CTRL+N

SAFETY PERIMETER & ALERTING SYSTEM

GOALS OF SPAS IMPLEMENTATION

Enhancing safety level

- Eliminating the human factor in the signaling function
- Improving the reliability of informing crews about the approach of rolling stock
- Enhancing the quality of notifications

Enhancing economic efficiency

Replacing the human role of a signaler

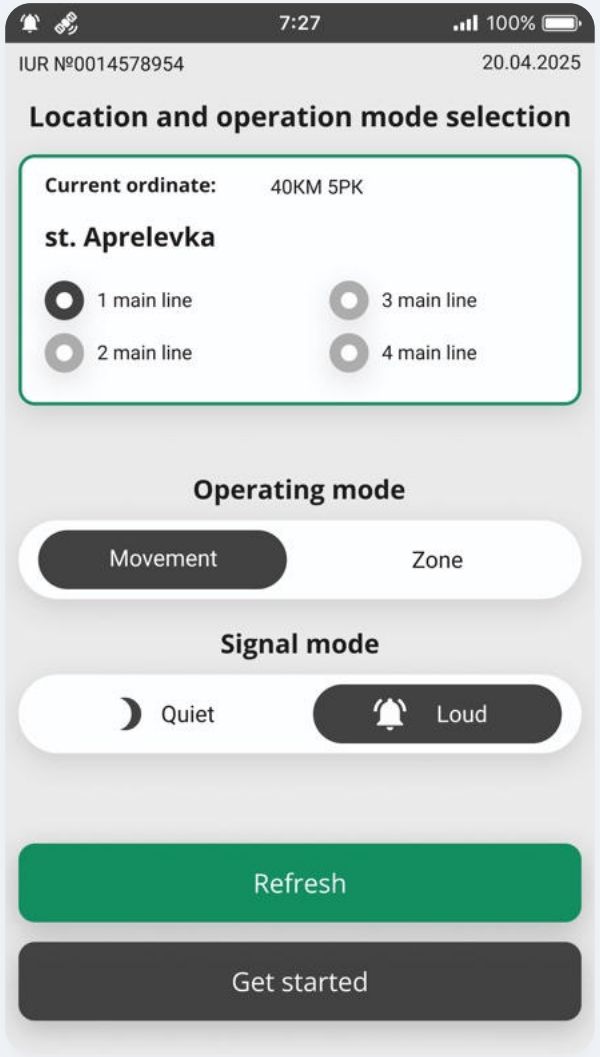
SPAS SYSTEM FUNCTIONS

Key functions

- Informing workers about the approach of rolling stock to the worksite
- Alerting operators about obstacles for rolling stock movement

Additional functions

- Controlling the movement of workers during the passage of rolling stock
- Providing individual and collective alerts of workers about the approaching of rolling stock
- Recording the actual time of works execution



SPAS APPLICATION

Areas of application

- Running lines (single and multiple tracks)
- Stations

Type of works

Without track closure (notification)

Type of crews

- Track maintenance crews
- Diagnostic crews

REQUIREMENTS FOR SPAS OPERATION

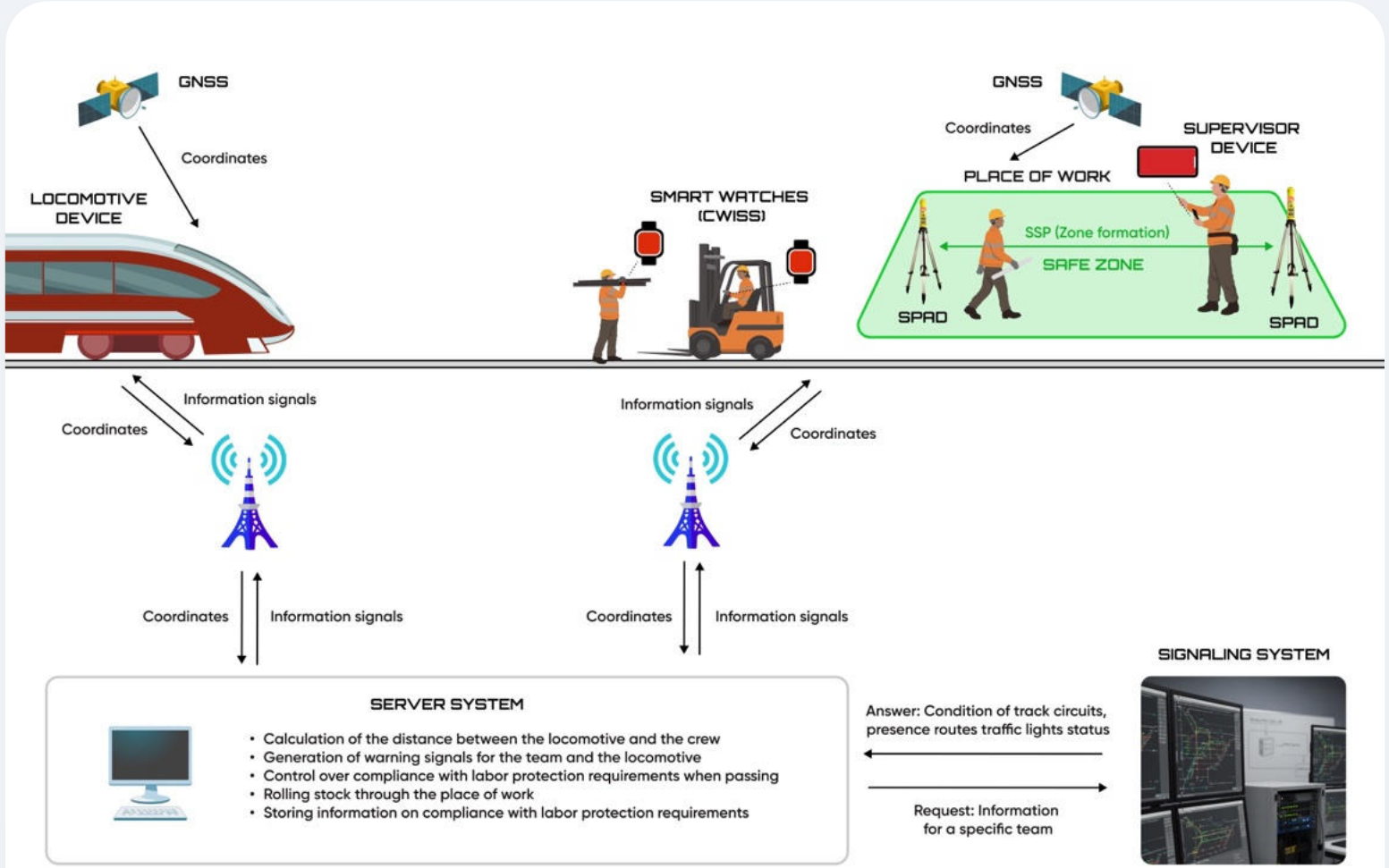
1

Availability of technical diagnostics and monitoring systems or other data sources (DC) capable of transmitting information to the SPAS server about the position of switches, the status of track circuits, and signals

2

Availability of reliable coverage of GSM networks, 3rd generation and above

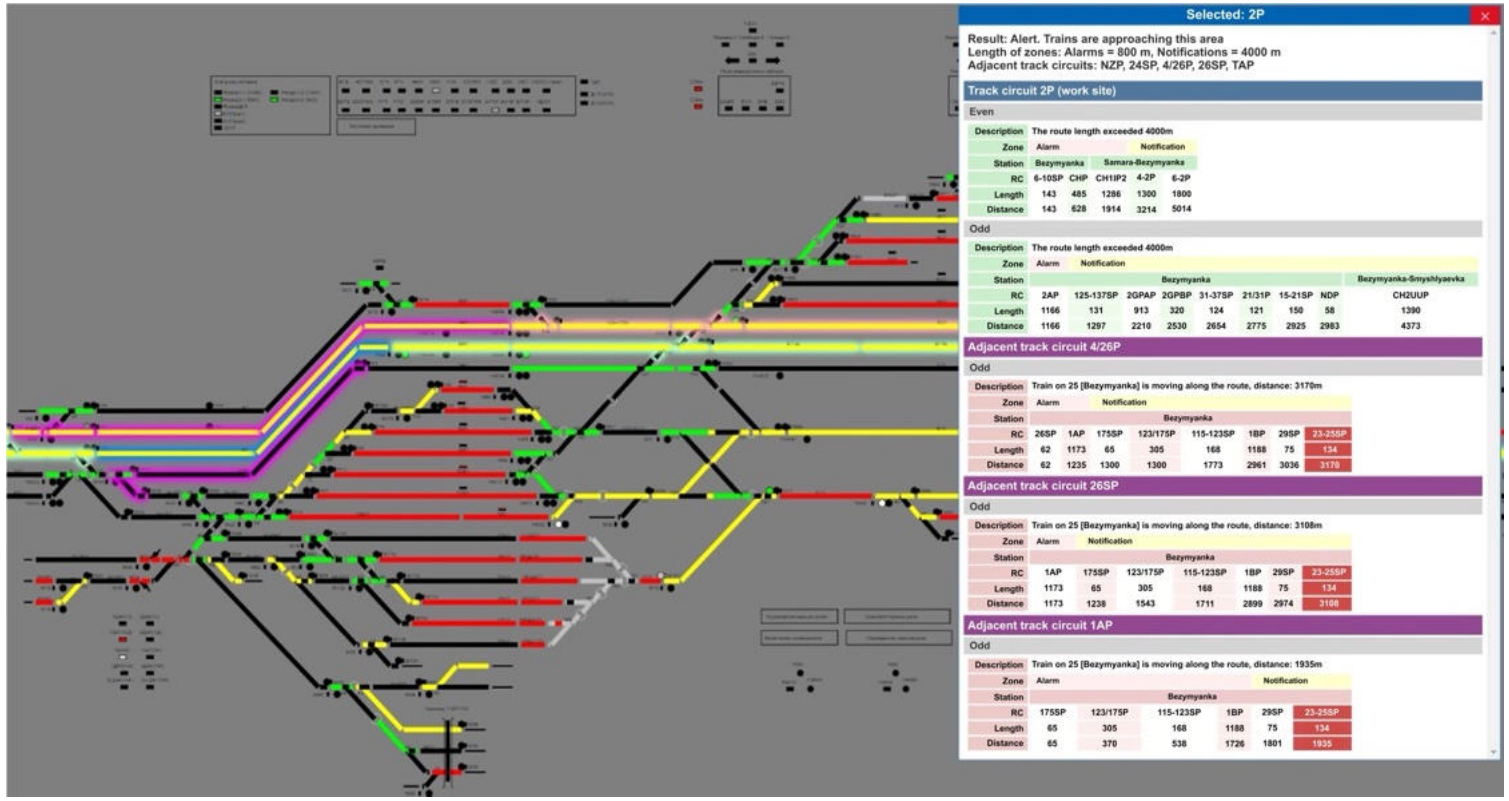
DATA TRANSMISSION SCHEME



SPAS provides

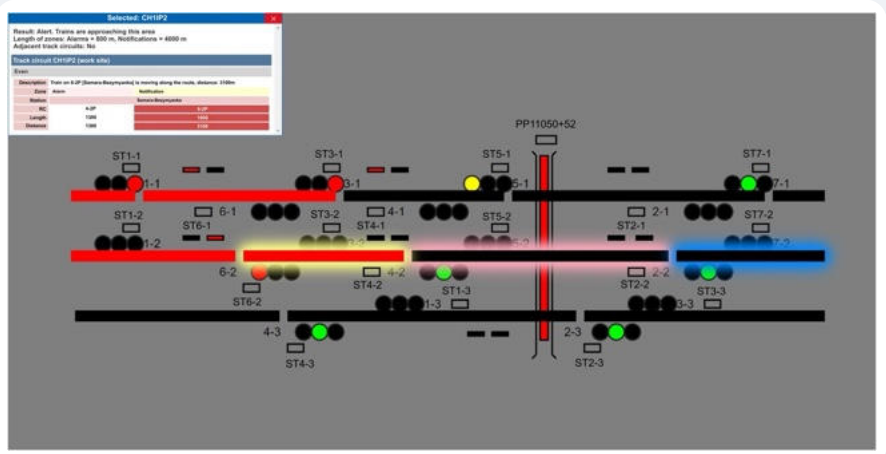
- Notification of the crew about the track number and the direction of the approaching rolling stock
- Target notification to locomotive crews about the approach to the worksite, including when moving to adjacent tracks
- Monitoring the approach of locomotives and other rolling stock not equipped with locomotive devices
- Using two independent sources of information about the approach of rolling stock (data from signaling system and data on the geographic coordinates of the locomotive module)

SIGNAL FORMATION BASED ON SIGNALING DATA



Implemented functionality

- Analysis of routes through the worksite
- Analysis of routes through adjacent tracks to the worksite
- Analysis of track circuit occupancy
- Calculation of distance to rolling stock based on the lengths of track circuits included in the routes



EXAMPLE OF NOTIFICATION SIGNAL FORMATION

The figure illustrates the operation of SPAS with the integration of signaling system using a specific example

The worksite is designated as track 1BP
«Alarm» signal, as movement is occurring on an adjacent track
Distances for triggering «Alarm» and «Notification» signals
Adjacent track circuits for which notifications of movement will be issued

Information about movement on each track is displayed separately
The direction of rolling stock movement has been determined
The length of the route is sufficient for timely notification
Track circuits are grouped into alarm and notification zones
Location of track circuits
Names of track circuits included in the alarm and notification zone
Length of track circuits included in the alarm and notification zone
Distance from the worksite to the rolling stock

Information on movement on the adjacent track

Selected: 1BP

Result: Alert. Trains are approaching this area
Length of zones: Alarms = 800 m, Notifications = 4000 m
Adjacent track circuits: 5BP, 69SP, 33/69P, 31-37SP

Track circuit 1BP (work site)

Odd

Description	The route length exceeded 4000m					
Zone	Alarm				Notification	
Station	Bezymyanka			Bezymyanka-Smyshlyaevka		
RC	29SP	23-25SP	NP	N1IP1	3P	5P
Length	75	134	153	1390	2040	1203
Distance	75	209	362	1752	3792	4995

Adjacent track circuit 1AP

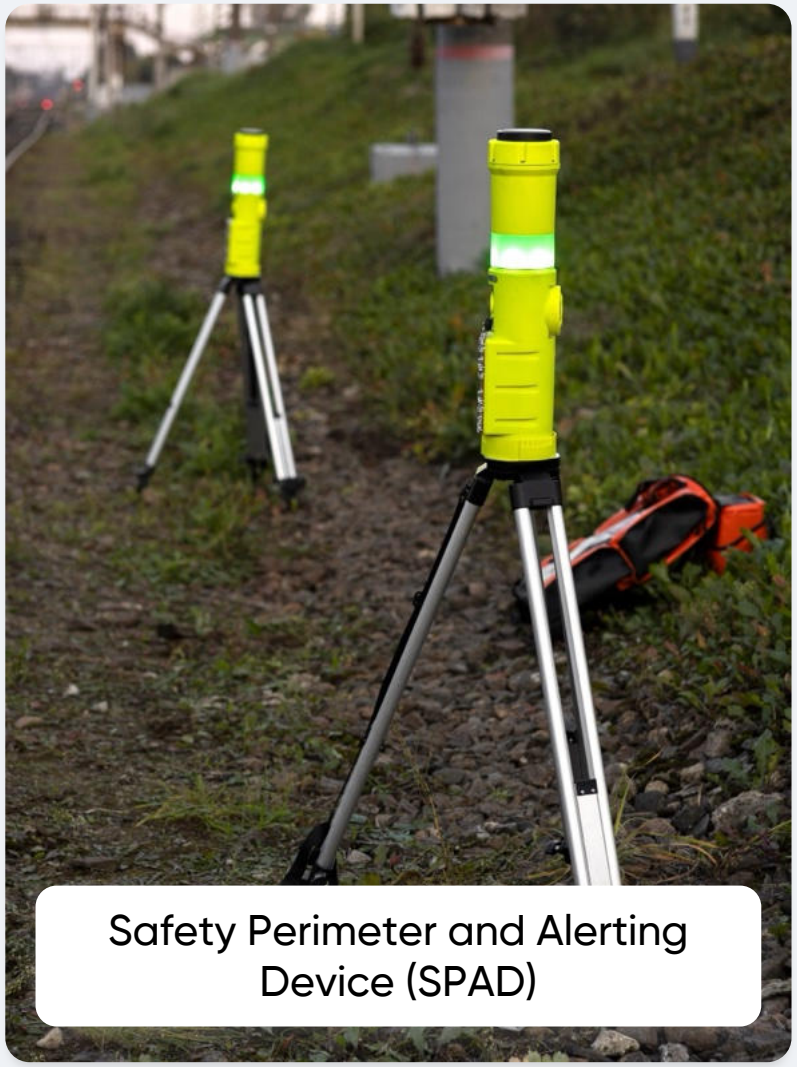
Odd

Description	The train is on this section
Zone	Alarm
Station	Bezymyanka
RC	5BP
Length	896
Distance	

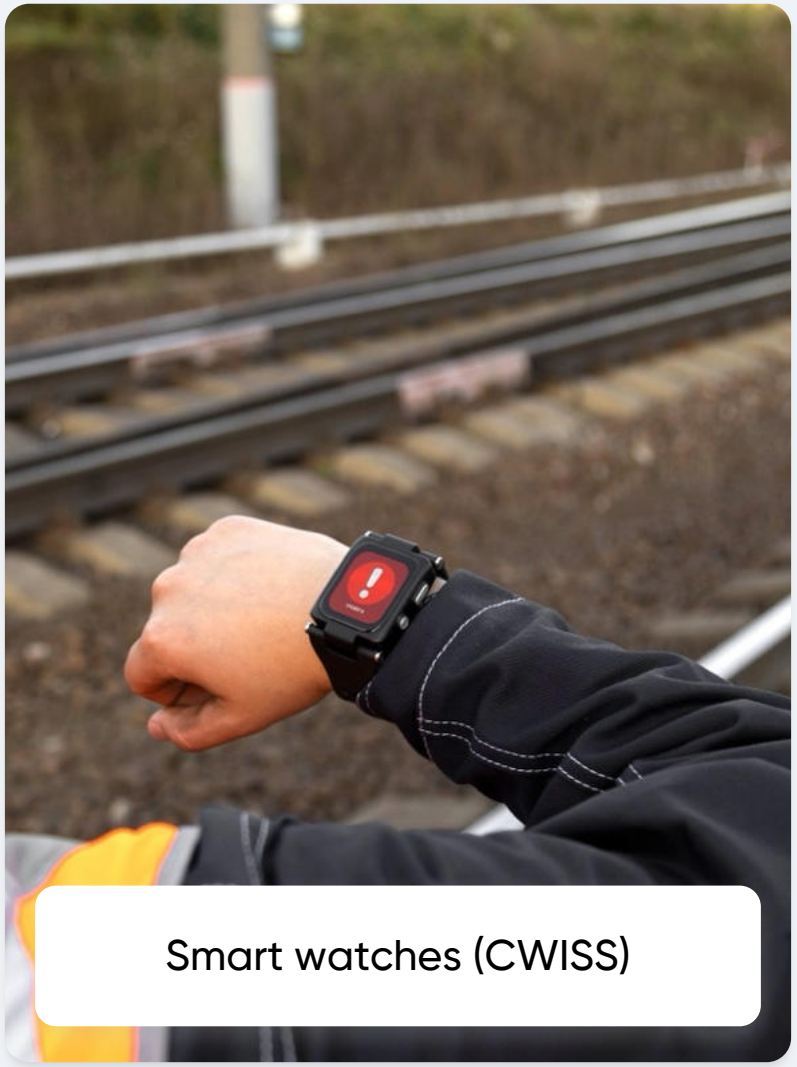
SYSTEM APPLICATION BY MAINTENANCE CREWS

- The crew creates **a virtual safety zone** at the trackside using devices integrated into the System
- The System provides **timely notifications to the crew** about the approach of rolling stock
- The devices monitor the movement of workers **into the safety zone**
- If workers are in the danger zone, the System promptly informs the track maintenance crew and the locomotive crew about **the approaching rolling stock at a critical distance from the worksite**
- In case of an emergency, the supervisor can manually activate **the alarm signal** on the individual devices of each worker and on the locomotive device

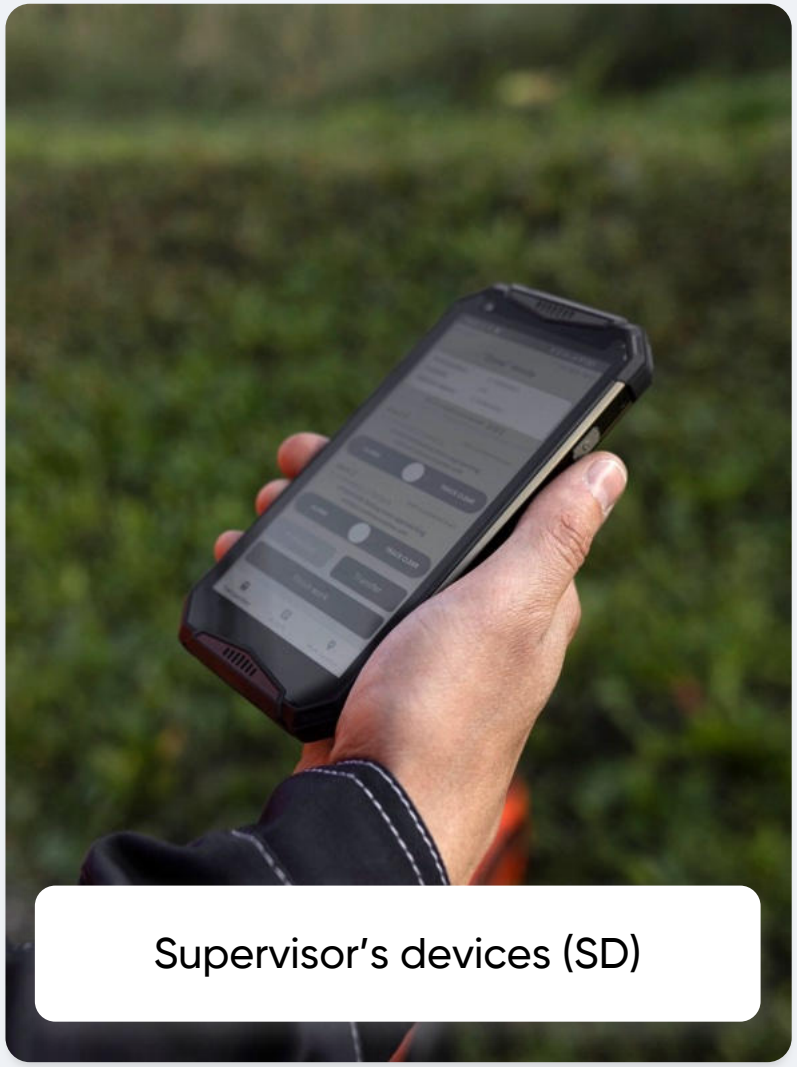
SPAS DEVICES



Safety Perimeter and Alerting Device (SPAD)



Smart watches (CWISS)



Supervisor’s devices (SD)

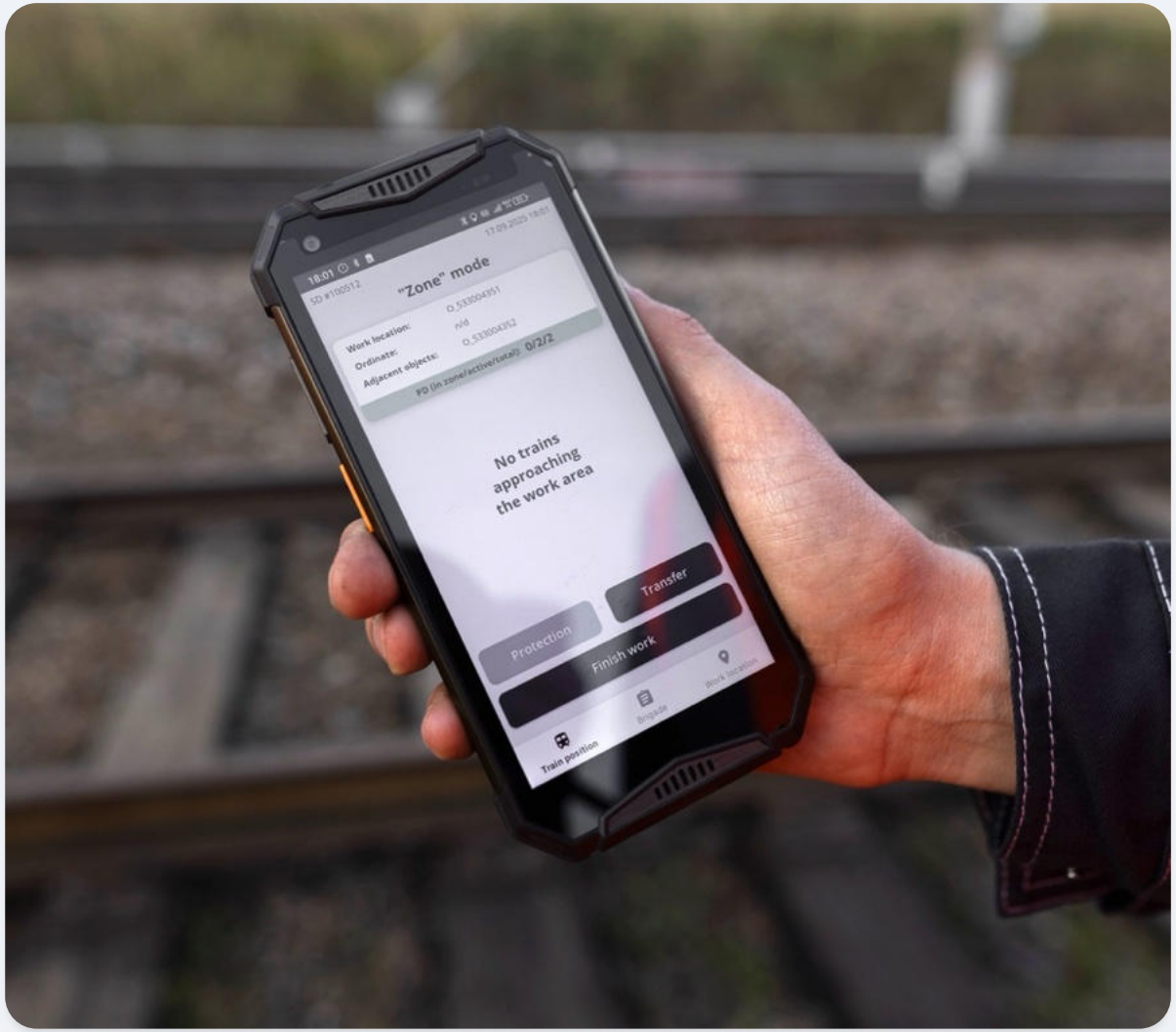
SUPERVISOR'S DEVICES (SD)

Technical Specifications

- Dust and Moisture Protection: IP68/IP69K standard
- Impact Resistance
- Battery Capacity: 10,850 mAh (over 12 hours at t = -45°C)
- Support for required communication standards

Functions

- Built-in self-diagnosis
- Crew management
- Selection of work location and mode
- Playback of light and sound alarms
- Monitoring the status of all crew devices
- Displaying information about approaching trains
- Issuing alarm or track occupancy signals to approaching trains
- Verifying compliance of the worksite with actual location



FUNCTIONS OF THE SUPERVISOR'S DEVICES

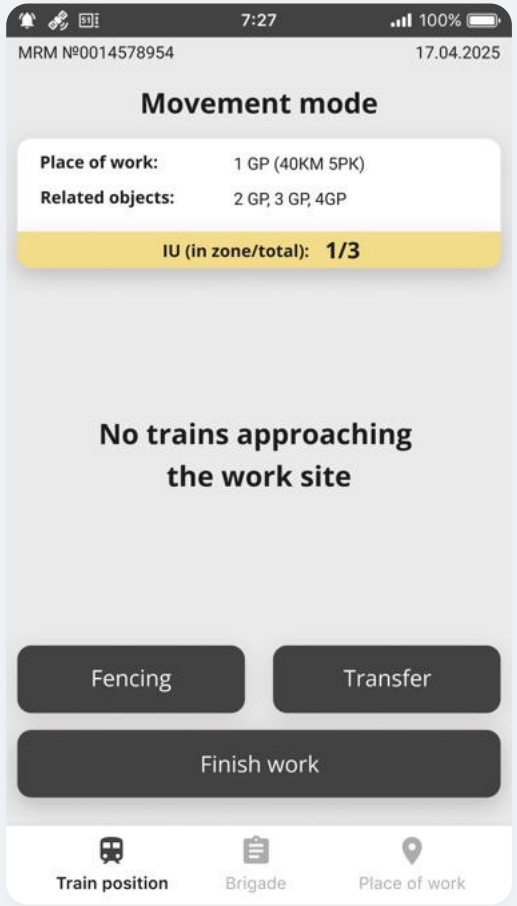
Displaying information about the approaching train

- Direction of movement (up and down traffic)
- Current location

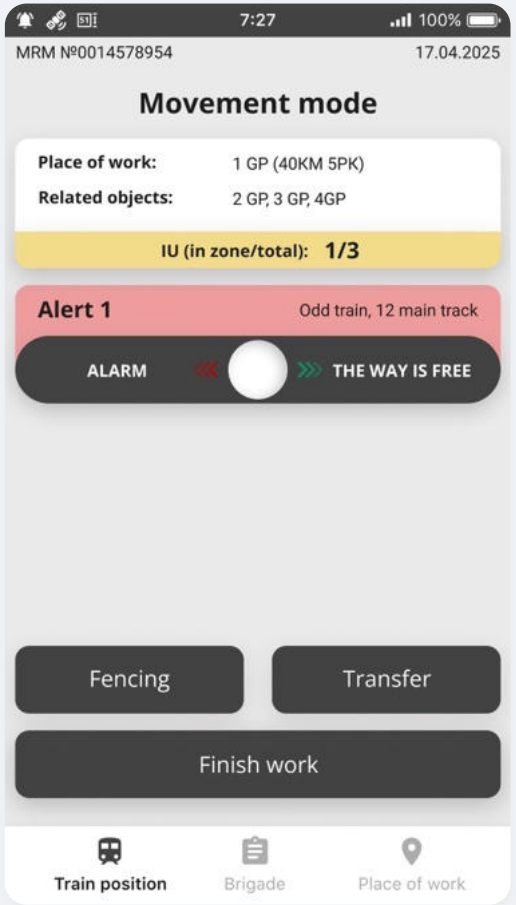
Functionality

- Playback of sound and vibration alarms
- Issuing alarm or track occupancy signals to the locomotive device

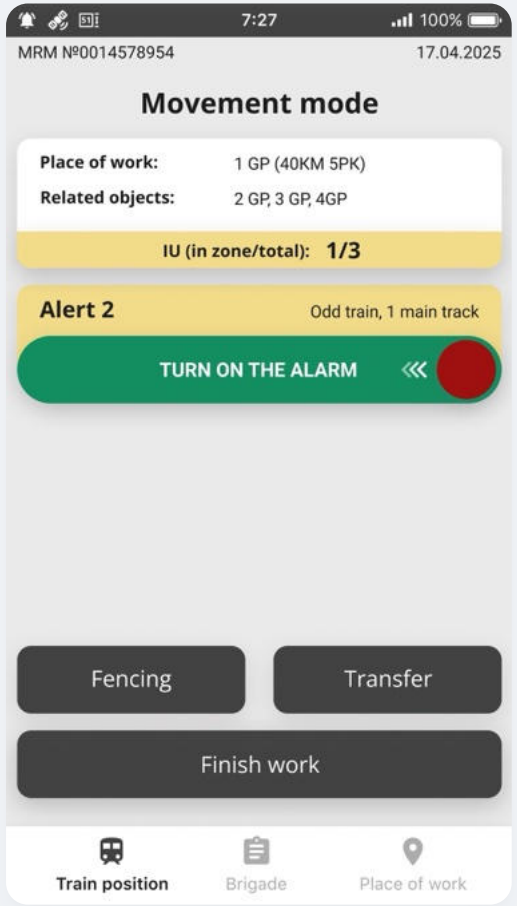
No trains present
Work is allowed



Train approaching
Move to a safe zone



Train approaching
Workers are safe
Track access is prohibited



ANCORS (SPAD) AND SMART WATCHES (CWISS)

SPAD functions

- Playback of light and sound alarms (collective notification)
- Displaying Information about the approaching train
- Issuing alarm or track occupancy signals to approaching trains
- Establishing a safety zone and monitoring workers' location

CWISS functions

- Sound signal
- Light signal
- Vibration signal

DESKTOP APP FUNCTIONS

Tracking of devices

Real-time monitoring of maintenance crew operations

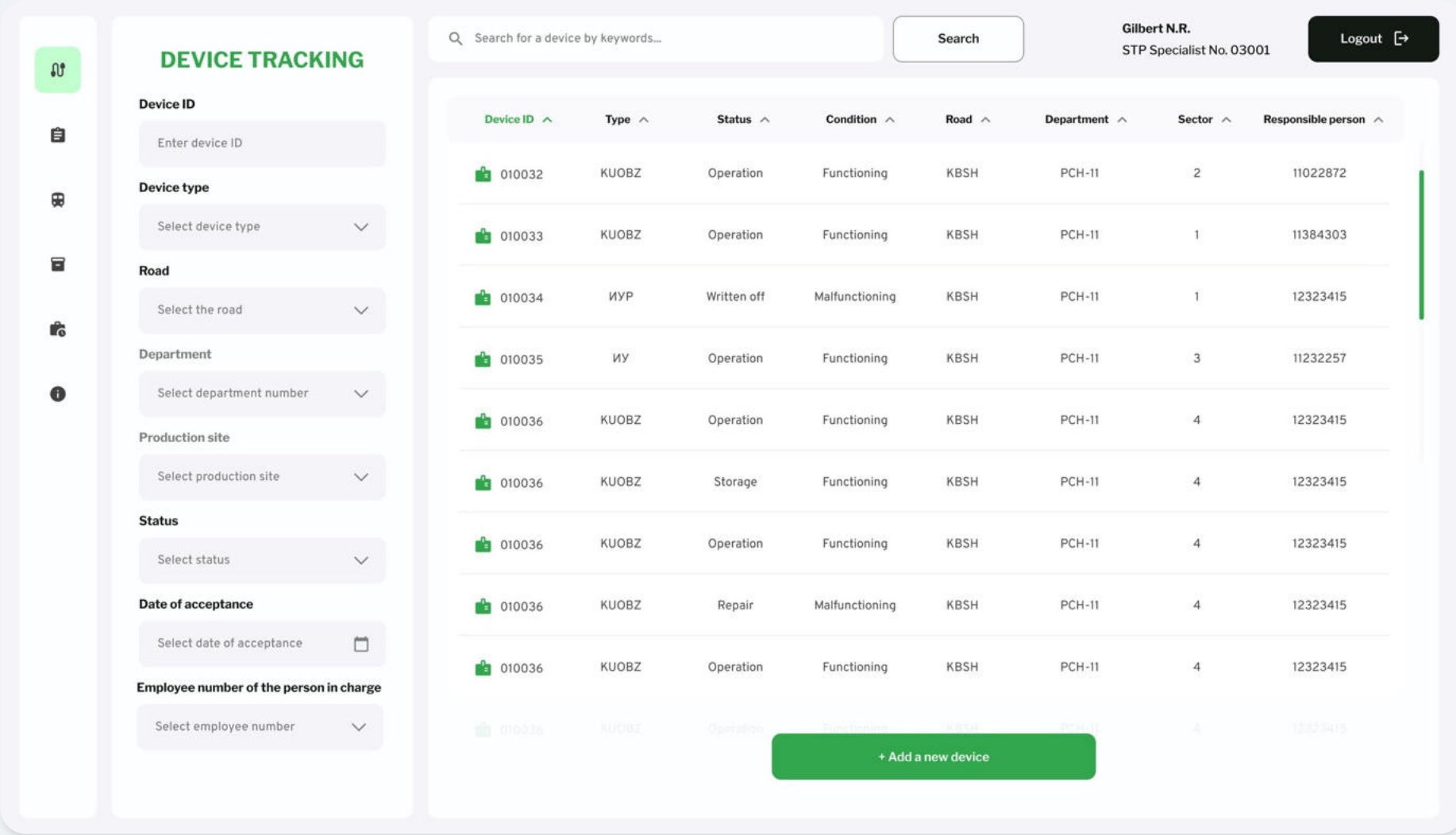
Real-time tracking of locomotive devices

Formation of reporting documentation

DESKTOP APP FUNCTIONS

Device tracking

- Tracking of devices throughout their lifecycle (operation, maintenance, storage, decommissioning)
- Storage of accompanying documents (handover certificates, defect reports)

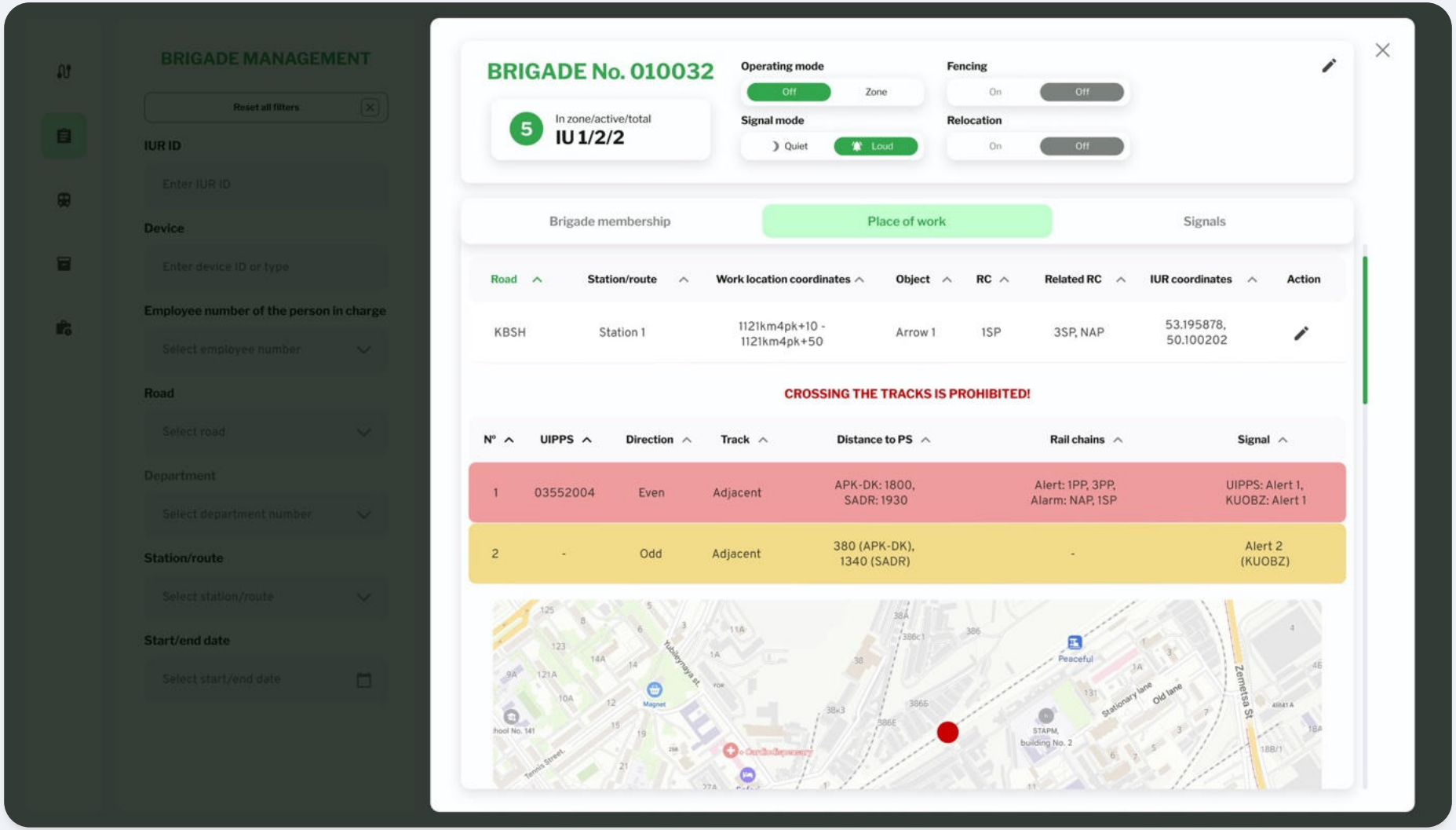


DESKTOP APP FUNCTIONS

Monitoring the operations of maintenance crews

The system allows real-time monitoring of the following parameters:

- Approach of rolling stock and its direction
- Distance to the rolling stock
- Signaling on devices
- Actions of supervisor and crew members (button presses or workers movement to the safe zone)

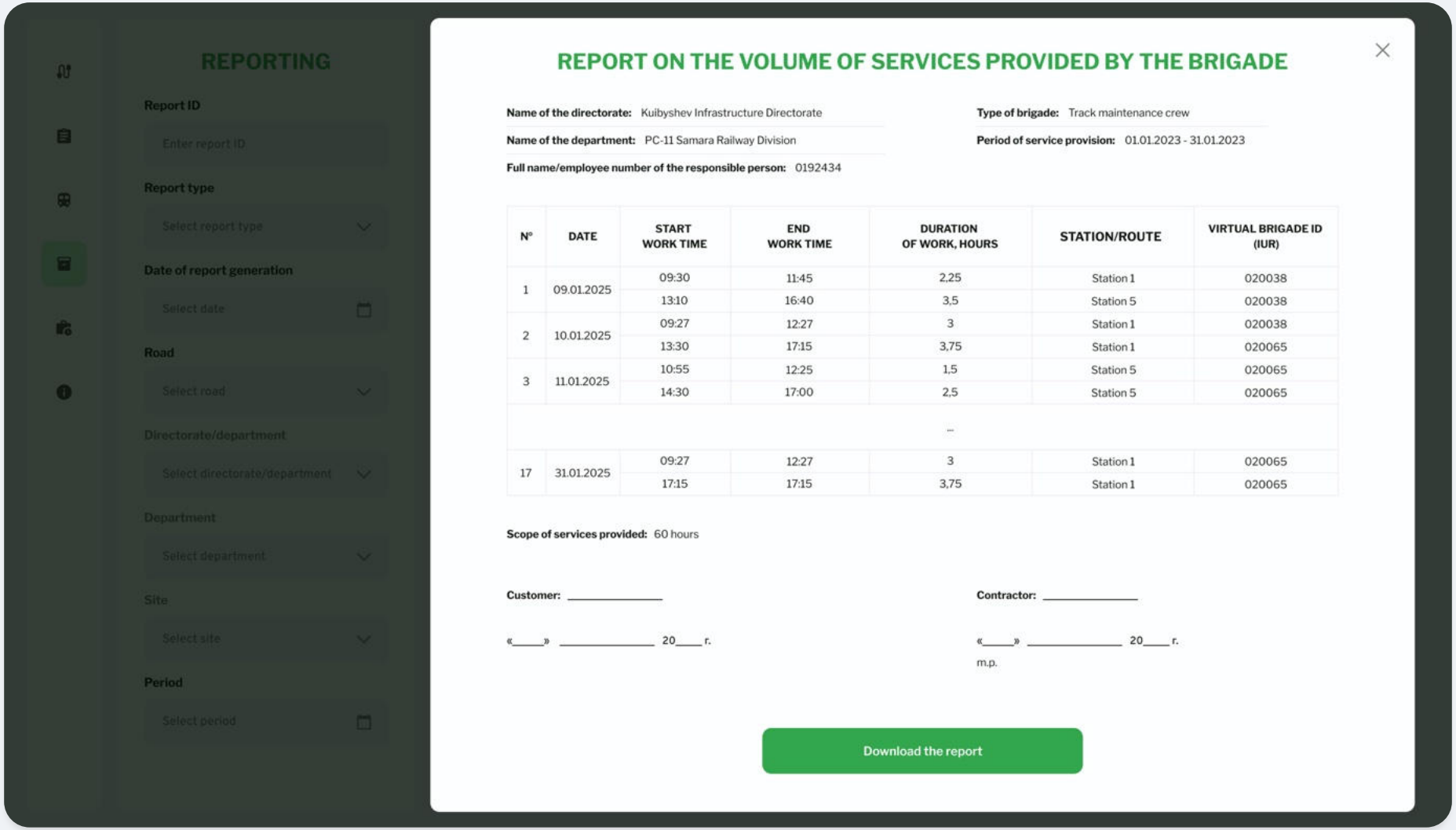


DESKTOP APP FUNCTIONS

Formation of reporting documentation

The system enables automated generation of reporting documentation, which serves as the basis for mutual settlements for the services provided

Log files for the operations of each crew are also available for export



N°	DATE	START WORK TIME	END WORK TIME	DURATION OF WORK, HOURS	STATION/ROUTE	VIRTUAL BRIGADE ID (IUR)
1	09.01.2025	09:30	11:45	2,25	Station 1	020038
		13:10	16:40	3,5	Station 5	020038
2	10.01.2025	09:27	12:27	3	Station 1	020038
		13:30	17:15	3,75	Station 1	020065
3	11.01.2025	10:55	12:25	1,5	Station 5	020065
		14:30	17:00	2,5	Station 5	020065
				...		
17	31.01.2025	09:27	12:27	3	Station 1	020065
		17:15	17:15	3,75	Station 1	020065

SPAS EXTENDED FEATURES

SPAS can be integrated with the enterprise systems such as ERP, WFM, etc.

This solution will enable objective monitoring of work execution through SPAS devices in the following areas:

Compliance of the crew size with the planned work

Adherence to safety regulations

Monitoring compliance of the worksite location

Tracking work time

CTRL+ IS A RELIABLE PARTNER ON THE WAY TO MODERN AND SAFE OPERATIONS OF RAIL TRANSPORT

1435 SYSTEMS DMCC

Operations Office — Binary Tower, Dubai, UAE

CTRL N DOO

R&D Lab — Pivljanina Baja 19, Belgrade, Serbia

Phone: +381 64 641 64 39

E-mail: admin@ctrln.tech

LinkedIn: ctrlnbeograd

Website: ctrln.tech