



MOVE

(MONITORING using shared VEHICLES)

Background

The MOVE project is framed in the context described below:

- Milan is one of the European capitals of smart mobility. Milan citizens are inclined to use shared vehicles and have at their disposal 3,000 cars, 13,000 bikes, 2,600 motorcycles, 2,200 scooters with various sharing companies.
- Smartphones are widespread, contain several types of sensors (such as accelerometer, cameras, GPS) and have on-board computing capabilities, embedded batteries, and internet access. These features make smartphones particularly suitable to form low cost, mobile and distributed networks of sensing devices able to collect crowdsensing data for monitoring purposes.
- Recently, innovative indirect vibration-based Structural Health Monitoring (SHM) strategies have been proposed which make use of the dynamic response of instrumented vehicles to carry out “drive-by” monitoring of road pavement and bridges.

Problems/needs

MOVE faces several challenges and needs, namely:

- The maintenance of infrastructures is a concern for transport authorities due to the increasing number of structures reaching their design life, the need to optimize allocation of economic resources during structural maintenance activities, and the increasing intensity of extreme events related to climate change.
- The need to reshape the offer of public transport within cities following the Covid-19 pandemic and to support the shared mobility service.
- Extend the available knowledge on indirect SHM techniques, exploring the possibility of using unconventional vehicles for monitoring purposes such as bicycles and scooters.

Objectives

MOVE aims to develop an innovative approach for vibrational monitoring of road surface conditions and bridges based on data provided by users of shared vehicles. The availability of continuous vibrational data from different vehicle typologies will contribute to a low-cost early detection of anomalies, such as potholes in the road pavement or damage related to loss of stiffness in urban bridges. The design of a multi-platform application and of specific smartphone supports deployed in shared vehicles allows users to become part of the monitoring community simply by placing their devices in the dedicated supports while moving around the city. Their smartphones will record, process, and transmit vibration data via the Internet while recharging battery and providing driving directions.

Results/impacts

- Optimization of maintenance operations of urban road and bridges, resulting in minor management costs and safer roads and infrastructures.
- Enhancing the social responsibility of citizen by their direct involvement in the evaluation and maintenance processes of roads.
- Promote the use of shared mobility as an alternative and sustainable transport system within the city. Users of shared vehicles will be encouraged to participate in road monitoring through prizes, discounts, and gamification. New users will be encouraged to use shared vehicles thanks to these incentives.

Novelties

The model proposed by MOVE is innovative both from the technologic and the operative point of view. In particular, MOVE proposes an original use of shared vehicles and investigates the critical issues of indirect SHM and crowd-sensing, such as the management and interpretation of large amounts of data coming from different devices deployed on heterogeneous vehicles.