SOLUTIONS FOR A SUSTAINABLE MOBILITY

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What means a sustainable mobility

"To ensure that our transport systems meet society's economic, social and environmental needs whilst minimising *their undesirable impacts on the economy, society and the environment"*

STEMS MISSION

- Smart transport infrastructures, networks and terminals that create an integrated intermodal, clean and resilient system for the mobility of passengers and goods. Mobility-as-a-Service (MaaS) and last mile logistics; mobility services based on ICT enabling technologies.

- Tools and methods for the analysis, planning, regulation and management of transport and mobility systems.

- Knowledge and technologies for sustainable mobility in the urban context, through techniques for complex systems; interaction of the different transport modes integrated with the socio-economic dynamics of the urban ecosystem.

Review of the EU Sustainable Development Strategy (EU SDS)—
Renewed Strategy; 10917/06; Council of European Union: Brussels, Belgium, 2006

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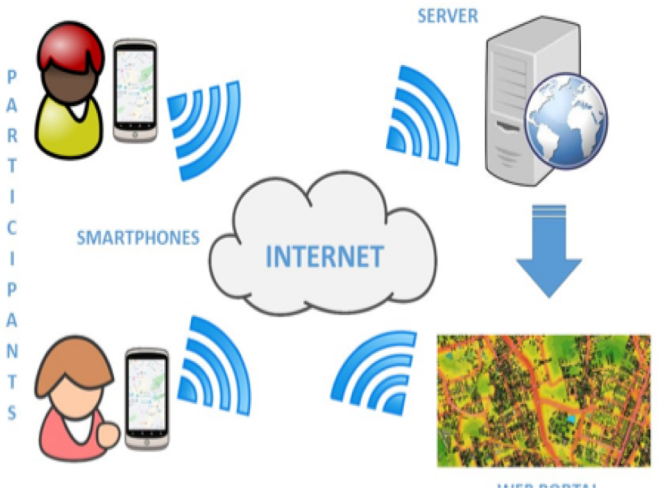
- Reduction of atmospheric pollution (60% transport emissions decrease by 2050)
- Reduction of noise pollution
- Reduction of road congestion and of the number of accidents
- Better use of the land (especially urban) through a reduction of land occupied by transport infrastructures
- Cost reduction and increase transport efficiency

Development of technologies and methods for new solutions also based on new ICT technologies and digitalization for the transition of urban transport mainly based on the needs of the citizen, makes use of an integrated mobility (not motorized e.g. on foot, by bicycle, with scooters) and public transport or shared private services (e.g. car-sharing or car-pooling), limiting the the use of the individual private car to a minimum.

Integration of Systems for mobility

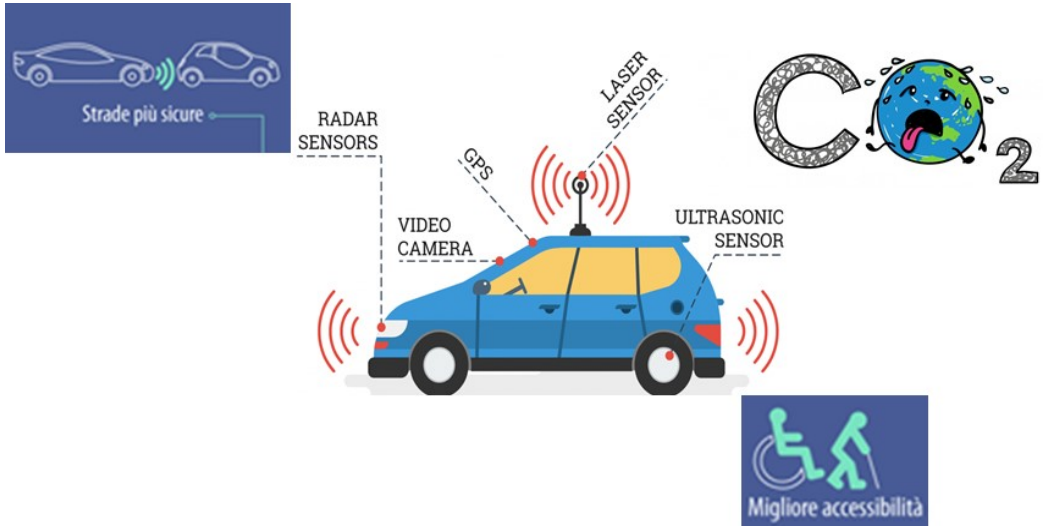


- Distributed electronic systems over vehicle network, for a global optimized control;
- Human-machine interface systems for calibration and diagnostics;
- Vehicle sensorization to detect the surrounding environmental (eg.: LIDAR);
- Automation of acttuations.

(Gessi&Martelli)

Characterization of the sound environment and evaluation of its perception by smartphone

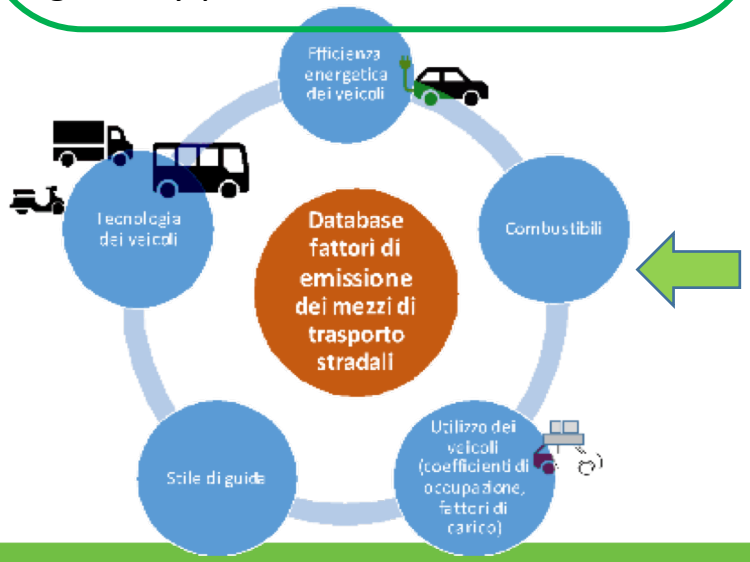
(Pedrielli& al.)



Vehicles Emissions

Indicators for specific emissions of CO, NMVOC, NO_x, PM e CO_2 from vehicles (buses, cars and motocycles), pollutants linked to long range transboundary air pollution and to air quality in urban centers

Important for transport and mobility planning and management and for regulatory policies for vehicular traffic

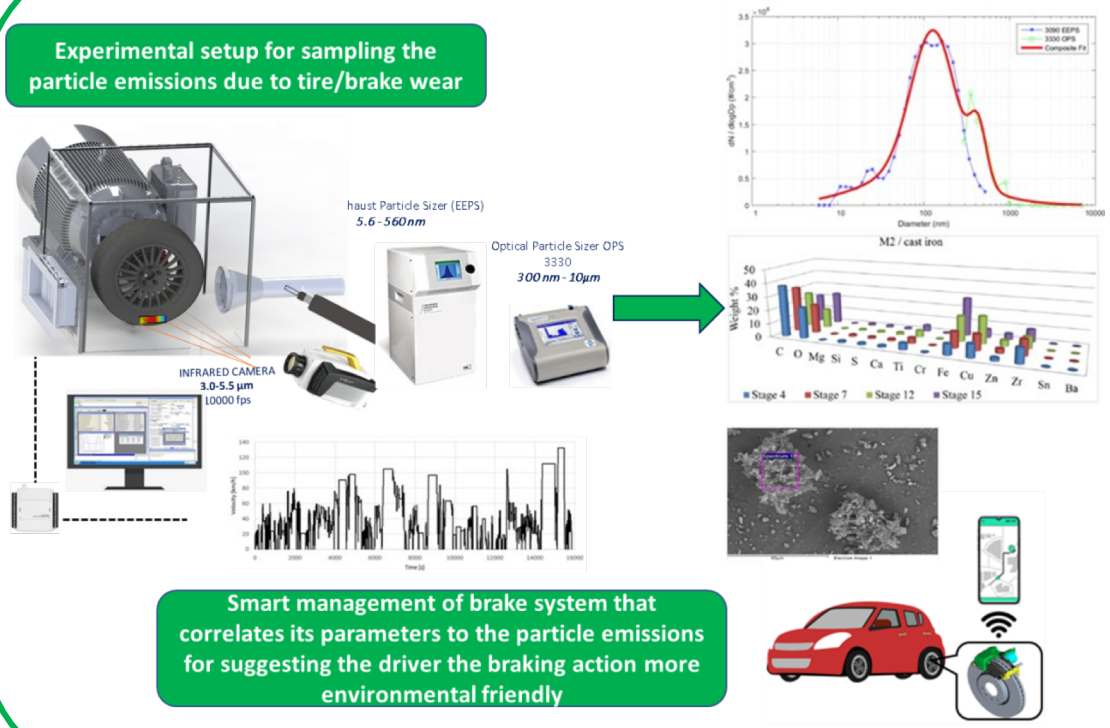


Update of a national emissions database of:

- vehicle technology
- energy efficiency of the vehicle
- fuels used
- use of vehicles (occupancy factors and load factors)
- driving characteristics (speed and driving style)

(Costagliola &Prati)

Experimental setup for sampling the particle emissions due to tire/brake wear



Smart management of brake system that correlates its parameters to the particle emissions for suggesting the driver the braking action more environmental friendly

(Apicella,Catapano, Di Iorio&Magno)

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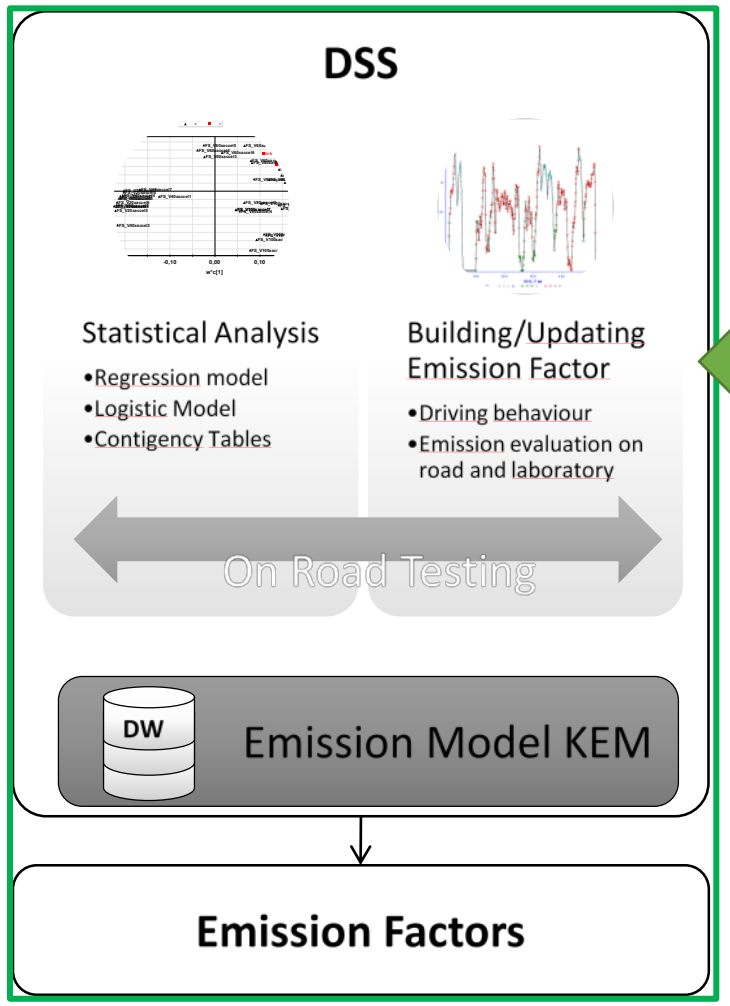

Life Cycle Assessment (LCA) of the modes of transport

LCA is a useful tool which can be used in the entire context of mobility in relation to land, rail, sea and air transport to compare the sostainability of alternative solutions.

a statistical evaluation integrated between emission data, vehicular kinematics and correlation with a precise geolocation for routes with minimum environmental impact.

I modelli statistici multivariati consentono la definizione di possibili scenari ottimali utili nel contesto della sostenibilità ambientale.

The LCC approach completes the environmental aspect of the LCA by integrating social and economic costs, aiming at much more consisten choices with minimal environmental impact.

The following steps take place

LCC (Life Cycle Cost) calculates the LCC year by year for all cost items of the CBS (Cost breakdown structure) and for all items of the SBS (System breakdown structure)

SENSITIVITY carries out sensitivity analyzes of the total LCC and by item with respect to a range of alternatives proposed

(Della Ragione&Meccariello)

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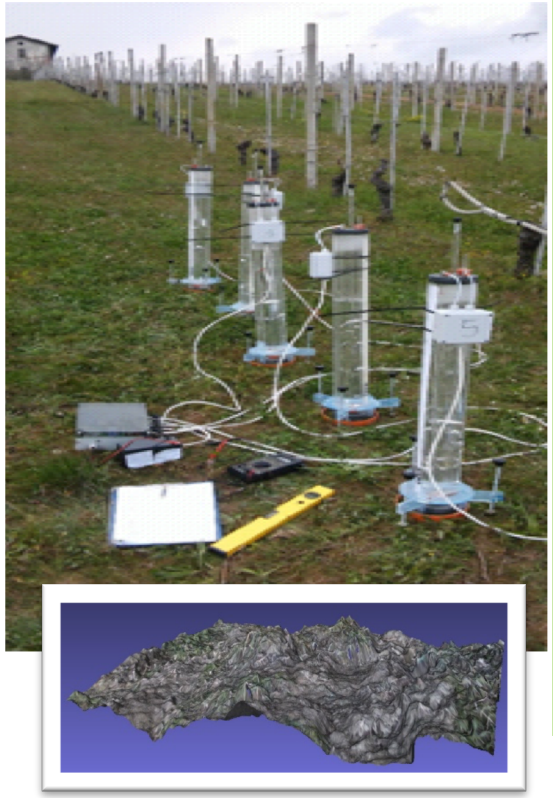


- Monitoring of soil degradation induced by agricultural traffic by using sensors in the field
- IInvestigation of solutions to preserve the sustainability of soil and water resources with the use of advanced data analysis techniques and modeling with DSS integration.

Projects **IN-GEST SOIL** (PSR Piemonte 2014-2020) e **ATLAS** (H2020) https://www.atlas-h2020.eu/

(Biddoccu)

Autonomous robot for the treatment of rows of vines (also located in places with high slopes).

The use of sensors allows to detect the rows and the points where it is necessary to spray or treat the plants.

SCORPION https://scorpion-h2020.eu/?page_id=937

(Gessi&Martelli)

The main goal

One of the most critical, but still unresolved issues, is to find a systematic way to bridge the gap between the different spatial and temporal scales ranging from the mobility of individuals to the city/urban scale, where population dynamics emerge and where it is crucial to have management and control decisions.

Autonomous vehicles Technology

- *Connected Autonomous Driving mini-bus (CMB)*
- *Connected Autonomous Cars*

Agent-Based Simulations of Pedestrians and CMBs

Emergent Dynamics At The Urban Scale

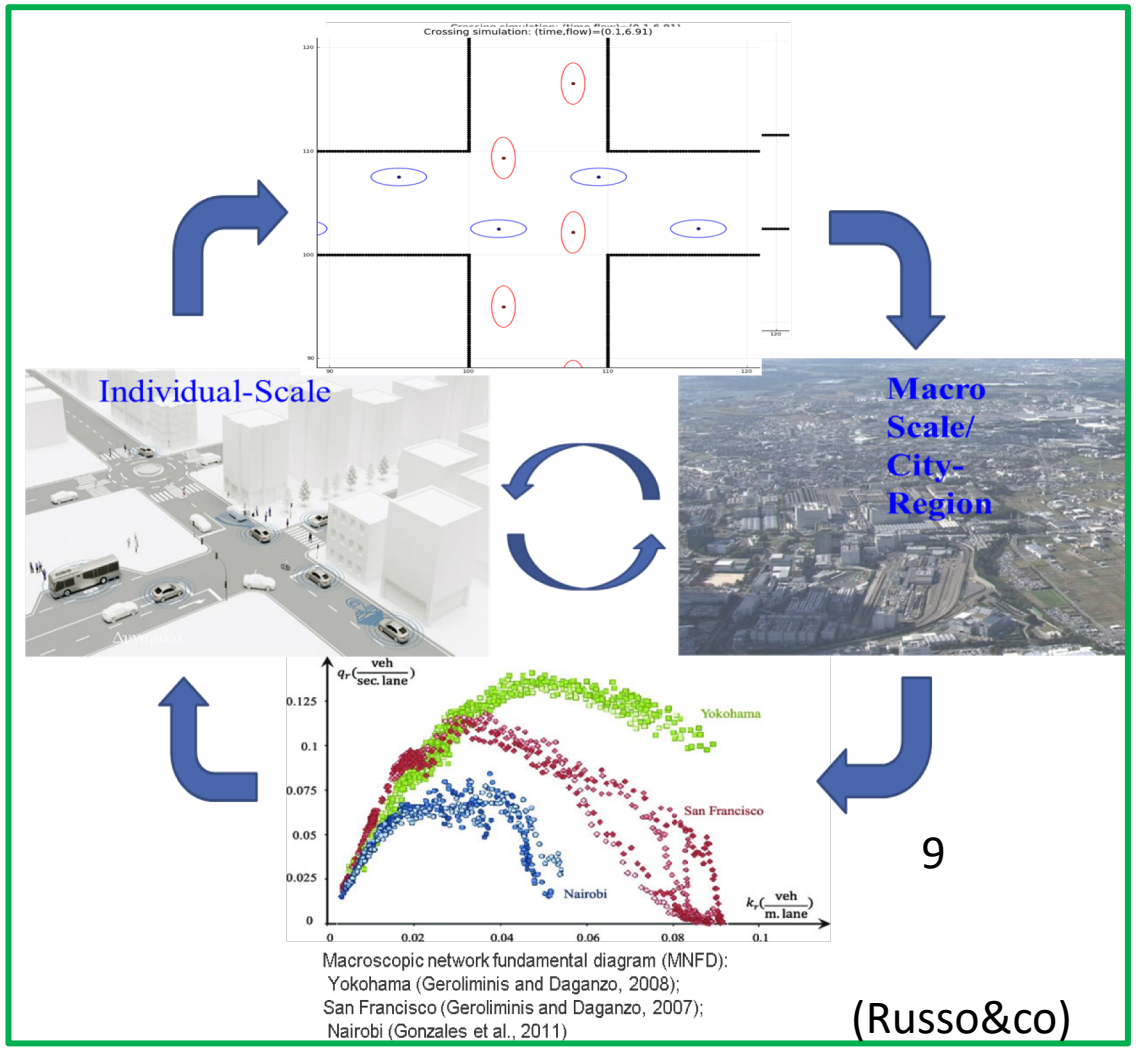
Multimodal Urban Mobility and MaaS-Mobility as a Service

- Integration of different public and private transport services offered to the end user through digital tools, including car-sharing and car-pooling services, light mobility services and services based on autonomous cars.
- Development of decision support systems for traffic management that also include autonomous vehicles.

Methodologies

Development of multiscale methodologies for analysis of critical conditions of the urban transport network (congestions/ accidents), which include: data mining, equation free methods, complex networks, multi-agent systems

- ❖ Development of heterogeneous micro-models based on agents that include different interactions between autonomous cars and vulnerable vehicles (pedestrians/ bicycles/scooters) with attention to the analysis of self-organized emergent behavior in shared urban spaces, road crossings and intersections.
- ❖ Development of decentralized and data-driven advanced control systems



Macroscopic network fundamental diagram (MNFD):
Yokohama (Geroliminis and Daganzo, 2008);
San Francisco (Geroliminis and Daganzo, 2007);
Nairobi (Gonzales et al., 2011)

(Russo&co)

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