GVDAS
Global Vehicle Dynamics
Driver Assistance
Active Safety

VULNERABLE ROAD USERS AWARENESS USING WIRELESS COMMUNICATION

Christian Ress
Technical Expert Connectivity
Global Driver Assistance & Active Safety
Ford Research & Advanced Engineering Europe

17.04.2013

Ford
Go Further

AGENDA

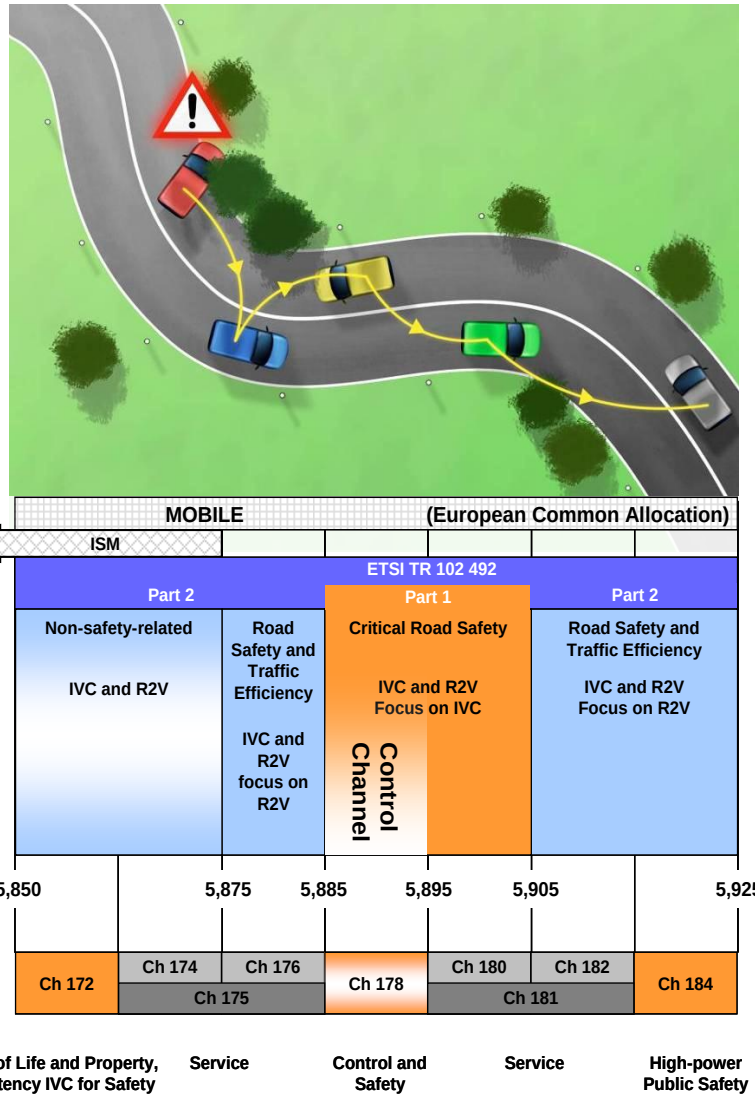
- Connected Car Technology – V2X
  - Example V2X Application
- V2X for Vulnerable Road Users
  - KO-TAG research project
  - Japanese activities
- Summary & Outlook

CONNECTED CARS TECHNOLOGY – V2X

GVDAS
Global Vehicle Dynamics
Driver Assistance
Active Safety

Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication

- Connect vehicles to each other and to the infrastructure
- Use vehicles as a sensor to increase traffic safety and efficiency
- Provide foresighted information and warnings to the driver, even if out of sight
- Ad-hoc network using Wireless LAN
  - Reserved frequency spectrum at 5.9GHz
  - Communication technology available and standardised
    - IEEE 802.11p
    - ETSI ITS G5A (EU)
    - SAE J2735 (US)



Ford
Go Further

V2X APPLICATIONS

- Wide area of applications using V2X communication:
  - Driver assistance and active safety
  - Driving efficiency and traffic management
  - Comfort functions, infotainment, health & wellness
- Low cost technology
- Democratize driver assistance features
- V2X deployment in Europe from CY2015 on expected
  - CAR 2 CAR Communication Consortium: MoU signed (OEMs, suppliers)

APPLICATION EXAMPLE: DRIVER ASSISTANCE

GVDAS
Global Vehicle Dynamics
Driver Assistance
Active Safety

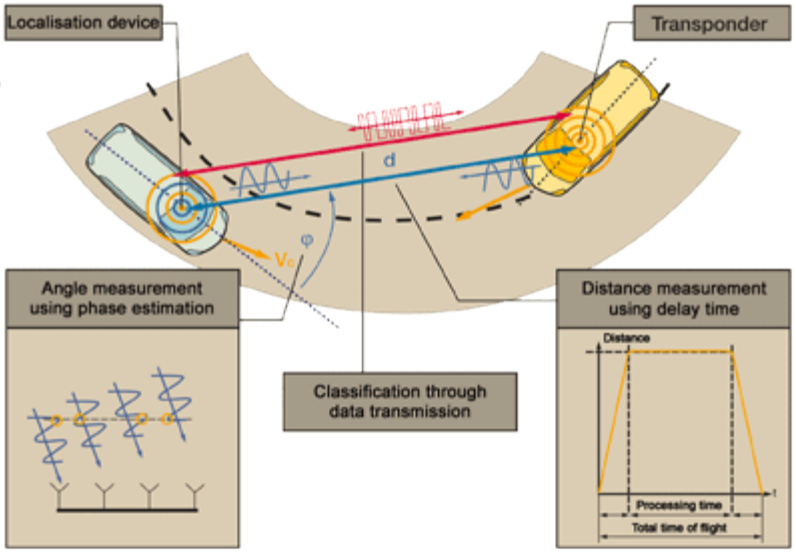
- Electronic Emergency Brake Light (EEBL)

Ford
Go Further

V2X FOR VULNERABLE ROAD USERS (VRU)

Use V2X technology not only for vehicles but also for pedestrians, bicycles, etc.

- Cooperative sensor technology on the basis of transponder systems (active RFID tags)
- VRU users carry tags, e.g. integrated in school bags, helmets or mobile phones.
- Localization device in vehicle sends a query to transponders.
- Transponders respond on query with specific information.
- Localization devices conclude the type and relative position of other road users around them and calculate possible collision risks.
- Tags are located, clearly classified and tracked anonymously.

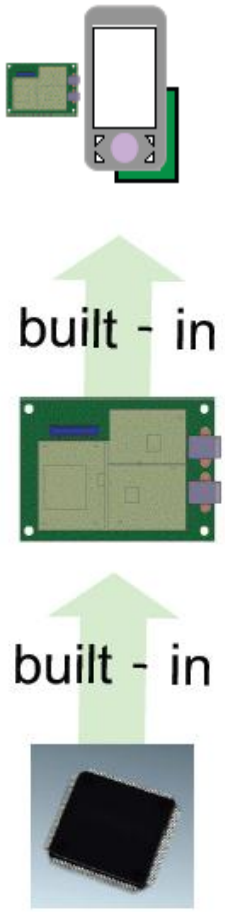


Pictures © KO-FAS

Go Further

WIRELESS TRANSPONDERS

- Active RFID tag
- Transmit power: 20-100 mW
- Communication range <= 200m
  (within urban area or at cross sections, communication ranges far below 200m are sufficient)
- Transmission rate 200 kbit/s (sufficient for communication only - no positioning)
- Latency: <= 30 ms
- Requires power (battery or device integration)



KO-TAG - COOPERATIVE TRANSPONDERS

GVDAS
Global Vehicle Dynamics
Driver Assistance
Active Safety

Part of German government co-funded research initiative “KO-FAS”

- “Cooperative Sensor Systems and Cooperative Perception Systems for Preventive Road Safety”
- 4 year joint research project: 2009 – 2013
- Final Project presentation 18./19. September 2013, Aschaffenburg, Germany
- Web: http://www.kofas.de/

Sub-Project KO-TAG

- Research cooperative sensor technology on the basis of transponder systems
- Applications:
  - “Protection of vulnerable road users”
  - “Vehicle-vehicle-safety”
- Project partners:

BMW Group Forschung und Technik
Continental
DAIMLER
Fraunhofer IIS
Steinbeis Transferzentrum Embedded Design und Networking
Steinbeis Innovationszentrum Embedded Design und Networking
Duale Hochschule Lörrach
Fraunhofer Institut Nachrichtentechnik Heinrich-Hertz-Institut

Project receives funding from Bundesministerium für Wirtschaft und Technologie

Ford
Go Further

JAPAN: PERSON-TO-VEHICLE COMMUNICATION SYSTEM

University of Tokyo, 2009:

A person-to-vehicle communication system was developed for improving security and safety of On-demand bus by using cellular phones and vehicle-mounted devices.

- Exchange information between persons and vehicles via mobile network and wireless LAN
- Detect existence of pedestrians in situations where they are difficult to notice
- Give information support by employing the algorithm for estimating the collision risk
- Passengers inform their location to the driver in waiting for the bus and get information about the location and estimated arrival time of the bus.
- The effectiveness of the system in On-demand bus was successfully evaluated in Tokyo.

Source: Paper presented at “”6th International Workshop on Intelligent Transportation”, Hamburg University of Technology, Hamburg, Germany, 2009

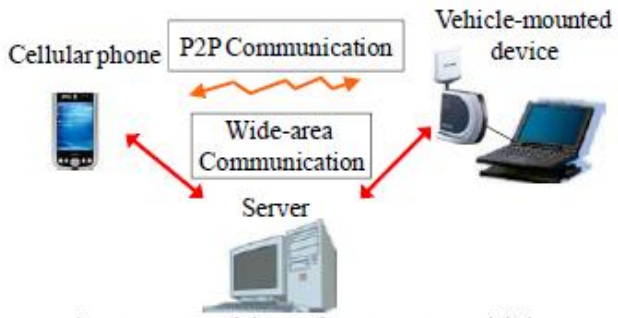


Fig.1 Composition of person-to-vehicle communication system

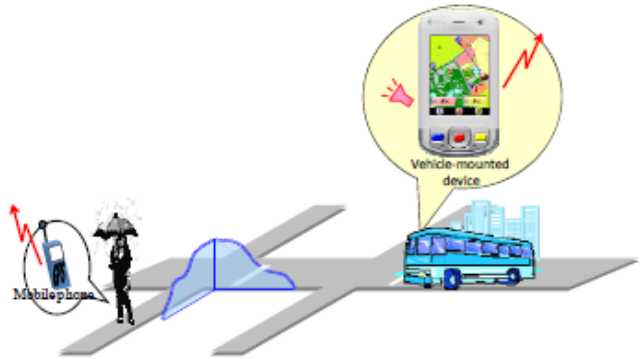


Fig.2 Notification of the location of passengers

Fig.3 Notification of the risk for accident avoidance

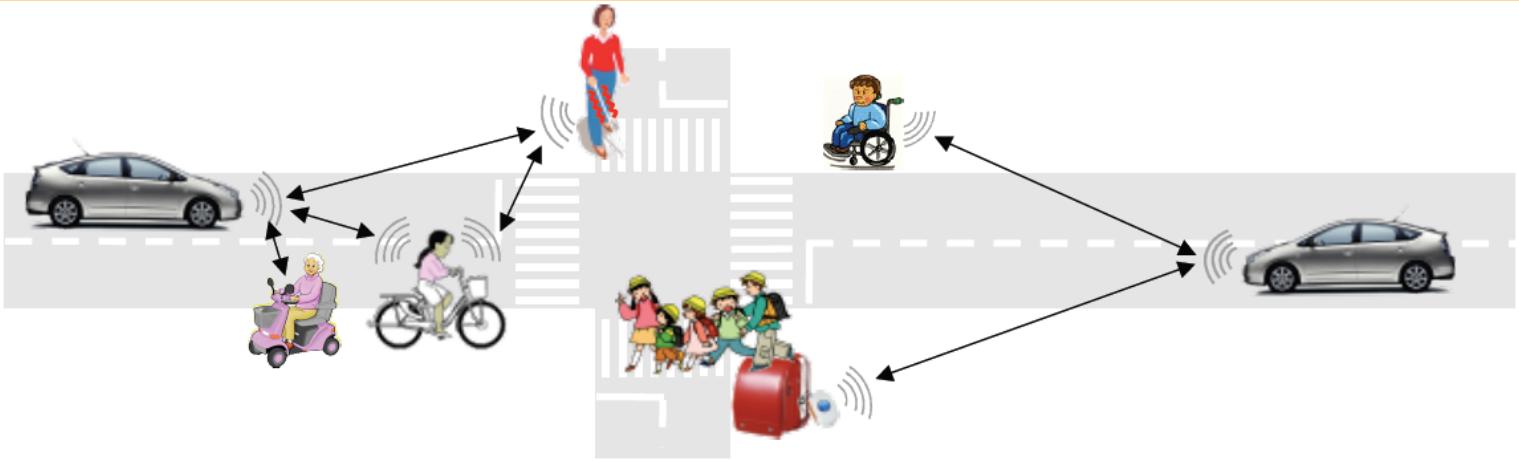
JAPAN SUPPLIER ENGAGEMENT – EXAMPLE SANYO

SANYO

Our activity for future ITS (minimizing accident)

Back ground (motivation)

Target number of death by traffic accident	:	less than 2,500 person @ 2018 (5,000 person @ 2010)
Old person who didn't ride car	:	1,600 person @ 2010 (32%)
Major target	:	Old person / Walking person / Bicycle



Human/bicycle to Vehicle wireless communication (Vehicle to Human/bicycle) is required.

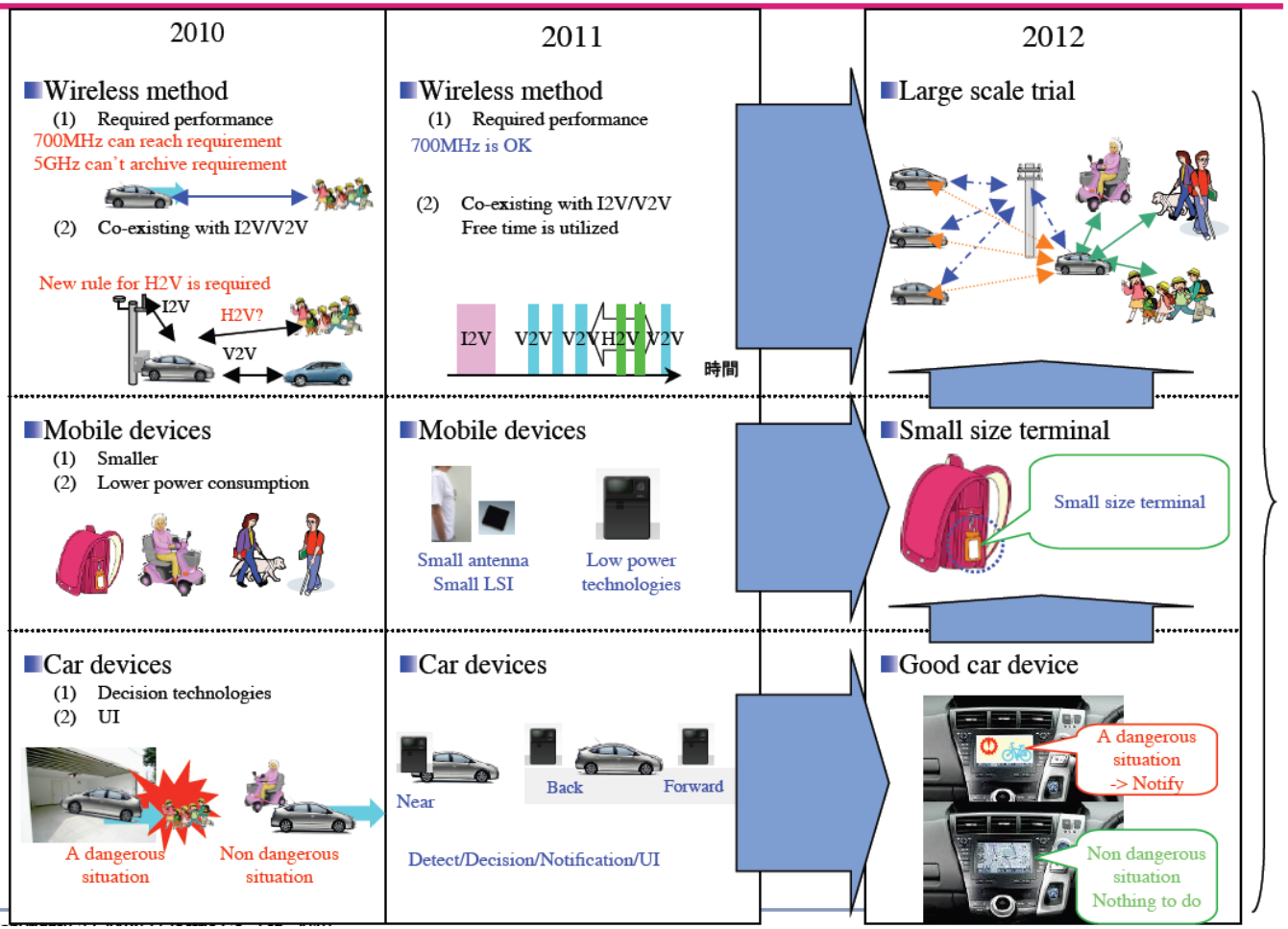
Source: SANYO Electric Co. Ltd 2011

JAPAN SUPPLIER ENGAGEMENT – EXAMPLE SANYO

GVDAS
Global Vehicle Dynamics
Driver Assistance
Active Safety

SANYO

H2V technical roadmap (tentative)



Source: SANYO Electric Co. Ltd 2011

Ford
Go Further

SUMMARY

- Vehicles of the future are expected to use vehicle-to-vehicle and vehicle-to-infrastructure (V2X) communication.
- V2X deployment expected from CY2015 on
- Cooperative systems potentially allow safer, more efficient and more comfortable driving.
  - Foresighted warning against hazardous situations, even if out of sight due to a bend or other vehicles ahead
  - Continuous updates about traffic jams, road works and detour recommendations to enhance trip planning
- Opportunity to use V2X communication also for Vulnerable Road Users
  - Use of active RFID tags
  - Inform both vehicle driver and other road users
  - Technology available for vehicles, ongoing efforts for “H2V” communication
  - Potential market introduction within this decade

Investigate opportunity to use communication-based systems also for electric vehicle notification!