

Open Source Railway (OSR) initiative project:

(TTI) Sector Plenary Meeting



"Before we begin... a small disclaimer!"

Who I Am

Dib Mehdi



Current Role

Deputy CEO & CTO at EPE
Rail Electr SPA

My Experience

- 10+ years of mixed experience in Maintaining signaling, electric traction, SCADA.
- Hands-on involvement in both modern rail systems and legacy infrastructure.
- Focus on retrofitting, adapting, and improving older equipment.
- Worked on IoT-based monitoring and network upgrades in mixed environments.



RAIL ELECTR



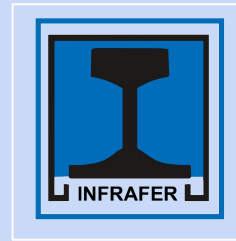
**Electrification and
energy solutions
for rail networks.**

INFRARAIL



**Civil works,
prefabricated
concrete, and railway
construction.**

INFRAFER



**National leader in
railway
infrastructure &
aggregates
production.**

SETI RAIL



**Engineering &
technical studies
for rail projects.**

Major Challenge : Reactive Maintenance

- No predictive maintenance system in place
- Failures are often detected after they occur
- Maintenance is driven by breakdowns, not data
- Increases downtime, cost, and risk



Major Challenge Example : Electrification Maintenance: Plan Smart, Act Fast

Limited track possession time → Precision is everything

- Predictive maintenance over reactive
- Every minute counts during operations
- Full documentation before & after work



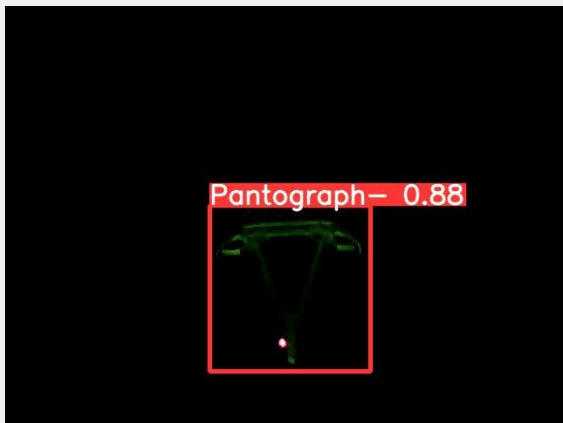
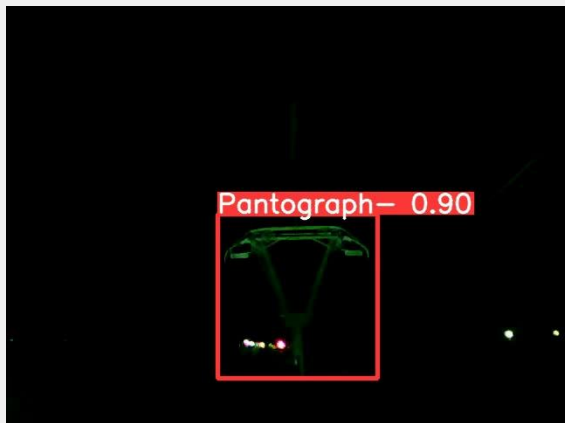
Smart OHL Inspection (In-House Built)

- Internal tool for preventive catenary (OHL) inspection
- Uses open-source tech for data capture & analysis
- Detects stagger anomalies, arcing patterns, and track-related issues
- Supports shift from reactive to predictive maintenance

Pantograph Detection with OpenCV + YOLO

- YOLOv5 trained to detect pantograph head in real-time video
- OpenCV used to process frames and extract coordinates
- Fast, lightweight deployment on embedded or mobile platforms



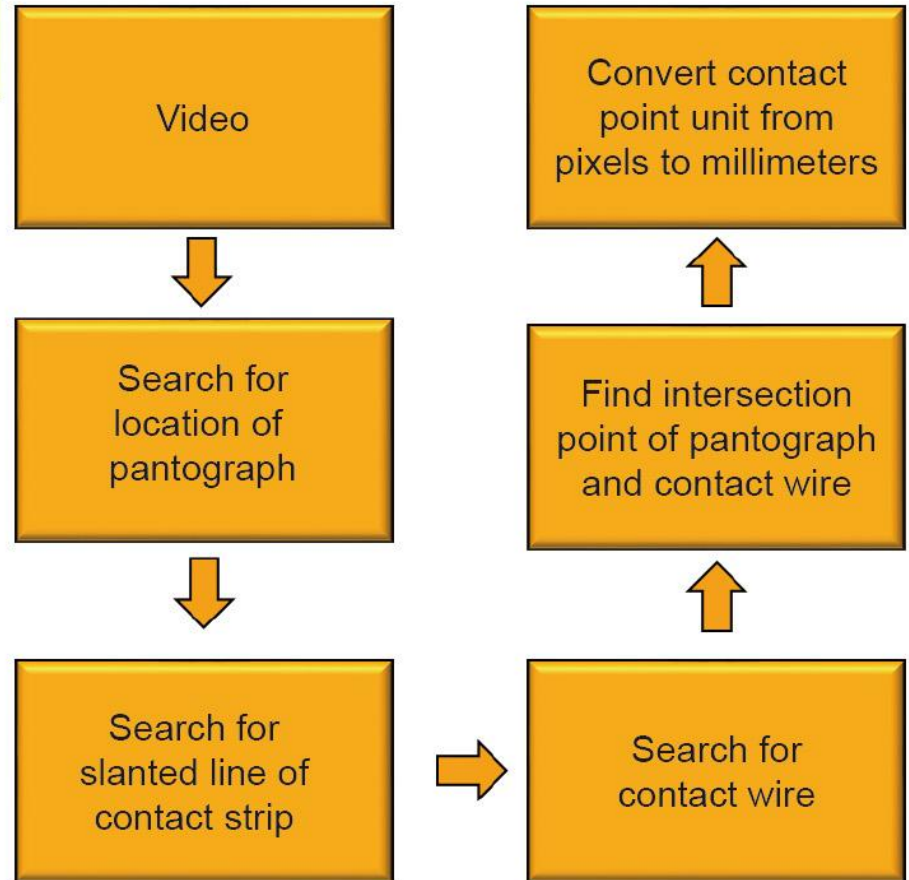
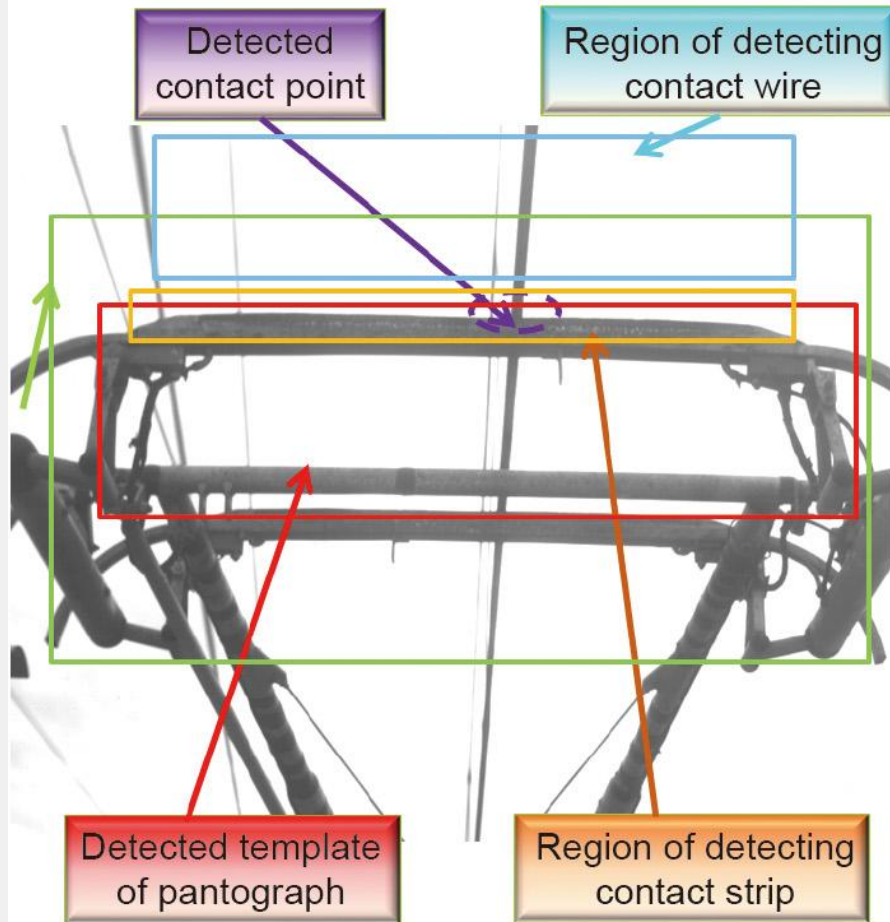




Virtual Line for Stagger Monitoring

- Virtual reference line created in camera view
- Calculates lateral deviation of contact wire (stagger)
- Logs contact point between pantograph & wire
- Graph built over time to visualize stagger drift

Algorithm of dynamic stagger measurement

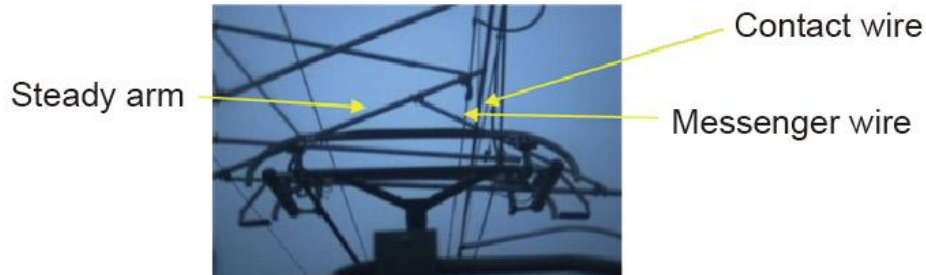


Environment
recognition

Pantograph/contact
wire detection

Data association

Dynamic stagger
calculation



Hard to distinguish contact wires from similar features



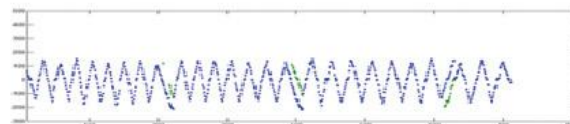
More than one contact wire may exist



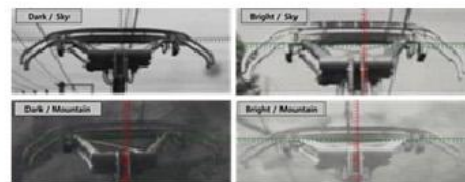
Cloudy weather
situation

Sunny weather
situation

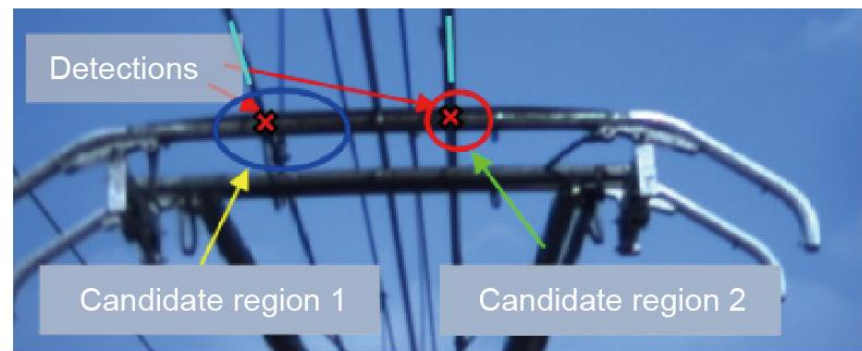
Rapidly changing background and light



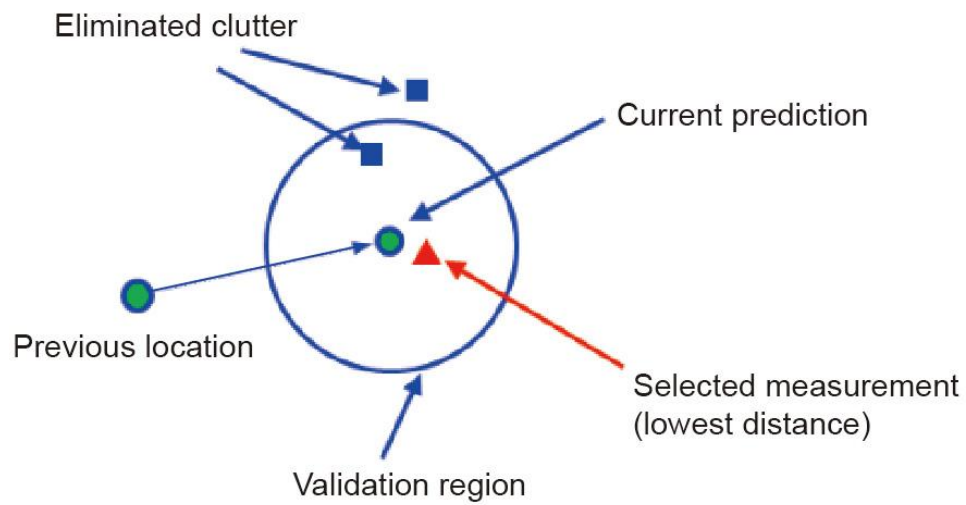
Rapidly moving contact position in high-speeds



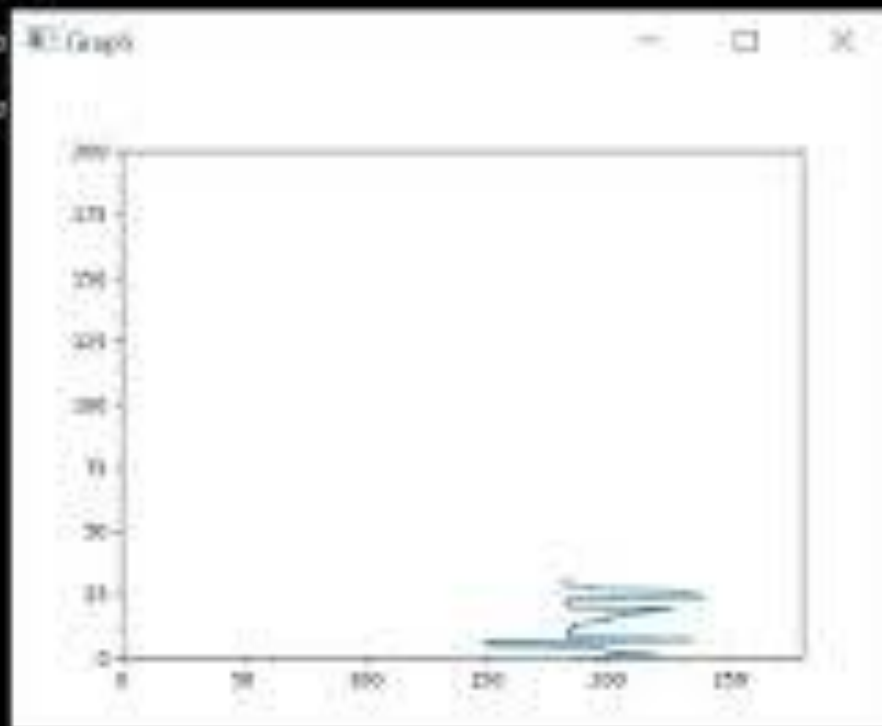
Differing conditions of environment



(a)

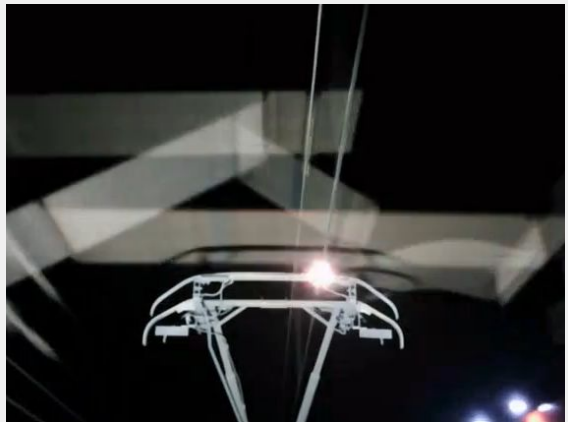
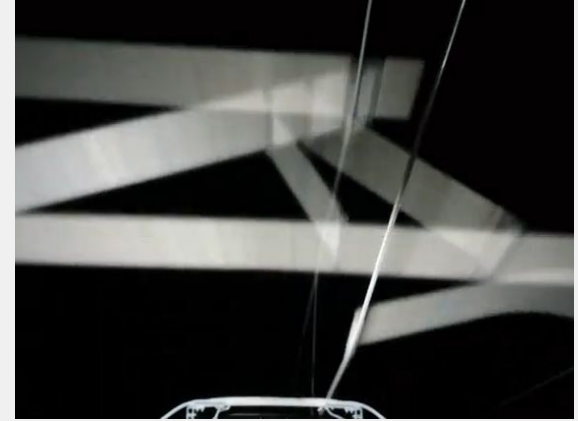
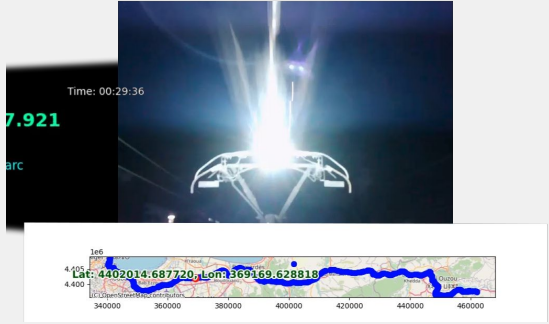


(b)



Detecting Arcs + Localization with PK

- Arcing events trained separately using light intensity patterns
- Location synced using GPS + PK data
- Logs exact kilometer & timestamp of each event



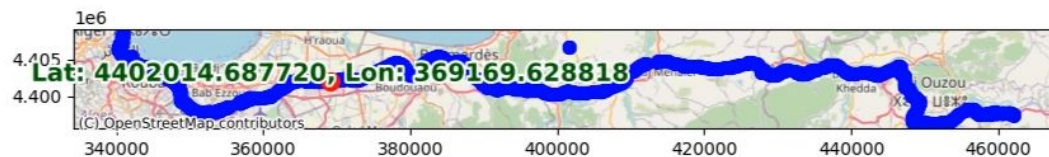
Sensor Data Fusion for Track Health

- Data from onboard vibration, tilt, and current sensors
- Correlated with video to analyze root causes
- Helps detect track misalignment, uplift, or tension issues

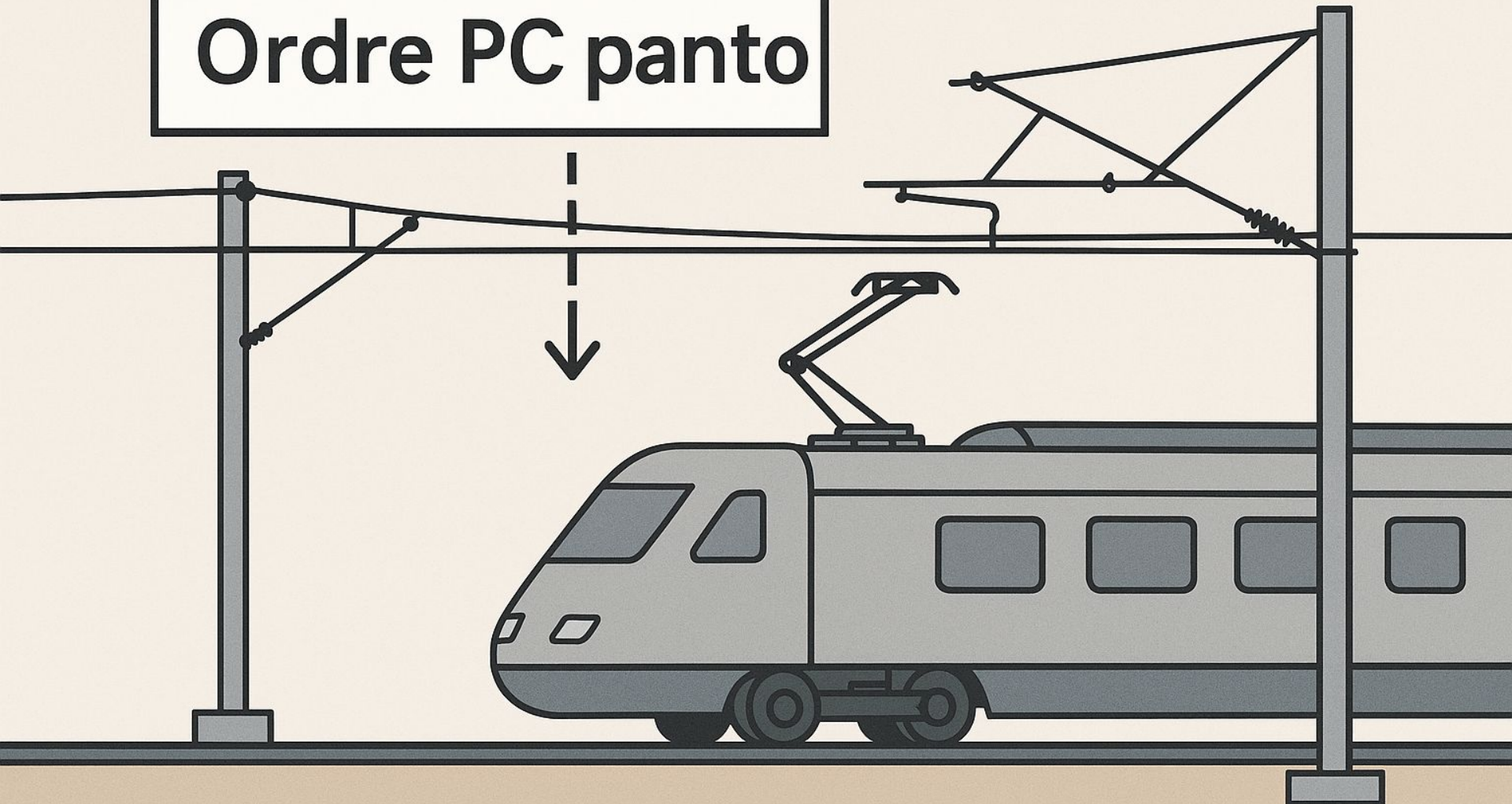
PK 27.921

arc

Time: 00:29:36



Ordre PC panto







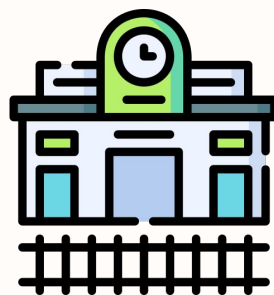
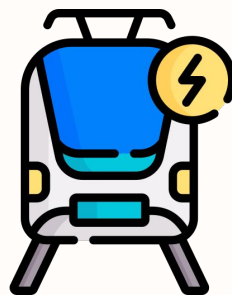
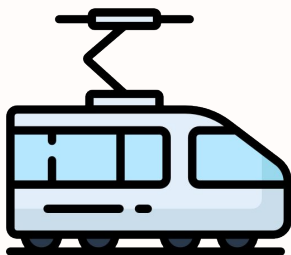
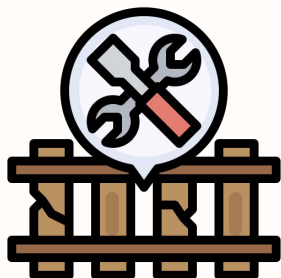
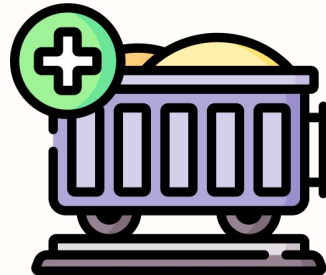
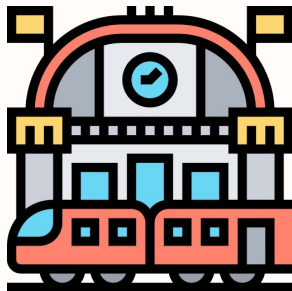
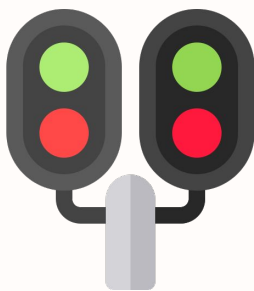
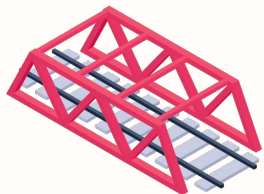
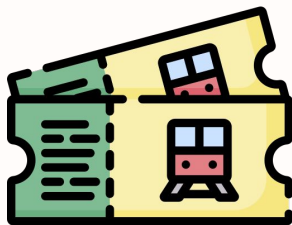
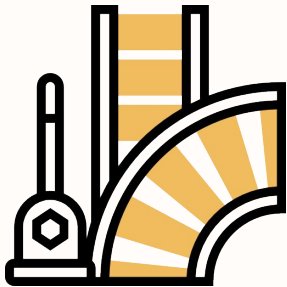
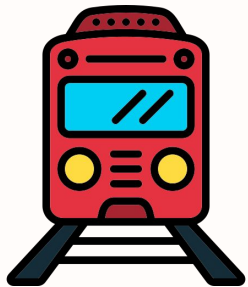
**Open
Source
Railway**

What is it?

A small community initiative focused on sharing tools, ideas, and open solutions to support railway work in Africa.

Our goals:

-  Document and share repair guides, diagnostic tools, and open hardware
-  Build simple, open-source software for monitoring, ticketing, and maintenance
-  Support local teams dealing with outdated or unsupported equipment
-  Encourage learning, reuse, and low-cost innovation
-  Provide a space to test, validate, and improve free open-source hardware and software solutions



OUR MISSION:

Empowering Railways, Empowering Communities

Democratize access to railway technology by providing open-source tools, technical protocols, and educational resources—empowering engineers, operators, and local communities to enhance railway infrastructure, safety, and mobility outcomes, especially in resource-limited regions.

[Get Involved](#)[▶ Watch Video](#)

Signaling
& SCADA



Smart
Stations



OLE



Maintenance



Level
Crossing



Switches



Rail Tracks



Infrastructure

osrail.eco



Thank you!