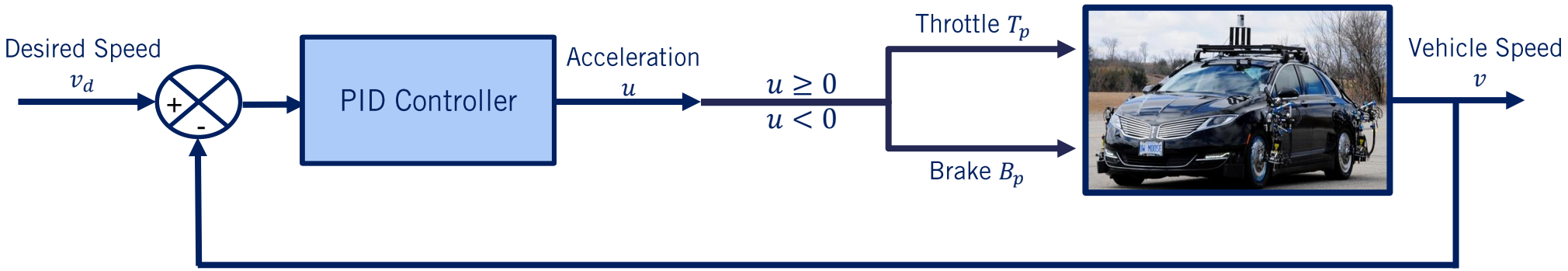
Final Project Solution

Module 7, Lesson 3

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Longitudinal Control



- Desired speed (v_d) Vehicle speed (v) Acceleration input (u)
- No low level controller details required

$$u = K_P(v_d - v) + K_I \int_0^t (v_d - v)dt + K_D \frac{d(v_d - v)}{dt}$$

- Throttle position (T_p) Brake position (B_p)
- If $u \geq 0$: $T_p = u,\ B_p = 0$
- If $u < 0$: $T_p = 0,\ B_p = -u$

Lateral Control

- Cross track error:

$$e = \frac{ax_c + by_c + c}{\sqrt{a^2 + b^2}}$$

- Cross track steering:

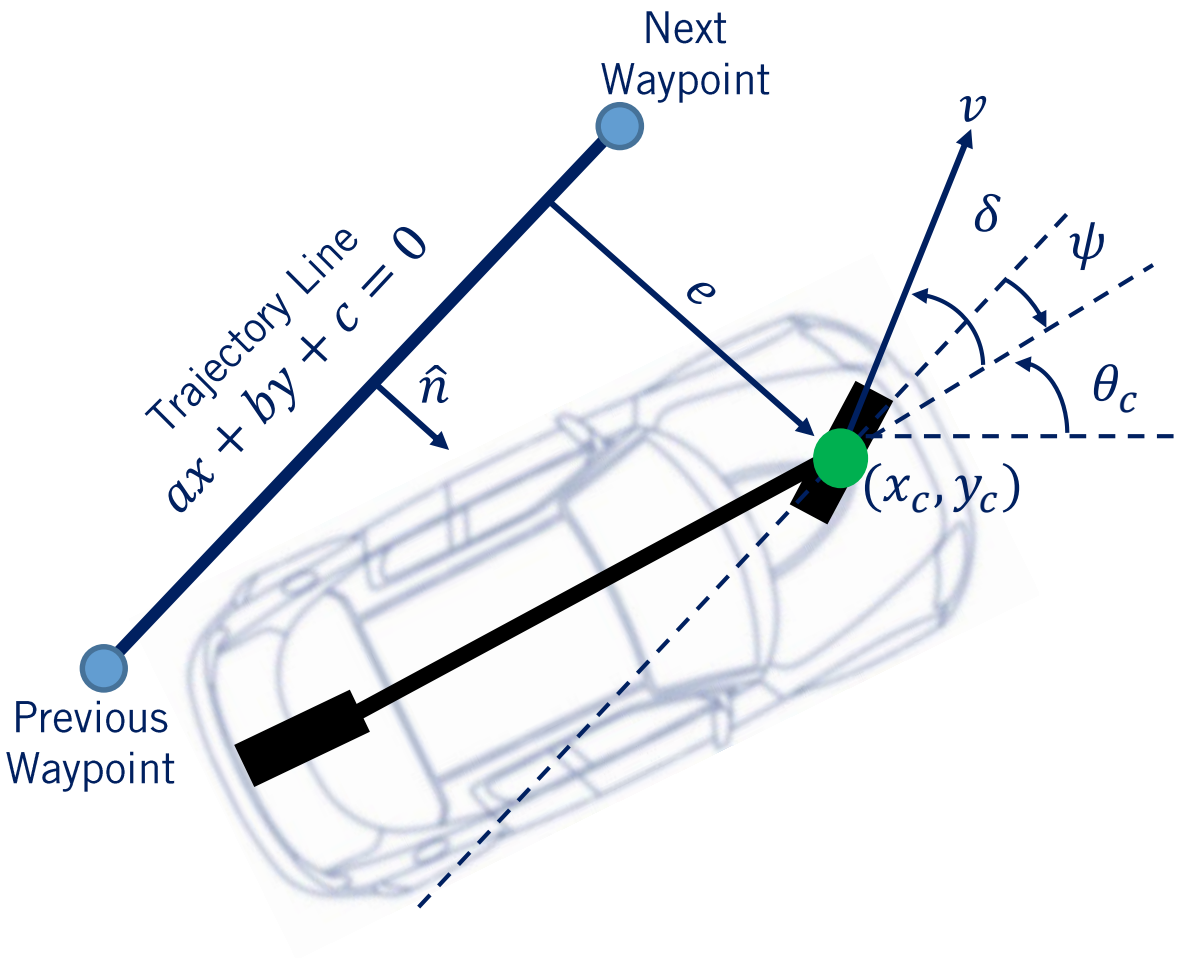
$$\tan^{-1}\left(\frac{ke}{v}\right)$$

- Heading error:

$$\psi = \tan^{-1}\left(\frac{-a}{b}\right) - \theta_c$$

- Total steering input:

$$\delta = \psi + \tan^{-1}\left(\frac{ke}{v}\right)$$



Solution Figures