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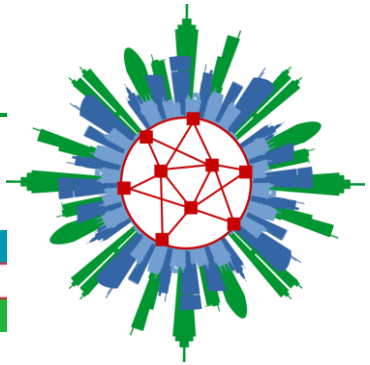
SuMoCoS

Sustainability and Mobility in the Context of Smart Cities



# ECOSense – Collection and analysis of cycling data

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# Agenda

| No. | Topic |
|---|---|
| 1. | Motivation |
| 2. | Project presentation |
| 3. | Sensor development |
| 4. | Data analysis |


mFUND
Das Startkapital für die Mobilität 4.0

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aufgrund eines Beschlusses des Deutschen Bundestages

# Motivation

- Many challenges in the transport sector
  - Climate and environmental impacts
  - Noise pollution
  - Traffic jam
  - Limited parking spaces
  - …

- **Promoting cycling as a possible solution!**

➡ **Integration in Smart City Infrastructure**

  - Increasing the availability of cycling data
  - Communication with infrastructure
  - Sensors

# Project ECOSense

- Sensors attached to the bicycle, collects data from the following areas:
  - Speed and acceleration data
  - Route and geographical data
  - Traffic safety data
  - Environmental data

Refinement of the collected data with already existing bicycle data (e.g. counting loop data) and integration in Smart Cities

- Analysis of the data with reference to:
  - Speed
  - Environmental influences
  - Route selection
  - Driving behavior
  - Hazardous zones

New insights for the optimization and digitalisation of the bicycle infrastructure

# Project schedule and goal

- **Project duration:** 01.06.19 – 28.02.2020


- Current project phase:
  - Sensor development
  - Acquisition of test persons
  - Preparation of data collection

- Goals:
  - Development of a sensor for bicycles to record driving data, vibration and environmental data
  - Equipping 200 bicycles with the developed sensor
  - Collection of data over 4 months
  - Analysis of the collected data (e.g. route selection, road safety, environmental impacts)

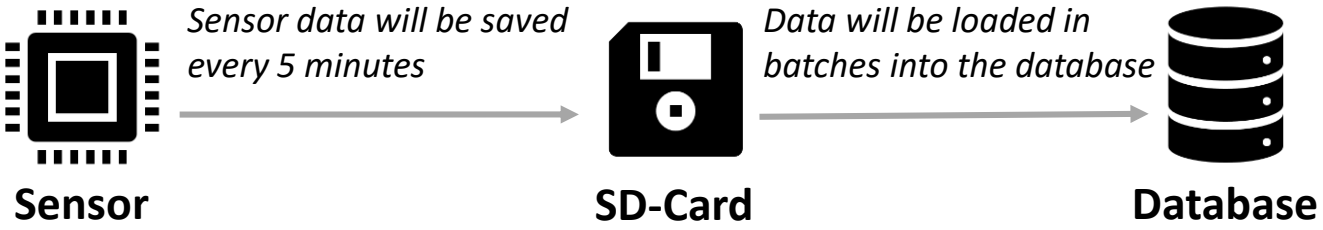
# Sensor development

- Current status: Specification phase completed


- Attributes of the sensor

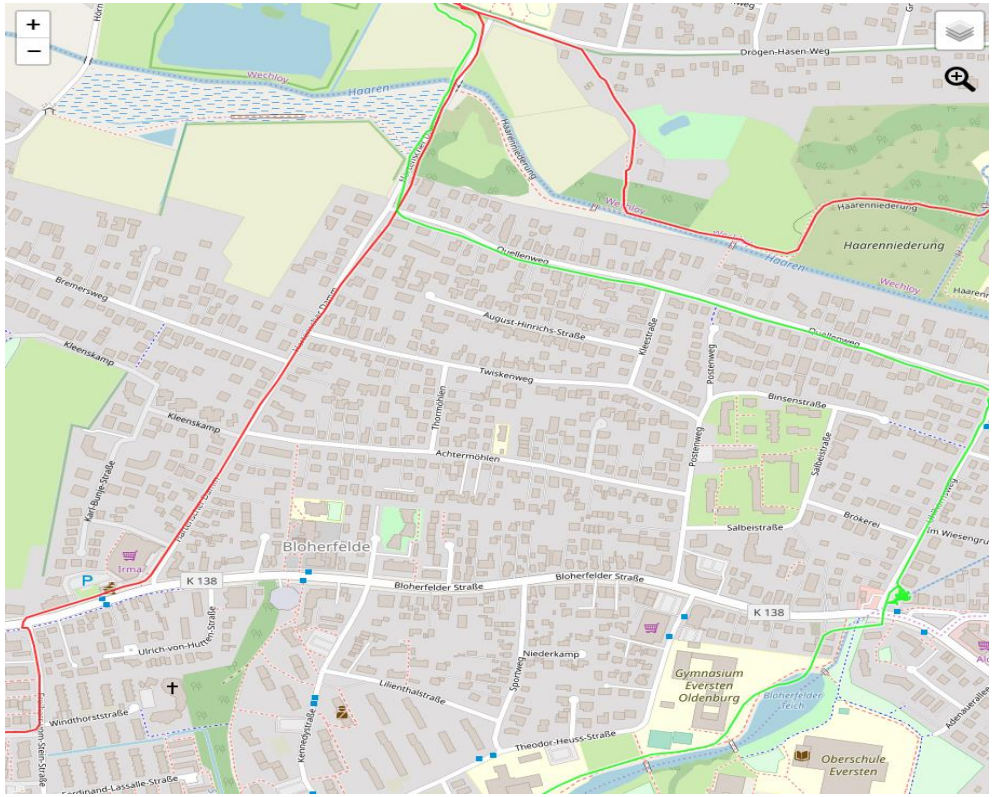
  for data collection:
  - GPS for position and time
  - Acceleration, position and direction (compass) for driving behavior, path quality etc.
  - Air pressure, temperature, humidity, brightness as environmental specifications

- Data transfer:



# First results of measured data

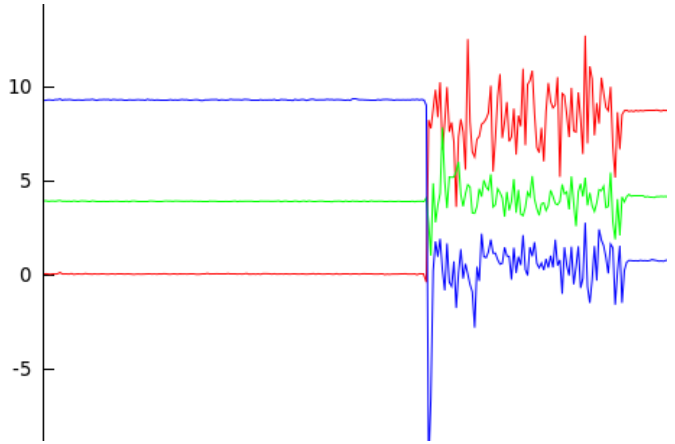
- Good GPS results and the correct side recognition of the road (e.g. use of cycling paths)



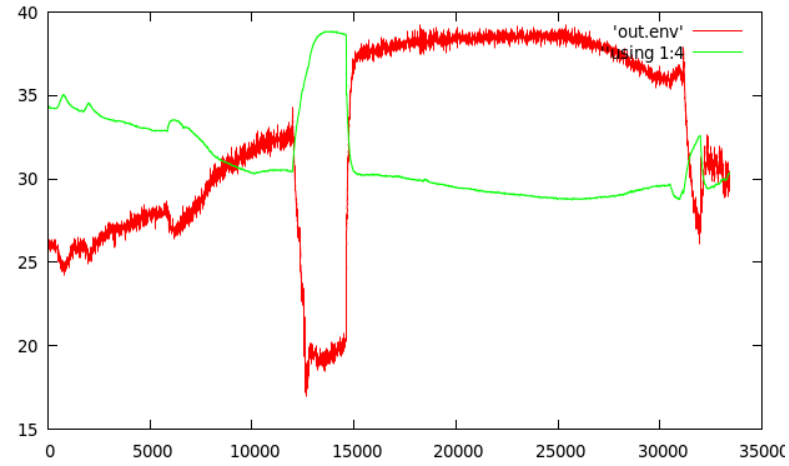

Example: two recorded routes (red and green)

# First results of measured data

- Acceleration data still needs to be calibrated and further calculated
  - Three independent vectors
  - Difficult to interpret



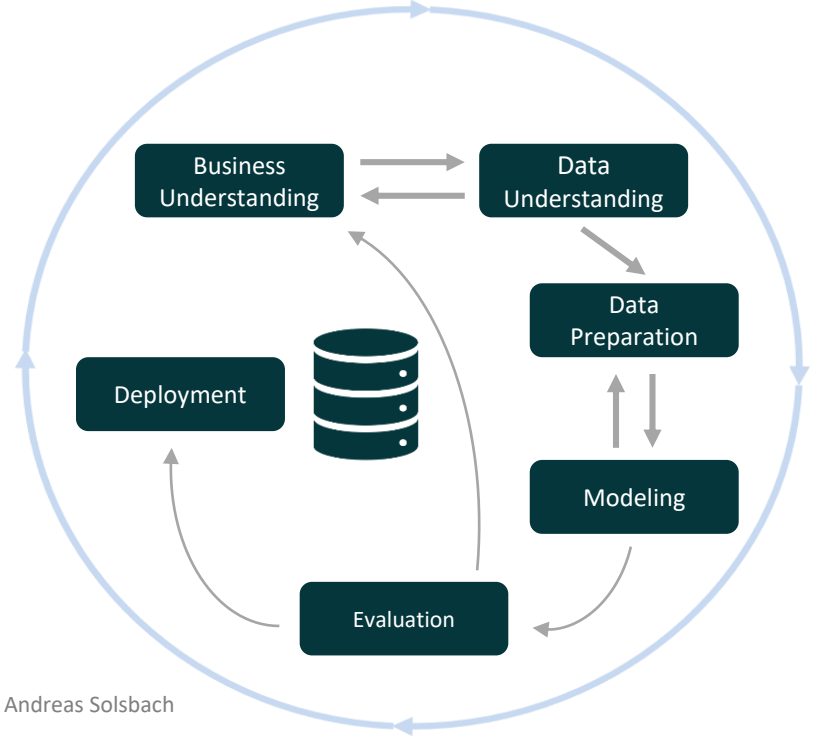

- Temperature (not calibrated, green) and humidity (red)
  - Example:
    - Sensor is placed in a pocket
    - Temperature rises while humidity is decreasing



# Data protection and analysis

- Data protection:
  - In the sensors:
    - Data storage is encrypted on SD Cards
    - The data can only be read when the SD cards are removed
  - After removing the SC cards:
    - Storage of the data on internal servers of the University of Oldenburg
    - Data will be pseudonomised
    - Data will be evaluated, aggregated and further processed
    - Data will be erased after analysis

- Data analysis:
  - Use of CRISP-DM
  - One iteration per use case



# Data analysis – Use Cases and Categories (1/2)

| Use Case | Analysis categories | Required data | Complexity |
|---|---|---|---|
| Influence of weather on bicycle traffic<br>• How often will the bicycle used in bad weather conditions?<br>• Are different routes used depending on the weather? | Environmental data/ Route and geographical data | • GPS<br>• Temperature<br>• Humidity<br>• Weather data | High |
| Detection of road damage and quality of the road surface<br>• Can the sensor on the bike detect road damage?<br>• Is the quality of the road related to its use? | Traffic safety data/ Speed and acceleration data | • GPS<br>• Acceleration<br>• Location | Very high |
| Factors that influence route use<br>• Does the use of a road depending on the time of day (e.g. night lighting)?<br>• Does the time of day influence the choice of a route? | Environmental data/ Route and geographical data | • GPS<br>• Maps<br>• Counting data | Middle |

# Data analysis – Use Cases and Categories (2/2)

| Use Case | Analysis categories | Required data | Complexity |
|---|---|---|---|
| Identification of hazardous points<br>• At which points is braking particular strong ( e.g. negative acceleration)? | Acceleration data/<br>Traffic safety data/<br>Route data | • GPS<br>• Acceleration data | High |
| Influence of weather and driving style (e.g. acceleration, speed, braking behavior)<br>• How does the weather influence acceleration and braking?<br>• Do cyclists slow down in bad weather conditions? | Traffic safety data/<br>Environmental data | • Weather data<br>• GPS<br>• Acceleration data<br>• Temperature<br>• Humidity | High |
| Average speed on different routes<br>• Does the average speed depend on different routes (e.g. cycle paths and cycle roads)? | Traffic safety data | • GPS | Low |

# Project partner

University of Oldenburg – Very Large Business Applications
https://uol.de/vlba/projekte/ecosense

baron mobility service GmbH
https://mein-dienstrad.de/

CoSynth GmbH & Co. KG
http://www.cosynth.com/

# Contact

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