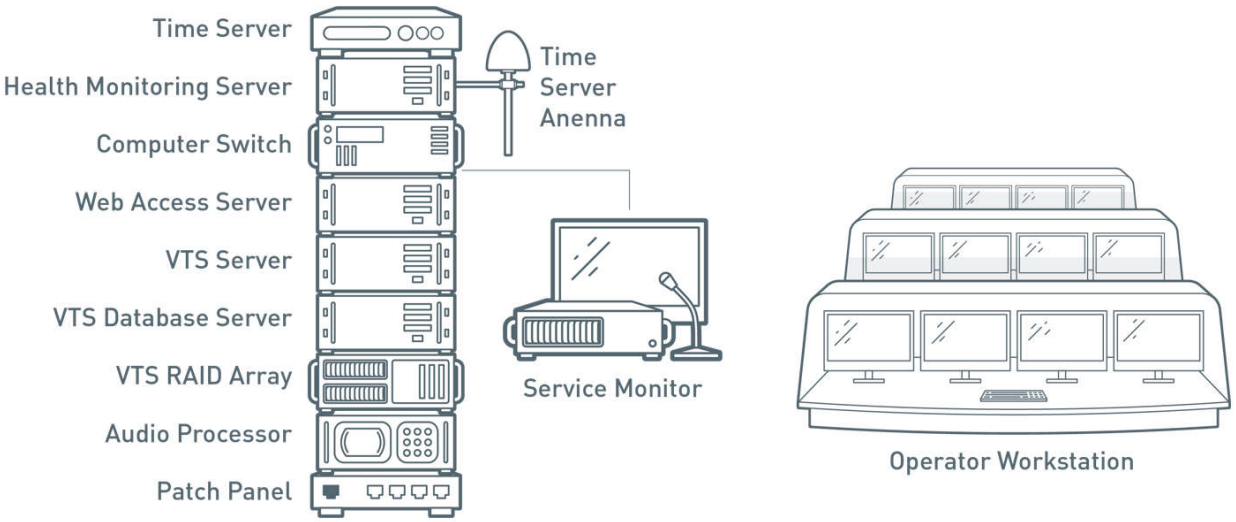


Figure 2: Configuration of the VTS system

VTS server deployed as a part of the configuration is used for the following functionalities:

- Radar, AIS, CCTV, RDF, Meteo-Hydro sensors support and control
- Multi-Sensor Tracking and integration of targets
- Monitoring of traffic situation and generation of alarms and warnings
- Storage and sharing of the common system static data (VTS charts, sensor charts etc.)
- Continuous synchronous recording of VTS data
- Interface to export real-time tracked target data to the external users or systems via Ethernet TCP/IP protocol
- Support of redundant system configuration

Operator workstation has the following capabilities. However, it does not cover those functionalities that will be achieved as a part of the proposed project:

- Display and control of the electronic chart of coverage area
- Presentation of radar video over electronic chart
- Target data presentation and management
- Integrated AIS and radar video presentation

- Integrated VTS database client
- System configuration security
- Automatic CCTV camera tracking of a selected vessel
- Generation of alarms and notification messages
- Sensor remote control and diagnostic functionality
- Target simulation
- User plotted events displayed on all Operator consoles
- Password protected electronic chart editing capability

VTS system uses the following overlays, or overlay maps, as shown in Figure 3. below.

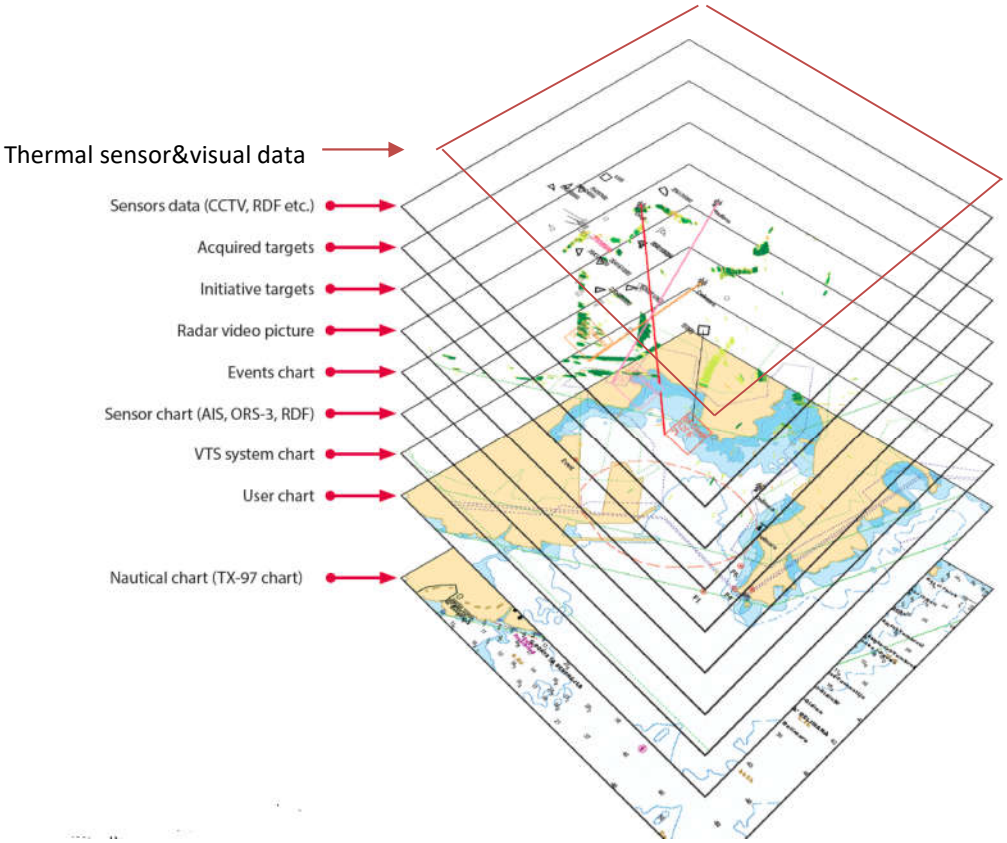


Figure 3: VTS overlays and added-value information

So, as shown in previous Figure 3, execution of the pilot project will directly benefit resolution and visibility of objects in the port, by including an additional level of increased resolution, as a direct consequence of the inclusion of new sensing hardware.

Oversight and integration with the Rijeka Traffic system in the segment of the visual feed, will be achieved by using a pair of varifocal IP67 IP cameras that will server the data feed using a dedicated switch for further processing and visualisation on the publicly available Web page towards end users (passengers). The idea is to present maritime traffic information in conjunction with other geospatial data and information to the end passengers.

A suitable candidate for the camera is, for example, manufactured by HIKVISION, DS-2CD2683G0-IZS, 8 MP IR Varifocal Bullet Network Camera.

This way, there will be twofold benefit for the end users – passengers – increased safety of maritime traffic on the VTS/VTMIS level, used by the Port Control Center, and the visualization of the area, on the passenger level.

The intention is to create Web-based system for the end users in order to simplify the usage and avoid creation of two separate applications for mobile devices (Android and iPhone), that would not fit within the project's financial constraints.

4.2 Resource tendering

An external consultant was contracted to follow up work within scope of the WP5, aiming to implement and test innovative technologies. Main task of the consultant was to create a Pilot's work plan defining steps and success check methodology and later on, Pilot's Transferability plan, including KPIs and differentiation between "as is" and "to be" situations.

Call for offers was issued by PP7 on the 9th September 2020 and three offers were collected. Using the criteria of lowest offered price, a consulting company Aksentijevic Forensics and Consulting, Ltd. from Rijeka was selected. The contract for services was stipulated on the 22nd September 2020.

After creation of the basic technical and functional specification for the purchase of required equipment/integration and development services will have been completed, a call for offers will be issued by PP7, with tentative date of execution falling in October 2020. PP7 is aiming to collect at least three offers. Using the primary criteria of lowest offered price, as required by the public procurement rules, PP7 is aiming to select integration services vendor and stipulate underlying contract.

This activity marks the end of procurement/tendering phase of the pilot execution.

4.3 Pilot solution design

A suitable candidate for the project core selected during preliminary research, and also as a part of previous WP packages, is The Oculus Scout. It is a highly modular, ready to go, compact surveillance solution using video and fixed lens thermal cameras, which is ideal for short to medium range surveillance applications.

The Oculus is a compact, rugged, continuous rotation PTZ camera that has been specifically designed for marine, harsh and challenging environments. With a range of features such as the fixed lens uncooled thermal cameras and low light HD 30:1 zoom day/night video camera make the Oculus Scout a versatile and cost effective solution.

A wide range of thermal and video cameras are available for the Oculus, all supplied in cable managed housings for protection in the harshest environments. With belt driven gears as standard the Oculus has virtually zero backlash ensuring the capture of stable images even at very long distances over land or water.

All Silent Sentinel Pan and Tilt systems are designed with absolute positioning feedback as standard. So when twinned with radar or any automated control program, it can be driven automatically to any threat detected and remain on target as the threat moves. As with all Silent Sentinel products the Oculus can easily be deployed as a standalone system or a combined solution to increase the performance.

The fact that Oculus platform can be configured and optimized for a broad range of applications and operational theatres with the ability to detect, identify, track and react to the surveillance requirement was crucial in order to be selected as a primary candidate for the pilot project.

Key features (capability demonstration shown in Figure 4. on the right side)

- Supporting ranges up to 2.6km for human detection and 3.4km for vehicle detection.
- Short to medium range fixed lens thermal cameras (up to 50mm).
- Starvis HD Colour camera.
- Thermal camera 'Image Contrast Enhancement' (ICE™).
- Multiple thermal colour palettes.
- Focal length dependent speed control (zoom).
- Anti fog, anti haze and image stabilisation capabilities.

Figure 4: Symbolic demonstration of capabilities

- Absolute positioning feedback for radar control.
- 360° continuous rotation.
- High performing pan and tilt speeds up to 180° per second.
- Virtually zero backlash with automatic self position correction.
- Optical encoders for preset accuracy (0.05° repeatability).
- Compact housings with wipers as standard*.
- ONVIF Profile S compliant.
- Highly ruggedized for extreme and marine environments.
- IP67, REACH, ROHS & CE Compliant.

Optional capabilities include:

- Image Fusion, Image Stabilization,
- 2 Axis Gyro Stabilisation,
- Automatic Object Tracking,
- Heaters,
- Various Mounting Options,
- Stainless Steel Finish,
- Custom Paint Colours,
- Bird Spikes, and Sunshields.

4.3.1 Specifications of Oculus Uncooled Short to Medium Range Thermal Fixed Lens Camera Modules

The Silent Sentinel short to medium range uncooled thermal fixed lens camera modules are designed to provide the perfect value added video surveillance solution when integrated into the compact Oculus PT platform. Specifications are shown in Table 1. below.

Figure 5: Oculus Scout system

Lens			
Focal Length	**14mm**	**35mm**	**50mm**
Optical Zoom (Continuous)	-	-	-
F Number	F1.4	F1.2	F1.2
Horizontal Field of View	44°	17.6°	12.4°
Focus		Fixed, preset with Athermalization	

Camera	
Detector Type	Uncooled VOx Microbolometer
Resolution	640 x 480
Pixel Size	17 µm
Spectral Band	8 to 14 µm (LWIR)
Sensitivity	< 50 mK (NEdT) f/1.0 @ room temperature
Frame Rate	25 Fps (9 fps, 30fps options)
Frequency	25Hz (9Hz, 30Hz options)
Digital Zoom and Pan	4x Digital zoom, Region of
Digital Video	Interest 14/8-bit
Video Output	LVCMOS/Camera Link®
Window	IP and Composite (PAL / NTSC)
	Germanium thermal optical quality glass, with a low reflection coating
Image Stabilisation	Yes (cost option)
Image Enhancement	Image Contrast Enhancement (ICE™)
Image Control	Polarity: White Hot / Black Hot, Orientation: Invert / Revert

Detection, Recognition and Identification Ranges (Johnsons Criteria*)			
Detection (Human / Vehicle)	740m / 950m	1850m / 2370m	2650m / 3390m
Recognition (Human / Vehicle)	190m / 240m	460m / 580m	660m / 850m
Identification (Human / Vehic	110m / 150m	285m / 360m	410m / 520m
Human at 1.8m x 0.75m, vehic	m², Detection at 2	8 pixels and Identification at 13 pixels.	
2.3			

Table 1: Technical specifications of Oculus Camera Modules

4.3.2 Specifications of Oculus Short to Medium Range HD Video Camera Module

The Silent Sentinel short to medium range HD video camera module is designed to provide streamlined surveillance solution when integrated into the compact Oculus PT platform.

It features superb low light HD performance, dynamic noise reduction (saving bandwidth), intelligent auto exposure and auto focus to enable a crisp image at range.

Specifications are shown in Table 2 below.

Lens	
Focal Length	**4.3mm to 129mm**
Optical Zoom (Continuous)	30x, Motorised
F Number	F1.6 to F4.7
Horizontal Field of View	63.7° (W) to 2.32° (T)
Format Size	1/2.8“
Focus	Auto focus and motorised manual focus
Iris	Auto iris
Camera	
Sensor	1/2.8“ CMOS Exmor (2.13MP)
Sensor Mode	Full HD 1080p (1920 x 1080) HD
Wide Dynamic Range	Yes (120 dB)
Video Performance (High Sensitivity Mode)	Colour 0.01 lux Mono 0.0008lux
White Balance	Auto, push and manual
Automatic Level Control (ALC)	Auto / manual
Shutter	1/1 s to 1/10,000
Day/Night Mode	Auto, colour, monochrome
Backlight Compensation	On / off
Noise Reduction	Yes
Digital Zoom	12x (360x combined)
Video Output (PAL / NTSC)	IP (HD-SDI option)
Window	High Definition optical quality glass, with a low reflection and water resistant coating
Defog	Yes
Image Stabilisation	Yes

Table 2: Technical specifications of Video Camera Module

4.3.3 Electrical and Mechanical specifications of Oculus Compact ("*Pan*" and "*Tilt*")

The compact aluminum housing is rated to IP67, it is hard anodized and has a white marine grade paint to withstand harsh environmental and marine conditions. The Oculus employs belt drives with virtually zero backlash and the optical encoder ensures the unit retains position and will even self correct.

Electrical and Mechanical	
Camera Construction	Die-cast hard anodised aluminium with A4 stainless fittings
Repeatability	0.05°
Optical Encoder Preset Accuracy	0.01°
Pan Rotation	360° Continuous
Pan Speed	180° per second (excluding ramping)
Tilt	+90° to -30° upright (-68° inclined), +30° to -90° inverted
Range	180° per second
Tilt	(excluding ramping)
Speed	Zoom dependant speed
Speed Control	control
Position Control	Capable of retraining position without drift. Automatic position recovery if forced away by a 'non-control' intervention
Motor Drive	Long life toothed polypropylene belt drive, Pulleys bonded to keypad shafts for minimum backlash
Rotational Contacts	Heavy duty slip rings for power, data, video and switching for washer
Pan / Tilt Bearings	Sealed for life – no maintenance required
Actuation	Pan and tilt stepper motors
Position Encoders	Optical encoders on pan and tilt motors
Mounting Profile	Upright or inverted
IP rating	IP67
Temperature Range	-20°C (-4°F) **Up to 65°C (1**49°F) (-40°C with optional heater)
Power	14 to 36vDC or 14 to 26vAC, 45W peak (100W with optional heater) (20W typical in low power mode when idle without heater)
Fixing Material	Stainless steel with external fall protection
Housing Finish	White powder marine grade paint finish (other colours are available upon request)
Weight	7kg (15.43lb)
Turning Diameter	220mm / 8.66" Normal - 370mm / 14.57" Offset
Height	370mm / 14.57" Normal - 340mm / 13.86" Offset
Telemetry	

Presets	127x Preset positions, 16x preset tours (maximum of 60 positions each), four 8 minute mimic tours
Protocols	Pelco-D, Pelco P, Pelco D Extended, CBC OCP485, Forward Vision Mic1 FV300, Philips, Vicon, SSP, ONVIF Profile-S
Parameter Programming	IP, RS485 (not IP)
Privacy Zones	Maximum of eight on-screen simultaneously
Positioning	Absolute positioning
Additional features	Programmable text within picture (camera ID), parameter control (RS232 or RS485) TCP/IP prepared, compass heading (cardinal point and/or degrees), focal length dependant pan and tilt control, in built real time clock and date

Table 3: Electrical and Mechanical specifications of Oculus Compact

Other features and options of the system are shown in table 4. below.

Image Processing	
Video Compression	H.264/MPEG4 Part 2, M-JPEG
H.264 Performance (Standard)	Total D1 at 390 fps or Full HD 1080p at 65 fps Examples: 2x 1080p at 30 fps (HD video/thermal) or 2x D1 at 30 fps (thermal / SD)
Image Processing	Image resizing and scaling ratio, noise reduction, edge enhancement (sharpness), ROI based video compression
Software Update	Remote / IP accessible
Other Features	Email Notifications, Text Overlay
Options	
Brackets	Tower mount, pole mount, 1m pendant mount, wall mount, corner mount, swan neck mount, heritage mounts
Wiping	Wiper nozzle and wash tank (for the video camera only)
Gyro	2 Axis gyro stabiliser
Image Fusion	Thermal and video Image Fusion with stepped preset zoom
Analogue	Analogue composite camera alternatives are available upon request
Storage	Up to 64GB in total via SD/MMC (32GB available per channel if using thermal and video / 2x cameras)
Additional Optional Modules	Bird Spike, Sunshield, Automatic Object Tracking, Image Stabilisation, Heater, Satin Stainless Steel Housing, Custom Paint Colours Please contact us if you have a specific requirement that is not mentioned or detailed in the part numbers
RC3-SCOUT-50-W	Oculus Scout – with a 640x480, 50mm fixed lens thermal camera and a HD video camera with optical zoom of 30x, white colour
Options	All cable, ancillary and optional part numbers are available upon request

Table 4: Image processing and options

4.3.4 Specifications of 8 MP IR Varifocal camera

Key features of the varifocal camera are shown as follows:

1. BLC/3D DNR/ROI/HLC
2. IP67, IK10
3. Built-in micro SD/SDHC/SDXC card slot, up to 128 GB
4. 1/2.5" Progressive Scan CMOS
5. 3840 × 2160 @15 fps
6. 2.8 to 12 mm varifocal lens
7. Color: 0.01 Lux @ (F1.2, AGC ON), 0.018 Lux @ (F1.6, AGC ON), 0 Lux with IR
8. H.265+, H.265, H.264+, H.264
9. 2 Behavior analyses
10. 120dB WDR
11. BLC/3D DNR/ROI/HLC
12. IP67, IK10
13. Built-in micro SD/SDHC/SDXC card slot, up to 128 GB

Full specifications of the camera are shown as follows.

Specifications	
Camera	
Image Sensor	1/2.5" Progressive Scan CMOS
Min. Illumination	Color: 0.01 Lux @ (F1.2, AGC ON), 0.018 Lux @ (F1.6, AGC ON), 0 Lux with IR
Shutter Speed	1/3 s to 1/100,000 s
Slow Shutter	Yes
Auto-Iris	No
Day & Night	IR Cut Filter
Digital Noise Reduction	3D DNR
WDR	120dB
3-Axis Adjustment	Pan: 0° to 355°, tilt: 0° to 90°, rotate: 0° to 355°
Lens	
Focal Length	2.8 to 12 mm
Lens Type	Motorized
Aperture	F1.6
Focus	Auto
FOV	Horizontal field of view: 105° to 34.5° Vertical field of view: 55° to 19°

	Diagonal field of view: 125° to 40°
Lens Mount	Φ14
IR	
IR Range	Up to 50 m
Wavelength	850nm
Compression Standard	
Video Compression	Main stream: H.265/H.264 Sub-stream: H.265/H.264/MJPEG Third stream: H.265/H.264
H.264 Type	Main Profile/High Profile
H.264+	Main stream supports
H.265 Type	Main Profile
H.265+	Main stream supports
Video Bit Rate	32 Kbps to 16 Mbps
Audio Compression	G.711/G.722.1/G.726/MP2L2/PCM
Audio Bit Rate	64Kbps(G.711)/16Kbps(G.722.1)/16Kbps(G.726)/32-192Kbps(MP2L2)
Smart Feature-set	
Behavior Analysis	Line crossing detection, intrusion detection
Face Detection	Yes
Region of Interest	Support 1 fixed region for main stream and sub-stream
Image	
Max. Resolution	3840 × 2160
Main Stream	50Hz: 12.5 fps (3840 × 2160), 20fps (3072 × 1728), 25 fps (2560 × 1440, 1920 × 1080, 1280 × 720) 60Hz: 15 fps (3840 × 2160), 20fps (3072 × 1728), 30 fps (2560 × 1440, 1920 × 1080, 1280 × 720)
Sub-Stream	50Hz: 25fps (640 × 480, 640 × 360, 320 × 240) 60Hz: 30fps (640 × 480, 640 × 360, 320 × 240)
Third Stream	50Hz: 25fps (1280 ×720, 640 × 360, 352 × 288)

5. Project development

This section describes the phases of Pilot project development. It is covering the following topics (subchapters), as follows.

5.1 Preparation of the Pilot environment

Main idea behind the pilot is provision of enough coverage of the area inside Rijeka port breakwater, especially in terms of detection, diversification and identification of smaller targets in close proximity to one another. Since area inside of breakwater is designated for commercial cargo vessels, including service vessels supporting them (i.e. tugs, pilots, etc.), but also fishing vessels, yachts and leisure boats, end users and operators serving them would benefit from covering the area with camera solution which would provide another possibility for insight into traffic and redundancy to the existing radar system, giving the passengers and identified stakeholders inside target groups an improved situational awareness.

Situational view of Rijeka's Cruise Facilities, including City Center, Container pier, Passenger pier and Passenger Terminal (including tendering) is shown below in Figure 6.

Figure 6: Rijeka's Cruise Facilities

Maritime Passenger Terminal and location of Port Control Center is shown in the Figure 7.

Figure 7: Maritime Passenger Terminal

Location of the tendering area is shown in Figure 8 below.

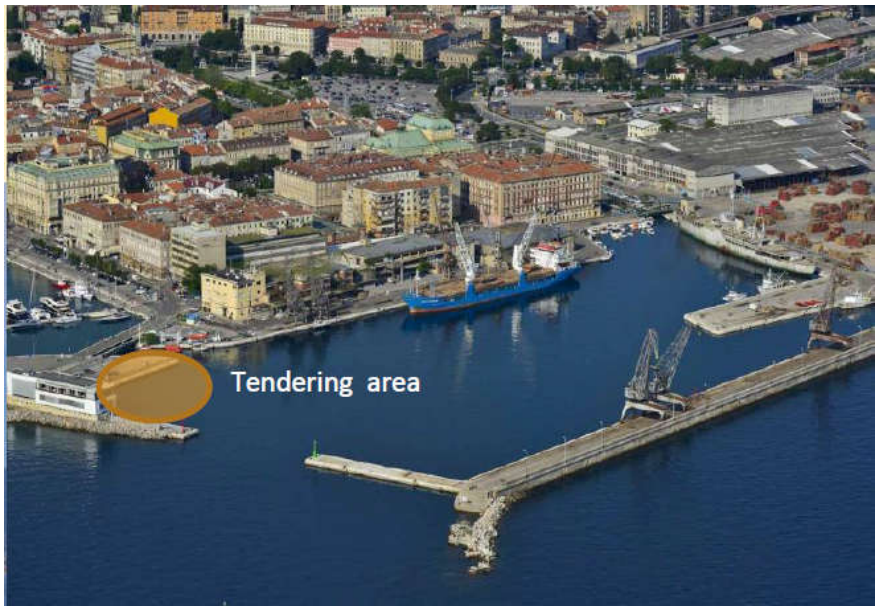


Figure 8: Location of the tendering area

Passenger terminal facilities, where most end stakeholders congregate, have the following characteristics:

1. Information desk,
2. Restaurant, small shops, bathroom,
3. Free wi-fi,
4. Walking distance into town is 300 m,
5. Shopping kiosks,
6. Rental car area,
7. Segregated metered taxi marshalling area,
8. Protected from wind and wave conditions (all-weather), and
9. Capable of accommodating a small and medium size cruise ship.

Pilot planning was basically performed from the beginning of the DigLogs project, through participation in previous phases of the project and WP1, WP2, WP3 and WP4. Basis for the planning was set during tele conference and live meetings, and they are set out in the roadmap for particular projects within passenger sector.

Selection of the innovation to be a base for the project was based on the DigLogs innovative technologies and project portfolio and real needs of port of Rijeka. Definition of technical characteristics was done in cooperation with field experts and vendors, where in direct consultations, most appropriate solution was selected from a selection of different solutions.

Pilot budget was allocated from DigLogs funding and budget in order to guarantee equipment purchase, installation and development of accompanying application. External consultant with expertise in maritime IT systems was also deployed in order to facilitate the pilot project. So, the project team is comprised of Port of Authority experts in EU funding, technical experts working with VTS system, external consultant, selected hardware vendor and applications development vendor.

5.2 Development of the Pilot application

During pilot integrative development, deeper insight into "*as-is*" situation was gathered and technical documentation used in similar projects in other ports was studied in depth, in order to get more information about real life implementations. Existing solutions were studied, and a number of teleconference calls and live meetings were held in order to transfer previous experience. Common elements were identified, and joint decision was made to proceed with the project but incorporating identified experience. Considering that the pilot project in fact exists of two, seemingly unrelated phases (purchase and installation of hardware equipment and application development), it was very important to synchronise both stages in order to ensure timely project execution. An input from specialists in the Port Control Center was crucial, in order to integrate envisaged hardware into overall VTS system already used.

For purchase of hardware and development services, it was crucial to prepare timely the technical specifications. Technical specifications are a part of public tender invitation for both activities. No public call had to be made, as the public procurement rules allow to make decision based on several collected offers by direct solicitation, if the value of services is less than 30.000 EUR+VAT. This way, two vendors will be selected, one for provision of hardware and its installation and the other for integration of the output using Rijeka Traffic information system.

In cooperation with the **hardware vendor**, an order will be placed and meanwhile, suitable position will be selected in order to reach project goals. Selected position has to be reasonable protected from elements, but to have physical overview of the port basin, with emphasis on the passenger traffic. Also, suitable checks were made to ensure location permit for installation, and to ensure security of the equipment and network cabling.

In order to develop **end user information and visualisation panel**, and achieve set goal of delivering the port basin overview to end users (passengers), similar path will be followed, but the involvement of the Port of Rijeka Authority's team will be more limited, as the technical specification has to be drawn up, but then, development entrusted to the developers (external company). Several interim meetings will be held to acknowledge development technologies, translate user requirements and approve GUI mock-ups. When these elements will be formed, it

will be up to the developer to follow the technical specification that will be part of the public procurement and deliver the final product.

As s basis for the development of the end user information panel, internally used Rijeka Traffic software will be used. This business information system utilizes information related to vessels, arrival time, berth, agent and status, and it is used by the Port Control Center to track vessel activity in the area of interest, determine free berths and berth utilization and oversee port control activities. Screen of Rijeka Traffic showing basic functionalities is shown in Figure 9. on the next page.

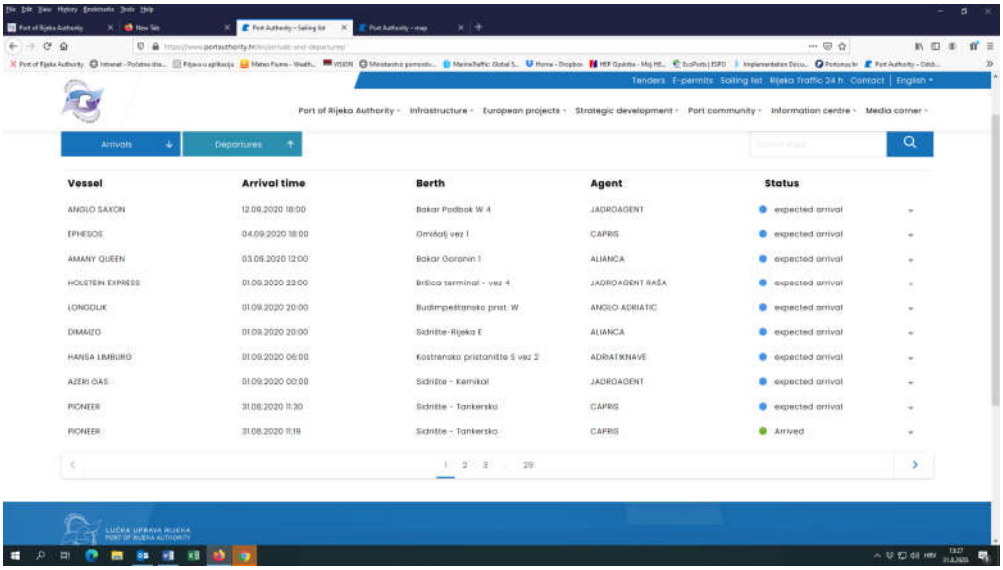
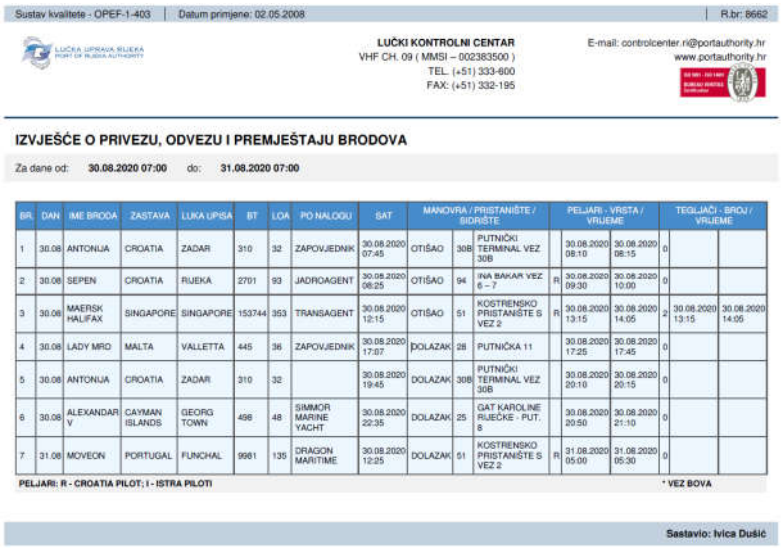


Figure 9: Rijeka Traffic – vessel list, berth and other port situational data

Information contained in the database is further used to create daily lists with port status information report that is distributed to all stakeholders in the port area. A sample of such report is shown in Figure 10. on the next page.



Sustav kvalitete - OPEF-1-403 | Datum primjene: 02.05.2008 | R.br: 8662

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IZVJEŠĆE O PRIVEZU, ODVEZU I PREMJEŠTAJU BRODOVA

Za dane od: **30.08.2020 07:00** do: **31.08.2020 07:00**

BR.	DAN	IME BRODA	ZASTAVA	LUKA UPISA	BT	LOA	PO NALOGU	SAT	MANOVRA / PRISTANIŠTE / SIDRIŠTE			PELJARI - VRSTA / VRIJEME			TEGLJAČI - BROJ / VRIJEME		
1	30.08	ANTONIJA	CROATIA	ZADAR	310	32	ZAPOVJEDNIK	30.08.2020 07:45	OTIŠAO	30B	PUTNIČKI TERMINAL VEZ 30B		30.08.2020 08:10	30.08.2020 08:15	0		
2	30.08	SEPEN	CROATIA	RIJEKA	2701	93	JADROAGENT	30.08.2020 08:25	OTIŠAO	94	INA BAKAR VEZ 6 – 7	R	30.08.2020 09:30	30.08.2020 10:00	0		
3	30.08	MAERSK HALIFAX	SINGAPORE	SINGAPORE	153744	353	TRANSAGENT	30.08.2020 12:15	OTIŠAO	51	KOSTRENSKO PRISTANIŠTE S VEZ 2	R	30.08.2020 13:15	30.08.2020 14:05	2	30.08.2020 13:15	30.08.2020 14:05
4	30.08	LADY MRO	MALTA	VALLETTA	445	36	ZAPOVJEDNIK	30.08.2020 17:07	DOLAZAK	28	PUTNIČKA 11		30.08.2020 17:25	30.08.2020 17:45	0		
5	30.08	ANTONIJA	CROATIA	ZADAR	310	32		30.08.2020 19:45	DOLAZAK	30B	PUTNIČKI TERMINAL VEZ 30B		30.08.2020 20:10	30.08.2020 20:15	0		
6	30.08	ALEXANDAR V	CAYMAN ISLANDS	GEORG TOWN	498	48	SIMMOR MARINE YACHT	30.08.2020 22:35	DOLAZAK	25	GAT KAROLINE RIJEČKE - PUT. 8		30.08.2020 20:50	30.08.2020 21:10	0		
7	31.08	MOVEON	PORTUGAL	FUNCHAL	9981	135	DRAGON MARITIME	30.08.2020 12:25	DOLAZAK	51	KOSTRENSKO PRISTANIŠTE S VEZ 2	R	31.08.2020 05:00	31.08.2020 05:30	0		

PELJARI: R - CROATIA PILOT; I - ISTRA PILOTI

* VEZ BOVA

Sastavio: Ivica Dušić

Figure 10: Rijeka Traffic – daily port berth report

This data is further visualized using online maps published on open Internet using address https://www.portauthority.hr/map/ . At the moment, the interactive map shows several basins (Rijeka, Rijeka – passenger's terminal, Bakar, Raša and Omišalj). Layers include borders (on the sea and on the land), Port of Rijeka Authority's facilities, railways and roads. It also shows several phases of Zagreb Deep Sea container terminal (phases 1, 1a and 2). This data is shown in Figure 11.

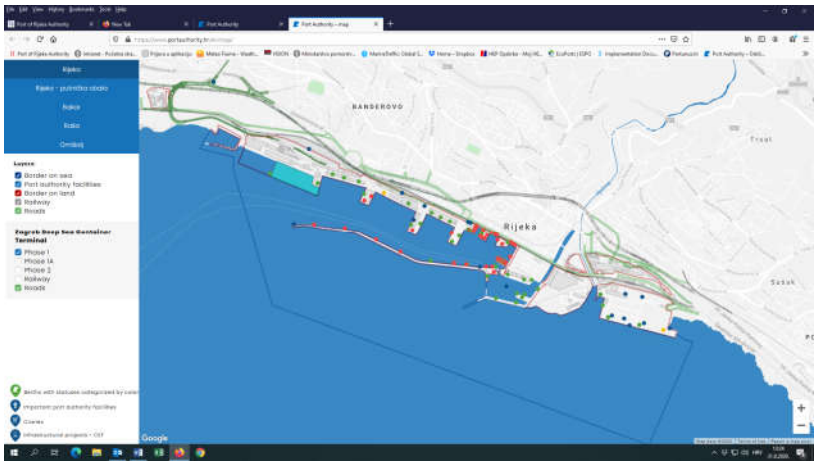

Figure 11: Interactive Rijeka Traffic map

Furthermore, berths with designated status according to colours, important Port of Rijeka Authority's facilities, cranes and locations of infrastructure projects are also shown on the map.

The map can be zoomed in or out, and then, more information about described objects, and even vessel position can be obtained. Enlarged portion of the passenger terminal and surrounded area with vessels is shown in figure 12.

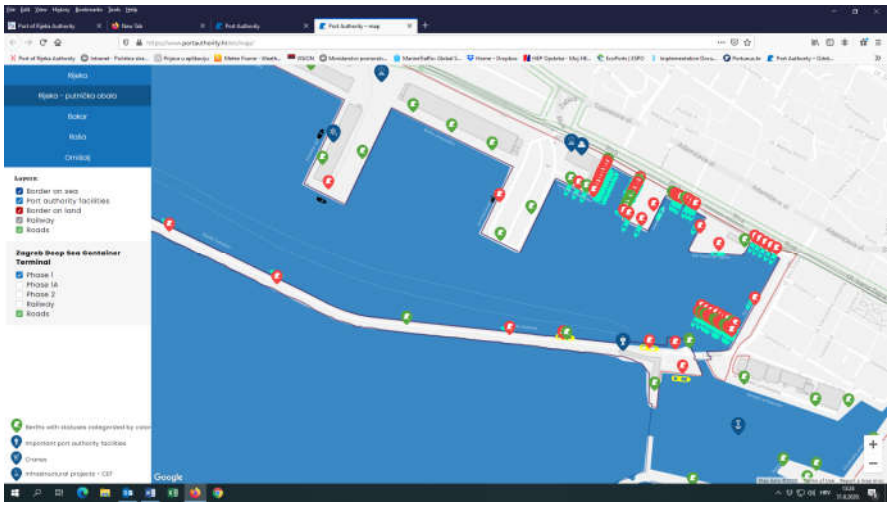

Figure 12: Detailed section of the passenger's terminal

When the hardware will be installed and calibrated at the designated position, and the gathered data is stored to a database, feeds will be connected, mixed and routed, and displayed using Rijeka Traffic map system to the end users – passengers.

Similar methodology is expected for integration of the thermal visualization equipment with the existing VTMIS system.

5.3 Pilot application testing and acceptance

Testing will be performed using several levels and each time, development and installation team, Port of Rijeka Authority, external consultant and end users were involved.

A test on a real population will be required in order to measure adoption of the technology by end users (operators and passengers). This is the main objective of a pilot action immediately preceding the final system deployment.

Internal testing is planned, first by the developer's team, and then UAT (user acceptance test) will be performed both by the Port Security expert and the external expert (consultant).

Final configuration and testing will mark the final phase of the pilot deployment, when the camera will be turned on, connected with Rijeka Traffic and the access URL will be sent to identified stakeholders from target groups. Feedback will be gathered and hopefully, it will be largely positive, marking establishment of a satisfactory new service to the end users. Some suggestions that will be received probably will not be acknowledged as a part of this project, but they will be considered as a part of future system upgrades using other sources, which is what is normally expected in similar projects.

Pilot integration testing will include several phases:

1. *Unit testing* - separate testing of parts of pilot (specification, hardware, cabling, software). This test is performed primarily by the persons in charge, using development environment, during development phase,
2. *Integration testing* - already tested modules are combined and tested as a group, within certain functionalities,
3. *System testing* - check of functionalities and reliability of the completed pilot, using test scenarios covering all processes. Initially it will be completed by the hardware and software vendors, and then, by dedicated consultant and Port of Authority Rijeka,
4. *Performance testing* - testing and check of functionalities, includes stress test and reliability of the system as a whole (camera-sensing unit, cabling, Web subsystem), and
5. *User acceptance testing* - performed at the end of development and installation, during system deployment. User acceptance testing encompasses functional and operational

landscapes of the pilot.

All found and known errors and issues will be classified to a few categories and handled in order of importance until all were fixed:

1. *Critical errors* - all errors that could cause the system to be inoperative were identified and fixed,
2. *Less important problems* - such errors were treated using workarounds, and
3. *Requests for Enhancement (RFE)* - this is input that will be gathered during testing, but after the plan was drafted, and hardware and services procured. Such requests could not be fulfilled as a part of the project, due to time and budgetary constraints. They will be treated as separate small projects, in the period after pilot deployment, using own funding, if their evaluation shows it could be beneficial for the port community, focused on the passengers

5.4 Pilot deployment and documentation

Direct added value of the project is further extension of the gathered and processed information towards end users-passengers, thus enabling direct benefits for them. For example, a QR code or similar interconnectivity technology may be used as a form of notification that would be posted at the passenger terminal, or using digital outlets with similar functionality, which would allow passengers to download and install mobile application via smart mobile devices, and access visual representation and numerical data representing all information related to the vessel traffic in port of Rijeka that is applicable and significant for them.

First step following completed procurement formalities is installation of the hardware, currently pland mid- to end- Q4/.2020. The sensing devices will be installed in several suitable locations with adequate visibility and connected to power source and data links.

Front-end development for user centric services will run in parallel, and completion is planned mid to end Q1/2021. Output from the camera device will captured and tunnelled to the front-end and visualised using map on the Internet, freely available to all interested stakeholders from target groups and passengers.

Information related to the pilot, including QR code leading to the map will be placed on information panels installed in easily accessible locations.

Stakeholders within identified target groups will be informed about the pilot's go-live by means of e-mail and social networks dedicated to DigLogs project later in Q1/2021.

With completion of these steps, the pilot will pass from the planning phase through development and execution to the production/exploitation phase of the project. Figures on the following pages show some described aspects of the project.

Validation (sign off) on the project on the whole at this stage will be done at the level of the PP7 and its consultant, hardware and development vendors and again, PP7, during acceptance test.

The application would also be useful for passengers arriving at the port of Rijeka as they would have real-time information into the arrival / departure and position of the maritime traffic inside the port of Rijeka, and presents a possibility for further project enhancement.

As a part of post deployment activities, some additional steps will be performed. General public will be informed about the project deliverables using channels already identified as a part of project's WP2. A video promotion campaign will be used, where a video company will be hired to create a video presenting DigLogs pilot project actions as a whole. Interested stakeholders are also informed about the pilot using placement on the Port of Rijeka Authority's web page.

End of the pilot action will mark beginning of the operative system exploitation and maintenance. No specific maintenance is envisaged, considering robustness of the installed equipment. In terms of ongoing maintenance, it will be primarily reactive, meaning that appropriate actions will be taken if there is interruption in the functioning. Representation using Internet map will be checked for functioning and managed as a part of the Rijeka Traffic information system. Check procedures and maintenance became an integral part of the IT department's duties inside Port of Rijeka Authority.

Financial means required for maintenance of the product are considered to be marginal, and after depreciation and end of functional amortization, it will be replaced within regular asset renewal policy of the Port of Rijeka Authority.

Usage of the system will be measured using web access counter page and regular Web page metric, already used for access to map served by Rijeka Traffic information system. This metric will show utilization of the map by the end users – passengers and stakeholders within identified target groups.

As a summary, successful pilot project execution and deployment marks beginning of additional functionality provided to end users in a simple and easily accessible manner, adding a layer of visibility in the port area, especially aimed at safety and oversight of the passenger traffic, thus achieving the pre-set project goals.

6. Project team

Core project team tasked with project execution is comprised of the following resources with identified roles and responsibilities:

1. *Denis Vukorepa*, internal team member, job role: Port of Rijeka Authority director, project role: Project Director, in charge of top level project steering,
2. *Tvrtko Tomljenović*, internal team member, job role: EU projects manager, project role: Project Manager, responsible for overall project governance, and financial and organizational aspects of the project,
3. *Davorin Mance*, internal team member, job role: IT manager, project role: Technical Manager, responsible for technical aspects of the project,
4. *Ivica Dušić*, internal team member, job role: VTS manager, project role: Port and Maritime Traffic Safety Manager, responsible for integration, VTS and VTMIS aspects of the project, and
5. *Saša Aksentijević*, external team member, job role: consultant, project role: technologies, process and EU funding methodology consultant, responsible for technical aspects of the project, documenting and funded project compliance.

Extended project team includes members of the vendors and DigLogs WP5 leader:

1. *Karmen Krivičić Spajić*, external team member, job role: Project manager for PP5 team involvement within DigLogs, project role: DigLogs WP5 package leader, in charge of WP5 steering, progress assurance and compliance assurance with the Application Form, and
2. *Representatives of respective vendors*, external team members, project role: vendors, tasked with delivery of project requisitioning goods and integration services.

7. Project Timeline

Project timeline for the duration of the he entire pilot project is shown in table 5 below, along with the most important milestones.

		Year and month							
Activity number	**Activity title**	2020					2021		
		8	9	10	11	12	1	2	3
1	Creation of the pilot work plan draft								
2	Creation of the pilot work plan		*						
3	Creation of the technical-functional specification								
4	Completed public procurement documentation								
5	Awarded equipment purchase and system integration contracts				**				
6	Delivery and installation of equipment								
7	Equipment UAT testing								
8	Development and system integration								
9	Fully integrated system UAT testing								
10	Full system deployment in production								*

Table 5: Project timeline

(*) – an asterisk marks a measurable milestone, as communicated to WP5 leader

8. Project risk management

Common risk register methodology was developed by the LP of the WP4, in earlier stages of the project, and it will be used to identify and mitigate risks that might arise from the pilot execution.

Goal of the risk management of the pilot project is to address all foreseen risks from various aspects:

- Use preventive measures and risk avoidance, where possible, in order to avoid risk occurence (most favorable),
- Use mitigation measures, where possible, to lessen the risk impact (less favorable),
- Use risk transfer (to third parties), to lessen the risk impact, and
- Establish a clear list of actions and contingencies including escalation path towards WP5 leader and LP and have informed opinion on residual risk.

However, the project will be relatively short in duration (pilot execution), so it is logical that this fact will help significantly in its successful completion.

No higher levels of technical risks are anticipated, so mostly common project risks may reasonably be expected.

Used risk register is shown in Table 6. below.

ID	**Date raised**	**Risk description**	**Likelihood of the risk occurring**	**Impact if the risk occurs**	**Severity** *Rating based on impact & likelihood.*	**Owner** *Party who will manage the risk.*	**Mitigating action applicable to pilot project action** *Actions to mitigate the risk e.g. reduce the likelihood.*	**Contingent pilot project action** *Action to be taken if the risk happens.*	**Progress on pilot project actions**	**Status of the registered pilot project risk**

1	[risk identification date]	Pilot project purpose and need is not well-defined	Medium	High	High	LP/SC	Complete a business case for the harmonization pilot if not already completed and ensure purpose is well defined according to project plan	Escalate to the LP/SC and inform WP5 leader with an assessment of the risk of runaway costs/never-ending project.	Business case re-written with clear deliverables and submitted to the LP/SC for acknowledgement	[Open/Closed]
2	[risk identification date]	Project design and deliverable definition is incomplete.	Low	High	High	LP/SC	Define the scope in detail via design details, workshops and meetings with PP/LP and input from subject matter experts.	Document assumptions made and associated risks. Request high risk items that are ill-defined are removed from scope.	Design workshops and meetings scheduled.	[Open/Closed]
3	[risk identification date]	Project schedule is not clearly defined or understood	Low	Medium	Medium	PP	Hold scheduling workshops with the project team (internal and external providers) so they understand the plan and likelihood of missed tasks is reduced.	Share the plan and go through upcoming tasks at each weekly project progress meeting.	Workshops scheduled.	[Open/Closed]
4	[risk identification date]	No control over staff priorities	Medium	Medium	Medium	PP	PP should brief internal team managers on the importance of the project. Soft book resources as early as possible and then communicate final booking	Escalate to the PP's top management and bring in back up resource, inform LP/PSC, and inform WP5 leader	PP's top management has to agree to hold briefings. Identification of suitable arrangements (meeting room, teleconferencing tools)	[Open/Closed]

							dates ASAP after the scheduling workshops and meetings. Identify back ups for each project team member engaged on the project.			
5	[risk identification date]	Consultant or subcontractor delays	Medium	High	High	PP	Include late penalties in pilot project contracts. Build in and protect lead time in the schedule. Communicate schedule early. Check in with supplier's progress regularly. Query statements like '90% done'. Ask again and again if the supplier or consultant requires additional information.	Escalate to LP, SC and top management of the supplier and inform WP5 leader. Implement late clauses.	Lead time from each contractor built into the project schedule. Late penalties agreed to and contracts signed.	[Open/Closed]

6	[risk identification date]	Estimating and/or scheduling errors	Medium	High	High	PP	Break this risk into two parts: 'cost estimating' and 'scheduling errors'. Use two methods of cost estimation, and carefully track costs and forecast cost at completion making adjustments as necessary. Build in 10% contingency on cost and scheduling. Track schedules daily and include schedule review as an agenda item in every project team meeting. Flag forecast errors and/or delays to the Project Board early.	Escalate to LP and SC and inform WP5 leader. Raise change request for change to budget or schedule. Pull down contingency.	Contingency agreed by the top management of the PP; LP informed.	[Open/Closed]

7	[risk identification date]	Unplanned work that must be accommodated	Low	High	Medium	PP	Attend project scheduling workshops. Check previous projects, for actual work and costs. Check with peer companies for actual events during similar projects. Check all plans and quantity surveys. Document all assumptions made in planning and communicate to the vendor's project manager before project kick off.	Escalate to the vendor's project manager with plan of action, including impact on time, cost and quality.	PP's team attending scheduling workshops.	[Open/Closed]
8	[risk identification date]	Lack of communication, causing lack of clarity and confusion.	Medium	Medium	Medium	LP/SC/ PP	Write and discuss a communication plan which includes frequency, goal, and audience of each communication. Identify stakeholders early and make sure they are considered I	Correct misunderstandings immediately. Clarify areas that are not clear swiftly using assistance from Project Sponsor if needed.	Communication plan in progress.	[Open/Closed]

							the communication plan. Use most appropriate channel of communication for audience e.g. don't send 3 paragraph email to developers, have a call instead.			
9	[risk identification date]	Pressure to arbitrarily reduce task durations and or run tasks in parallel which would increase risk of errors.	Low	High	Medium	PP	Share the schedule with key stakeholders to reduce the risk of this happening. Patiently explain that schedule was built using the expertise of subject matter experts. Explain the risks of the changes. Insist on contractual obligations towards pilot project vendors.	Escalate to LP and SC with assessment of risk and impact of the change, and inform WP5 leader Hold emergency risk management call with decision makers & source of pressure and lay out risk and impact.	Awaiting completion of the schedule.	[Open/Closed]

10	[risk identification date]	Scope creep	Medium	High	High	PP	Document the pilot project scope in a Project Initiation Document or Project Charter and get it authorised by the PP. Include the full scope in the contract. Refer to it throughout the project and assess all changes against it also ensuring alignment of any changes with the business case.of the pilot project.	Document each and every example of scope creep NO MATTER HOW SMALL in a change order and get authorisation from the project board BEFORE STARTING WORK. This includes ZERO COST changes.	Scope clearly defined in the contract.	[Open/Closed]
11	[risk identification date]	Unresolved project conflicts not escalated in a timely manner	Low	Medium	Medium	PP	Hold regular project team meetings and look out for conflicts. Review the pilot project plan and stakeholder engagement plan for potential areas of conflict.	When aware immediately escalate to LP and PSC and gain assistance from LP to resolve the conflict. Inform WP5 leader	Project team meetings scheduled.	[Open/Closed]
12	[risk identification date]	Proposed pilot action becomes obsolete or is undermined by external or internal changes.	Low	High	High	PP	No ability to reduce likelihood, but make sure early warning is given by reviewing pilot action on regular	Initiate escalation and project close down procedure.	Project close down procedure confirmed with Project Board.	[Open/Closed]

							basis with the LP/PSC prior to stipulating the contract.			
13	[risk identification date]	Delay in earlier project phases jeopardizes ability to meet fixed date. For example delivery of just in time materials, for conference or launch date.	Medium	High	High	PP	Ensure the project plan is as accurate as possible using scheduling workshops and work breakdown structure. Use Tracking Gantt and Baseline to identify schedule slippage early.	Consider insurance to cover costs and alternative supplier as a back up, if possible.	Awaiting completion of the schedule.	[Open/Closed]
14	[risk identification date]	Added workload or time requirements because of new direction, policy, or DigLogs project changes	Low	Medium	Medium	PP	No ability to reduce likelihood.	Acquire advanced notice from PSC/LP if possible. Inform WP5 leader	Pilot project management reviewing options.	[Open/Closed]
15	[risk identification date]	Inadequate testing by the project team or involved (aimed) stakeholders leads to large post go live snag list.	High	High	High	PP	Ensure that test cases/quality checks are timely prepared and testing/quality assurance window is protected.	Raise risk immediately and raise issue if it is clear that UAT testing is inadequate. Stakeholders could extend testing & bring in additional resource.	Stakeholders preparing test cases.	[Open/Closed]
16	[risk identification date]	Legal action delays or pauses project.	Low	Medium	Medium	SC/LP/PP	Ensure all contracts signed before starting the pilot project. Follow all regulatory requirement	Escalate to the PP's management who will notify legal department. Follow instructions from legal	Contracts issued.	[Open/Closed]

							s and complete stakeholder managemen t plan.	department and inform LP/PSC. Inform WP5 leader		
17	[risk identificati on date]	Stakeholder or PP refuses to approve deliverables/mile stones or delays approval, putting pressure on project manager to 'work at risk'.	Medium	Mediu m	Mediu m	PP	Ensure that PP's decision maker with budgetary authority is identified before project start and is part of the project board. Communicat e dates for sign-off points up front.	Escalate to PP's management and LP and recommend action e.g. - to stop the project. Inform WP5 leader	Pilot project manager is confirming their sponsor / top management of the supplier.	[Open/Closed]
18	[risk identificati on date]	Theft of materials, intellectual property or equipment.	Low	High	High	PP	Follow security procedures, ensure Non-Disclosure Agreements (NDAs), & compliance certificates are in place along with required confidentiali ty clauses. Verify all physical security measures in place. Secure insurance, if applicable.	Notify appropriate authorities e.g. police, legal department, LP, PSC and initiate internal investigations. Inform WP5 leader	NDAs issued. Security certificates confirmed for contractors/su ppliers working on the pilot project.	[Open/Closed]

19	[risk identification date]	Acts of God for example, extreme weather, leads to loss of resources, materials, premises etc.	Low	High	High	PP	Ensure insurance in place and valid. Familiarise project team with emergency procedures. Where cost effective put back up systems in place, if applicable.	Notify appropriate authorities. Follow health and safety procedures. Notify stakeholders, LP and PSC. Inform WP5 leader	Public Liability Insurance confirmed along with additional premises insurance at site / for the pilot project.	[Open/Closed]
20	[risk identification date]	Pilot project stakeholder's action (or lack of) delays project.	Low	High	High	PP	Identify interested and dedicated stakeholders before start of the pilot project, analyze power and influence and create a stakeholder engagement plan. LP/PSC to check and if applicable, authorise the plan. Revisit the plan at regular intervals during pilot project execution to check all external stakeholders are managed. Consider getting additional insurance.	Notify appropriate authorities and follow internal procedures e.g. for activist demonstrations. Inform WP5 leader	Stakeholder involvement analysis in progress.	[Open/Closed]

Table 6: Risk register

References and attachments

[1] Screenshots – N/A
[2] Links – N/A
[3] Documents used – N/A
[4] Information sources – N/A
[5] Other references – N/A