VI Warmian-Masurian Road Forum
Safe Roads of the Future

Mikołajki September 22-23 2019

CAD (CONNECTED AND AUTOMATED DRIVING): IMPACT ON ROAD SAFETY AND MOBILITY

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FORESEE THE FUTURE

120 YEARS AGO…

FORESEE THE FUTURE

...TOMORROW

A FAST GLANCE AT CAD

Automated driving, or driverless vehicles, is indeed this new Century's predominant technological innovation
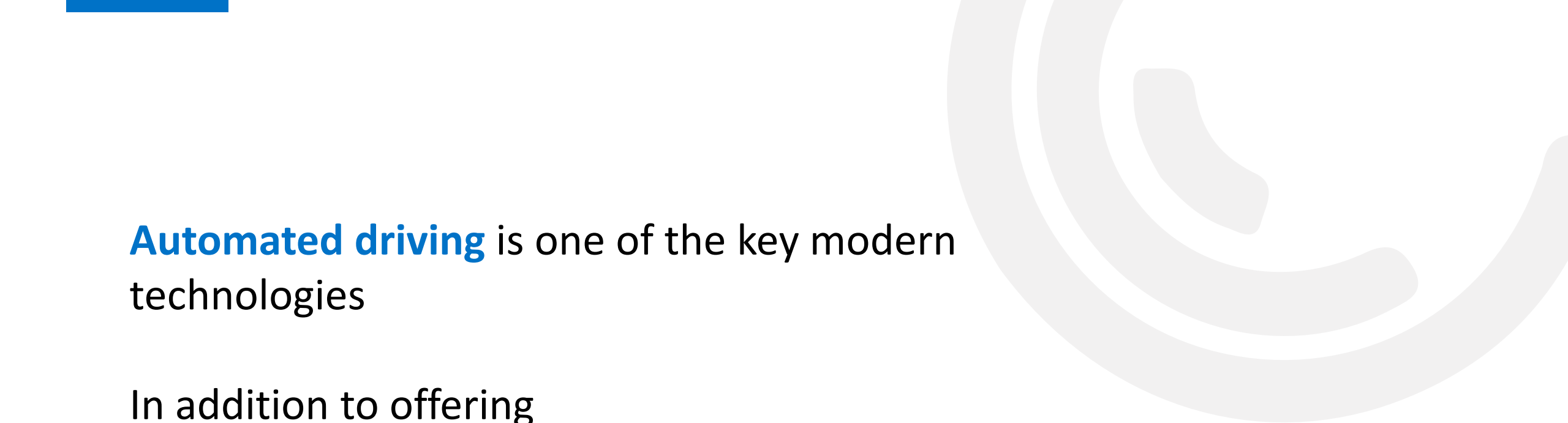
It will change not only road mobility but also peoples' lifestyle

Automated driving is a wide concept that brings us towards a shared mobility concept

An environmental respectful concept

A human being concept

Automated driving is one of the key modern technologies

In addition to offering
➢ broader access to mobility, it can also help to
➢ reduce the number of driving-related accidents and crashes.

When doing so, the safety of automated driving vehicles is one of the most important factors
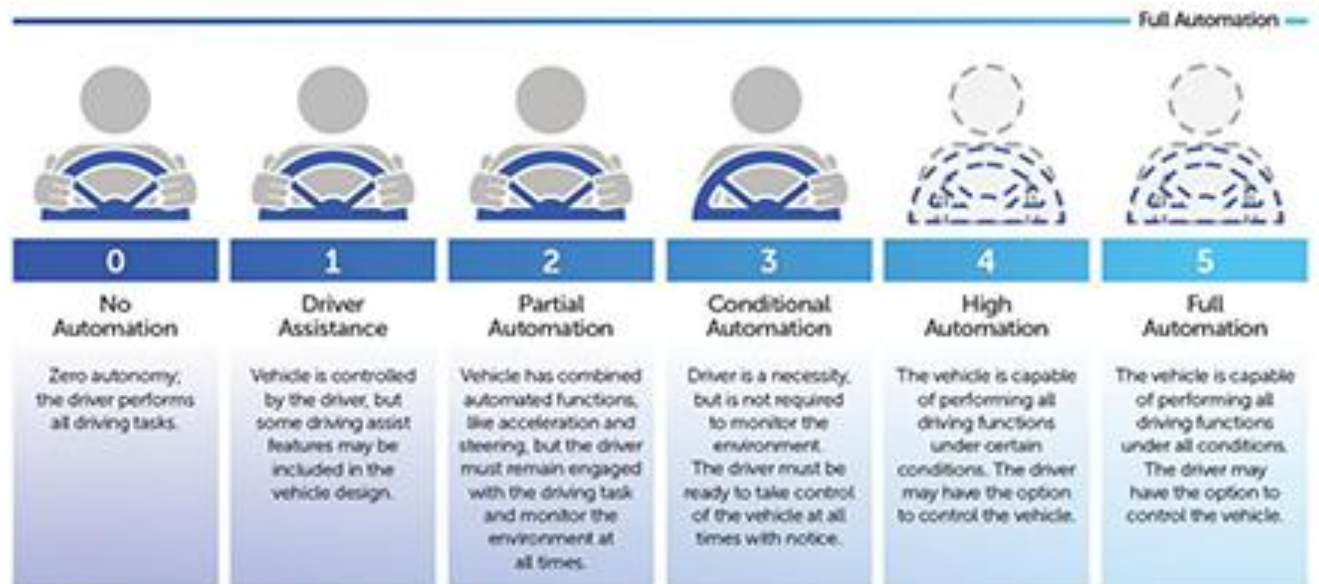
WHERE IS AUTOMATED MOBILITY GOING?

Automated Mobility's progress is strictly linked to technological development

A 5 levels progression is widely recognized

Starting from LEVEL 1 with no automation arriving at LEVEL 5 with full automation

SECTION 1: VOLUNTARY GUIDANCE

SAE AUTOMATION LEVELS

Full Automation

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.

CRITICAL CHANGE FOR CITIES

As well as making more efficient use of roads, AVs are likely to **change city landscapes** — although this might take different directions depending on how usage develops.

If AVs lead to less car ownership, less urban space will be needed for roads, parking and garaging, potentially allowing higher population densities and more green space.

A FULLY AUTOMATION SCENARIO

In a fully automated city
vehicles circulating will be only
20%
of today's number

Fewer crashes, wounded, casualties, damages to things, no insurance costs

Better life style for citizens

AUTOMATING IS SHARING

VEHICLES , AT THE END, WILL NO LONGER BE THE USERS' PROPERTY BUT THEY WILL BE SHARED AMONG OTHER USERS

ABOUT ROAD CRASHES

Distraction seems to be the main cause of road crashes accounting **to 94%** causes that often lead to fatal casualties

Human behaviour is therefore to be accounted for the main culprit

Automated vehicles will substitute partially or totally humans at the wheel removing any possibility of error or distraction

SAFE AS A BIRD

Vehicle makers, trying to reassure the public about Avs, could follow the **aviation industry**, where aircraft makers have embedded safety in their processes Airlines share information and learn from accidents on a no-blame basis.

Modern passenger aircraft are regularly flown by **autopilot software**, albeit with the supervision of human pilots — and in 2017, there were no fatalities at all in commercial passenger aircrafts.

THE VIENNA CONVENTION

- The **Vienna Convention of 1968** states that the driver must be in control of their vehicle at all times (United Nations, 1969). In 2014, the UNECE amended the regulation to include highly automated systems, provided that these continue to have a driver who is ready to take over driving functions and who can override the system and switch it on and off. However, this still presupposes that every vehicle must have a driver.

- UNECE WP.1 is currently working on a draft resolution regarding the deployment of highly and fully automated vehicles in road traffic, which includes recommendations to contracting parties of the 1949/1968 Conventions on how to safely deploy such new technology.

PRESENT DAY

Today we already have available in the newest models of vehicles automatic safety systems that can substitute drivers whenever they make mistakes

These systems are known as **ADAS** Advanced Driver Assistance Systems.

➢Automatic breaking

➢Lane keeping

Are the most widely known

- Advanced driver assistance systems are systems developed to automate, adapt and improve vehicle systems for safety and better driving.

- It has been proven that the automated system provided by **ADAS** to the vehicle reduces the number of road deaths, minimising human error.

- The safety devices are designed to prevent collisions and accidents by offering technologies that not only warn the driver of an imminent danger but also intervene in his place to prevent it.

Adaptive functions can automate lighting, provide adaptive cruise control and collision avoidance, incorporate satellite navigation/traffic alerts, connect to smartphones, alert the driver of other cars or hazards, lane departure warning system, automatic lane centering or show what is in blind spots.

Starting from seat belts, airbags, helmets, ABS the possibility of dying in a road accident has drastically decreased.

All these devices, which today we take for granted, were not present in our cars until a few years ago.

Take for example the ABS, which was only installed on high level car models as a luxury option, but became a complementary part of any car after a while.

The automotive industries have recognized vehicle safety devices no longer as an "optional feature" of their high-end cars, but as a necessary and complementary requirement of all models.

The European Parliament itself, with its Resolution of 14 November 2017 on "Saving lives: improving vehicle safety in the EU" (2017/2085(INI)), provided for the acceleration of the implementation of ADAS devices on all new car models.

IMPLEMENTING THE CAPABILITIES

- DETERMINE LOCATION
- PERCEIVE RELEVANT STATIC AND DYNAMIC OBJECTS IN PROXIMITY TO THE AUTOMATED VEHICLE
- PREDICT THE FUTURE BEHAVIOR OF RELEVANT OBJECTS
- CREATE A COLLISION-FREE AND LAWFUL DRIVING PLAN
- CORRECTLY EXECUTE AND ACTUATE THE DRIVING PLAN
- COMMUNICATE AND INTERACT WITH OTHER (VULNERABLE) ROAD USERS
- ENVIRONMENT PERCEPTION SENSORS

ENVIRONMENT PERCEPTION SENSORS

1. CAMERA
2. LIDAR
3. RADAR
4. ULTRASONIC
5. MICROPHONES

SENSOR ARRANGEMENT

A sensor cluster designed for a system on highways needs to cover ranges and precision levels that are different to those of urban scenarios.

A DRIVERLESS ENVIRONMENT

The safety of an automated driving system is influenced by several factors, which can be grouped according to the three entities of traffic: The driver, the vehicle with the automated driving system and the traffic environment. The traffic environment or the traffic scenario contains several characterizing factors that are split into six layers of a scenario:

LAYER 1 Street layout and condition of the surface

LAYER 2 Traffic guidance infrastructure, e.g. signs, barriers and markings

LAYER 3 Overlay of topology and geometry for temporal construction sites

LAYER 4 Road users and objects, including interactions based on maneuvers

LAYER 5 Environment conditions (e.g. weather and daytime), including their influence on levels 1 to 4

LAYER 6 Digital information (e.g. V2X information, digital map)
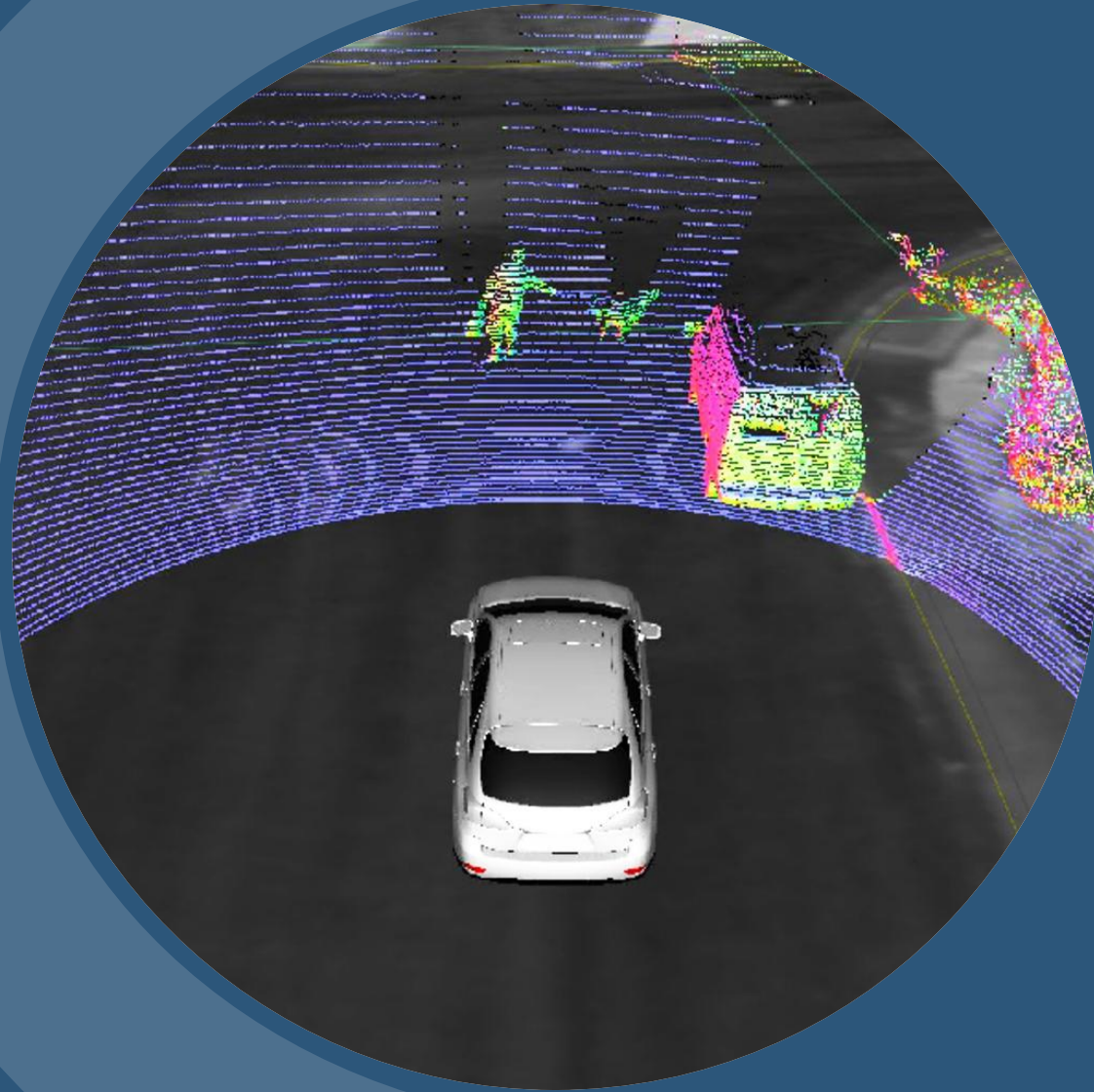
HOW AN AUTOMATED CAR SEES THE ROAD

SMART ROADS

- Vehicle to Infrastructure and Infrastructure to Vehicle communication is also another fundamental component of CAD.

- The road infrastructures connects with passing vehicles alerting of forecoming dangers or obstacles.

- Advising for alternative routes and road accidents.

- This information can be rebounded to other vehicles by vehicles

- This creates a **virtuous circle** for Road Safety

SMART C-ITS

the worldwide diffusion of "Intelligent Systems", used both in urban and extra-urban environments, has amply demonstrated how it is possible, with their use, to obtain innumerable advantages such as:

➢ **Reduction in the number of accidents**;
➢ Reduction of congestion;
➢ Increased network capacity;
➢ Reduction of travel times;
➢ Reduction of polluting emissions;
➢ Reduction of energy consumption.
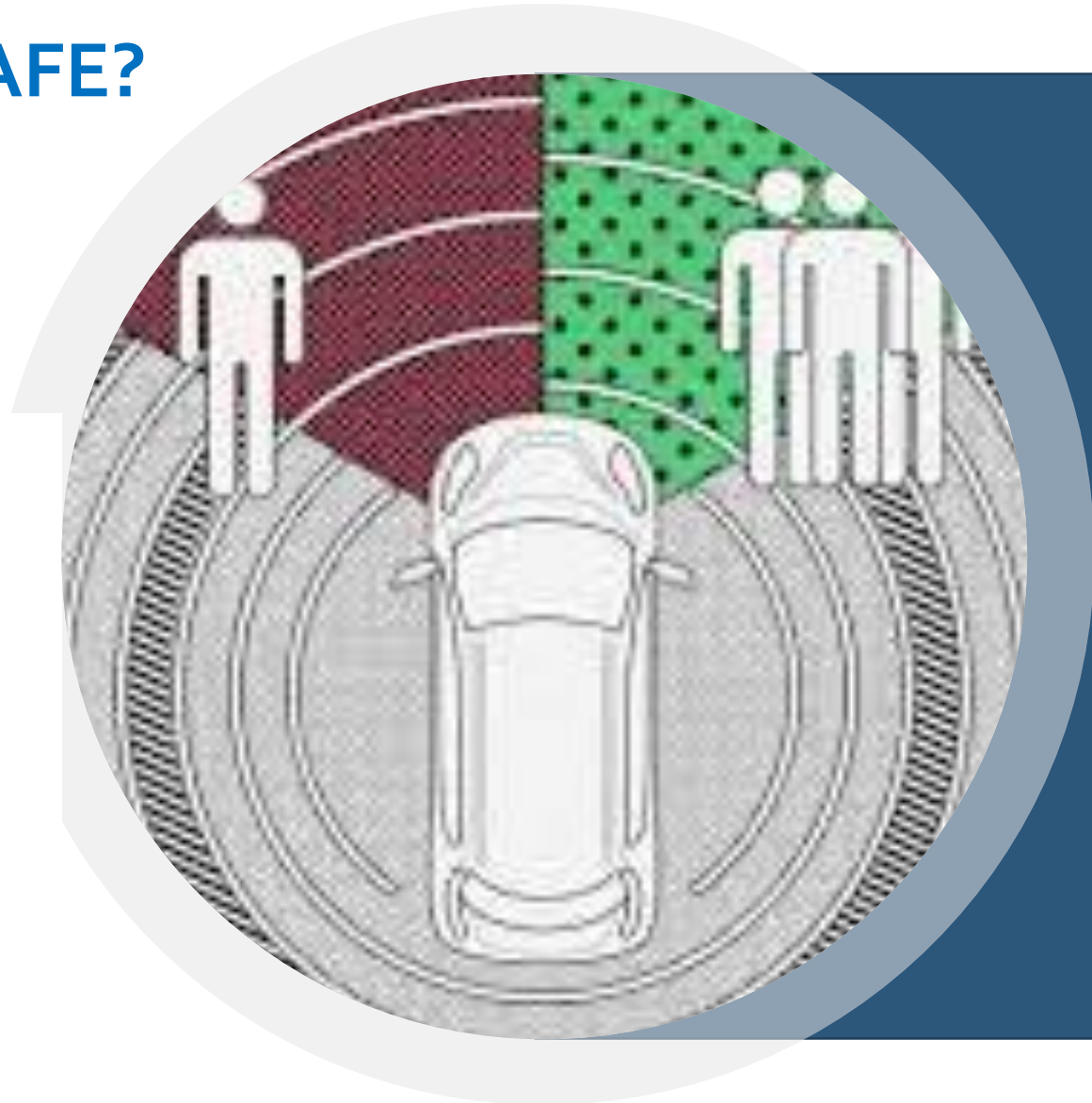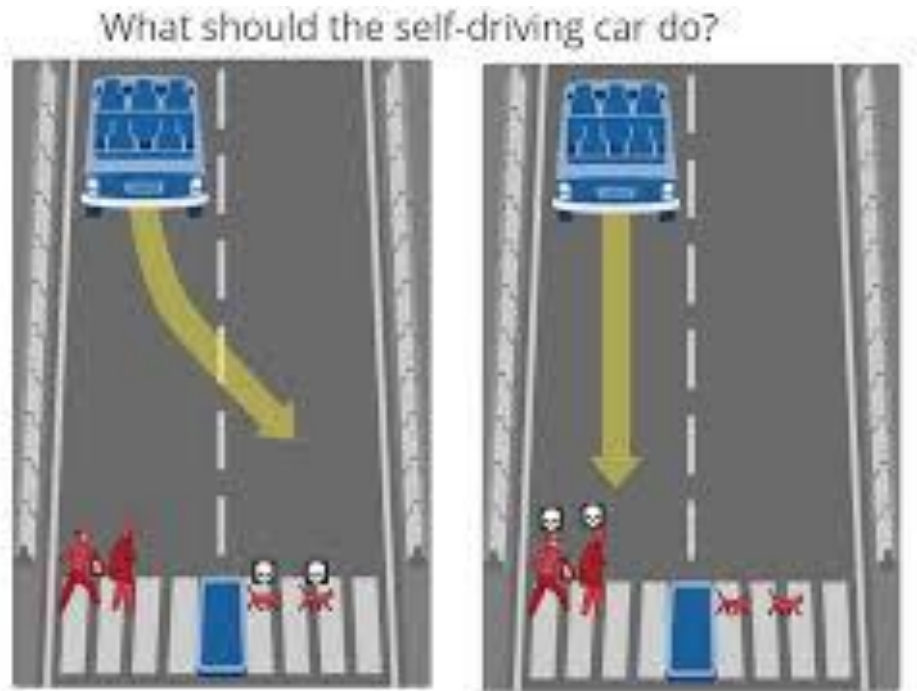
ITALY'S SMART ROAD PROJECT
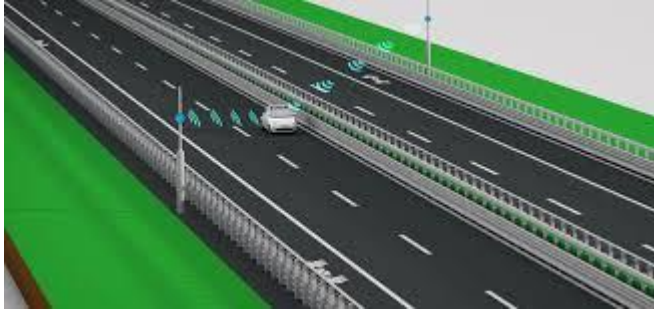
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SMART ROAD PROJECTS

➢ Motorway Salerno Reggio Calabria km 432

➢ Rome's Ring Motorway km 68

➢ Rome – Fiumicino Airport Km 30

➢ Cortina Adduction System 100km

IS CAD INTELLIGENTLY SAFE?

- The Moral Machine Experiment

What should the self-driving car do?

LEVEL 5
FULL AUTOMATION
NO HUMAN INTERCHALLENGE

VALIDATION OF (SUB) SYSTEMS
THAT ARE BASED ON MACHINE
LEARNING SEVERAL ELEMENTS OF
AUTOMATED VEHICLES MAY RELY
ON ALGORITHMS BASED ON
MACHINE LEARNING

FORESEE THE FUTURE

100 YEARS AGO...

FORESEE THE FUTURE

...TOMORROW

VISION ZERO

ZERO DEATHS ON OUR ROADS
With automated vehicles

THANK YOU AND HAVE A NICE FUTURE!

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