Role of Digital Maps in Road Transport Security

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TS07E: Multi-Sensor Positioning

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Outline

- Motivation and Introduction
- Map Data Availability Analysis
- Map Data Quality Analysis
- Map Preview in Demonstration
- Outlook
Motivation

Autonomous Emergency Manoeuvring and Movement Monitoring for Road Transport Security ➔ TransSec

• Funded: GSA (European GNSS Agency) within the H2020-GALILEO-GSA
• Duration: February 2018 to February 2021 (3 years)
• Partners:
  o Daimler AG (DAI), Germany
  o TeleConsult Austria GmbH (TCA), Austria
  o Vicomtech (VICOM), Spain
  o Waterford Institute of Technology (WIT), Ireland
  o Institute of Engineering Geodesy, University of Stuttgart (USTUTT), Germany
Introduction
TransSec Project

WP2: Precise Vehicle Positioning
WP5: Vehicle Movement Monitoring
WP6: V-2-X Communication
WP4: Environment Object Detection
WP3: Road and Environment Map
WP7: Autonomous Emergency Manoeuvering
In addition:
WP1: Project Management
WP8: Integration and Pilot Testing
WP9: Dissemination
Introduction
Overview of WP2-Precise Vehicle Positioning

PPP Approach (TCA)  Multisensor Integration (USTUTT)

Source: TransSec Deliverable D2.1
Requirements for Positioning Quality

Image source: https://www.vboxautomotive.co.uk/images/products/IMU04-with-xyz.jpg
Introduction
Overview of WP3 - Road and Environment Map

WP2: Precise Vehicle Positioning

Map-Aiding Approach

Local Dynamic Map (LDM)
Enhanced Static Map Data
Standard Static Map Data
Additional static features
Detected Dynamic Environment Objects

WP4: Environment Object Detection

Electronic Horizon Provider
eHorizon provides most likely route of ego-vehicle in near future

WP5: Vehicle Movement Monitoring

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Map Data Availability Analysis

- NDS (Navigation Data Standard) Map

- NDS is worldwide map standard for automotive grade use. It is a standardized **binary** database format and enables the exchange of navigation data and flexible map update.

- Map Data Availability Analysis based on Use Cases. E.g. shopping street are as line feature and market places are as area feature available etc.

- Availability of **standard attributes** and **truck-related attributes** was investigated. E.g. attributes like direction of travel, speed limit, road access restriction and limitation in weight and/or dimensions for trucks are available.
Map Data Quality Analysis

Reference Trajectories: measurement from geodetic GNSS receiver
- Overall length of ca. 100 km, tested trajectories include **35 non-highway roads**, 43 highway entrance/exit ramps and part of one highway nearby Stuttgart.
- Absolute accuracies: about **1.51 m**, 1.45 m and 1.33 m
- Relative accuracies are **0.6 m**, 1 m and 0.3 m, respectively.
Map Preview in Demonstration

(a) high zoom factor

(b) low zoom factor

Source: TransSec Deliverable D2.2 Galileo Positioning System for Trucks
Outlook
Electronic Horizon Provider

Electronic Horizon provides **Most Probable Path** of ego-vehicle in near future

Map Aiding

https://www.infoware.de/en/automotive/electronic-horizon/

Digital Roadmap = Model of the Real World

Map

Real World

Truck

inaccuracy of position

inaccuracy of Map

Digital Roadmap = Model of the Real World
Outlook

Positions of traffic signs and traffic lights

Traffic signs (source: https://www.alamy.com/stock-photo/forest-of-traffic-signs.html)

Positions of the traffic signs and traffic lights, lane marking are not available!

Traffic lights (source: Google Earth Street View)

Traffic signs (source: Google Earth Street View)

Enhanced Static Map
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