

TRACKSAFECORE™

Enterprise Telematics, Fleet SaaS & Keyless-Go Defense

Master System & Architecture Specification for logbook.tracksafecore.de

■ Tax-Compliant Digital Logbook Tamper-proof trip logging, 1-click categorization & cryptographically verified audit reports (GoBD).	■ SECOTM Anti-Theft Defense Keyless-Go Relay Attack protection via BLE EYE Beacon, failsafe NC relay & ISO 26262 anti-stall safety (< 5 km/h).
■ OBD-II & EV Telematics Real-time DTC trouble code decoder with diagnostic clarity, 1-click clearing & EV battery metrics (SoC %).	■ Eco-Score & Fraud Defense Driver behavior scoring, automated fuel theft detection & receipt matching against live gas station price APIs.
■ Multi-Tenant Fleet Portal Granular RBAC roles, service/TÜV countdowns, 1GLOBAL IoT SIM monitoring & AI-powered Helpdesk ticketing.	■ Cross-Platform & Smart Home Native Flutter Driver App (iOS/Android/Web) & Home Assistant bidirectional MQTT auto-discovery integration.

Platform URL / Live Portal:	https://logbook.tracksafecore.de (Web Portal & Driver App)
Technology Stack:	Python 3.11+, FastAPI (Async), SQLAlchemy ORM, PostgreSQL (Cloud SQL), Flutter SDK, ReportLab
Telematics Protocols:	Teltonika Codec 8 / Codec 8 Extended (TCP/UDP), Teltonika Codec 12 GPRS/SMS, MQTT, WebSockets
Supported Hardware:	Teltonika FMC003, FMP100, FMC880, FMC130, FMC125, FMC150, ECAN02, CAN-CONTROL, EYE Beacon
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1. Platform Overview & Executive Summary

TrackSafeCore™ is a cutting-edge, modular telematics SaaS ecosystem engineered for enterprise fleet management, tax-compliant digital logbook automation, vehicle anti-theft defense, and granular diagnostic telemetry. It elevates telematics from passive GPS tracking into an intelligent, active vehicle management platform.

■ ■ EXECUTIVE SUMMARY

THE 6 CORE MODULES OF TRACKSAFECORE:

1. **Digital Tax Logbook:** Automated trip detection with 1-click categorization and tamper-proof tax reports.
2. **SECO™ Keyless-Go Defense:** Proximity-validated engine immobilizer preventing wireless relay attacks.
3. **OBD-II & Diagnostics:** Real-time DTC fault scanner with causes, symptoms, 1-click reset, and EV battery monitoring.
4. **Eco-Scoring & Fraud Detection:** AI-driven driver behavior insights, fuel theft alarms, and automated receipt validation.
5. **Fleet & Tenant Administration:** Multi-tenant isolation, role-based access, maintenance count-downs, and IoT SIM tracking.
6. **Smart Ecosystem:** Native Flutter Driver App, Home Assistant MQTT 2-way sync, and AI Helpdesk ticketing.

Target Audiences & Market Segments

Target Segment	Primary Value Proposition & Platform Features
Corporate Fleets & SMEs	Tax-compliant trip tracking, automated maintenance scheduling, driver dispatching, and cost reduction.
Field Service & Craftsmen	Proof of service times at client sites, automated customer geofencing, and pool vehicle sharing.
Leasing & Rental Fleets	100% factory warranty preservation via contactless ECAN02 inductive reading, verified odometer auditing.
Carsharing & Mobility	Remote door lock/unlock via CAN-CONTROL, comfort window closure, automated check-in / check-out.
Private Owners & Premium SUVs	Protection against Keyless-Go wireless repeater theft (SECO™), movement alerts, and 1-click remote kill.

2. System Architecture & Cloud Infrastructure

TrackSafeCore is architected for continuous high availability, minimal latency, and strict audit compliance. Backend services operate containerized on robust cloud infrastructure (Google Cloud Compute Engine / IONOS), leveraging async I/O pipelines capable of ingesting high-frequency telematics streams concurrently.

Layer / Service	Technology / Protocol	Role & Core Responsibility
Telematics Gateway	Async Python / TCP Sockets Ports 5000 & 5027	Ingestion and CRC verification of binary Teltonika Codec 8 & Codec 8 Extended AVL packets.
Command Dispatcher	Teltonika Codec 12 GPRS / SMS	Bidirectional remote device execution (SECO arming, engine kill, terminal reboot, parameter updates).
REST API Backend	FastAPI (Python 3.11+) Uvicorn ASGI Engine	RESTful endpoints for Web Portal & Flutter App, JWT token authentication, and business validation chains.
Real-Time Streaming	WebSockets & MQTT (Eclipse Mosquitto)	Sub-second live map positioning, instant push notifications, and Smart Home state synchronizations.
Database Cluster	PostgreSQL 15+ (GCP Cloud SQL / asyncpg)	Multi-tenant schema segregation, tamper-evident audit tables, geospatial indexes, and time-series telemetry.
Geofencing Engine	Haversine / Polygon Math + Google Places API	Automated matching of 5,400+ gas stations, customer headquarters, and custom geofence boundaries.

✓ AUTOMATED GEOFENCE MATCHING

AUTOMATED GEOFENCING & POINT-OF-INTEREST RECOGNITION:

Every trip start and stop is automatically verified against saved geofences and customer POIs. With over **5,400 nationwide gas stations** pre-mapped, refueling stops are detected instantly and paired with fuel receipts.

3. Tax-Compliant Digital Logbook (GoBD)

The digital logbook engine in TrackSafeCore adheres to the strictest tax authority guidelines (e.g. German GoBD standards). It provides companies with an audit-proof, verifiable foundation to replace flat-rate vehicle taxation.

Compliance Pillar	Technical Execution in TrackSafeCore
Immutability & Audit Trails	Trips are locked with immutable UTC raw telemetry stamps. Edits to journey purposes are recorded with user ID, timestamp, and audit diffs.
Seamless Trip Ingestion	Trips trigger strictly on physical ignition (Term. 15) or OBD signals. Gaps or trip deletions are blocked by database constraints.
1-Click Categorization	Drivers assign trips as Business , Private , or Commute in the mobile app. Private destination addresses are masked for privacy compliance.
Cryptographic PDF Export	Monthly and yearly PDF exports include SHA-256 integrity hashes proving the document was not altered after period closure.
Odometer Synchronization	CAN/OBD vehicles read dashboard odometer directly from ECU; GPS-only vehicles use high-precision Haversine summation.

✓ PROVEN TAX SAVINGS

TAX BENEFIT & SAVINGS:

Compared to flat-rate 1% company car taxation, an automated digital logbook saves businesses **2,500 € to 5,000 € per vehicle annually** in taxes, supported by legally robust audit exports.

4. SECO™ Keyless-Go Anti-Theft & Immobilizer

SECO™ (Secure Engine Cut-Off) is an innovative security framework developed to defeat modern **Keyless-Go wireless relay attacks**. It pairs Teltonika telematics (FMC130/FMC125) with Bluetooth EYE Beacons and a failsafe automotive NC relay circuit.

■ ■ SECO™ KEYLESS-GO DEFENSE

OPERATIONAL PRINCIPLE OF SECO™ DEFENSE:

1. **Ignition & BLE Scan:** On ignition ON, tracker immediately scans for the driver's Teltonika EYE Beacon.
2. **Cabin RSSI Validation (> -75 dBm):** If signal confirms the key is on board, the NC relay remains at rest.
3. **Automatic Interception:** If the beacon is missing (key relayed from inside house), DOUT1 triggers after 5s.
4. **Anti-Stall Speed Watchdog (< 5 km/h):** If a remote kill command is sent while moving, tracker waits autonomously until vehicle safely halts (ISO 26262).

Comparison: Contactless ECAN02 vs. Direct CAN-CONTROL Tap

TrackSafeCore accommodates two connection methods depending on warranty preservation needs versus carsharing control:

Criteria	Standard: Contactless ECAN02	Extended: Direct CAN-CONTROL Tap
Wire Manipulation	Zero wire stripping (pure inductive clamp).	Stripping & galvanic connection to CAN wires.
Factory Warranty	100% warranty preservation (ideal for lease cars).	Professional workshop installation required.
SECO™ Anti-Theft	100% active via independent DOUT1 relay.	100% active via independent DOUT1 relay.
Active Controls	Listen-Only (no bus write capability).	Carsharing Lock/Unlock, comfort window/mirror closure, indicators, trunk, factory alarm.
Telemetry Scope	Ignition Term. 15, Engine RPM, Vehicle Speed.	Fuel Level (%/L), Doors (FL/FR/RL/RR/Trunk/Hood), EV Battery SoC %, VIN, Oil status, Lights.

5. OBD-II Diagnostics, EV Telematics & Fraud Defense

TrackSafeCore's telemetry engine decodes standard OBD-II (FMC003) and CAN data in real time, converting cryptic diagnostic trouble codes into actionable workshop insights.

Diagnostic Feature	Specification & Value in TrackSafeCore
DTC Trouble Code Analysis	Reads SAE/OEM fault codes (e.g. P0300). Translates automatically into clear diagnostic explanations (causes, symptoms, severity) + 1-click DTC clearing via portal.
Torque Pro & HUD Dashboard	Live streaming of advanced engine parameters (boost pressure, coolant/oil temp, throttle position, lambda) rendered in a high-tech HUD cockpit interface.
Fuel Theft Detection	If fuel level drops by more than 5.0 liters while parked with ignition OFF, an instant 'fuel_theft' alarm triggers push/email notifications to fleet managers.
Fuel Fraud Verification	When drivers upload fuel receipts, the system cross-references entered liters against real OBD tank sensor delta and live local fuel station prices. Discrepancies > 3L / 10% trigger alarms.
Electric Vehicle (EV) Telematics	Monitors High-Voltage Battery State of Charge (SoC %), Battery Health (SoH), charging cable lock state, AC/DC charging rate, and remaining electric range in km.

6. Eco-Drive Scoring & Maintenance Management

TrackSafeCore incentivizes defensive, fuel-efficient driving with automated **Driver Behavior Scoring** and prevents expensive downtime through proactive maintenance alerts.

Eco-Drive Index (0 - 100 Pts): Evaluates harsh acceleration, heavy braking, cornering forces, and speeding. Reduces fleet fuel consumption by up to 15%.	Maintenance & Inspection Countdowns: Automated countdowns tracking remaining days and km until next service, official technical inspection, or tire rotation.
Pool Vehicle Check-In / Check-Out: Drivers claim shared pool vehicles with 1 tap; all subsequent trips are assigned directly to their driver profile.	Speeding Infraction Audits: Detailed reporting for fleet managers with configurable tolerance thresholds (duration, margin over speed limit).

7. Multi-Tenancy, Security & AI Helpdesk

TrackSafeCore offers an enterprise-grade role-based access model with multi-tenant data partitioning, integrated cellular IoT management, and an AI-assisted helpdesk ticketing system.

Security / Governance Pillar	Architecture & Execution in TrackSafeCore
Multi-Tenant Segregation	Strict data partitioning across companies (<code>`tbl_firmen`</code> , <code>`tbl_benutzer`</code> , <code>`tbl_kfz`</code> , <code>`tbl_tracker`</code>). Clients access strictly their assigned fleet assets and records.
Role-Based Access Control	4 permission tiers: Superadmin (platform operations), Company Admin (organization settings), Fleet Manager (dispatch & audits), and Driver (logbook & SECO).
1GLOBAL IoT SIM Management	Direct integration with 1GLOBAL cellular IoT platform monitoring data volume, transmission costs, SIM status, and international roaming connectivity.
AI-Powered Ticketing System	Integrated helpdesk utilizing AI summary generation (<code>`generate_ai_summary`</code>) and contextual response suggestions (<code>`generate_ai_reply_suggestion`</code>) for rapid support turnaround.
Smart Home Bidirectional Sync	Native Home Assistant MQTT Auto-Discovery integration. Syncs real-time GPS, ignition, battery telemetry, and allows arming SECO via home automations.

8. Cross-Platform Apps & Interfaces

■ Web Management Portal (/app & /admin): Full-featured desktop portal with live map tracking, geofence manager, GoBD report generator, and fleet administration.	■ Flutter Driver App (seco_driver_app): Native iOS/Android/Web app for drivers featuring 1-tap trip classification, SECO security cockpit, and vehicle health status.
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9. Supported Telematics Hardware Matrix

TrackSafeCore supports the complete lineup of industry-leading Teltonika telematics hardware:

Device Model	Installation Method	Key Features & Interfaces	Application in TrackSafeCore
FMC003	OBD-II Port (Plug & Play)	4G LTE Cat 1, real ECU odometer, DTC diagnostics, anti-tamper unplug alarm.	Standard passenger cars and light commercial vans with OBDII.
FMP100	12V Cigarette Lighter	Plug & Play, virtual ignition via voltage/movement, integrated USB charger.	Subcontractors, pool vehicles, instant inter-vehicle transfer.
FMC880	Battery Mounted (IP65 waterproof)	2-wire battery clamp, robust weatherproof casing for under-hood mounting.	Classic cars, heavy construction machinery, non-OBD vehicles.
FMC130	Hardwired (Term. 30/31/15)	3x DOUT , dedicated Input 5 & 6 for CAN adapters (CAN-CONTROL, ECAN02).	SECO™ Anti-Theft , fuel pump immobilizer relay & siren alarm.
FMC125	Hardwired (Term. 30/31/15)	Dual-SIM for border crossers, industrial ports 1x RS232 , 1x RS485 , 1x DOUT.	International fleets & industrial external sensor integration.
ECAN02	Inductive (Listen-Only)	Contactless clamp; zero wire stripping , 100% factory warranty safe.	SECO™ ignition & telemetry sensing for leased vehicles.
CAN-CONTROL	Direct CAN Connection	Bidirectional CAN actuation (Lock/Unlock, windows, flashers) + 300 data points.	Carsharing, rental fleets, and active telematics control.

■ ■ TELTONIKA WIKI DOCUMENTATION

OFFICIAL TELTONIKA WIKI DOCUMENTATION & PINOUT SPECIFICATIONS:

- Teltonika FMC130 CAN Adapters & Pinouts: https://wiki.teltonika-gps.com/view/FMC130_CAN_adapters
- Teltonika FMC125 CAN Adapters & RS232/RS485: https://wiki.teltonika-gps.com/view/FMC125_CAN_adapters
- Teltonika FOTA WEB Remote Configuration: https://wiki.teltonika-gps.com/view/FOTA_WEB