awake

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Balocco, Italy

awake

Driver Fatigue Monitoring Technologies and future ideas

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Road Safety Workshop 2004

A continuous Technological Innovation Process (1)

DETER
DRIVE

SAVE

Initiate a real technology break

- Multi Sensor approach – Data Fusion - Behavioural and Physiological Information
- Development of new smart Sensors, new technologies (vision, . . .)
- Introduction of new Methodologies for Data Processing (neural, fuzzy, . . .)

Improved understanding of Hypovigilance

- Consequences on driving performances of Alcohol, sleepiness, . . .

Organizing and structuring Eu Competences

A continuous Technological Innovation Process (2)

DETER
DRIVE

SAVE

AWAKE
PREDIT

A direct and logical continuation to SAVE project

Technological developments

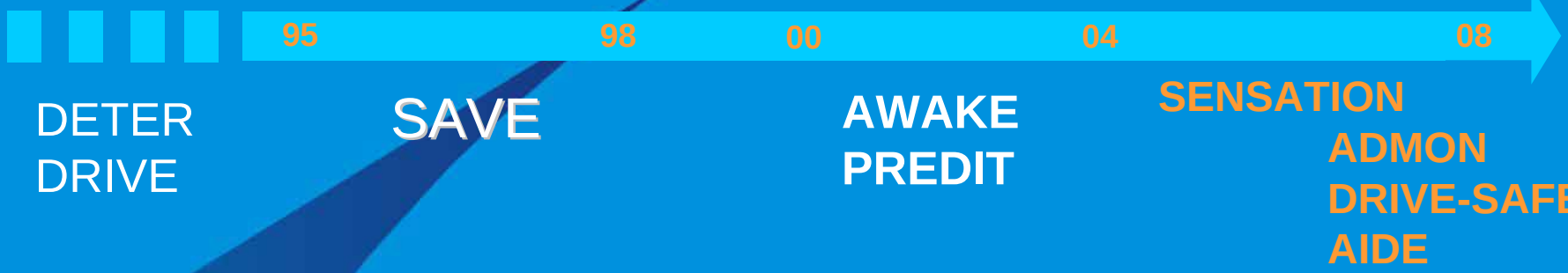
- 2nd Sensor generation (improved technology, reliability, . . .)
- Inter and intra driver variability
- Adapted methodologies for feature extraction and classification
- Vehicle driving environment

Experimental studies

Influences of medecines, physiological parameters (age, . . .) environemental parameters (cockpit temperatures, . . .) on driving performances.

Strong involvement of national government (French) to promote the research topic

A continuous Technological Innovation Process (3)



To broaden the investigation field & create synergies

- Understanding/ Interpretation of related physiological Information (Wakefulness, stages and transient)
- To address novel sensing technologies –nano-micro – Integrated – cheap - non-obstrusive
- To cooperate with other application fields:Industry, Medical.

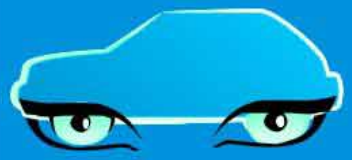
To Focus on shorter term applicative projects building up "Driver Vigilance" applicative products concepts based on extended version of mature functions (LDW, . .).

To make use of Driver monitoring concepts for the design of new generation of adptive HMI.

From the past to the future

A continuous process for

- Improving performances (accuracy, reliability, . . .)
- Measuring new/additional pertinent information driver activity, lid closure and aperture, . . .)
- Integrating sensors (to Micro and Nano sensors)
- Reducing of sensor costs (industrial constraints, . . .)
- Implementing novel data processing capabilities



From the past to the future through sensing technologies

SAVE

Behavioural Inf.
- Vehicle speed
- Lateral position (vision)
- Pedal movement
- Steering wheel angle

Driver Physiological & Behavioural information Inf.
- Eyelid movement (2D vision)
- Steering grip

AWAKE, PREDIT

Environemental Inf.
- Traffic
- Time to collision (radar)

Behavioural Inf.
- Vehicle speed
- Lateral position (vision)
- Steering wheel angle

Driver Physiological & Behavioural Inf.
- Eyelid movement (2D vision)
- Steering grip
- Eye gaze (2D vision)

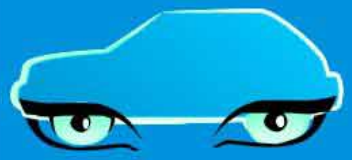
ADMON

Behavioural Inf.
- Vehicle speed
- Lateral position (vision)
- Steering wheel angle

SENSATION

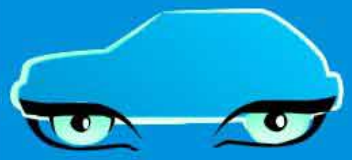
Driver Physiological & Behavioural Inf.
- Eyelid movement, Eye gaze, head pose (3D vision)
- Body and posture activities

Electrophysiological measurements (carbon nano-tubes)
Surfaces temperature (nano-sensors), Skin impedance
Pulse detection –breath, hearth rate (piezo film, miniaturized electret polymers)



Eyelid- Eye Gaze – Head Pose from SAVE to SENSATION

	SAVE	AWAKE, PREDIT	SENSATION
General characteristics	2D Vision CCD camera	2D Vision CCD camera (more compact and less expensive)	3D Vision (improved reliability and accuracy) Cmos camera (micro,cheap)
Dynamic range	Low	Low	High, up to 120db
Frame rate	50Hz	50Hz	up to 200Hz subwindowing capability
Resolution	CCIR (768x576)	CCIR (768x576)	600x800
Shutter, gain control	manual	Automatic	external
Temperature range	0; 60°	0; 60°	-40; +125°
Processor	3 DSP	PC processor	PC processor
Data processing	Template matching	Symbolic feature analysis (more robust against adverse conditions)	Supervised learning feature analysis



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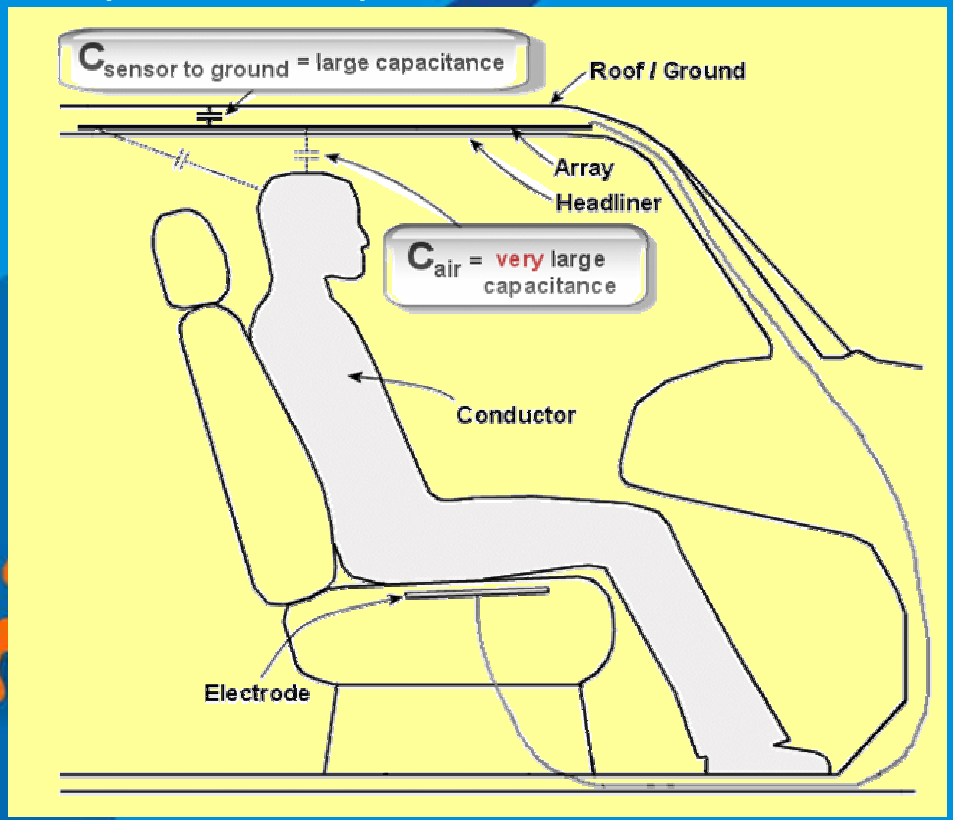
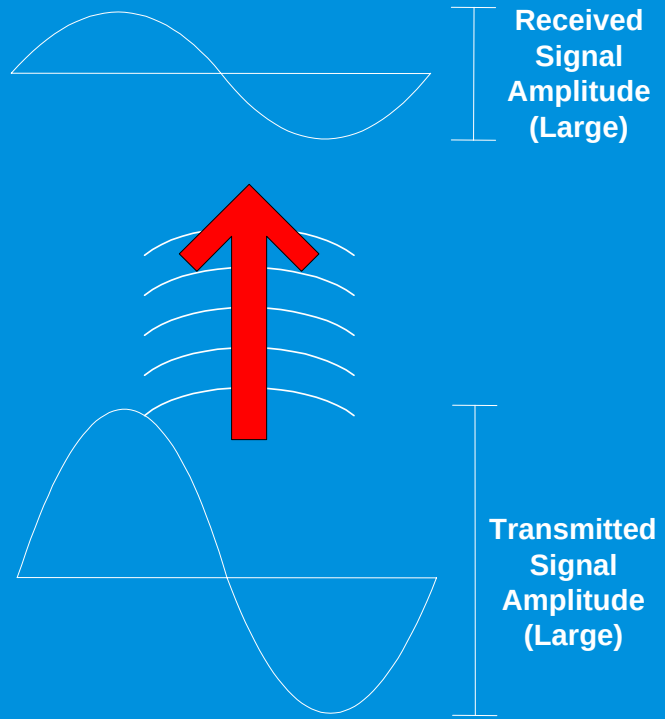
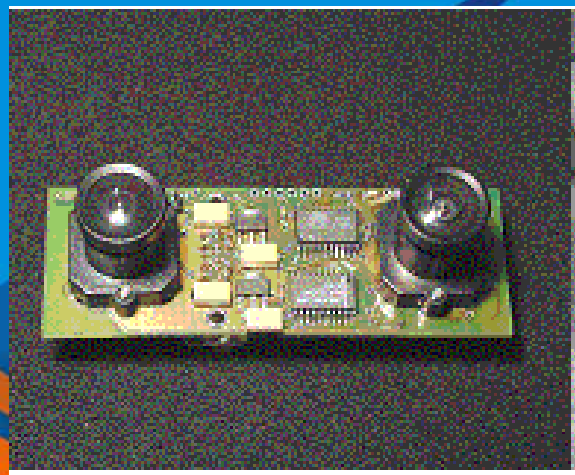
Capacitive Sensor for Driver posture and activity measurement

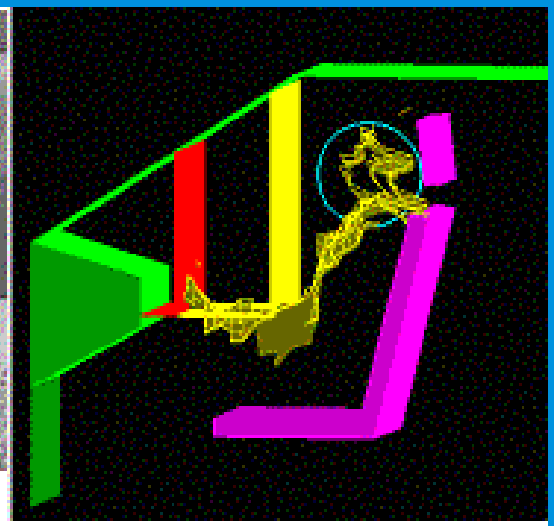
Occupied Seat Operation



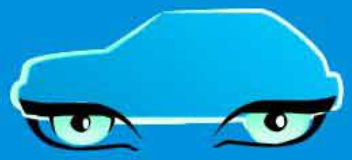


3D Vision reconstruction for Driver posture and activity measurement





Driver posture and activity measurement with EMFIT force measurement matrix



Conclusions

Since 10 years AWAKE and previous projects as well as developments related to ADAS have definitively made a technological break.

Technical advances from AWAKE could lead to mid term driver monitoring commercial application (with limited performance and restricted operatiing fields).

New developments within SENSATION should open wider perspectives: acces to a richest information giving the possibility to deliver more reliable on-line diagnostics