

100

Fig. 1a

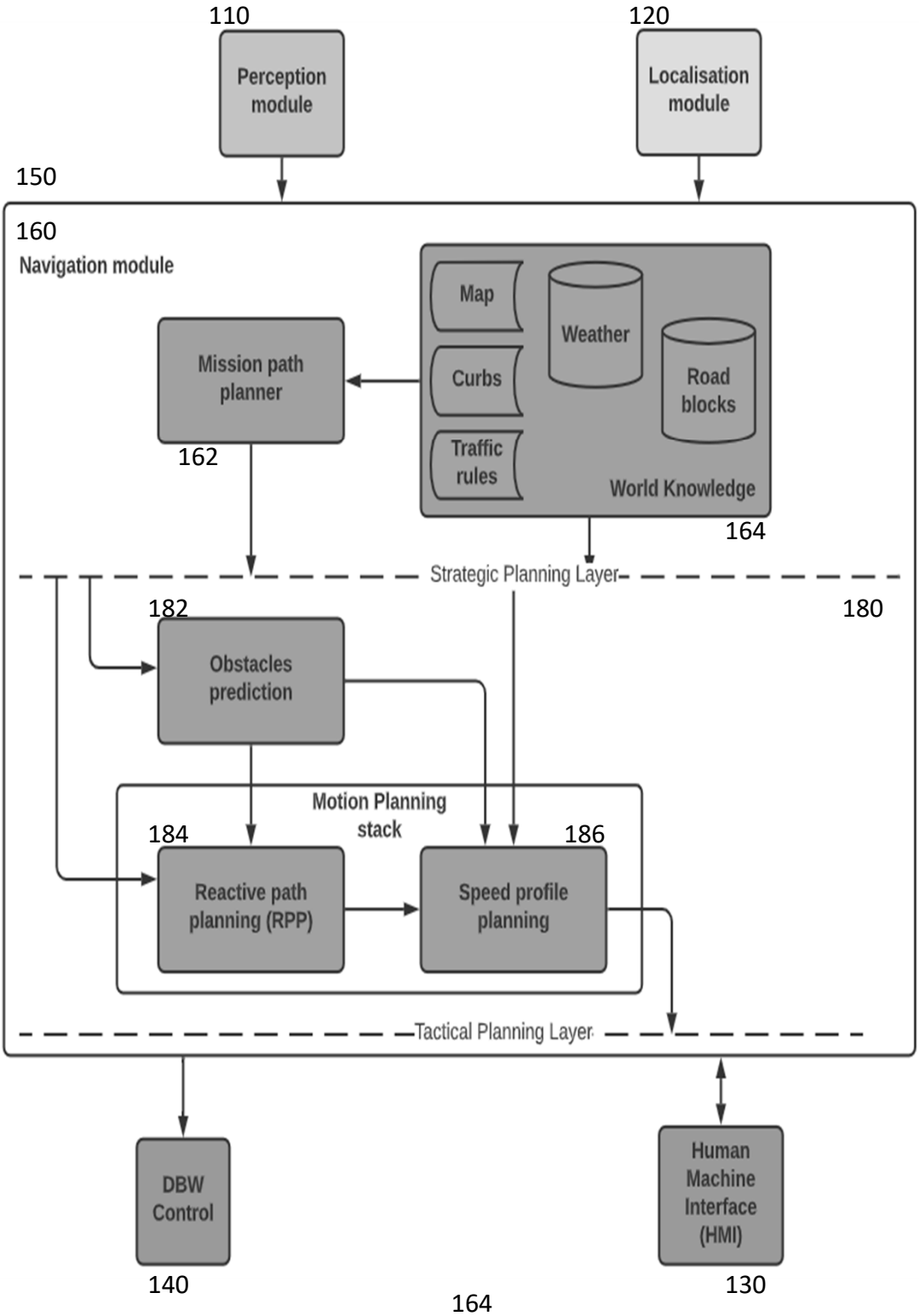
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Fig. 1b

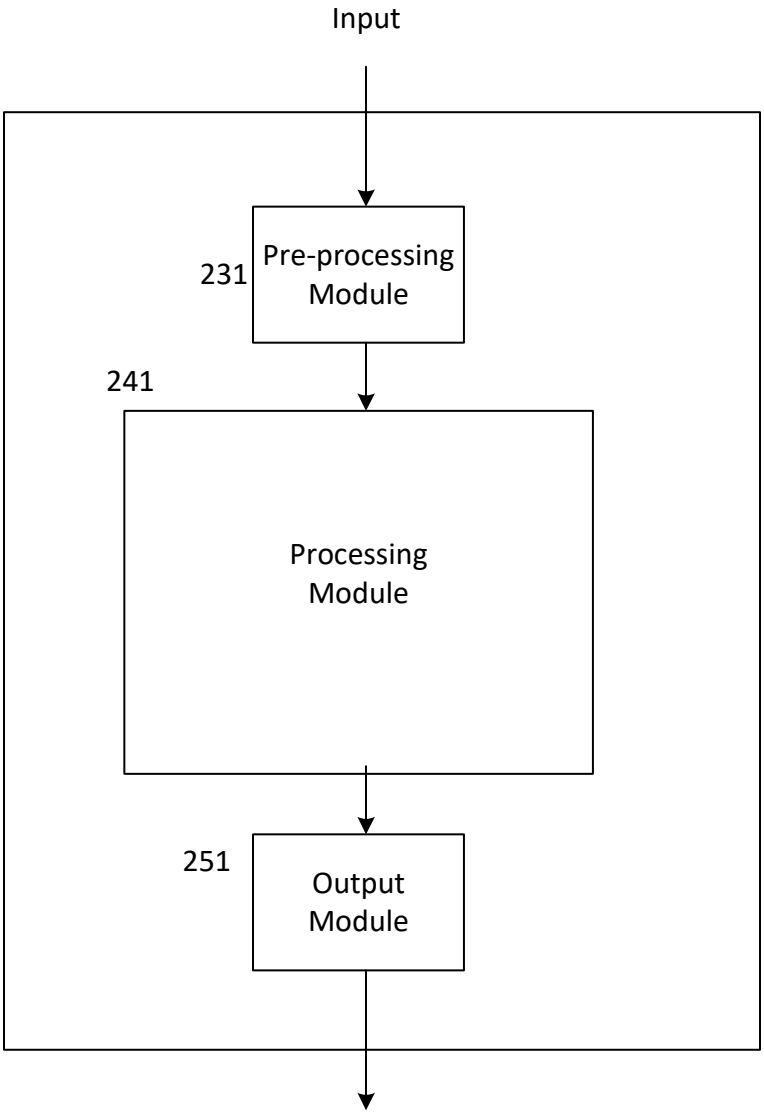
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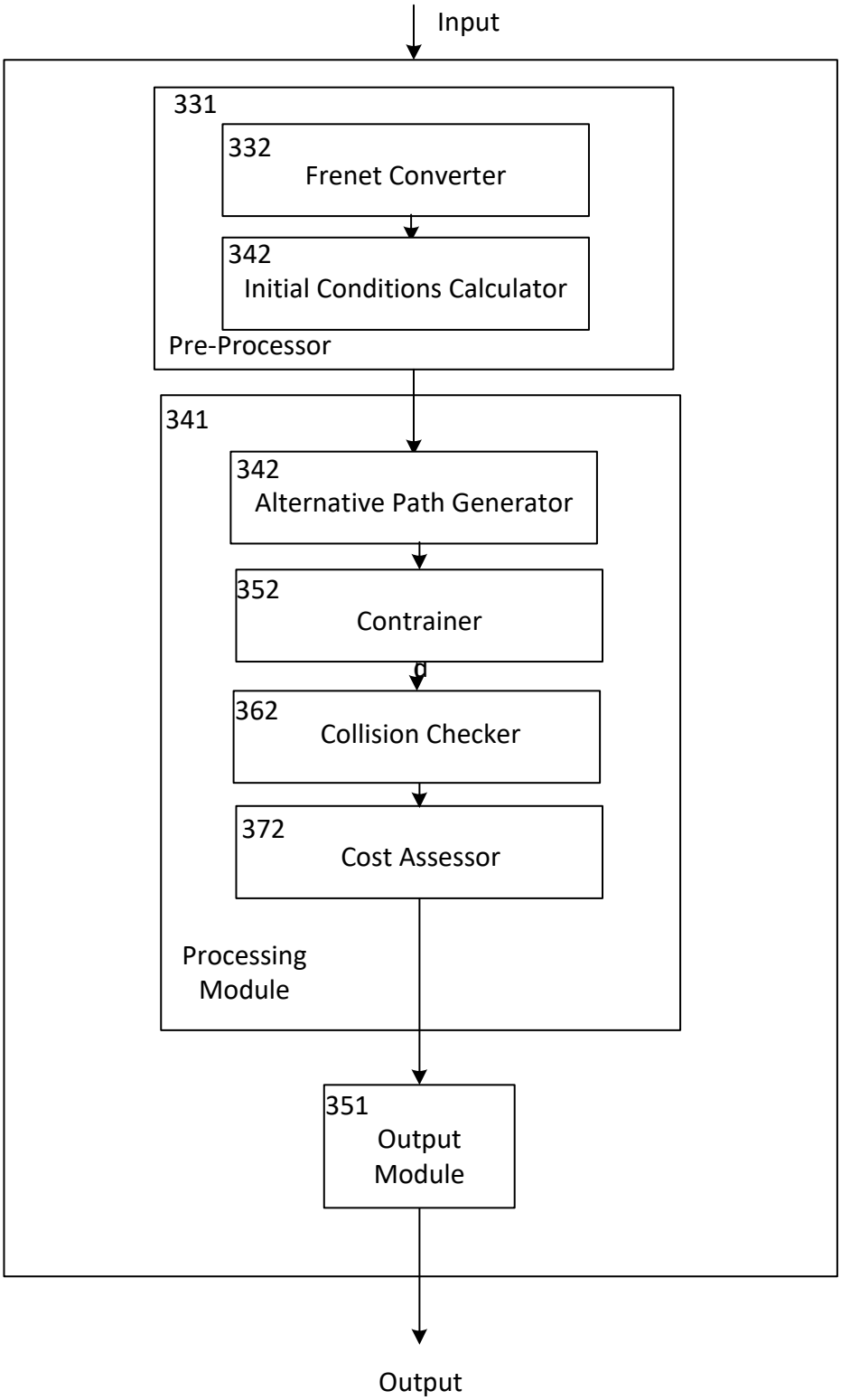
Fig. 2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Alternative Path Generator
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Contrainer
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Collision Checker
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Cost Assessor
Processing Module
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Output Module
Output

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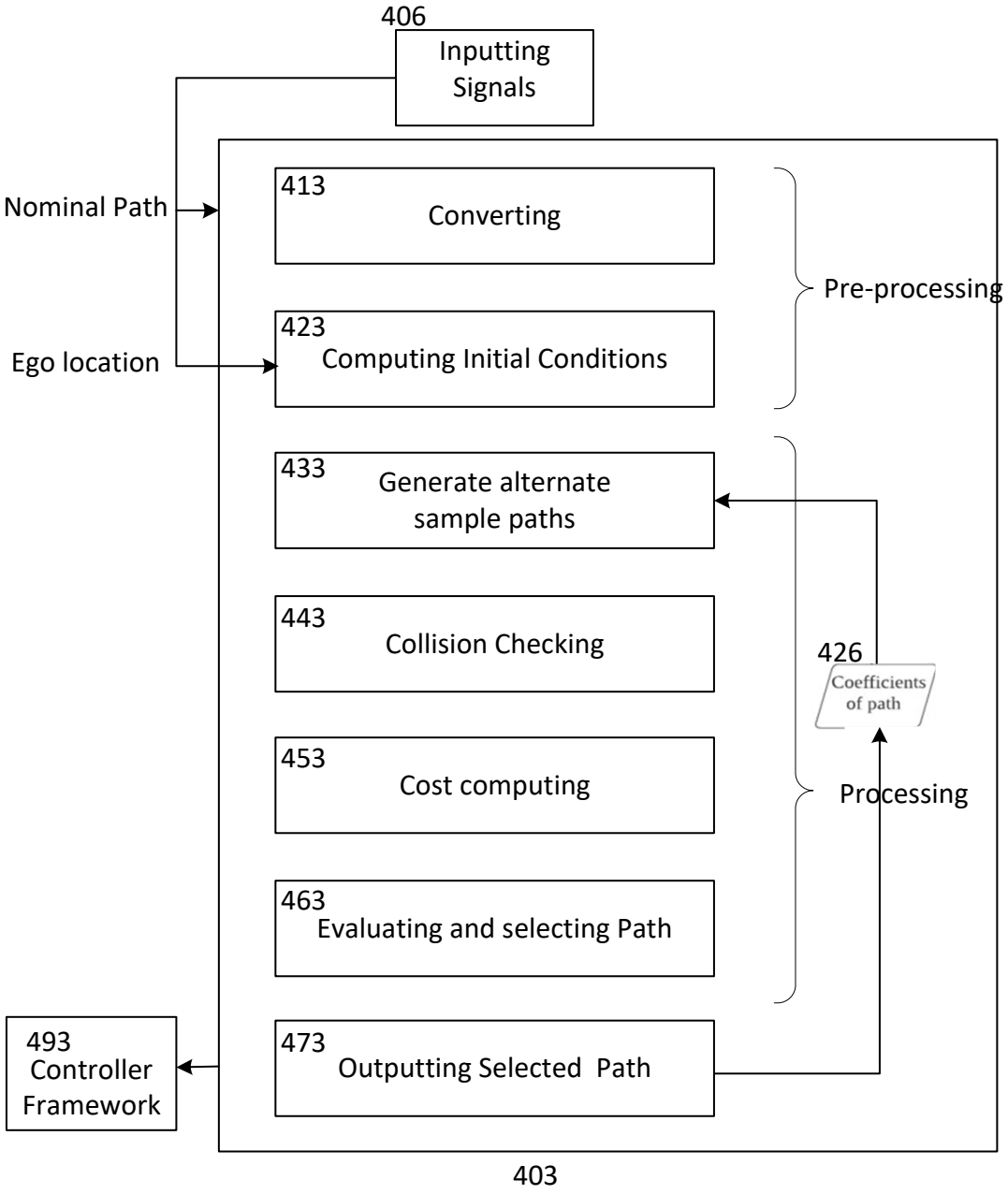
Fig. 3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Collision Checking
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453
Cost computing
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Evaluating and selecting Path
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473
Outputting Selected Path
403

Fig. 4

Input
$\mathrm{P}(s, d_f = 0)$ Nominal path
v_{ego} Velocity of ego vehicle
} 510

Output
$\mathrm{P}_{\mathrm{opt}}$ Optimal path
} 520

Compute initial conditions $s = s_0$
for $d_{lat} = (-N, \ldots, -1, 0, 1, \ldots, N)$ **do**
  Generate frenet sub path $\mathrm{P}(s, d_f = d_{lat})$
  Compute longitudinal goal $\mathrm{P}(s = s_{min}, d_f = d_{lat})$
  Find coefficients $a_0, a_1, a_2, a_3, a_4, a_5$
  for $s_i = s_0, \ldots, s_f$ **do**
    Find (x, y) for $\mathrm{P}(s = s_i, d_f = d_{lat})$
    Check for collision at (x, y)
    if collision **then**
      break
    end if
  end for
  Compute $C(\mathrm{P}(s, d_f = d_{lat})) = \lambda_1 C_1 + \ldots$
  if $C_{th} < C_{min}$ **then**
    $\mathrm{P}_{\mathrm{opt}} = \mathrm{P}(s = s_i, d_f = d_{lat})$
    $C_{min} = C$
  end if
end for
return $\mathrm{P}_{\mathrm{opt}}$
} 530

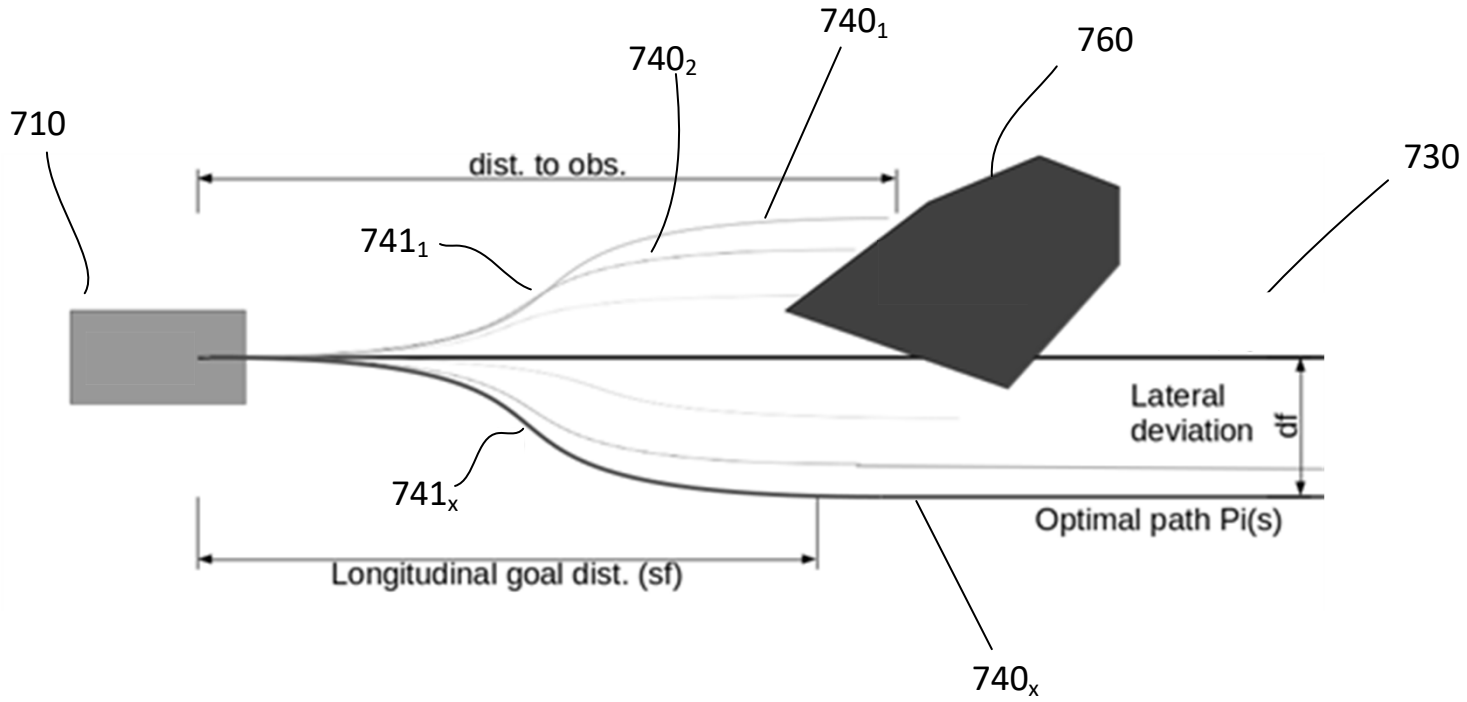
500

Fig. 5

Method	Samples Generated	Time (ms)	Time Per Sample (ms)
RPP	80	20	0.25
SAA	165	5870	35
OPA	100	66	0.66

600

Fig. 6


740_1
740_2
760
710
730
dist. to obs.
741_1
Lateral
deviation
df
741_x
Optimal path Pi(s)
Longitudinal goal dist. (sf)
740_x

700

Fig. 7a

Weight	Description	Value
W1	Mean curvature	35.5
W2	Maximum curvature	15
W3	Sigmoid (distance to obstacle)	1750
W4	Lateral distance to previous optimum path	15
W5	Time travelling along the path	50
W6	Lateral acceleration, ego speed	50
W7	Lateral distance to nominal path	50

700

Fig. 7b