SUCCESS STORY

Pro²Future
Products and Production Systems of the Future

Programme: COMET – Competence Centres for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: CORVETTE
4 years, multi-firm

CORVETTE: COGNITIVE SENSING FRAMEWORK FOR VEHICLES

MONITORING SYSTEM FOR HIGHER SAFETY, EFFICIENCY, REAL-TIME TRAFFIC INSIGHTS AND SITUATIONAL ANALYTICS OF VEHICLE FLEETS

With the increasing number of cars on the road, **tracking the traffic** and **environmental conditions** is crucial to ensure **efficiency**, **safety**, and **quality**. To avoid manipulation, such monitoring systems must function independently of the vehicle's internal systems and monitor driving behaviour in real time. In such a way they provide **valuable data** to **enhance safety**, **efficiency**, and **overall performance**. By continuously monitoring a vehicle fleet's performance, these systems can **detect potential safety issues** and alert drivers to take corrective action. Another benefit is that engineers can externally monitor the vehicle's performance and compare it with data from internal systems to identify potential issues, enabling them to make necessary adjustments and improvements.

In the CORVETTE project, Pro²Future, AVL List GmbH and TU Graz collaborated to develop an **in-car monitoring system** with the goal of establishing an **infrastructure for cognitive vehicle fleet monitoring**, which consists of collecting, evaluating, interpreting, and utilizing vehicle data for data-driven services. This encompassed supporting development processes and offering in-vehicle services like giving immediate feedback on driving situations during test drives. Over the course of the project several scientific and industrial contributions were made:

- **Rapid prototyping** of onboard measurement for efficient data collection
- Design of **modular devices** for use-case-specific data capture and future expansions
- **Onboard data capturing**, interpretation, and preprocessing for **intelligent analysis**
- A **scalable backend** for training, interpretation, and service integration
- **Detection models** based on ML using multimodal data to detect anomalies and categorize different driving situations, that ensure adaptivity, robustness, and stability in different situations and environments

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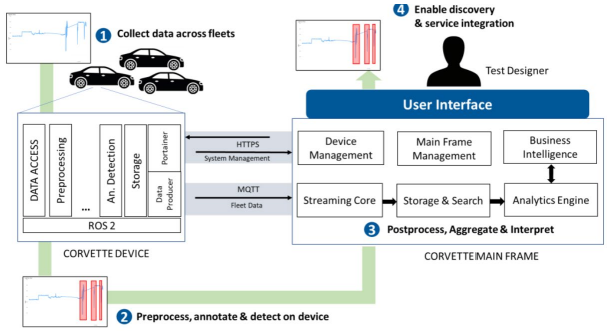
The system is designed to be **modular** and consists of three parts. The first part is the **CORVETTE monitoring device** installed in every vehicle, which includes sensors such as cameras, microphones, accelerometers, and temperature sensors. The device is equipped with a **NVIDIA Jetson** as a high-end processing unit with a powerful GPU, and an LTE/5G communication interface to the backend. It also detects real-time anomalies.



Real-Time Application Monitoring

The second part is the **CORVETTE cloud backend**, which enables MS Azure storage and data analysis, anomaly detection and re-training, data visualization for post-processing, and updates-over-the-air. The last part is the **REAL-TIME APPLICATION**, which includes machine learning models for environment detection such as weather and presence of tunnels. The system also has anomaly detection capabilities in the collected time series data (e.g., speed). The models are tested and evaluated in real use case scenarios.

Impact and Extended Effects

Providing relevant information to drivers can have a significant impact on driving behaviour and safety. For instance, it can help drivers make better decisions while driving since the developed services such as real-time anomaly detection, weather updates, and road condition reports will support drivers in **real-time decision making** and to **avoid** potential hazards on the road. On the other hand, an external monitoring system enables engineers to have a **second pair of eyes** on data, which can lead to **more reliable** testing processes. With a modular approach developed in the project, the devices can be integrated in multiple vehicles and create a cognitive fleet network monitoring that will in the end make traffic more observable and thus safer.

Pro2Future GmbH
Altenberger Straße 69
4040 Linz, Austria

T +43 (0) 732 2468 – 4783
office@pro2future.at
www.pro2future.at

Center Communications Manager
DI Dr. Markus Jäger, MLBT
markus.jaeger@pro2future.at

Area Manager
DI Dr. Michael Krisper
michael.krisper@pro2future.at

Success Story by
DI Dr. Amer Kajmakovic
Senior Researcher
amer.kajmakovic@pro2future.at

DI Daniel Kraus
Researcher, Project Coordination
daniel.kraus@pro2future.at

DI Peter Priller
peter.priller@avl.com

Assoc.Prof. Dr. Olga Saukh
Key Researcher @ Scientific Partner
saukh@tugraz.at

Project partner

- Graz University of Technology, Austria
- AVL List GmbH, Austria

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Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Federal Ministry
Republic of Austria
Digital and
Economic Affairs

Austrian Research Promotion Agency
Sensengasse 1, A-1090 Vienna
P +43 (0) 5 77 55 - 0
office@ffg.at
www.ffg.at