Cooperative systems for preventive traffic safety

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  - ADAS sensors in the vehicles and C2C communication
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Cooperative systems for preventive traffic safety
Cooperative technologies

MITIGATION

CONTACT

PREDICTIVE

CONNECTED

PREVENTION

2010

Integrated Occupant Protection

Cooperative Perception

Cooperative Localization (transponder)
Cooperative systems for preventive traffic safety
Research Initiative Ko-FAS – Goals and partners

Ko-FAS: Cooperative sensors and cooperative perception for the predictive traffic safety

Goal: Significant reduction of severe accidents and fatalities

Realization:

- Cooperative localization
- Seamless Traffic Surveillance
- Chronological Risk prediction
- Preventive measures

- HMI Guidance
- Autonomous
- Mitigation

Partner:
Cooperative systems for preventive traffic safety
Well established cooperative technologies

Secondary surveillance radar –
In the civil aviation since 1955

Cooperative transponder –
Transfer to road traffic in 20XX

1950

2010
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Cooperative transponders – functional principle

Angular Measurement Using Phase Estimation Techniques

Distance Measurement Using Time of Flight

Localization Unit

Transponder

Classification Using data-transfer

Distance

Processing Time

Overall run time
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Cooperative transponder: Prototypical realization

Vehicle Set-up

Antenna & Localization-Unit

Antenna

Goniometer

DoA

ToF

Performance Data:
Version: Ko-TAG 1.0
Frequency: 2.4 GHz (ISM Band)
Range: > 200 m
Accuracy: +/- 10 cm

Transponder-Unit:
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Cooperative transponders – unique applications

Predictive pedestrian protection

- Pedestrian accident statistics:
  - 20 % occur combined with occlusion
  - 33 % occur at night or twilight

Cooperative transponder can

- Classify objects by ID
- Locate pedestrians without line-of-sight
- Track objects chronologically
- Resolve individual pedestrians in groups
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Cooperative transponders – unique applications

Omnidirectional safety

- Accident statistics:
  35% of all severe accidents occur at crossings

Cooperative transponder can

- Recognize objects with significant lateral offset due to large aperture angle

> 120°
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Cooperative transponders – unique applications

Self-localization

- Precise self localization in urban environment

Cooperative transponder can

- Find the own position and orientation using infrastructure transponder
- Support guidance through difficult routings
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Cooperative transponders – Current test results

Pedestrian crossing scenario

Collision test

Near-miss test
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Cooperative transponders – Current test results

Vehicle turns in while pedestrian crossing scenario
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Cooperative transponders – Current test results

Cross-Road application

Messdatenfilm einfügen
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Alignment possibilities with related technologies

Approximation of latest C2C standard by:
- Usage of frequency bandwidth close to C2C standard (5.9 GHz)
- Implementation of 802.11p communication protocol

Segmentation in 3 Sub-channels
- Management channel for TAG handling
- DoA Channel for angle measurement
- TOF channel for distance measurement
- Dynamic communication topology
- Temporally separation of angle and distance measurement

Advantages for C2C and C2I
- Availability of precise relative position measurement in urban environment
- Communication link of C2C could be “physically” linked to position measurement (significant security advantage)

Possible realization
Integrated communication and localization unit

Source: Ko-TAG
Cooperative systems for preventive traffic safety

Interconnected sensors for cooperative perception
Cooperative systems for preventive traffic safety
Interconnected sensors for seamless observation of cross-roads
Cooperative systems for preventive traffic safety
Interconnected sensors for seamless observation of cross-roads

Public cross road:

Generic cross road:
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Unique features and perspectives

Unique Features:

- Clear classification of traffic partners
- Recognition and chronological tracking of hidden objects
- Big aperture angle (beyond 120 °): Cross-road sensor
- Physical replacement of security key required for C2C and C2X
- Precise localization in urban environment

Next steps:

- Proof of system performance at prototype stage
- Find possibilities for interweaving with related technologies (e.g.: C2C)
- Internationalization & standardization
Thank you for your attention!

COOPERATIVE SYSTEMS FOR PREVENTIVE TRAFFIC SAFETY

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