Self-Driving with PiCar

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1 Symbols

1.1 General

t Time Index

Δ Duration between two time steps

1.2 Angles

α_t Steering Angle fed into PiCar

ϕ_t Steering angle $\in [-\frac{\pi}{4}, \frac{\pi}{4}]$ used in most calculations.

1.3 Vehicle Position

$\vec{z}_t$ 2D position of the vehicle relative to the camera position

1.4 Lane Middle Approximation

$\vec{z}_{m,t}(\tau)$ Description of the lane middle with parametrization τ

σ Angle of the street middle

o_x Horizontal offset of the street middle, relative to the origin

1.5 Vehicle Velocity

$\vec{v}_t$ 2D velocity vector

2 Formulas

Angle Relations $\alpha_t = \phi_t + \frac{\pi}{2}$

2D Velocity $\vec{v}_t = v_t \cdot \begin{bmatrix} \sin\phi_t \\ \cos\phi_t \end{bmatrix}$

Position Update $\vec{z}_{t+1} = \vec{z}_t + \Delta \cdot \vec{v}_t$

Street Description $\vec{z}_{m,t}(\tau) = \begin{bmatrix} o_x + \tau \cdot \sin\sigma \\ \tau \cdot \cos\sigma_x \end{bmatrix}$