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

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MECH 6325 - MPC
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Outline

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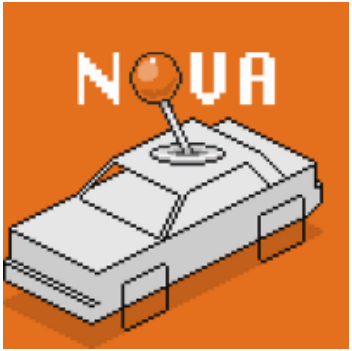
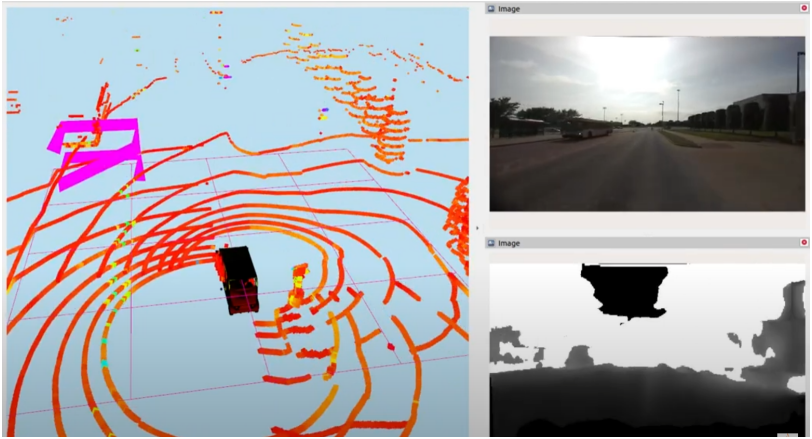
NOVA: Hail Bopp [1]

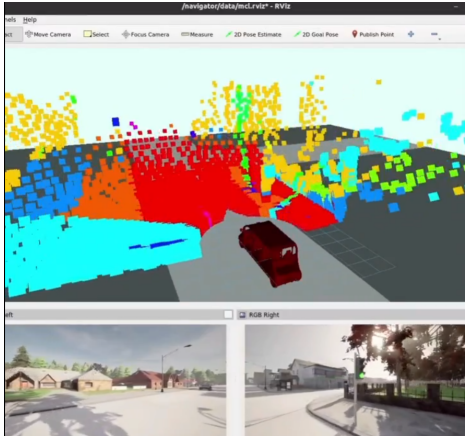


NOVA: Perception [1]



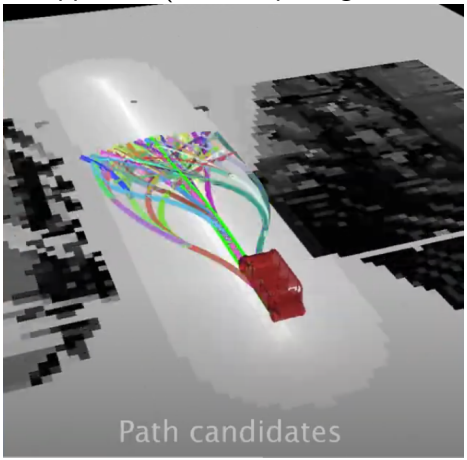
NOVA: Navigator [1]

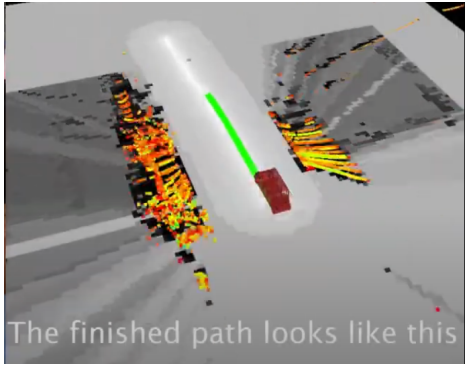
- Navigator is the self-driving software stack being developed by NOVA.
- Simulations done in then deployed to Hail Bopp.



Path Planning Objective [1]

Current Approach (random path generation and ranking)





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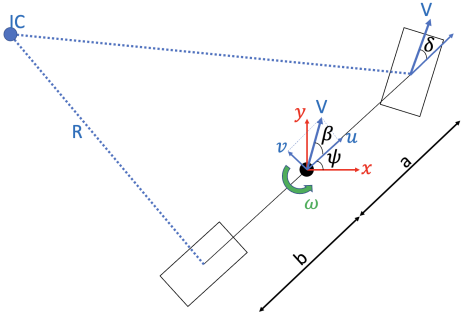
Kinematic Bicycle Model



Simple nonlinear kinematics model equations:

$$\begin{cases} \dot{x} = V\cos(\psi + \beta) \\ \dot{y} = V\sin(\psi + \beta) \\ \dot{\psi} = \dfrac{V\cos(\beta)}{l_f + l_r}(\tan(\delta_f) - \tan(\delta_r)) \\ \dot{\theta} = \psi \end{cases} \tag{1}$$

where

$$\beta = \tan^{-1}\left(\frac{l_f \tan(\delta_r) + l_r \tan(\delta_f)}{l_f + l_r}\right) \tag{2}$$

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

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Bibliography I


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