PROJECT

FRICITION

On-board Measurement of Friction and Road Slipperiness to Enhance the Performance of Integrated and Cooperative Safety Systems

Funding: European (6th RTD Framework Programme)
Duration: Jan 2006 - Dec 2008
Status: Complete with results
Total project cost: €4,300,000
EU contribution: €2,599,732

CORDIS RCN : 80572

Background & policy context:

Drivers detect road conditions and they learn how to estimate maximum tyre-road friction. However, most of today's vehicle systems don't—until the vehicle begins to slip.

Friction has a crucial role in driving, since all forces acting on a vehicle are put into action via the friction forces between the tyre and the road, except for aerodynamic forces and gravity. Unfortunately drivers often fail to estimate friction correctly and try unrealistic manoeuvres. The consequence is loss of vehicle control. For London women, the percentage of speed-related accidents was 31%, of which misjudgement caused 64% [5]. Along with driver behaviour and alertness, friction is one of the remaining key unknowns in the algorithms of future ADAS (Advanced Driver Assistance Systems) that calculate the risk of collision, or safe speed. For example, if a Collision Mitigation System assumes high friction, it will have poor performance on snow, since it will brake too late.

Project FRICITION focused on developing, demonstrating and verifying a system that provides continuous sense of friction for vehicle applications. The goal was to offer new information for the vehicle systems to enable them to operate more accurately especially in unusual road conditions. The main attention was on the friction conditions of paved roads like asphalt or concrete. Studied surface conditions were dry, wet, snowy and icy. The project is a continuation to the previous APOLLO project, which focused only on tyre sensor development for friction estimation.

Objectives:

The overall objective of the FRICITION project was to 'create an on-board system for measuring and estimating friction and road slipperiness to enhance the performance of integrated and cooperative safety systems'. More detailed objectives were to:

- Create an innovative model for an on-board estimation and prediction of tyre-road friction and road slipperiness.
- Build a prototype system of an intelligent low cost sensor clustering with a minimum number of generic sensors.
- Verify the system benefits by means of selected vehicle applications using friction and road slipperiness information.
- Enhance the functionality of preventive and cooperative safety systems applications in parallel running and upcoming EU Integrated Projects (in practice with SAFESPOT).

It was seen important to utilise existing vehicle sensors as much as possible. Additionally, the project aim was not to develop new applications—instead it aimed to provide more accurate friction information for other applications. The system could operate like a signal 'broker', collecting and distributing friction and road weather information.

Methodology:

The project did not developed new sensors, but used existing ones in a novel way. The aim was a solution for real-time estimation of the tyre-road friction using a sensor cluster in a moving vehicle.
Consequently, three kinds of sensors were used:

1. existing in-vehicle sensors for vehicle dynamics,
2. environmental sensors, and
3. tyre-based sensors.

Today, the signals from these sensors are used separately for vehicle safety systems without combining them.

The project characteristics were:

- vertical in developing a new system to enhance driver assistance, and
- horizontal in providing a system for different applications and for on-going projects in preventive safety and upcoming cooperative systems.

The innovative idea was to feed the signals into a FRICTI@N-Estimation-Observer to estimate the tyre-road friction by using on-line mathematical methods.

**Parent Programmes:**

**FP6-IST - Information Society Technologies - Priority Thematic Area 2 (PTA2)**

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

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| Pirelli Tyre Spa                                      | VIALE SARCA 222  
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| Siemens Ag                                            | Wittelsbacherplatz 2  
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Key Results:

The main achievements of FRICTI@N were:

1. The project demonstrated a near-continuous estimation of friction potential in changing road conditions, using sensor fusion and learning features. A careful checking for data validity, changes in conditions and driving were used to provide a reasonably valid estimate also in other conditions than high acceleration.

2. The project developed new sensing technology for classification of road conditions, especially for detecting ice, snow and water. The sensors included a polarization camera system, new features for radar, features for laser-scanner to detect weather, and improvements for Road Eye sensor.

3. Friction estimation practical benefits were demonstrated on collision mitigation systems and driver warning including HMI considerations.

4. An intelligent truck tyre sensor was demonstrated and the state-of-the-art tyre sensor from APOLLO project was further developed as a tool.

The project studied the benefits of friction estimation using a Collision Mitigation System prototype from APALACI project. The distances of driver warning and brake activation were compared with and without friction information. Tests confirmed further reduction of crash energy in a meaningful range of driving situations and road conditions.

As in collision mitigation, the FRICTION system could provide an initial estimate of current friction potential also for ABS and TCS, improving their operation during the initial cycles while the optimal forces haven't yet been measured.

Finally the project would like to state that the full FRICTION system can detect friction in the conditions of the study as well as an alert human driver.

Documents:

- Final Report (Final report)

STRIA Roadmaps: Cooperative, connected and automated transport
Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Digitalisation, Safety/Security
Geo-spatial type: Other