GNSS for ETCS/ERTMS: integration and benefits. Case Study

New Algorithm for odometric purpose
Background

• The use of Global Navigation Satellite Systems (GNSS) in the Railway industry is increasing rapidly.

• UNISIG started investigating the application of GNSS for ETCS in June 2011

• The aim is to reduce cost of ETCS trackside (fewer balises on the track) by radically improve the reliability of train position and speed estimation on the line
GNSS gaps

• Technical requirements for train position and speed estimation in ETCS are well defined

• Satellite Receiver alone does not fulfil these requirements
New Odometry Platform

MERMEC has developed a flexible odometry algorithm/platform able to accept and fuse measures obtained from different sensors.

Wheel sensors → MERMEC Odometry Platform → On Board Functionalities
Radars
Accelerometers
GNSS receivers

Odometry platform produces a sensitive increasing in the estimation precision for speed and distance.
Test Campaign

MERMEC has conducted several field campaigns on two different railway lines

- **Line 1**: main line, 88 km length
- **Line 2**: high speed line, 204 km length

Two different configurations (two bundle of inputs to the odometry platform) have been tested

- **Configuration 1**: One wheel sensor, one GNSS receiver
- **Configuration 2**: One wheel sensor, one accelerometer, one GNSS receiver
Configuration 1

1 wheel sensor
1 GNSS receiver

Distribution of errors on 88 km Main Line
Max instantaneous error -13 m

Distribution of errors on 204 km High-Speed Line
Max instantaneous error -9.9 m
Configuration 2

- 1 wheel sensor
- 1 GNSS receiver
- 1 Accelerometer

Distribution of errors on 88 km Main Line
Max instantaneous error -4 m

Distribution of errors on 204 km High-Speed Line
Max instantaneous error -4 m
Slipping Correction

the intervention of the slipping correction done by the algorithm at 30 km/h

Configuration 1: 1 wheel sensor + 1 GNSS Receiver
Slipping Correction
the intervention of the slipping correction done by the algorithm at 30 km/h

Configuration 2: 1 wheel sensor + 1 Accelerometer + 1 GNSS Receiver
Conclusion

- Configuration 1 and 2 don’t require external recalibration points for odometry purpose.

- **Configuration 2** is specifically suitable for heavy traffic scenarios due to the low average error value (around 2 meters).

- The odometry algorithm/platform is undergoing SIL4 certification process.
Thank you for your attention

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