# Smart and Safe Traffic Management

2022

LW 5

Technical solutions to increase the traffic safety

# WHAT AND WHY?

- ✓ Intelligent Transport Systems (ITS):
  - ✓ use the integrated communications and data processing technologies
  - ✓ purpose: improving the mobility of people and goods
  - ✓ increase safety

# TRAFFIC COMPONENTS

✓ Three classic components in traffic system:

  ✓ road user

  ✓ vehicle

  ✓ infrastructure
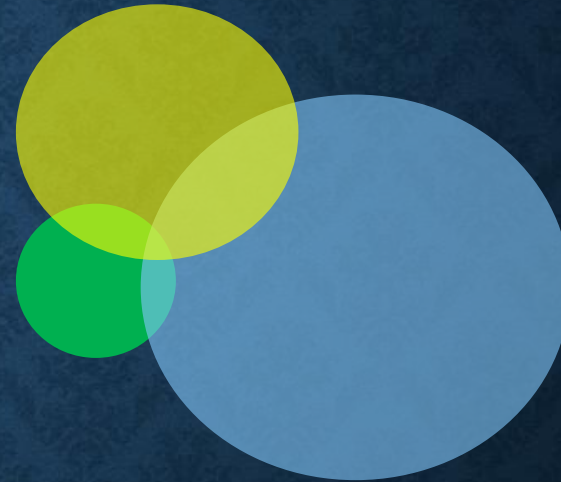
# WHERE WE ARE TODAY/ TOMORROW?

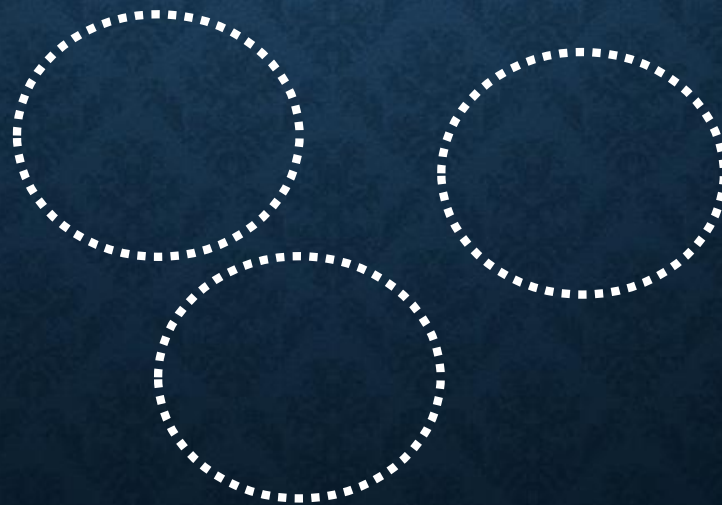✓ Relative importance today ......:

 ✓ road user

 ✓ vehicle

 ✓ infrastructure

✓ ...... in future:

 ✓ ???

# WHAT DEPENDS ON WHAT?

- ✓ Traffic safety depends on:
  - ✓ how smart is the road user
  - ✓ how smart is the vehicle
  - ✓ how smart is the infrastructure

- ✓ Are comfort and safety synonymous?

# COMPONENT: ROAD USER

- ✓ What we teach at school:
  - ✓ today
  - ✓ tomorrow
- ✓ In the future the driver will become the owner of the car as a high-tech device:
  - ✓ IT competence
  - ✓ IT skills in all age groups

- ✓ Traffic education in future - necessary or not?

# COMPONENT: VEHICLE

✓ Which is our car fleet like today?

✓ What are our resources for car fleet renewal?

✓ What to do with "older" vehicles?

# COMPONENT: VEHICLE

- ✓ The purpose of the development of automotive technology:
  - ✓ self-driving vehicle driven by artificial intelligence (AI)

- ✓ Development versus global health

- ✓ Is every innovation still an innovation?

- ✓ Agreements and strategies between different countries

# COMPONENT: VEHICLE
## SAE automation levels

| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **No Automation** | **Driver Assistance** | **Partial Automation** | **Conditional Automation** | **High Automation** | **Full Automation** |
| Zero autonomy; the driver performs all driving tasks. | Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design. | Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times. | Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice. | The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle. | The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle. |

https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

| SAE level | Name | Narrative Definition | Execution of Steering and Acceleration/ Deceleration | Monitoring of Driving Environment | Fallback Performance of Dynamic Driving Task | System Capability (Driving Modes) |
|---|---|---|---|---|---|---|
| **Human driver monitors the driving environment** | | | | | | |
| 0 | No Automation | the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems | Human driver | Human driver | Human driver | n/a |
| 1 | Driver Assistance | the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task* | Human driver and system | Human driver | Human driver | Some driving modes |
| 2 | Partial Automation | the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task* | **System** | Human driver | Human driver | Some driving modes |
| **Automated driving system ("system") monitors the driving environment** | | | | | | |
| 3 | Conditional Automation | the *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene* | System | **System** | Human driver | Some driving modes |
| 4 | High Automation | the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene* | System | System | **System** | Some driving modes |
| 5 | Full Automation | the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver* | System | System | System | **All driving modes** |

# COMPONENT: VEHICLE

- ✓ Smart Car - how much will the traffic environment become safer?

- ✓ Smart Car – perfect and flawless?

- ✓ Serious challenge - a self-driving vehicle and a man-driven vehicle in traffic at the same time

- ✓ Self - driving as a new opportunity for mobility (such as the elderly and disabled people etc.)
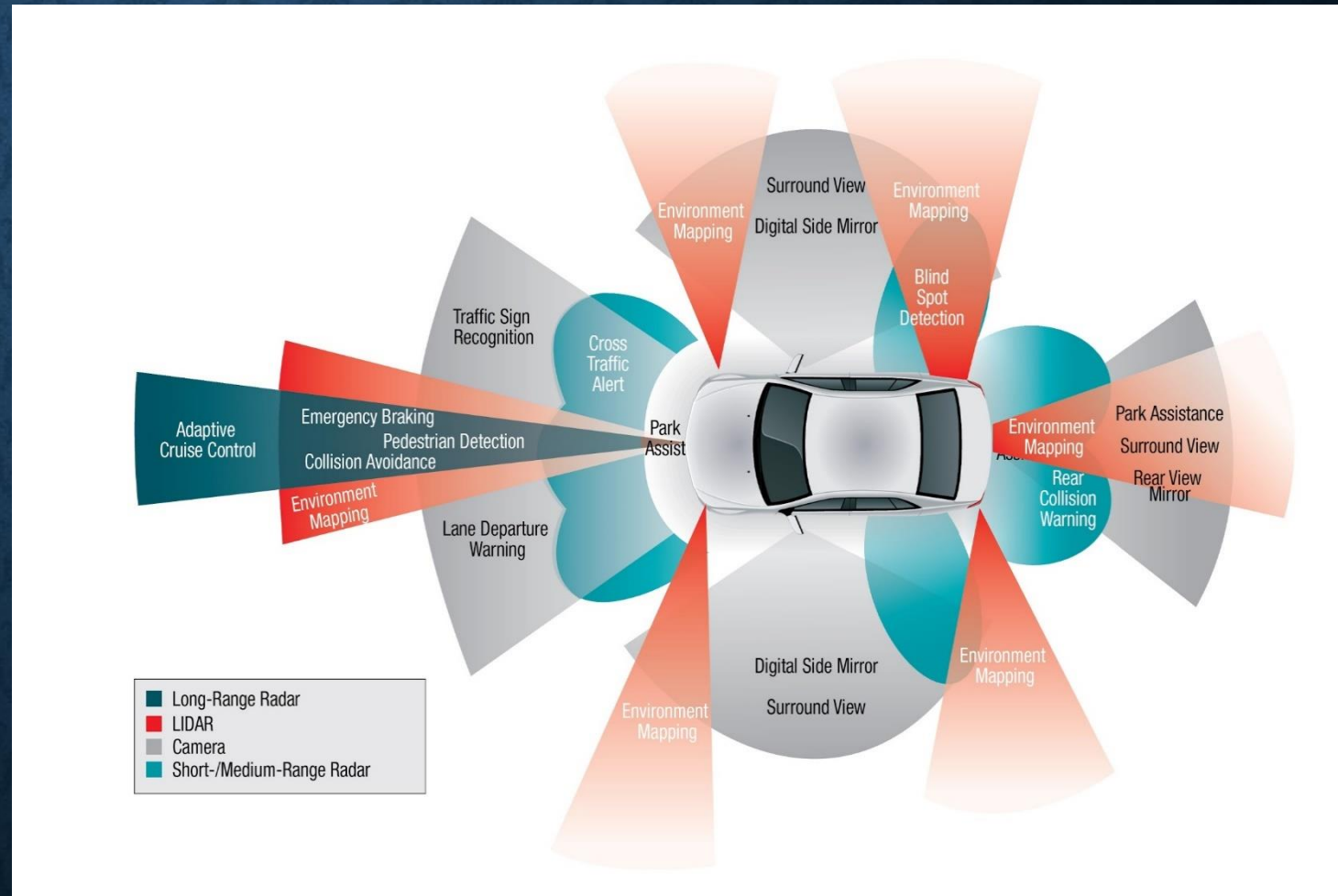
# COMPONENT: VEHICLE

✓ Driver Assistance

   Systems (DAS):

   ✓ what, when and how
      do they work?

   ✓ comfort *versus*
      reliability *versus*
      safety

# COMPONENT: VEHICLE

✓ Driver Assistance Systems - do you know your car?

| ✓ ACC | ✓ BSM | ✓ DFV |
| ✓ ADAS | ✓ BSW | ✓ DDD |
| ✓ AFLS | ✓ BOP | ✓ DMS |
| ✓ AHBC | ✓ CIB | ✓ EVWS |
| ✓ ALC | ✓ CDV | ✓ EDA |
| ✓ ANV | ✓ CAS | ✓ FCW |
| ✓ AEB | ✓ CMS | ✓ FSWS |
| ✓ APS | ✓ CTA | ✓ FCA |
| ✓ BSD | ✓ DDW | ✓ ………… |

# COMPONENT: VEHICLE

The automobile becomes the centerpiece of the

"Internet of Things"


Really?

# COMPONENT: VEHICLE

✓ V2I - Vehicle to Infrastructure:

    ✓ wireless exchange of data between vehicles and road infrastructure

✓ V2V – Vehicle to vehicle:

    ✓ wireless communication between vehicles

✓ V2X – Vehicle to everything:

    ✓ wireless exchange of data between a vehicle and its surroundings

# COMPONENT: VEHICLE

✓ V2P - Vehicle to Pedestrian:

  ✓ wireless communication between pedestrian's mobile device to avoid accidents

✓ V2N – Vehicle to Network:

  ✓ wireless communication between vehicle and data centers, road infrastructure and other cars

# COMPONENT: VEHICLE

✓ Platooning:

   ✓ technology by which two or more vehicles circulate on the road in a joint and coordinated manner

   ✓ the main target group at the moment is trucks

# COMPONENT: INFRASTRUCTURE

✓ Road/ Street:

   ✓ is it just a horizontal surface to move from point A to point B …?

   ✓ …or innovative traffic environment?


✓ Road / Street:

   ✓ is a conflict between vehicles and vulnerable road users unavoidable?

# COMPONENT: INFRASTRUCTURE

✓ Smart Road / Smart Street:

    ✓ variable message signs (VSM)

    ✓ traffic flow management systems

    ✓ parking arrangements

    ✓ information about public transport schedules

    ✓ charging of electric cars (incl. charging a moving car)

    ✓ .....

# COMPONENT: INFRASTRUCTURE

✓ Smart Road / Smart Street:

   ✓ online information about traffic environment and conditions:

      ✓ special portals, such as:

         ✓ Estonia: https://tarktee.mnt.ee/#/en

         ✓ Baltic countries: http://www.balticroads.net/

   ✓ RDS - Radio Data System

   ✓ V2I, V2V, V2X options

# COMPONENT: INFRASTRUCTURE

✓ Smart City:

    ✓ technologically modern urban area that uses different types of electronic methods, voice activation methods and sensors to collect specific data:

        ✓ cleaner air

        ✓ less wasted time

        ✓ reduced energy consumption

        ✓ safer living environment

# COMPONENT: INFRASTRUCTURE

✓ Smart City:

    ✓ <span style="color:yellow">transport system</span>

    ✓ buildings

    ✓ health services

    ✓ air quality

    ✓ energy distribution

    ✓ active use of the Internet of Things (IoT)

    ✓ …….

# COMPONENT: INFRASTRUCTURE

- ✓ Transport system:
  - ✓ public transport
  - ✓ shared travel service
  - ✓ commercial transport
  - ✓ personal vehicles
  - ✓ vulnerable road users (motorcycle, moped, bicycle, scooter ...)
  - ✓ pedestrians

# COMPONENT: INFRASTRUCTURE

- ✓ Transport system:
  - ✓ space sharing
  - ✓ traffic calming
  - ✓ different interests *versus* opportunities *versus* needs
  - ✓ research, analysis, planning

# 100% SAFE TRAFFIC?

✓ When and if at all possible:

  ✓ programmable vehicle and non-programmable pedestrian

  ✓ flawless hardware and software

  ✓ malicious manipulation over the network

  ✓ artificial intelligence decisions - on what basis?

  ✓ priorities for traffic space allocation

  ✓ privacy *versus* public interest

  ✓ .....

# AND FINALLY ....

With or without car?

# USEFUL LINKS

- https://www.daimler.com/innovation/case/connectivity/car-to-x-2.html

- https://www.theexplorer.no/stories/smart-cities2/smart-cities-in-norway-enhance-quality-of-life-and-reduce-emissions/?gclid=EAIaIQobChMI0Ni-vvWz9QIVtY9oCR0AUQ-EEAAYASAAEgKCbPD_BwE

- https://www.twi-global.com/technical-knowledge/faqs/what-is-a-smart-city

- https://maas-alliance.eu/homepage/what-is-maas/

- https://www.aptiv.com/en/insights/article/what-is-v2v

- https://www.autoweek.com/news/technology/a36190311/v2x-technology/

# USEFUL LINKS

✓ https://www.3m.com/3M/en_US/road-safety-us/resources/road-transportation-safety-center-blog/full-story/~/what-is-vehicle-to-infrastructure-v2i-communication-and-why-do-we-need-it/?storyid=021748d7-f48c-4cd8-8948-b7707f231795

✓ https://www.lanmodo.com/lanmodo-night-vision-system-insights-into-night-vision-gadgets/10-most-helpful-driver-assistance-systems-in-the-current-market.html

✓ https://www.samsara.com/uk/guides/adas/

✓ https://www.edge-ai-vision.com/2015/09/a-handy-list-of-automotive-adas-acronyms/

Thank you for your attention!