# Path Planning for Autonomous Vehicles based on Nonlinear MPC with using a Kinematic Bicycle Model

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  - Hail Bopp
  - Navigator
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## NOVA: Hail Bopp [1]







# NOVA: Perception [1]

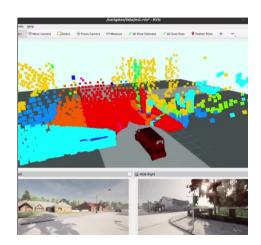




## NOVA: Navigator [1]



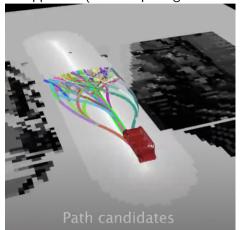
- Navigator is the self-driving software stack being developed by NOVA.
- Simulations done in then deployed to Hail Bopp.



## Path Planning Objective [1]



Current Approach (random path generation and ranking)



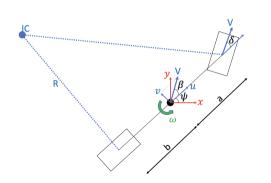




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### Kinematic Bicycle Model





Simple nonlinear kinematics model equations:

$$egin{cases} \dot{x} = V\cos(\psi+eta) \ \dot{y} = V\sin(\psi+eta) \ \dot{\psi} = rac{V\cos(eta)}{I_f+I_r} ( an(\delta_f)- an(\delta_r)) \ \dot{ heta} = \psi \end{cases}$$

where

$$\beta = \tan^{-1} \left( \frac{I_f \tan(\delta_r) + I_r \tan(\delta_f)}{I_f + I_r} \right)$$
 (2)

Note:  $\delta_r = 0$ ,  $I_f = a = 0.7[m]$ , and  $I_r = b = 0.7[m]$ .



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## Bibliography I





NOVA. nova-utd.github.io, 2023.