Roadside measurements of L-vehicle emissions

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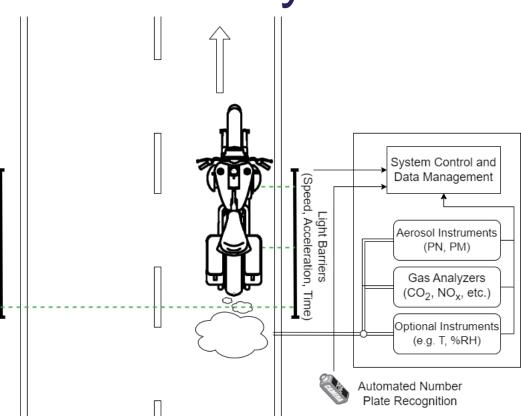
- Roadside Emission Measurements
 - Setup
 - Device Validation
 - Data Management
 - Data Analysis
 - Schlieren Imaging of Vehicle Exhaust Plumes



Roadside Emission Measurement by Point Sampling (PS)

- Sample extraction via tube, analyzers in PS bus
- Vehicle detection, speed and acceleration measurement via light barriers
- Al-based Automated Number Plate Recognition
- Logging vast amounts of data
- Battery powered operation







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Roadside Point Sampling (PS) Setup

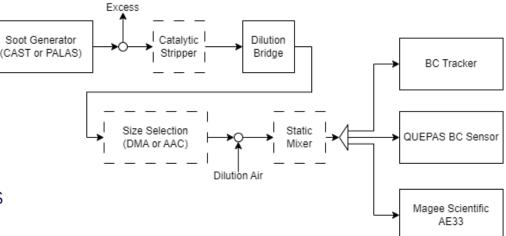




Device Validation Campaign

In-lab sensor calibration

- Calibration of black-carbon sensors for different EC/OC ratios
- Particle number (PN) Sensor calibration
- CO2-sensor and NOx-sensor factory calibrated
- Engine exhaust particle sizer (EEPS) calibrated
- Point Sampling Exercise
 - Around 150 passes of L-vehicles with different categories
 - Validation of all sensors with PS



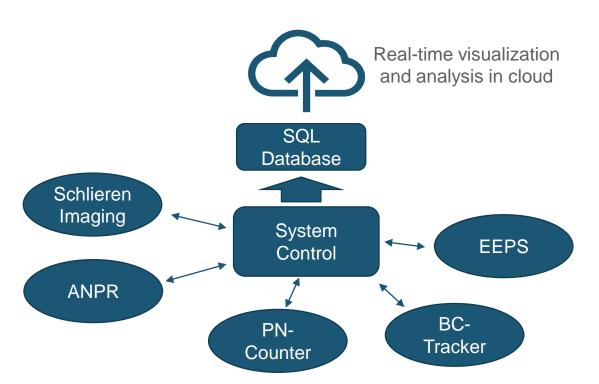


Data Management

- Point sampling data management
 - PS shelter equipped with central system control
 - Instrument time alignment
 - Sampling time correction
 - Data logging and storage \rightarrow local SQL database
- Optional cloud uplink
 - Link SQL database to cloud
 - Real-time visualization hub

mitigation Solutions

- publicly visible data stream (e.g. post link on webpage)
- log-in protected data stream (e.g. for project partners)
- log-in protected alarm page (e.g. for authorities)
- Cloud real-time data analysis possible option for future campaigns



COMM

THE DIGITAL GOVERNMENT EXPERTS

6

Data Analysis

 Based on [Knoll et al. Large-scale automated emission measurement of individual vehicles with point sampling. Pre-print. EGUsphere. 2023.] – approach for CARES data

30

25

m 20

Integrated

BC plume

10

5

16:43:25

TUG-PDA start range

6s

16:43:35

Passing vehicles

CO₂ plume

16:43:40

Time

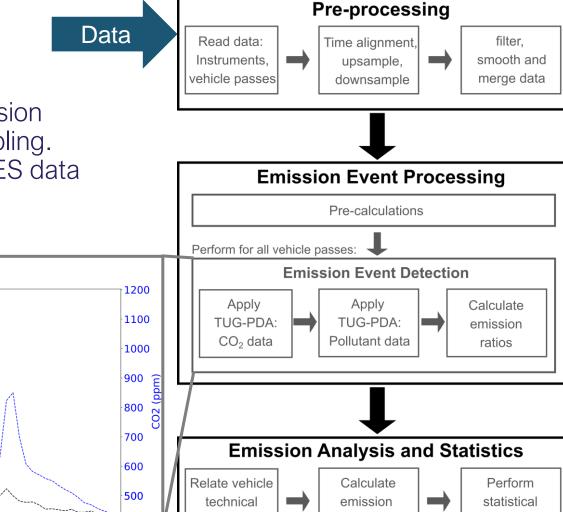
16:43:45

16:43:50

1s.

16:43:30

- Automated post-processing
 - Peak detection
 - Alignment
 - Pollution data
 - Obtain Efs
- Emission Factors (Emission Ratio ER) $ER = \frac{\int_{t_1}^{t_2} ([P]_t - [P]_{t_0}) dt}{\int_{t_1}^{t_2} ([CO_2]_t - [CO_2]_{t_0}) dt}$



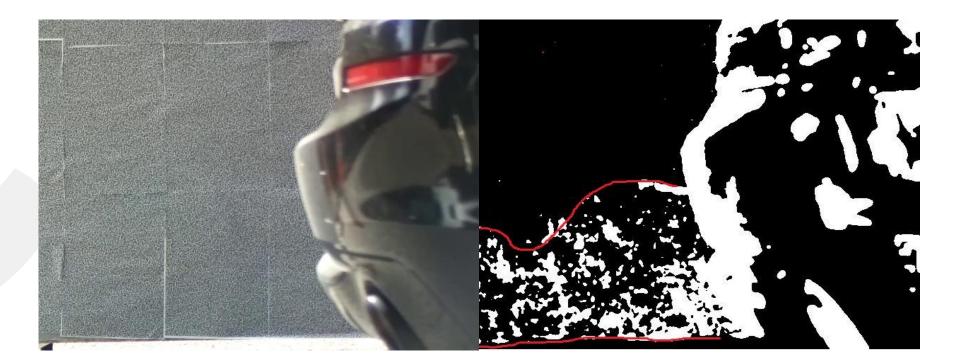
specifications

factors

evaluation

Schlieren Imaging Technique

Car – Leuven – Donkerstraat 37 - 2024-05-13 15:41:28



Original image

Schlieren image



Schlieren Imaging Technique

Scooter - Leuven - Donkerstraat 37 - 2024-05-13 17:20:41



Original image

Schlieren image



Schlieren Imaging Technique

Heavy Bike – Leuven – Donkerstraat 37 - 2024-05-13 16:14:25



Original image

Schlieren image



Conclusion

• Point sampling setup with all the sensing devices have been setup in Leuven

• More than 100 L-vehicles have been tested in Leuven in last two days

• Detection of high emitters will be done after post processing of data from all the devices

 Detection of high emitters in real time by PS in general possible when thresholds are defined, possibly by combining the analyzed LENS emission data



Thank you!



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Colour palette

RGB	HEX
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0/159/227	009fe3
40/35/93	28235d
81/192/72	51c048
225/225/225	E1E1E1

