CHAUFFEUR 2 Final Presentation, Ballocco, 07.05.2003

The CHAUFFEUR 2 project
Christophe Bonnet, DaimlerChrysler AG
The Electronic Towbar

- leading vehicle is driven conventionally
- following vehicle automatically follows like a “trailer”
- very close following distance (6-12m) due to dedicated image processing, vehicle-vehicle communication, vehicle control
Once upon a time ... **PROMOTE-CHAUFFEUR**

The Electronic Towbar with the DaimlerChrysler and IVECO trucks
Project overview

The CHAUFFEUR 2 consortium

DaimlerChrysler AG
Renault Recherche
Renault Trucks
IVECO
Clifford, Chance & Pünder
CSST
PTV
TÜV Rheinland
Central Research Laboratories
ZF Lenksysteme

Centro Ricerche Fiat
WABCO
Bosch
The CHAUFFEUR 2 applications

CHAUFFEUR Assistant:

- Extension to a “flexible” Electronic Towbar
- Truck is able to follow any other vehicle on a motorway in a **safe following distance** and **laterally guided**
- While driving alone, driver benefits from **lane keeping system** and **cruise control**
The CHAUFFEUR 2 applications

Platooning

- direct extension of the Electronic Towbar
- leading vehicle is driven conventionally
- both following vehicles automatically follows like “trailers”
- very close following distance (6-12m) due to dedicated image processing, vehicle-vehicle communication, platooning vehicle control
Non-technical project issues

But CHAUFFEUR 2 does not only realise technical systems. To develop truly operable and useful systems the project has also conducted system evaluation on theoretical and operational level.

Evaluation activities

- User acceptance tests, user workshops
- HMI studies
- Cost/benefit evaluation
- Traffic simulations
- Investigation of legal and liability issues
Expected benefits

- In general, the benefits identified for CHAUFFEUR 1 systems:
  - up to 20% reduction in fuel consumption,
  - improvement of traffic flow, reduction of transportation times,
  - reduction in operating cost
  - increased safety

  can be expected for CHAUFFEUR 2 as well

- Moreover, CHAUFFEUR 2 offers:
  - More flexibility in use,
  - CHAUFFEUR 2 systems useful for small vehicle fleets,
  - Reduction of driver’s workload even when driving alone
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The Platooning application

Christophe Bonnet, DaimlerChrysler AG
Platooning

Final Demonstration

Functions

- extension of the Electronic Towbar from 2 to 3 trucks
- automatic following at very short distance
- following vehicles like “trailers”
- coupling and de-coupling maneuvers

Requirements

- no additional infrastructure
- very short distance (6 to 13 m)
Platooning

System overview

Platoon Vehicle controllers
IR image processing system
5.8GHz vehicle-vehicle communication
electronically controlled drivetrain and steering system

Final Demonstration
The Platooning trucks

The two CHAUFFEUR1 trucks

- with integration of platooning components

“Drive-by-wire” truck with integrated powertrain (with DC power systems)

- steer-by-wire
- brake-by-wire
- powertrain interface for driving applications
- platooning components
Platooning

Final Demonstration

Image processing

Infrared pattern
  • active pattern for robust and accurate detection
Platooning

Final Demonstration

Image processing

Pattern recognition

- detection and tracking of infrared pattern
- robust and accurate measurement with 2 CCD cameras
- Measurement of towbar distance and towbar angle
Vehicle-vehicle communication

- 5.8 GHz bi-directional vehicle-vehicle communication
- integrated error management

- complex coupling / de-coupling platoon protocol

- VVC information
  - organisational information for coupling/de-coupling
  - status information for HMI
  - sensor and system information for platoon control
Platooning

Longitudinal platoon control

Platoon distance controller using inputs from:

- IR image processing (distance)
- own sensors (vehicle speed and acceleration)
  and
- sensor data from leading and preceding vehicle (speed and acceleration)

- platoon distance controllers designed for more than 3 trucks
- investigated and tested in simulation with up to 10 trucks
- challenges: platoon safety and platoon stability
Lateral platoon control

“Towbar” controller

- uses only inputs of infrared image processing: towbar distance and towbar angle of preceding vehicle
- controls steering to follow the preceding vehicle (same trajectory)
Platooning manoeuvres

Platooning manoeuvres with 3 trucks
- coupling: “flying joint”
- platooning driving (lane changing, accelerating, braking)
- de-coupling: inverted flying-joint
Platooning

Benefits

• improvement of traffic flow
• increased safety
• lower fuel consumption
• reduced environment impact
• no infrastructure needed
Final Demonstration

Enjoy your drive!
Platooning

Platooning video

01.09.2003

P R O M O T E – C H A U F F E U R 2