

Artery Dataset: SmartData Model

1. Dataset Description

This dataset is a recording of approximately 60 minutes of vehicles driving in the Artery simulator. Figure 1 shows the map vehicles drive in. Each vehicle follows a random driving pattern. We record vehicle dynamics. Data is collected every 100 ms.

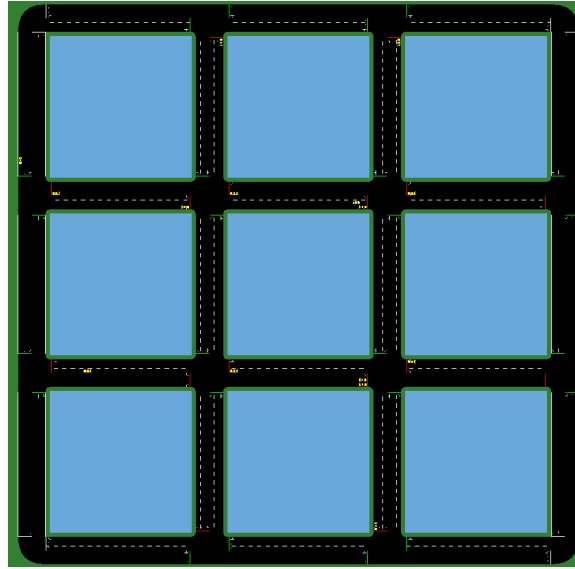


Figure 1: Simulation map.

1.1. Vehicular Dynamics

Vehicular dynamics are recorded through a set of sensors capturing velocity and acceleration. The vehicle itself is assumed to be aware of its geographical location, for instance, given by a GPS according to [WSG84](#) coordinate system. Therefore, its location is described by latitude, longitude, and altitude. The location given by the GPS sensor shall be corrected to match the center of its bounding box. Moreover, its heading is obtained as the angle in relation to the north coordinate defined by WSG84 (see Figure 2).

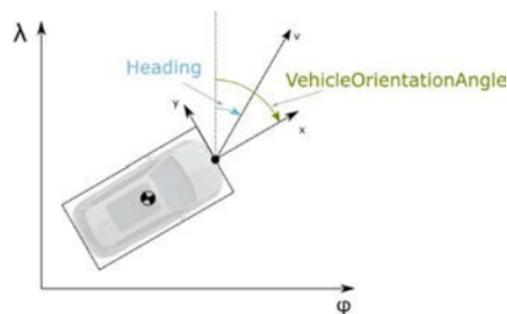


Figure 37: Vehicle Orientation Angle

Figure 2. Heading based on North from WSG84 coordinate system — Source: [ETSI Documentation of CPM](#)

Vehicles and perception objects are described through a motion vector based on the Constant Turn Rate and Velocity (CTRV) motion model. This model describes motion through the xy plane, the norm of the velocity vector, the heading angle and the yaw rate. Below are the state space and state transition equation:

$$x_{ctrv} = (p_x \ p_y \ v \ \Psi \ w)^T$$

$$x_{k+1} = x_k + \begin{pmatrix} \frac{v}{w} [\sin(\Psi_k + wT_k) - \sin(\Psi_k)] \\ \frac{v}{w} [\cos(\Psi_k) - \cos(\Psi_k + wT_k)] \\ 0 \\ wT_k \\ 0 \end{pmatrix}$$

Figure 3: CTRV motion model.

The data captured in the simulation is described in the table below with the unit for SmartData and the related SI unit.

Description	Unit	Desc	Semantics
Velocity	0xC4963924 (F32)	m/s	Velocity in heading vector.
Heading	0xC4B24924 (F32)	rad	Yaw angle in radians.
Angular Velocity	0xC4B23924 (F32)	rad/s	Gyroscopes Yaw rate in rad/s.
Acceleration	0xC4962924 (F32)	m/s ²	Acceleration in heading vector.

1.2. Vehicular Environment Perception

Vehicles perform environmental perception in the simulation and store the perceived objects as motion vectors. For ease of use, each object is stored using the global reference.

Description	Unit	Desc	Semantics
Position	0xC4B24924 (F32)	rad	Estimated object position in latitude, longitude, altitude.
Velocity	0xC4963924 (F32)	m/s	Estimated velocity in heading vector.
Heading	0xC4B24924 (F32)	rad	Estimated yaw angle in radians.
Angular Velocity	0xC4B23924 (F32)	rad/s	Estimated yaw rate in rad/s.
Acceleration	0xC4962924 (F32)	m/s ²	Estimated acceleration in heading vector.

2. Dataset

The dataset can be downloaded [here](#) along with an example reader. The data is stored in the csv format

with the columns timestamp, id, lat, lon, alt, x, y, z, speed, heading, yawrate and acceleration.

Note that, while the files are numbered sequentially, the vehicle IDs are not sequential. Vehicle IDs are generated based on ETSI ITS pseudonym rules. The timestamps of the data are in simulation time, following the 10Hz generation. The table below shows the vehicle IDs in order, and the start and end timestamps.

Description	Values
Vehicle IDs	1124, 1272, 1947, 680, 1426, 1503, 532, 757, 313, 2101, 1580, 1870, 1349, 2024, 1047
Start Timestamp (t0)	1748768400000000
End Timestamp (tf)	1748772002000000