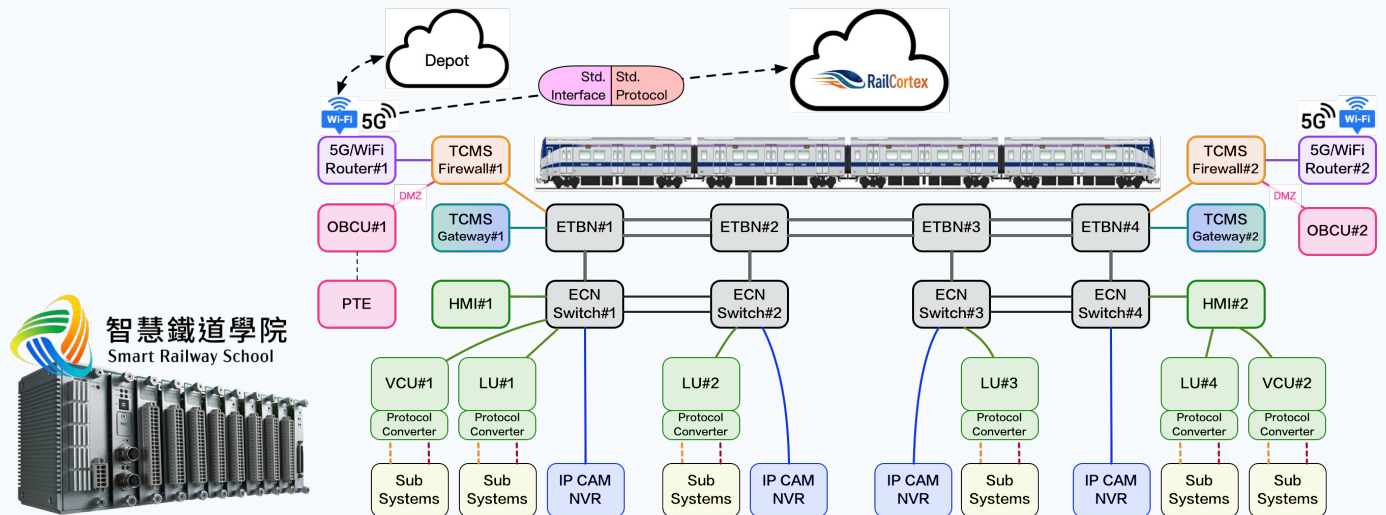


From Onboard Data to Intelligent Rail Operations.

RailCortex is a Train Control and Monitoring System (TCMS) developed independently in Taiwan. It serves as the central control platform of the train, combining real-time monitoring, vehicle control, fault diagnosis, and maintenance support in one system. The program is led by National Taipei University of Technology, together with MiTAC and InSynerger.



Independently Developed and Fully Under Local Control.

Hardware from domestic suppliers in Taiwan; software developed and maintained by our local team. Source code, data formats, and development schedule are managed by the team, with independent review and certification by TÜV Rheinland.

SYSTEM FUNCTIONS · A COMPLETE TCMS

Real-Time Monitoring

All subsystems are monitored — doors, HVAC, brakes, traction, and signaling — with instant alerts for abnormal conditions.

Vehicle Control

Lighting and HVAC are controlled centrally, and the driver interface follows human-factors design.

Fault Diagnostics & Recording

Faults are categorized, recorded, and traced automatically, with handling guidance for drivers and maintenance staff.

Maintenance & Test Support

A complete toolkit provides record downloads, self-checks, subsystem tests and parameter settings for daily maintenance.

PROJECT TEAM · PARTNERS & FUNCTIONS

LEAD · R&D

TAIPEI 國立臺北科技大學
TECH National Taipei University of Technology

GENERAL CONSULTANT

財團法人中華顧問工程司
China Engineering Consultants, Inc.

SYSTEM INTEGRATION

MiTAC

NETWORK SOLUTION

MOXA

ONBOARD EQUIPMENT

InSynerger

CYBERSECURITY

BCCS

OPERATOR PARTNER

metro
Taoyuan

INDEPENDENT REVIEWER

TÜVRheinland®



Native IEC 61375 Stack

RailCortex adopts IEC 61375, the common language of next-generation train communication, natively, including the backbone, the consist network, and application messaging.



Works with Any Fleet

RailCortex is easy to use for any fleet—subway, mainline, or light rail. Subsystems that do not comply with standard interfaces can be integrated via protocol converters.



Self-Configuring Consists

When the consist is reconfigured, settings for every car synchronize automatically — from network to subsystems setup, everything is handled without manual intervention.



Standard & Transparent

Full train communication adopts TRDP + CBOR: TRDP standardized transport framework; CBOR makes each payload transparent and easily readable by programming.



Secure by Design

Hardware and system design follow the IEC 62443 cybersecurity framework to ensure operational resilience and protect critical rail infrastructure from cyber risks.



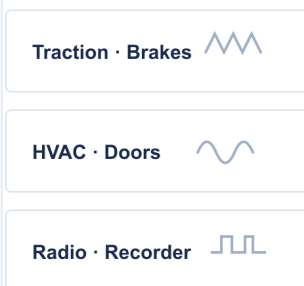
Open Data Foundation

Unlocking data silos to accelerate AI innovation: Convert raw data into shared data, rapidly scaling various AI applications in smart railways.

One Open Backbone. Infinite Consist Flexibility

Native subsystem protocols become the train-wide standard — via protocol converters

Legacy subsystems (native protocols)



each speaks its own dialect

Protocol Converter

decodes native protocols →
re-packs to the open standard
zero modification to subsystems

one common language

Open standard (IEC 61375 · train-wide)

TRDP — Transport Protocol

Cyclic Process Data + event-driven Message Data, real-time exchange across the whole train

CBOR — Data Format

Open encoding with a published data dictionary — readable and verifiable by anyone

read directly by onboard nodes · driver HMI · railway cloud

Protocol Converters — a Gateway to the Standard

Protocol converters translate native interfaces into IEC 61375 standards with zero subsystems changes. Seamlessly joining ETBN/ECN networks, this phased and reversible migration keeps operator risk strictly under control.

The virtual train runs first.

The real train arrives **proven**.

Operating off-train, RailCortex faithfully reproduces TCMS behavior using virtual communication, virtual I/O, and signal simulation. Connected via a standardized virtual–physical interface, the digital twin and real train run on one shared codebase and data model.

Three Common Development Bottlenecks, Solved at Once.

Scarce Vehicle Availability

Physical train testing is costly and constrained by limited depot access and tight operational schedules.

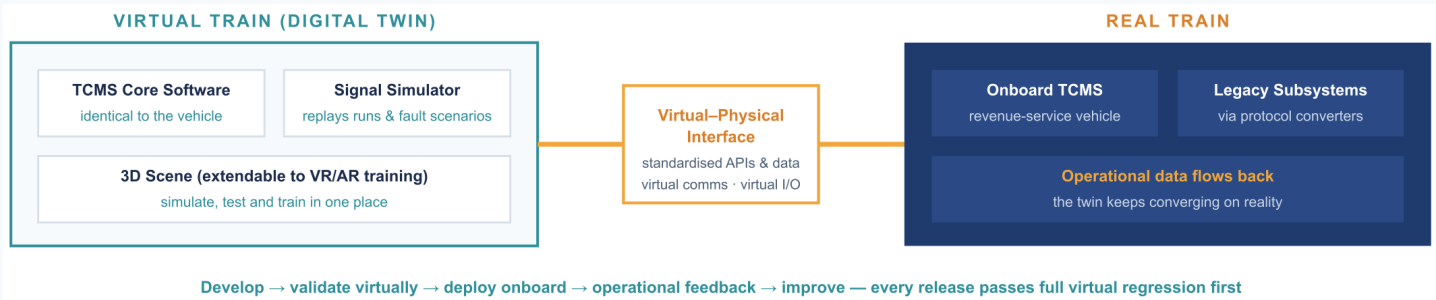
Late-Stage Issue Discovery

Integration defects often surface only on actual vehicles—where debugging and rework costs peak.

Unrealistic Simulator Responses

Most simulators cannot accurately mirror real TCMS responses or fault states, hindering realistic driver training and anomaly investigation.

VIRTUAL ⇄ REAL · One System, Seamlessly Bridging Both Worlds



01 · Unified Codebase

One codebase powers both the virtual simulation and onboard production, guaranteeing consistent, proven system behavior.

02 · Early Issue Detection

Replay fault scenarios at will in the virtual twin, catching and resolving critical issues before physical deployment.

03 · Automated Testing

Built-in test scripts and automated validation ensure every software release passes full train-level regression with verified data.

04 · Safe, Immersive Training

Train drivers and technicians on an authentic digital twin using 3D and VR/AR—without occupying active rolling stock.

More than a TCMS — an Intelligent Data Analytics Platform.

Most monitoring platforms treat data merely as operational logs. RailCortex is designed for AI from the ground up: every signal transition delivers structured, labeled, and train-wide consistent facts. Because AI is built directly into the core rather than added on, live data is instantly interpreted, correlated, and converted into actionable answers for maintenance crews.

STEP 1 Data Ingestion

Raw signals, fault logs, and operational telemetry land on a unified open-data foundation.

STEP 2 Knowledge Base

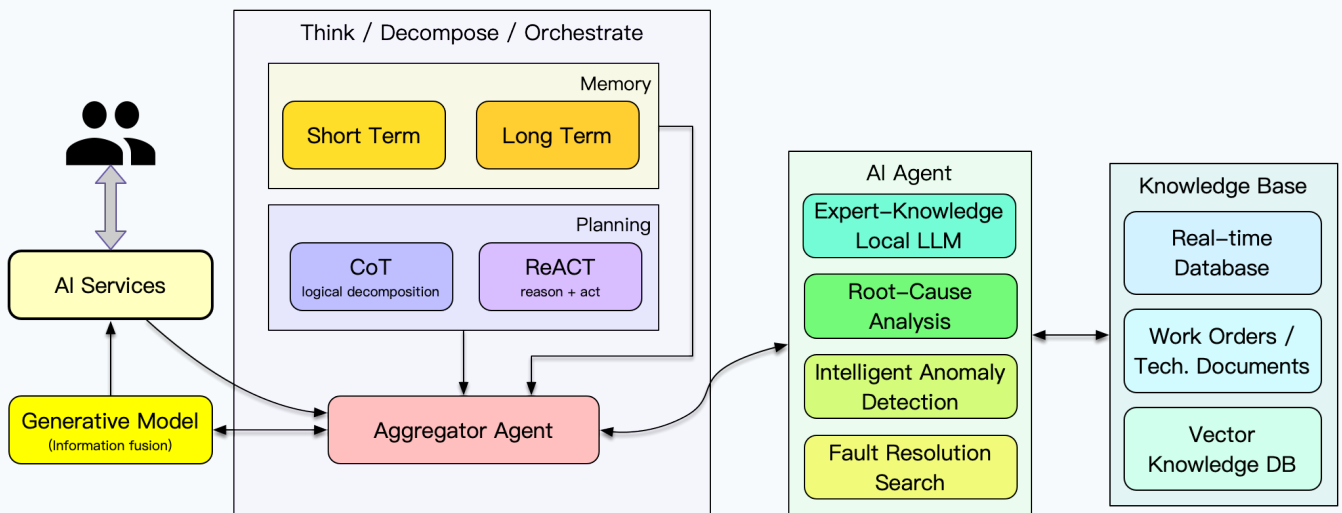
Manuals, technical documentation, and historical case records form a structured expert knowledge base.

STEP 3 AI Reasoning

Advanced models correlate real-time telemetry with domain knowledge to pinpoint anomalies, root causes, and fixes.

STEP 4 Actionable Output

Diagnostic insights translate directly into executable maintenance steps, backed by verifiable supporting evidence.



AI 01 · Expert Knowledge Base

Digitizes manuals, historical fault logs, and veteran know-how into a conversational knowledge base—delivering plain-language answers backed by traceable sources so critical expertise never leaves with turnover.



AI 02 · Root-Cause Analysis

Traces complex failure chains across subsystems (e.g., door anomalies rooted in power or comms) by fusing TCMS, signaling, and E&M telemetry into a verifiable evidence path.



AI 03 · Anomaly Detection

Learns normal operating signatures to detect deviations early across onboard TCMS and trackside assets (like point machines)—shifting operations from fix-on-failure to act-before-failure.



AI 04 · Fault Resolution Search

Instantly matches active fault codes against the knowledge base and historical precedents, providing step-by-step troubleshooting, safety precautions, and supporting evidence from minute one.