Dr. Sebastian Strunck, Continental Teves AG & Co. oHG

IMAGinE

12 MAY 22

FINAL EVENT

The Cooperative Perception in Real World Implementation

OUTLINE

Working CPM implementation on test track

Data flow and latencies

Influence of errors of self localization

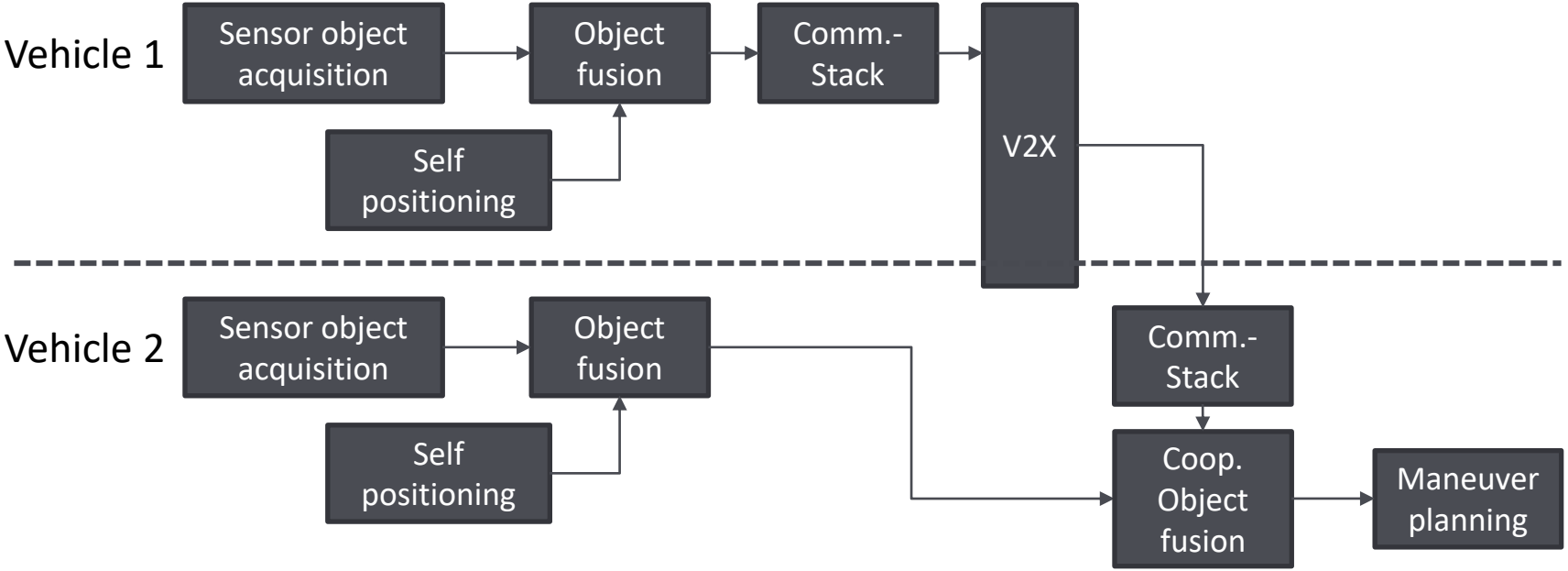
Influence of errors of sensor perception

Working CPM in real traffic

DATA FLOW AND LATENCIES

Data flow and latencies

Cascaded tracking filters and system delays



Cascaded tracking filters and system delays

High dynamic test situation

- Latency of software modules
- Low pass filter characteristics of fusion algorithms
- Observing vehicle: v1

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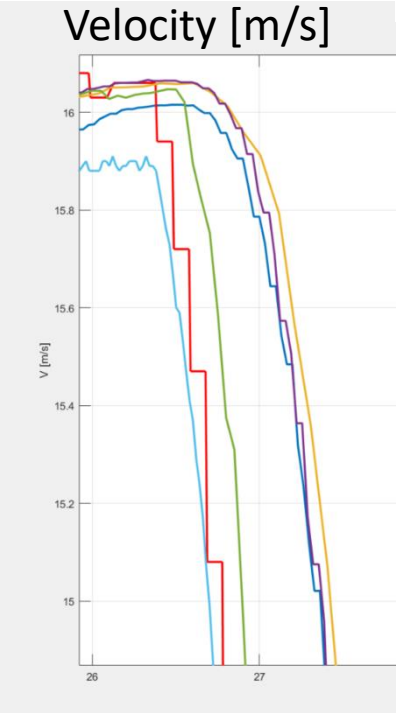
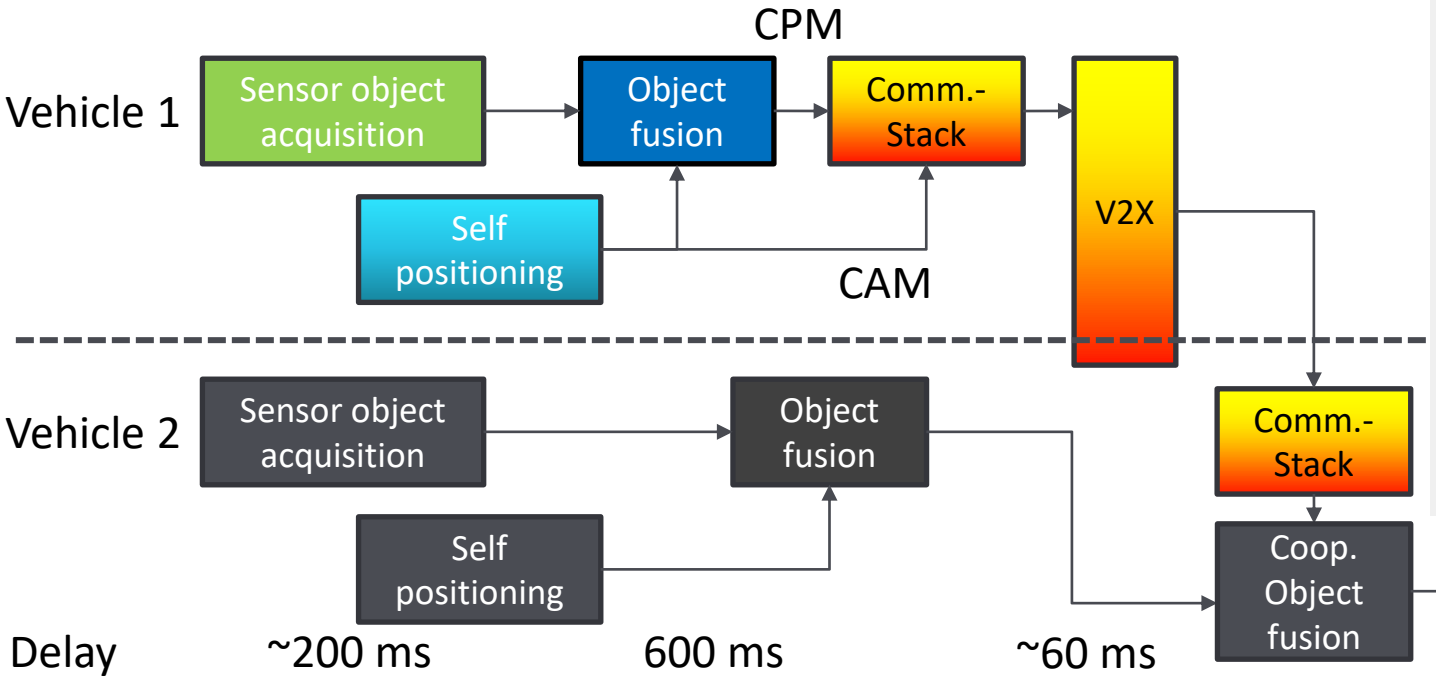
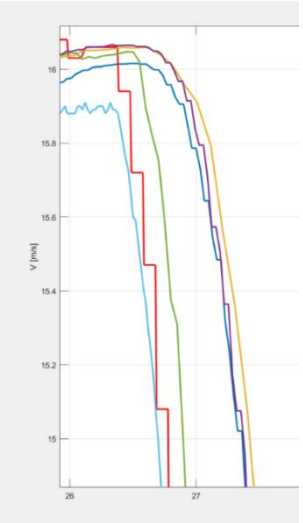


- Inertial sensorics of v3
- CAM from v3
- Tracked objects data in v1
- Local fusion in v1
- Local fusion in v2
- CPM from v2

Cascaded tracking filters and system delays

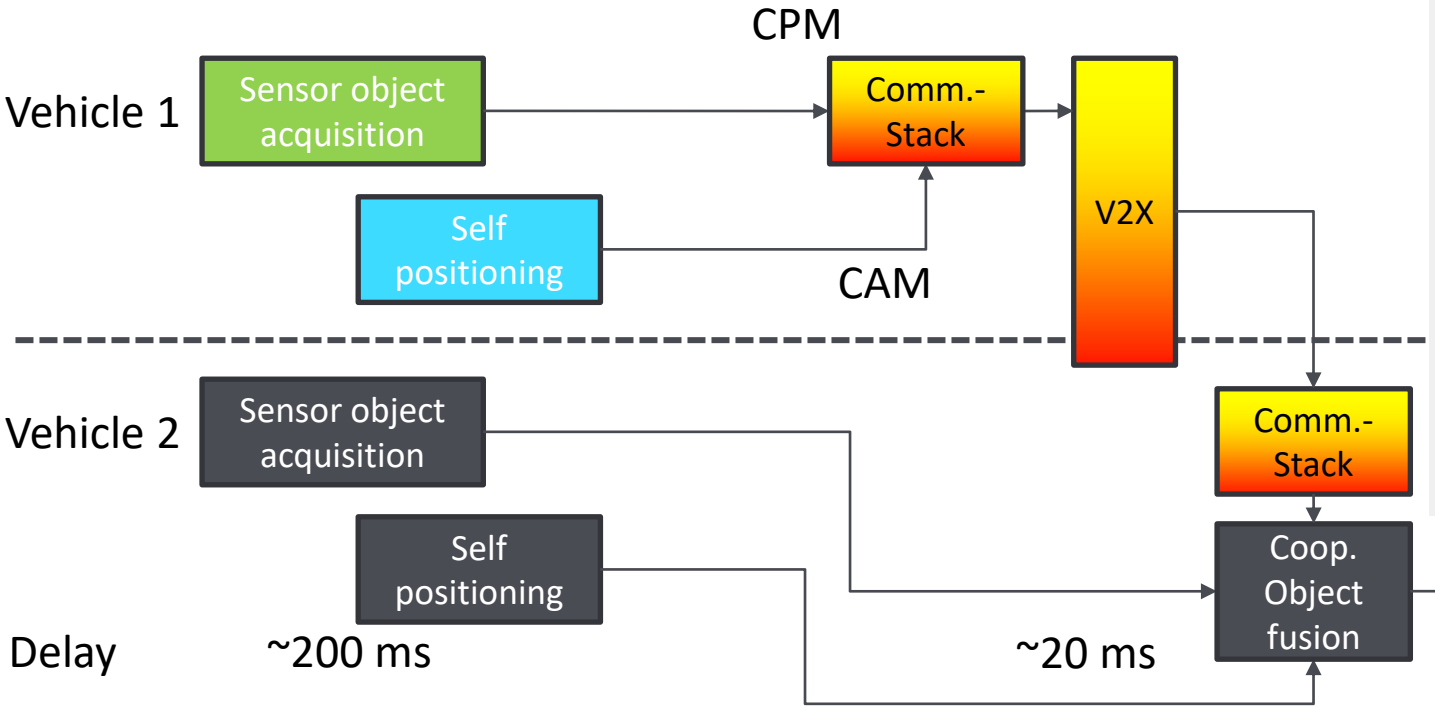
Object fusion on sender side

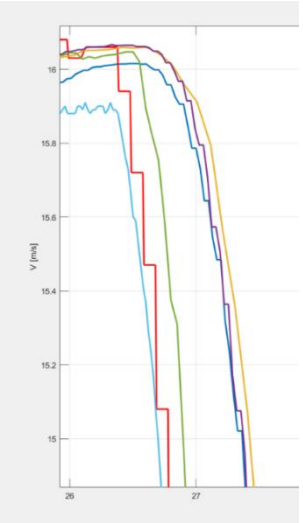




Cascaded tracking filters and system delays

Direct transmission of sensor based objects





Cascaded tracking filters and system delays

Summary

Object fusion in the sender vehicle

- Fuse sensor data before sending them via CPM introduces
  - Some small processing delay (depends on the cycle time)
  - Low pass characteristic of the data.
- The CPM can be filled with only relevant objects.

Only receiver-based object fusion

- Less delay and low pass filtered data.
- Bigger CPM payload due to multiple data objects of the same physical object.
- Fusibility of unprocessed sensor objects via CPM needs to be ensured.

INFLUENCE OF ERRORS

Influence of errors of self localization

Influence of errors of sensor perception

Influence of errors of self localisation

Summary

Legend

Green: Observing vehicle (EGO)

Blue: Sensorics of EGO

Yellow: CAM-Object (v2v)

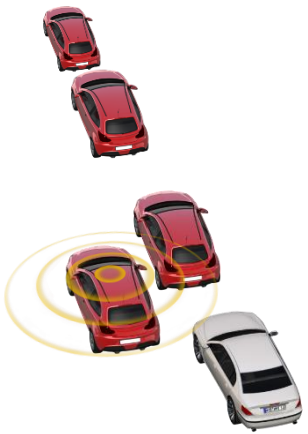
Orange: CPM-Object (v2v)

Cyan: Global fusion (sensors + v2v)

Situation

4 vehicles in a row

1 passing vehicle on the left



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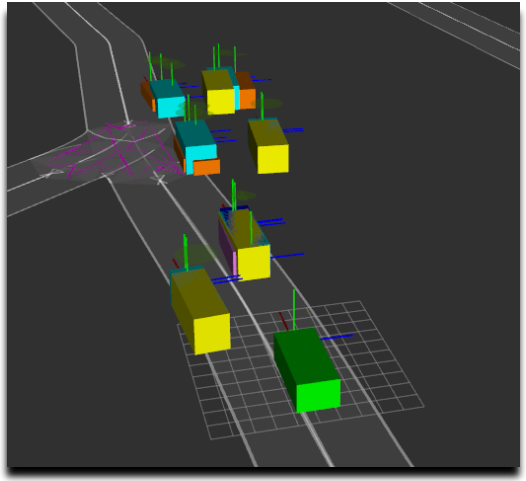
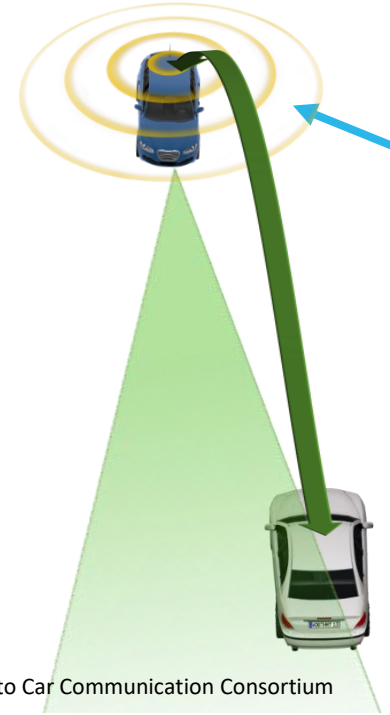


Influence of errors of sensor perception

Camera



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Sensing Vehicle

Observing Vehicle

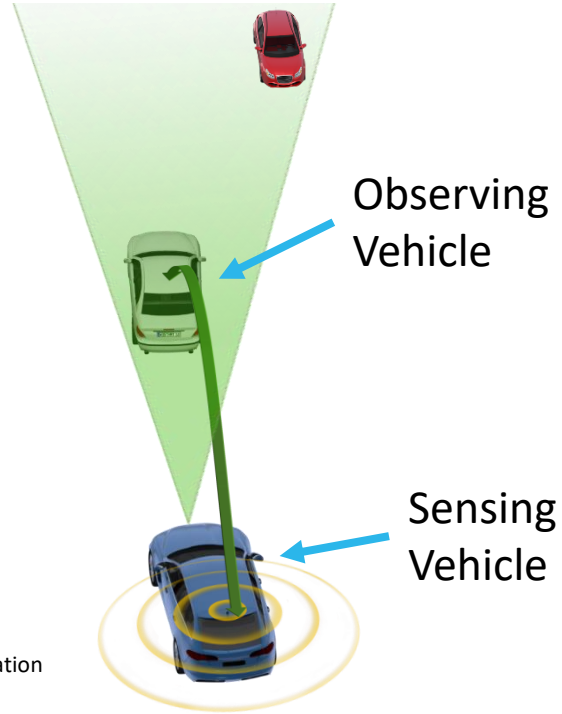
Ego

CAM

CPM

Influence of errors of sensor perception

Radar



Ego
CAM
CPM

WORKING CPM IN REAL TRAFFIC


contiVehicle.rviz* - RViz
Apr 20 2022 16:18
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
extraction/TactICalTargetPo
standby
Ego-Speed =0,3kmh
Ego-SetSpeed=30kmh (manual)
Ego-ObjList:(6) 80066=7,1m/2kph, 80068=8,4m/0k
Ego-CAM-diffs:80066=0,04s, 80068=0,03s, 25500=
Ego-Arbitrated=Auto
Ego-Blinker =
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click:: Move Z. Shift: More options.
31 fps

Summary and Outlook

- Either self positioning errors or object positioning errors lead to ghost objects.
- Any further driving function will be prevented by ghost objects on the road.

- Infrastructure based senders could be the first step.
  - Static and well calibrated sender-position.
  - Well calibrated sensors for precise localization of objects.
- Trustworthiness of provided data is required (but was not in scope of IMAGinE).
- Filter and prediction cascading should be prevented to keep the dynamics of the object tracks.

THANK YOU

Dr. Sebastian Strunck

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Images: IMAGinE, Unsplash Car to Car Communication Consortium