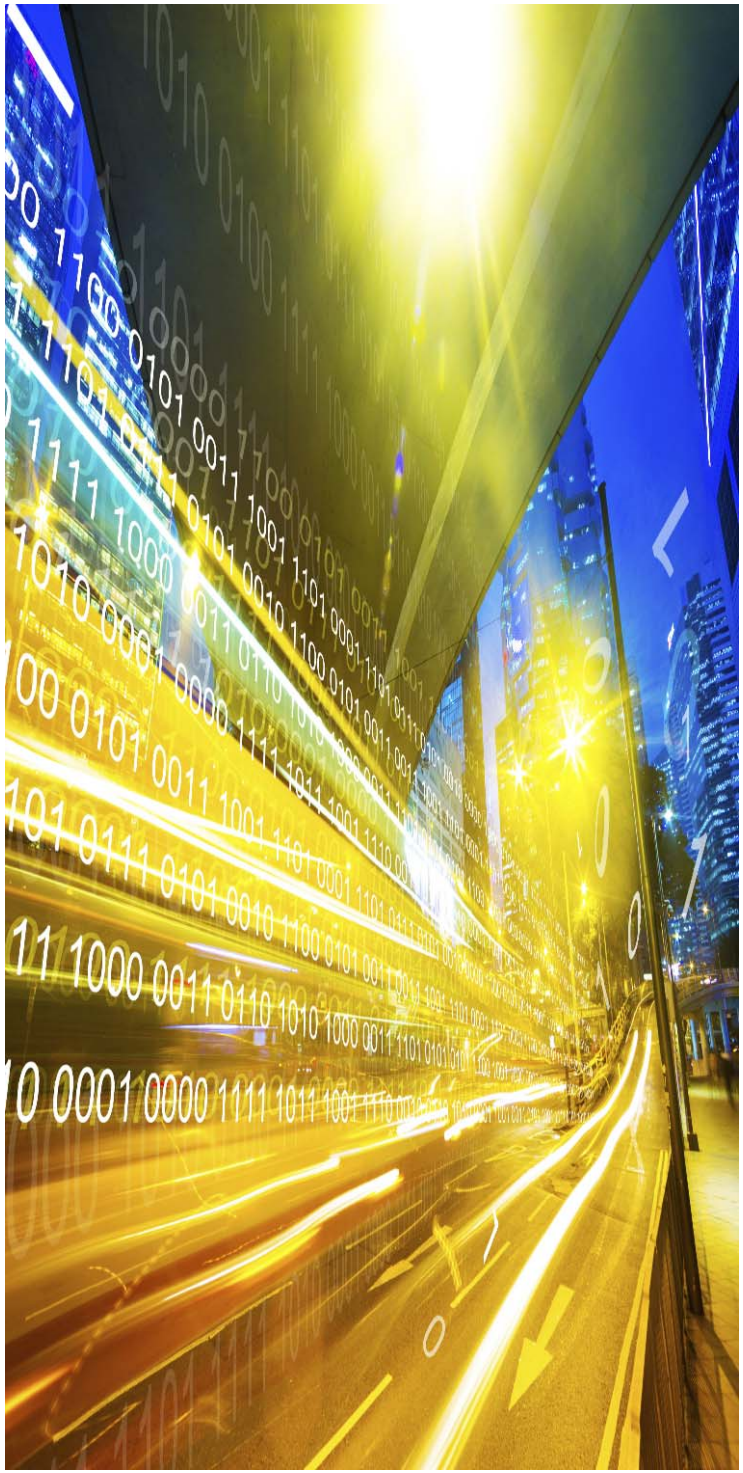

International Symposium on Road Safety Behaviour Measurements and Indicators
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Star rating driver traffic and safety behaviour through OBD and smartphone data collection

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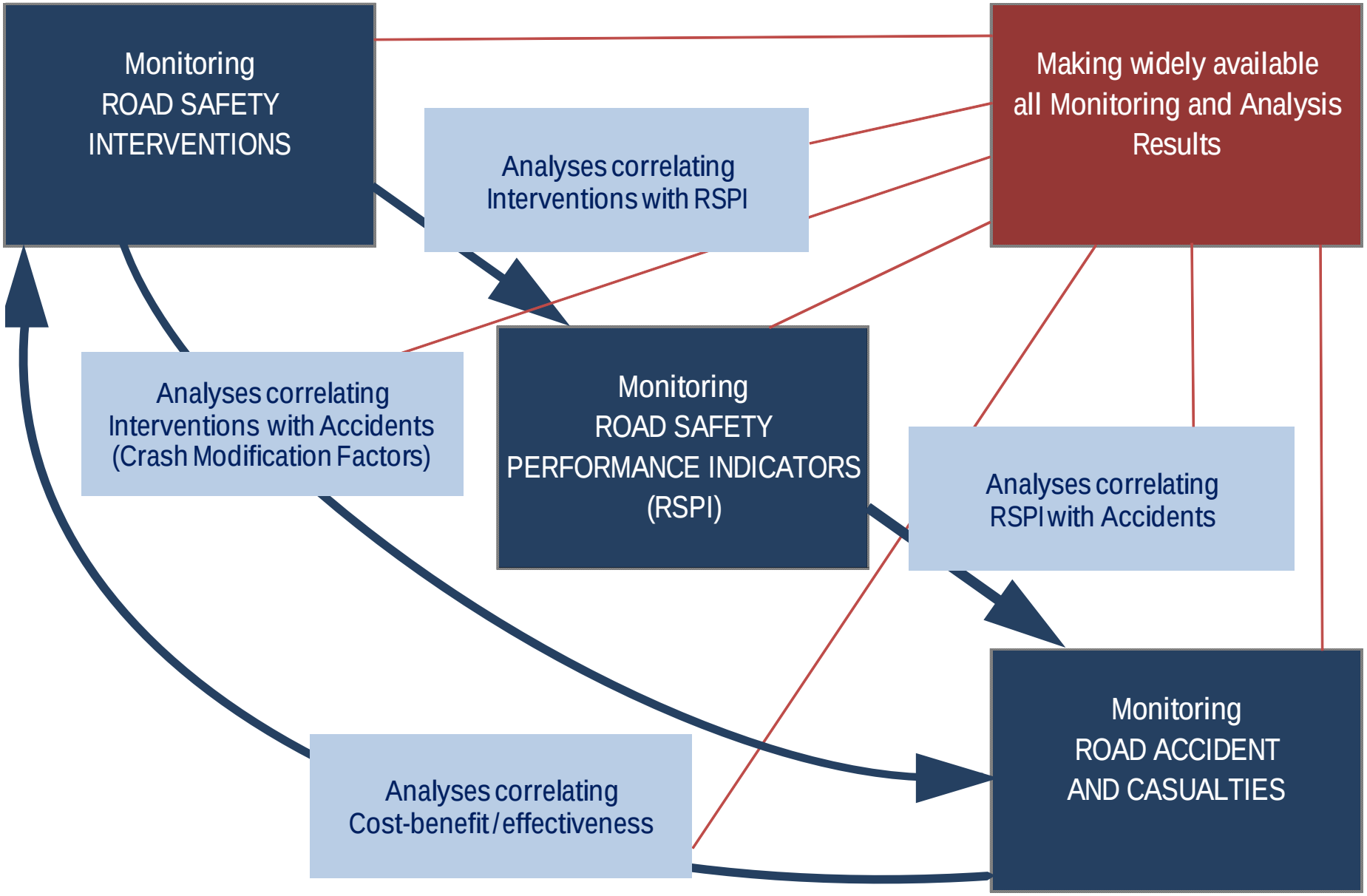
Background - Road Safety Performance Indicators



Background - Internet Of Things

The Internet Of Things (IoT) is progressively bringing new possibilities and opportunities:

- Affordable On Board Diagnostics (OBD) systems,
- Wide penetration of Smartphones & Social Networks
- Efficient Data Transmission (through GSM networks),
- Powerful Cloud computing,
- More insightful Big Data analysis,

Current technological advances
in Europe and worldwide
make data collection and exploitation
substantially easier and more accurate
than before.

Objective

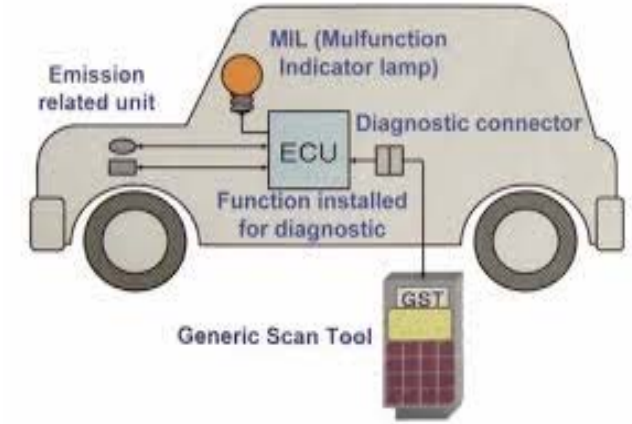
The objective of this presentation is to demonstrate the potential for **monitoring and star rating driver traffic and safety behaviour**, through the use of continuous data collection from the vehicle (On Board Diagnostics) and the smartphone.

This research attempts to address:

- The correlation between driving behaviour and degree of exposure with traffic risk,
- The impact of critical behavioural and exposure indicators on traffic risk
- Driving behavior and exposure models (and their combination) using the above indicators for traffic risk calculation.

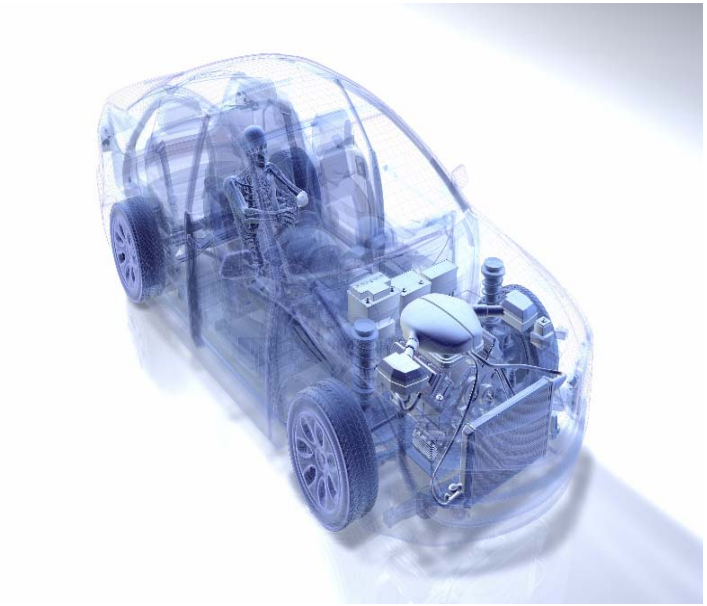
On Board Diagnostics (OBD)

- OBD is referring to a vehicle's self-diagnostic and reporting capability
- It provides access to data from the engine control unit (ECU)
- OBD systems give access to the status of the various vehicle subsystems
- It can be used for recording several driving characteristics
- It is easily installed through an existing plug in the vehicle
- Data are automatically transmitted in a central database through the mobile network of a telecom provider



Data Collection

Continuous data collection from the OBD and the smartphone is much easier today



- An OBD (on-board diagnostics) device can be easily installed in the vehicle at an affordable price.
- This OBD integrates GSM/GPRS technology which records and transmits critical driving behaviour features such as:

  - Mileage driven
  - Road network used (through GPS position)
  - Duration and time of the day driving

  - Harsh braking
  - Harsh acceleration
  - Speed
  - Fuel consumption

Data Transmission

Continuous data transmission from the Vehicle CAN bus via the OBD device and the GSM:

- Data collected can be continuously recorded (1 - 30 Hz frequency)
- Data recorded from the vehicle sensors is transmitted in real time by GSM cards (OBD or mobile phone)
- Data are stored through web clouds to remote servers and to back office databases

Discussion on data privacy is well open in Europe and worldwide (is data anonymisation possible?)

Big Data Processing and Analyis

The highly spatially and time disaggregated data from the OBD unit and the Smartphone can be converted into useful indicators

Big Data analysis:

- Signal processing methods (e.g. Fourier analysis) are used to clean the data, remove the “noise” and identify patterns
- Data mining methods are used for trajectory pattern mining, clustering and classification
- Indicators can then be calculated by ‘querying’ the processed data:
  - Risk exposure indicators
  - Behavioural indicators

Data reduction should avoid knowledge reduction

Feedback to the Driver

- The database is analysed in order to rate each driver based on his/her driving performance

- This allows the development of indicators of driver risk exposure and behaviour

- The outputs can be transferred through an application programming interface (API) to a user-friendly web portal or Smartphone App where driver is able to:
  - monitor his driving performance
  - receive feedback on his individual driving risk
  - identify behaviours that need to be improved

Data reliability and representativeness must be guaranteed

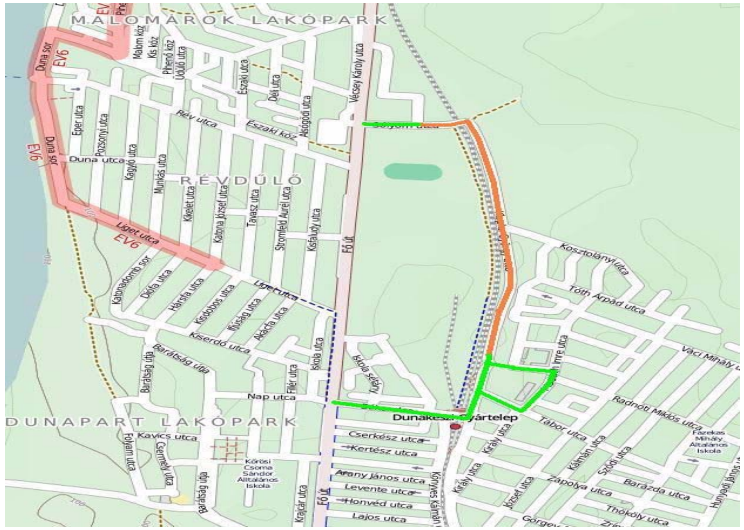
Risk Exposure Indicators

- Number of trips

- Total distance driven by the user (mileage)

- Type and specific segments of the road network used (given by GPS position)

- Time of the day driving and driving duration (driving during risky hours)



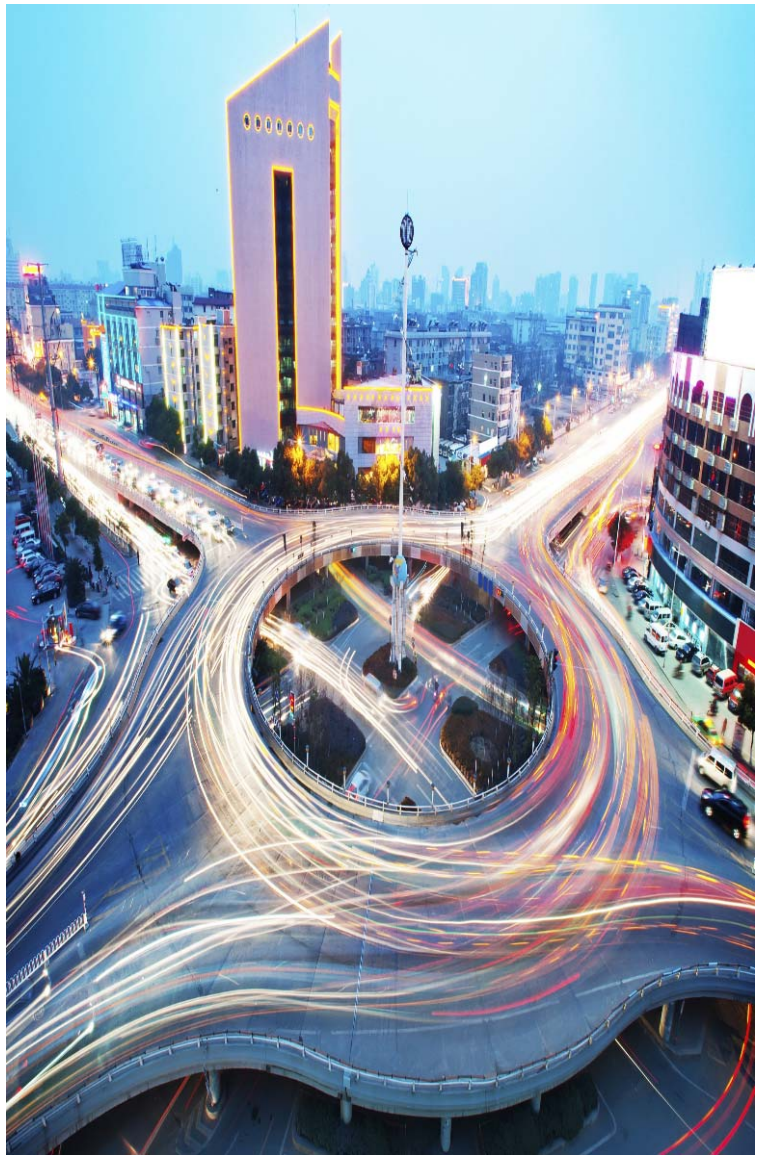
combined with other data files (road types and high risk sites, speed limits, traffic volume) by means of map matching algorithms.

Driver Behaviour Indicators

- Speed, acceleration, deceleration
- Steering angle
- Engine rpm and use of gear box
- Speeding (driving over the speed limit)
- Harsh braking (number and severity of brakings).
- Harsh acceleration (number and severity of accelerations)

- User's accident record.
- Vehicle's safety classification

All the above mentioned indicators are exploited either separately in a risk exposure model and a behavioural model or as a combined risk exposure and behaviour model.



More Driver Behaviour Indicators

In more advanced setups, when sufficient amount of data is available, new additional or composite parameters might be used such as:

- distraction from mobile phone use
- seat belt use
- alcohol consumption
- vehicle maintenance

- eco-driving could also be exploited in the future as it is proved to have a significant correlation with crash risk since fuel consumption is strongly correlated with aggressive driving and speeding

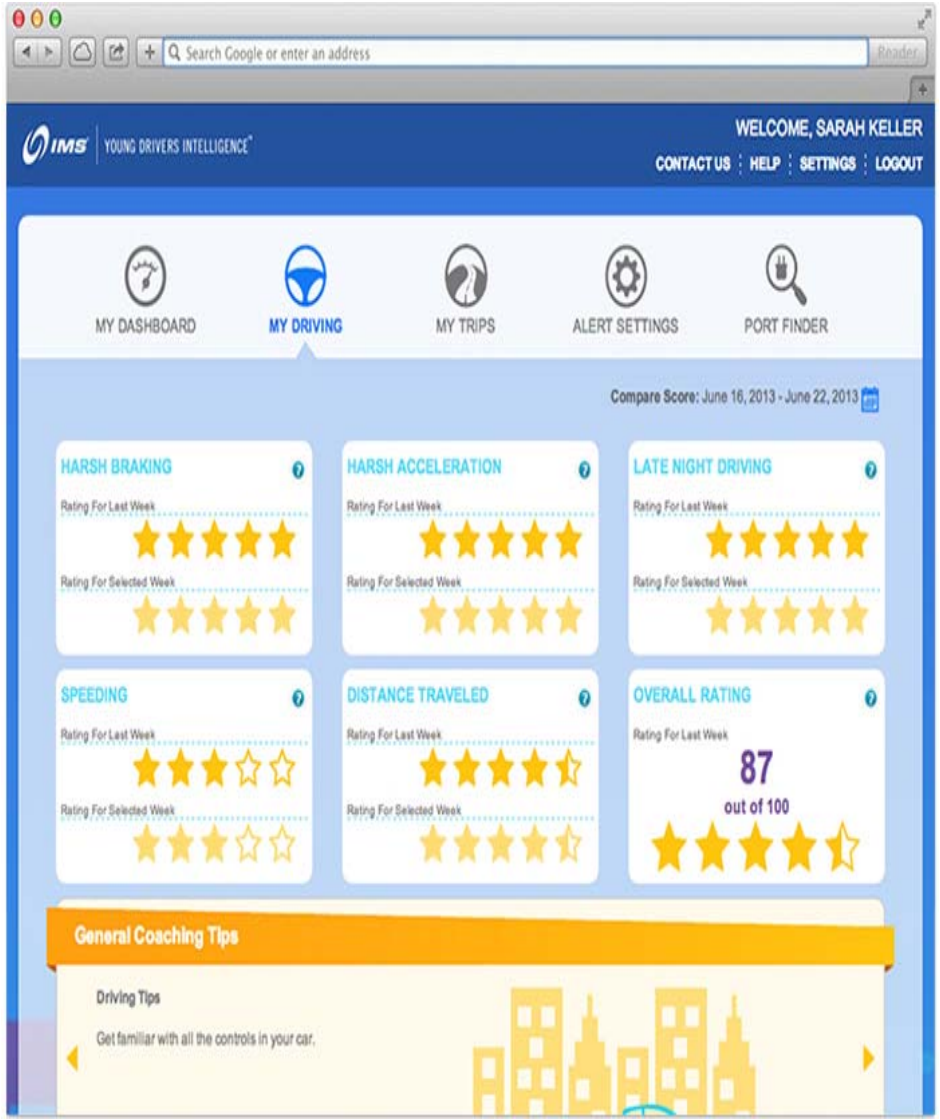
Driver Behaviour Star Rating

The risk exposure and behaviour indicators calculated can be translated into star rating scales:

- Driver risk exposure and behaviour monitoring and star rating can be initially derived as a weighted combination of the above parameters through sophisticated data analysis and modelling
- Weighting is gradually adjusted with the cumulative dataset
- The final outcome of this modelling can be a risk indicator in the scale 0-10(0) that depicts the risks associated with the driving behaviour

Driver Information, Feedback and Benchmarking

- The driver behavior “stars” system is communicated to the driver through smartphone apps or a web portal, providing:
  - Information and monitoring on individual driving behaviour and risks
  - Feedback and tips on driving aspects needing improvement
  - Benchmarking among peers
  - Data on fuel consumption may also be included in the “star rating” to monitor eco performance.

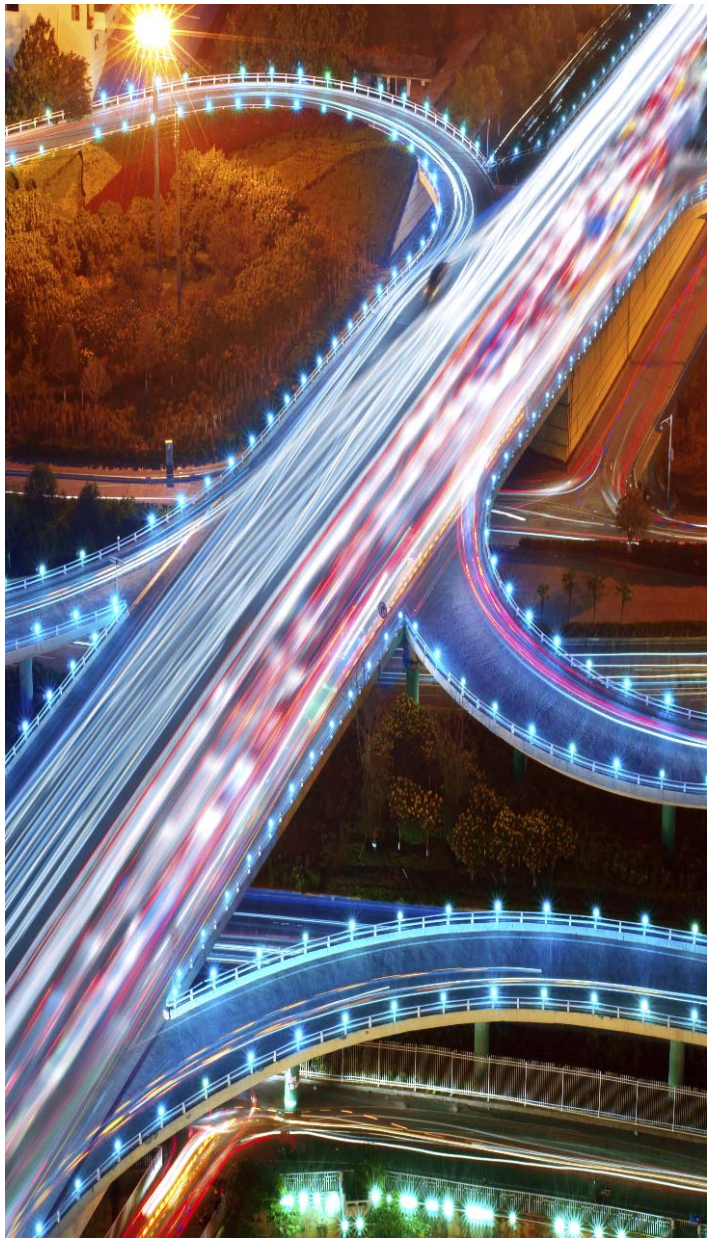


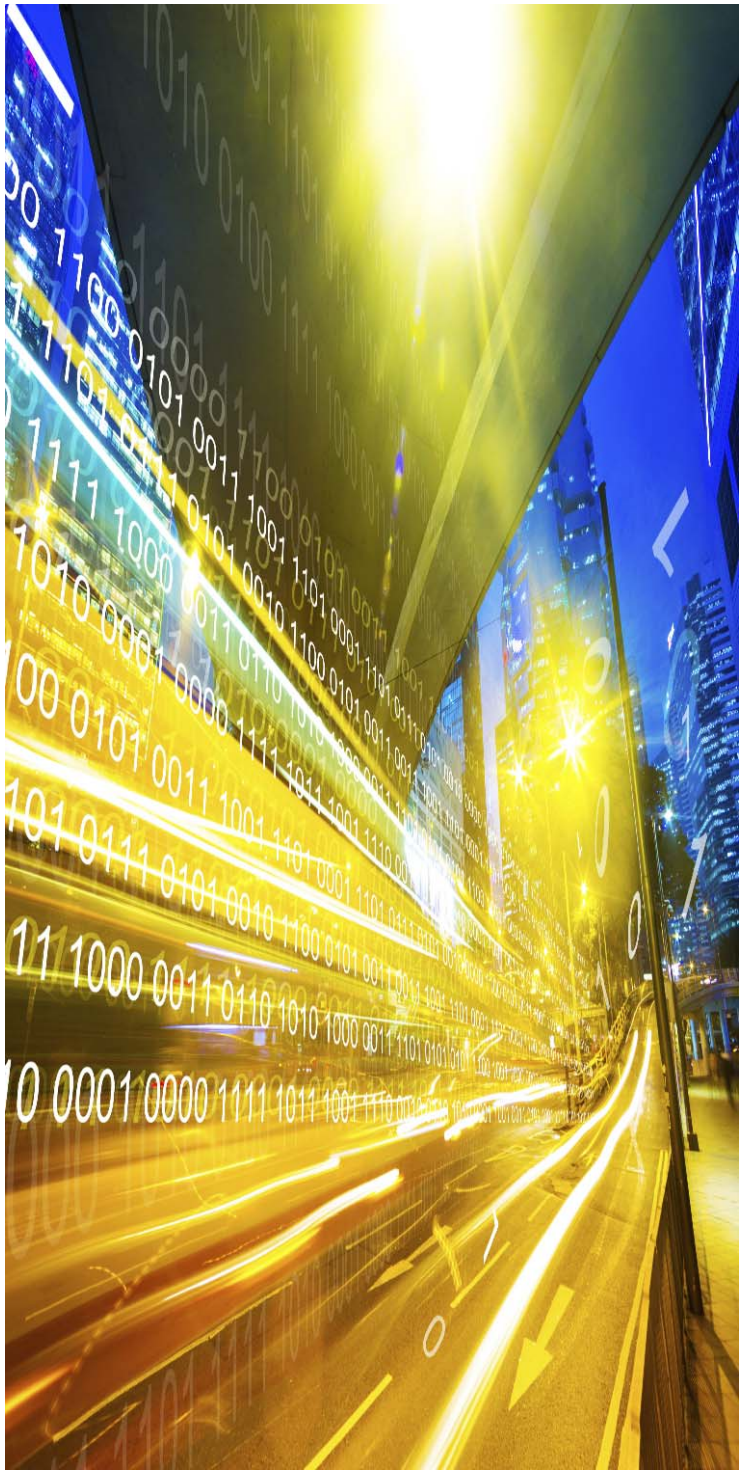
Conclusion

The Internet of Things makes gradually possible the continuous driver assessment, opening a new great potential for traffic and safety behaviour improvement, used either:

- Independently by the drivers in order to:
  - raise awareness and engagement on safe and environment friendly driving
  - provide feedback and support on driving performance and risks,

- Through customized insurance schemes by correlating driving exposure and behaviour with insurance premiums:
  - pay-as-you-drive
  - pay-how-you-drive





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