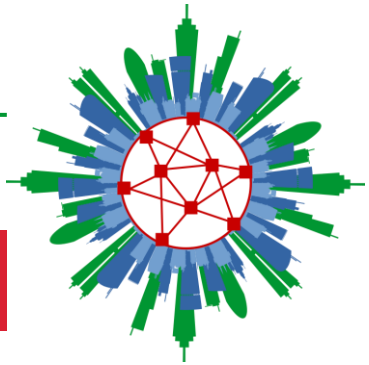
CARL VON OSSIETZKY universität OLDENBURG

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

Gefördert durch:
Bundesministerium für Verkehr und digitale Infrastruktur
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

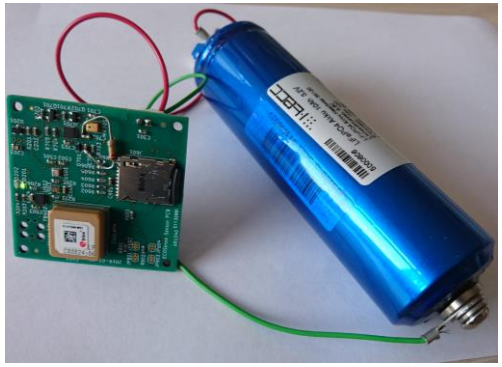
- **Project duration:** 01.06.19 – 28.02.2020

- 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 wit 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

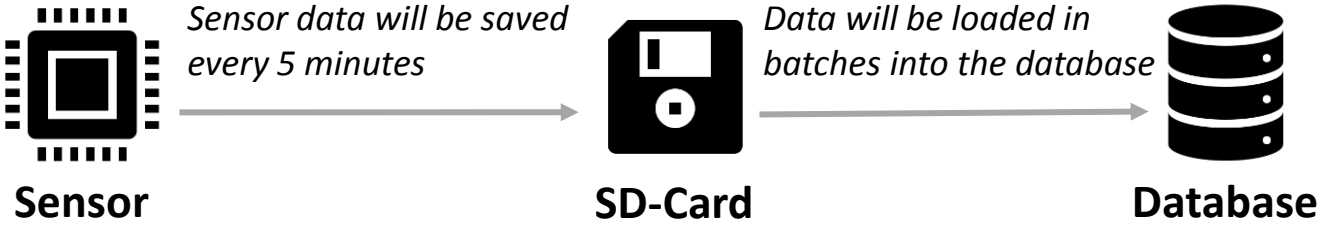


First prototype of the sensor
(200h battery life)

- Attributes of the sensor

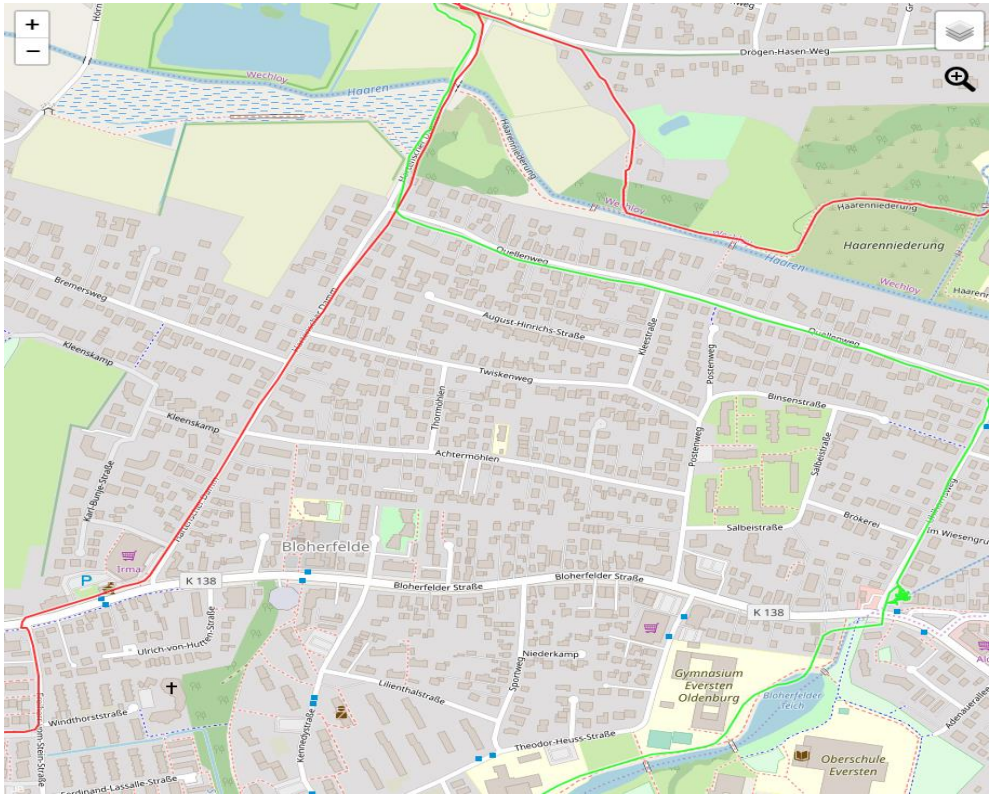
  for data collection:
  - GPS for position and time
  - Acceleration, position and direction (compass) for driving behavior, path quality etc.
  - Air pressure, temperature, humidity, brightness as environmental specifications

- Data transfer:



First results of measured data

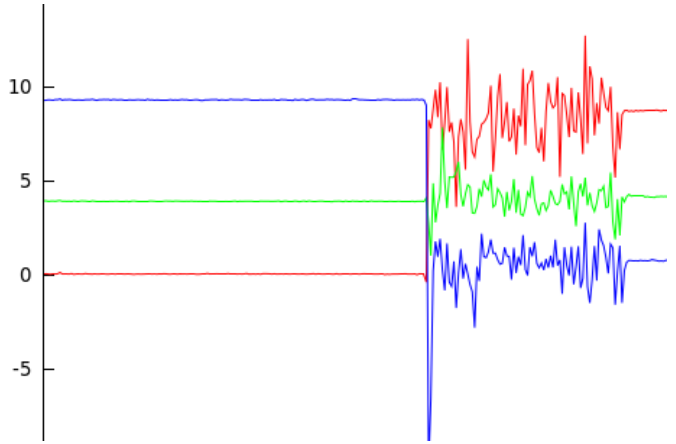
- Good GPS results and the correct side recognition of the road (e.g. use of cycling paths)



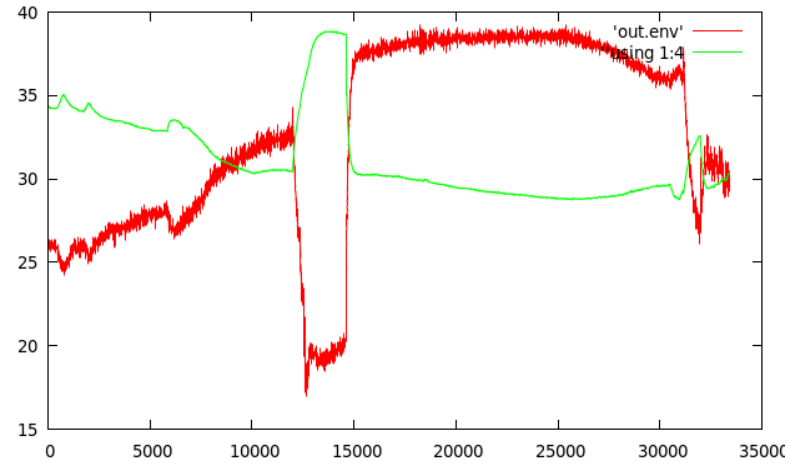
Example: two recorded routes (red and green)

First results of measured data

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



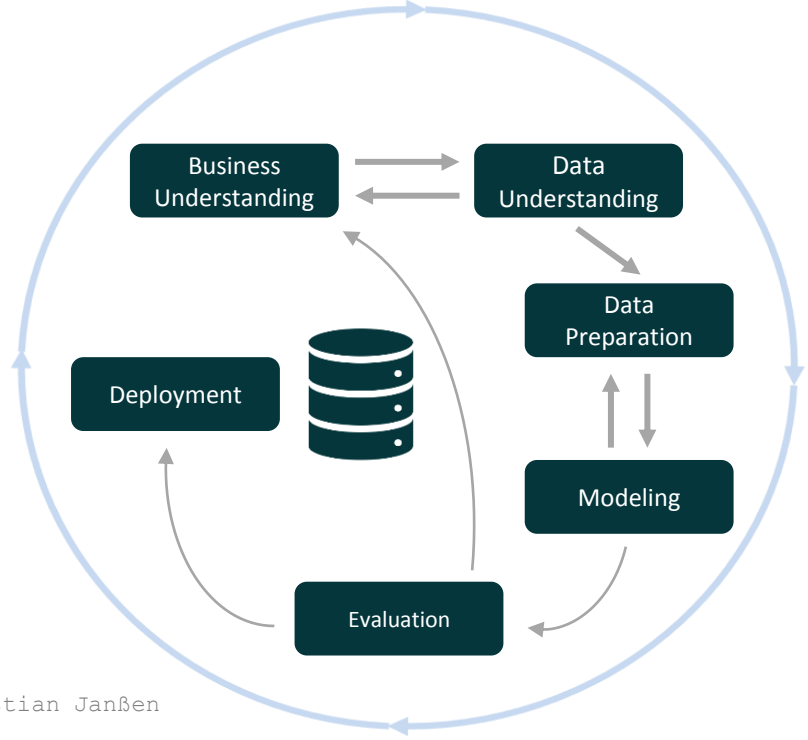
- Temperature (not calibrated, green) and humidity (red)
  - Example:
    - Sensor is placed in a pocket
    - Temperature rises while humidity is decreasing



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

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

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

Project partner

VERY LARGE BUSINESS APPLICATIONS
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University of Oldenburg – Very Large Business Applications

mein-dienstrad.de

baron mobility service GmbH

CoSynth GmbH & Co. KG
Embedded Systems

CoSynth GmbH & Co. KG

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