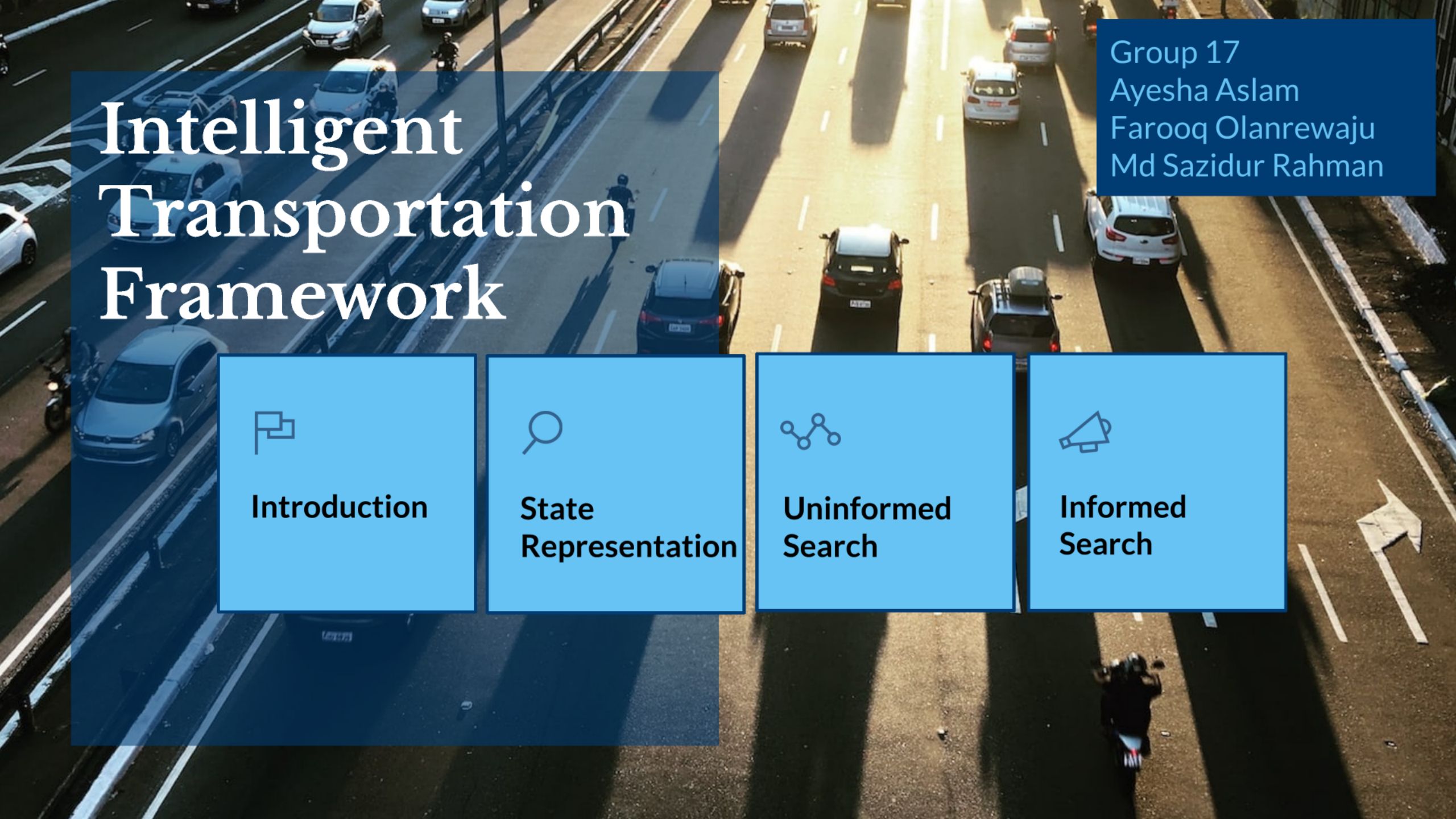

Intelligent Transportation Framework

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- Introduction
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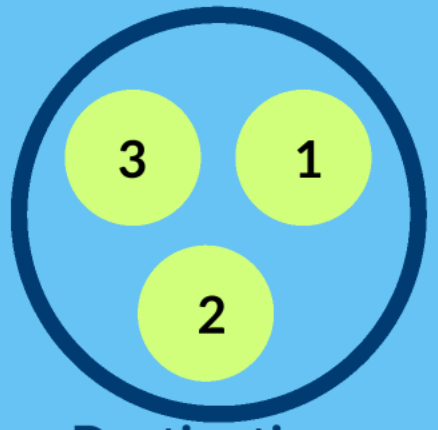
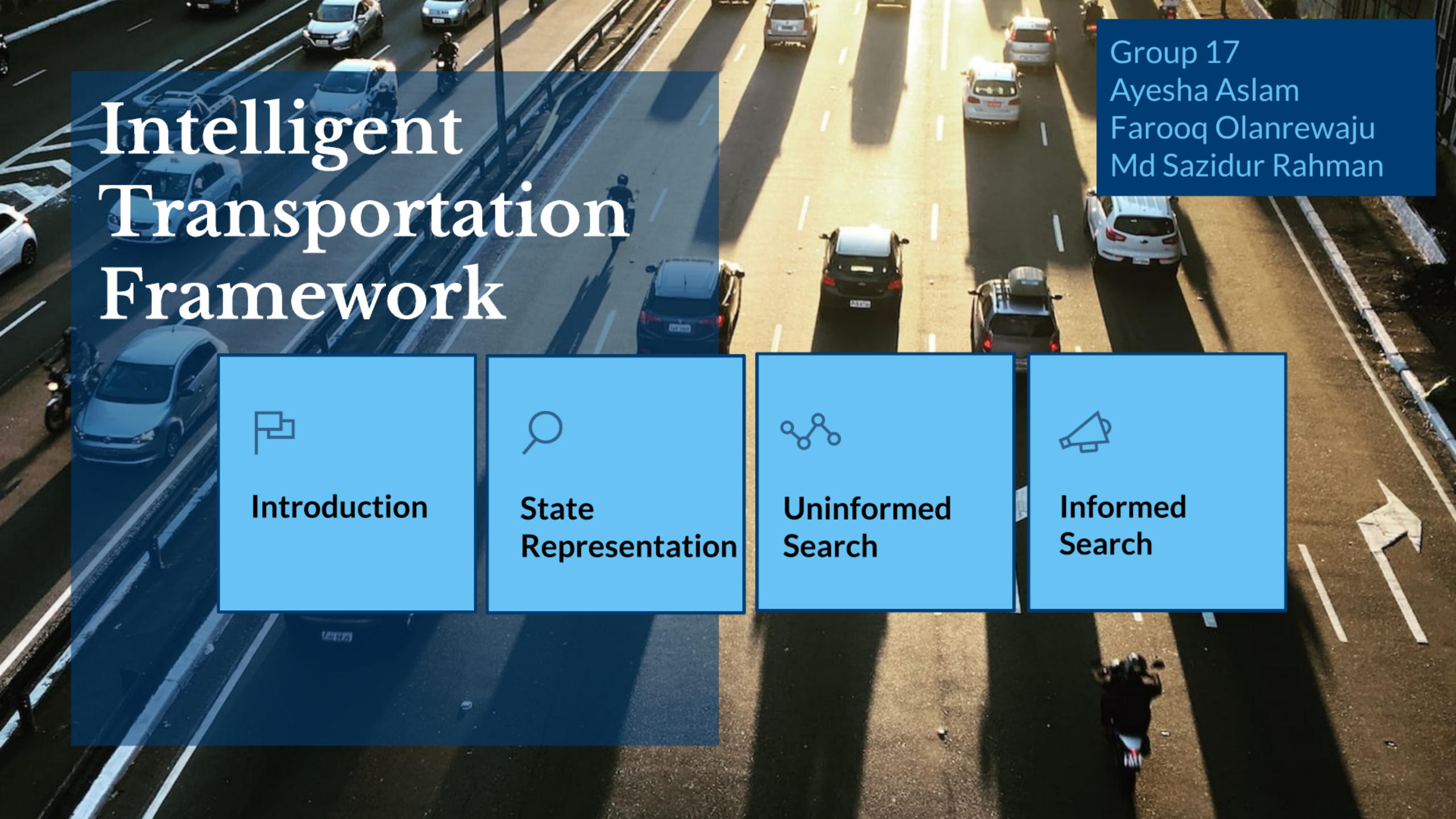
Problem Definition

Fleet of Vehicles
(Initially at same position)



Destinations

Pickup Points



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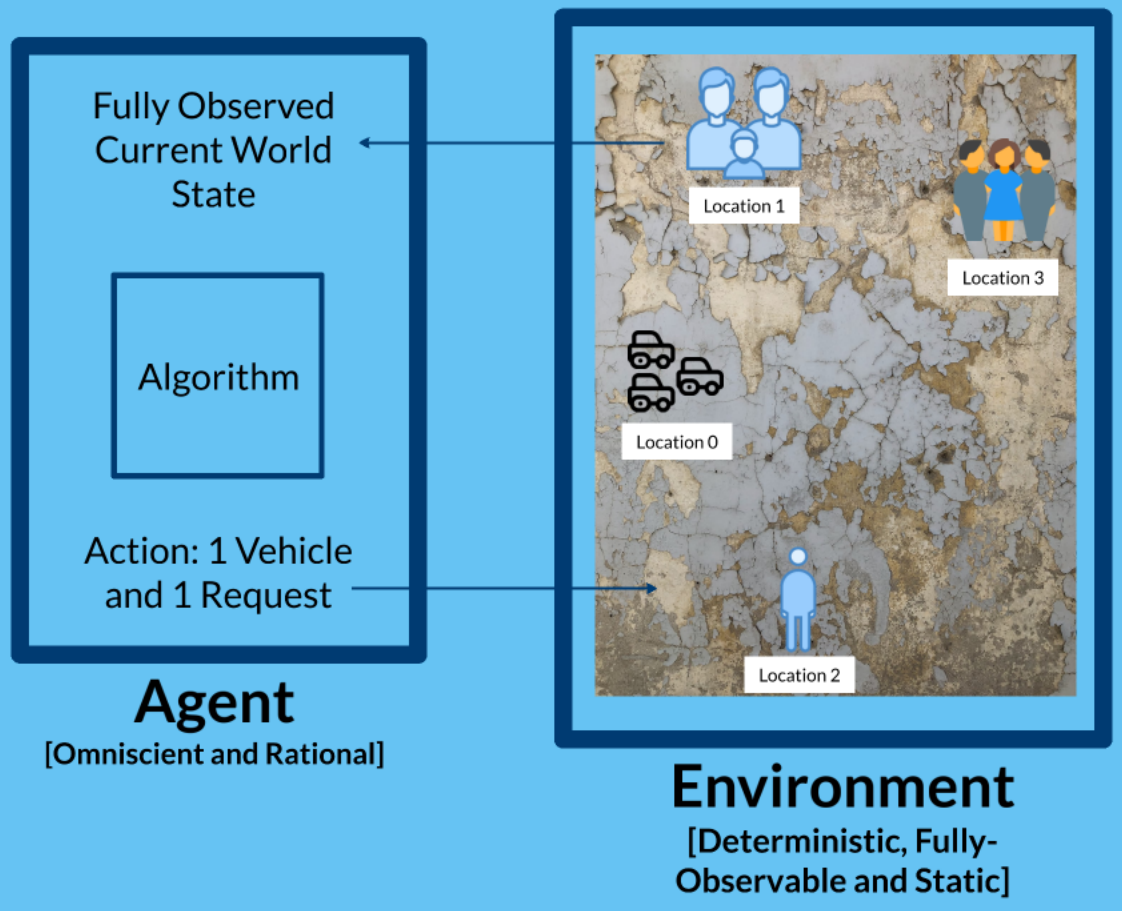
Agent and Environment



Environment Representation

Action Generation Algorithm

Action Effect

Agent Goal

Environment Representation

Unfulfilled Requests [List of Integers]


R-ID: 2


R-ID: 3


R-ID: 1

Vehicles [List of Vehicle Objects]


V-ID: 2


V-ID: 1

Path Cost

State Hash [Combination of above values]

World State
[Python Class]

Time of Travel
Capacity of Vehicles
Passengers' Information

Agent Knowledge

Location [Integer]

Time Elapsed [Float]

Available Space [Integer]

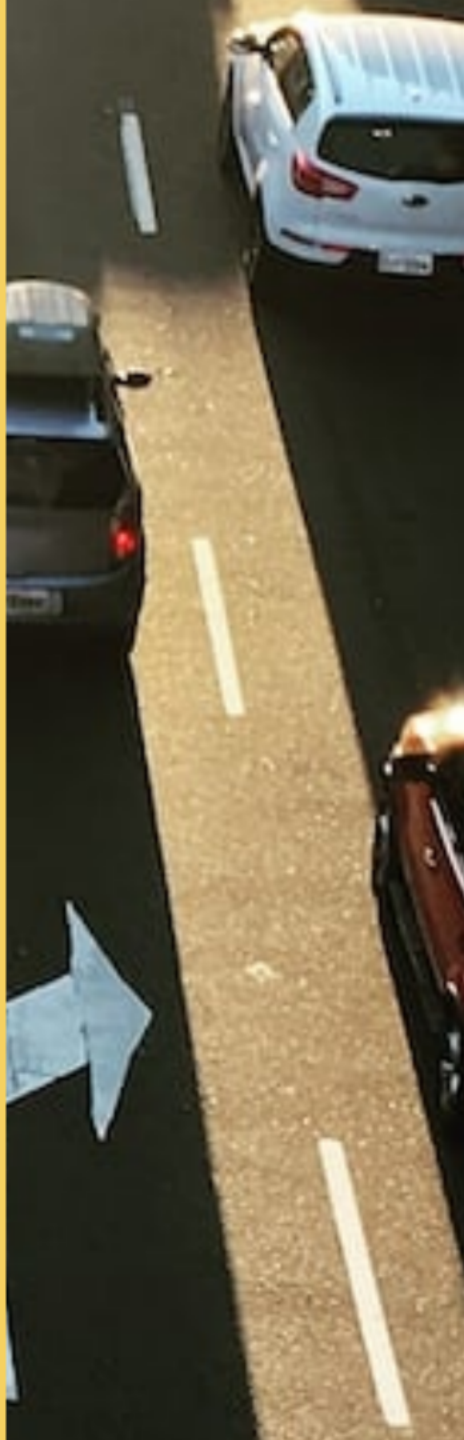
Passengers On-Board
[List of Integers]

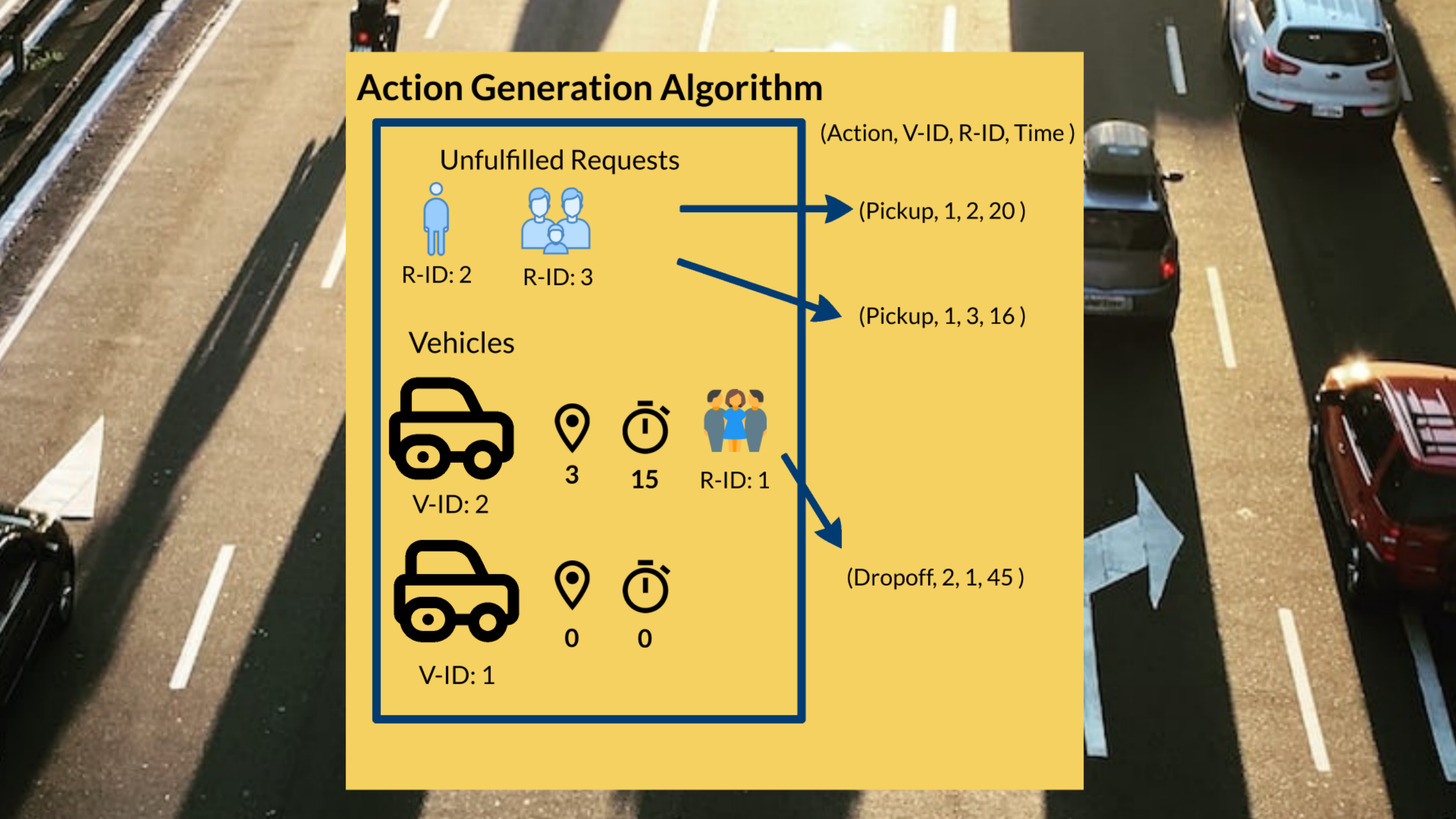

R-ID: 2


R-ID: 1

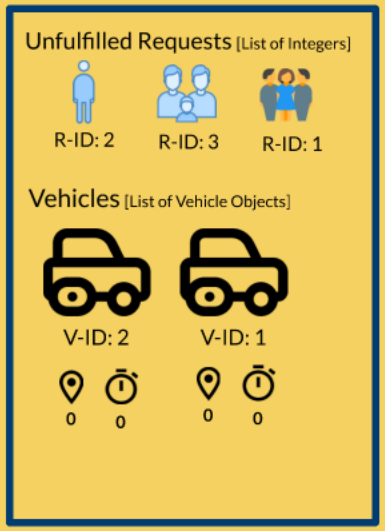
Pickup Time [List of Float]

Vehicle State
[Python Class]



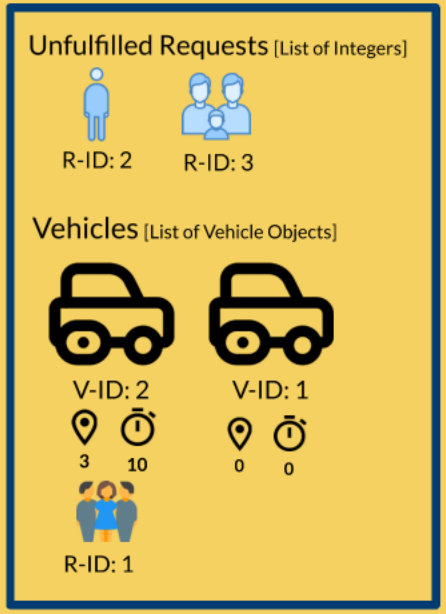

Action Generation Algorithm
(Action, V-ID, R-ID, Time)
Unfulfilled Requests
R-ID: 2
R-ID: 3
(Pickup, 1, 2, 20)
(Pickup, 1, 3, 16)
Vehicles
3
15
R-ID: 1
V-ID: 2
(Dropoff, 2, 1, 45)
0
0
V-ID: 1

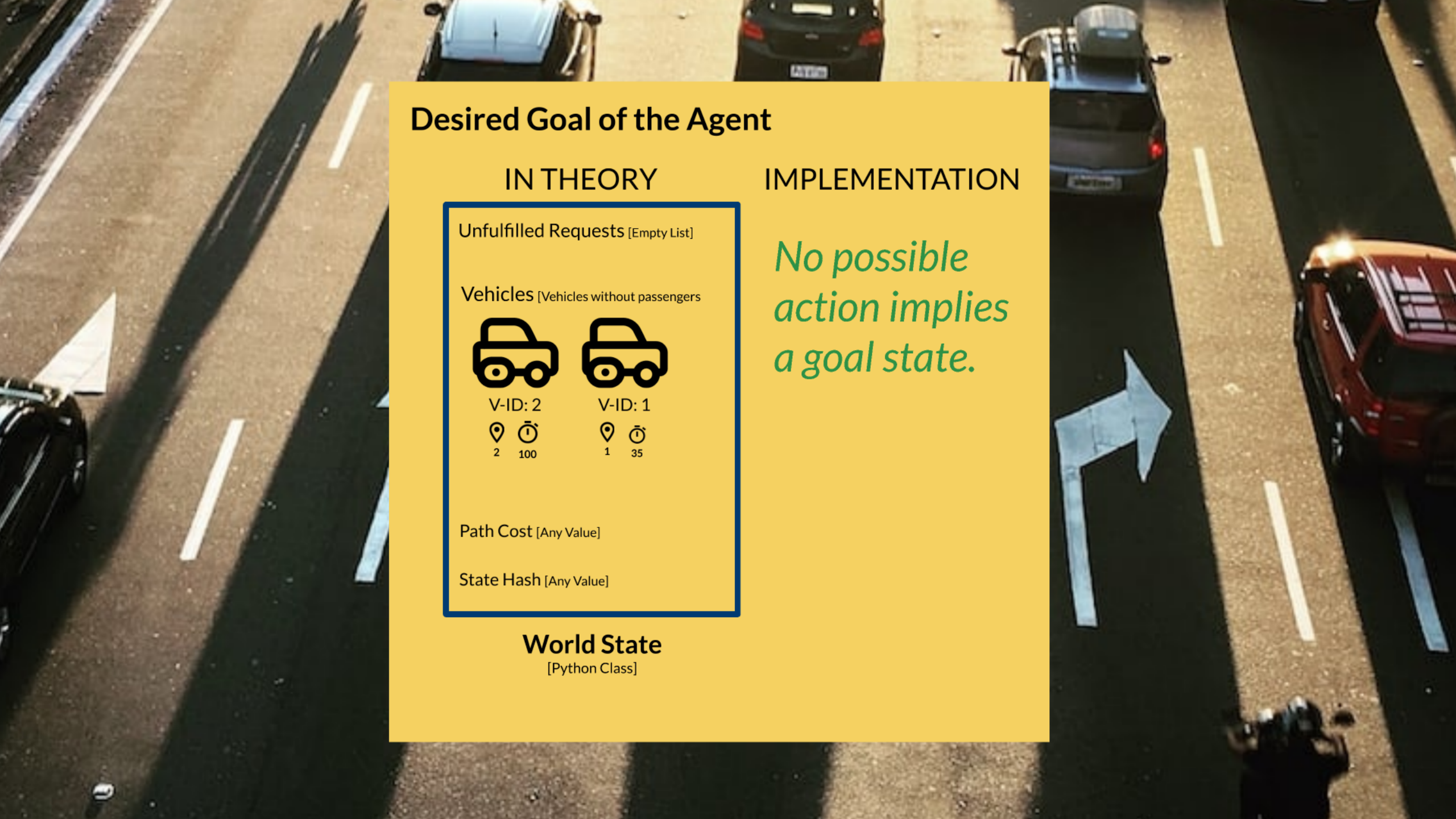
Action Effect on the Environment



- Request List in World State And/Or Passenger List in Vehicle
- Time and Location of Involved Vehicle
- Path Cost and Hash

(Pickup, 2, 1, 10)





Desired Goal of the Agent

IN THEORY

Unfulfilled Requests [Empty List]

Vehicles [Vehicles without passengers

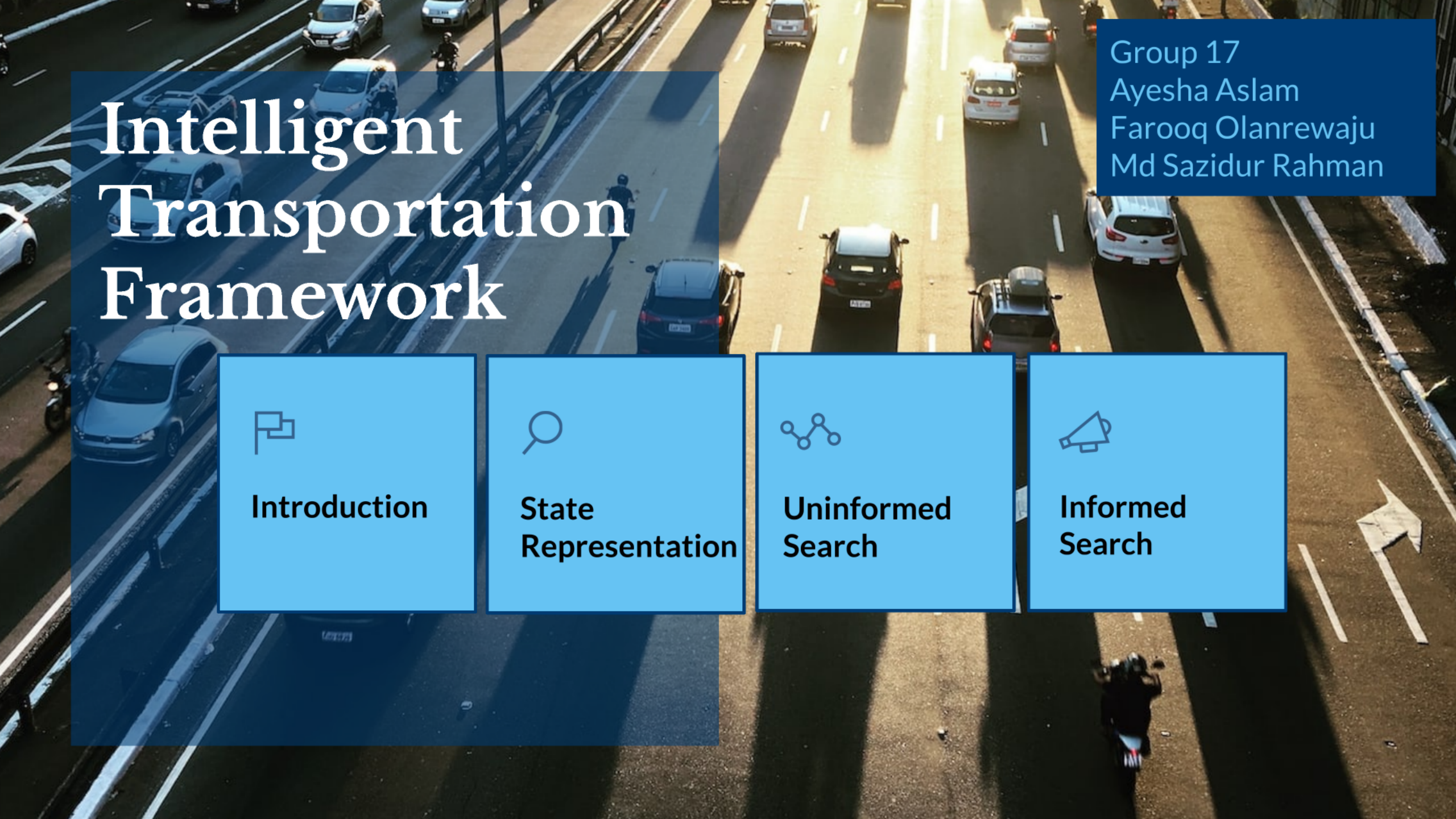
Path Cost [Any Value]

State Hash [Any Value]

World State
[Python Class]

IMPLEMENTATION

No possible action implies a goal state.



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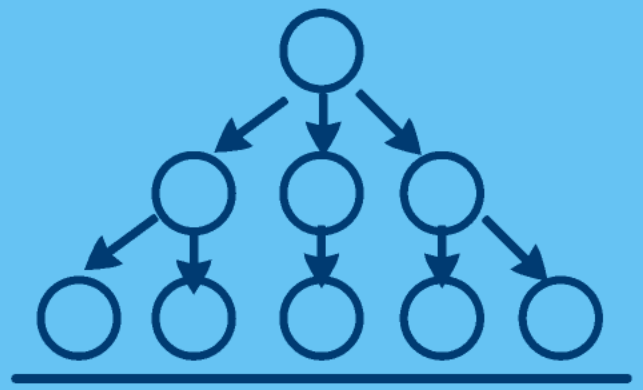
Depth Limited Search

Check if the current state could have any further actions.

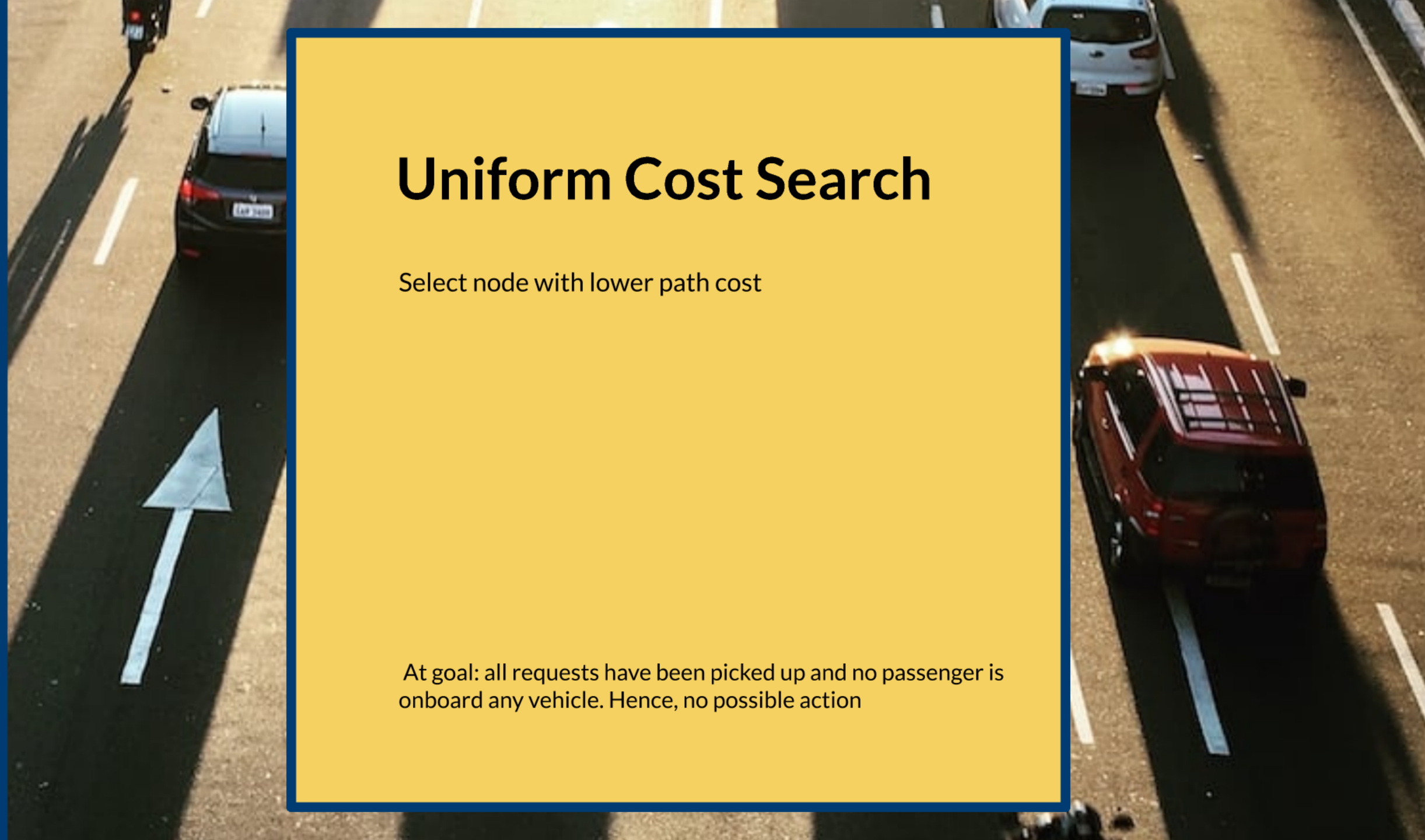


l=d

Very fast since the depth of goal node is known.

Not Optimal!

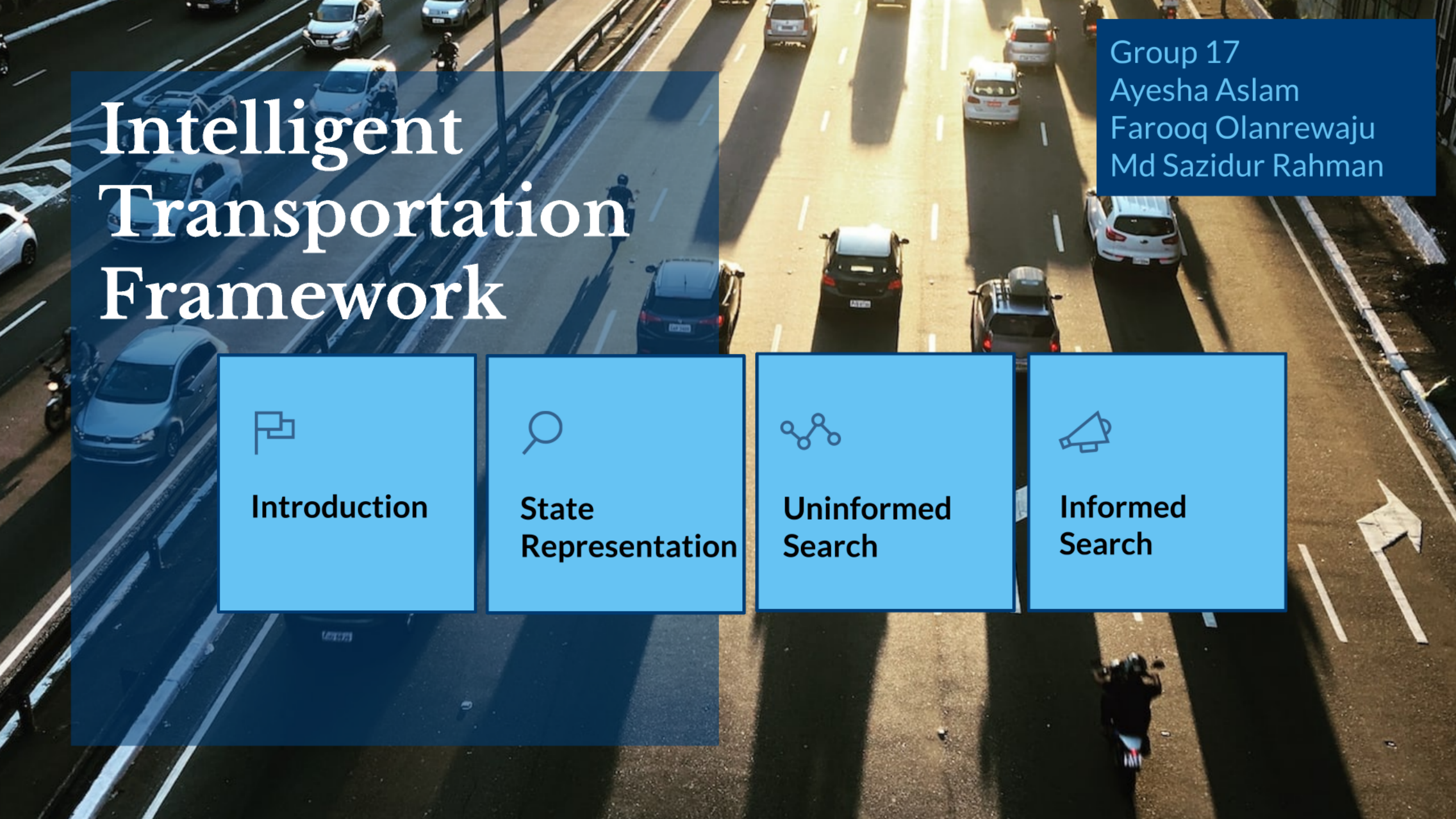
Optimal Solution



Uniform Cost Search

Select node with lower path cost

At goal: all requests have been picked up and no passenger is onboard any vehicle. Hence, no possible action



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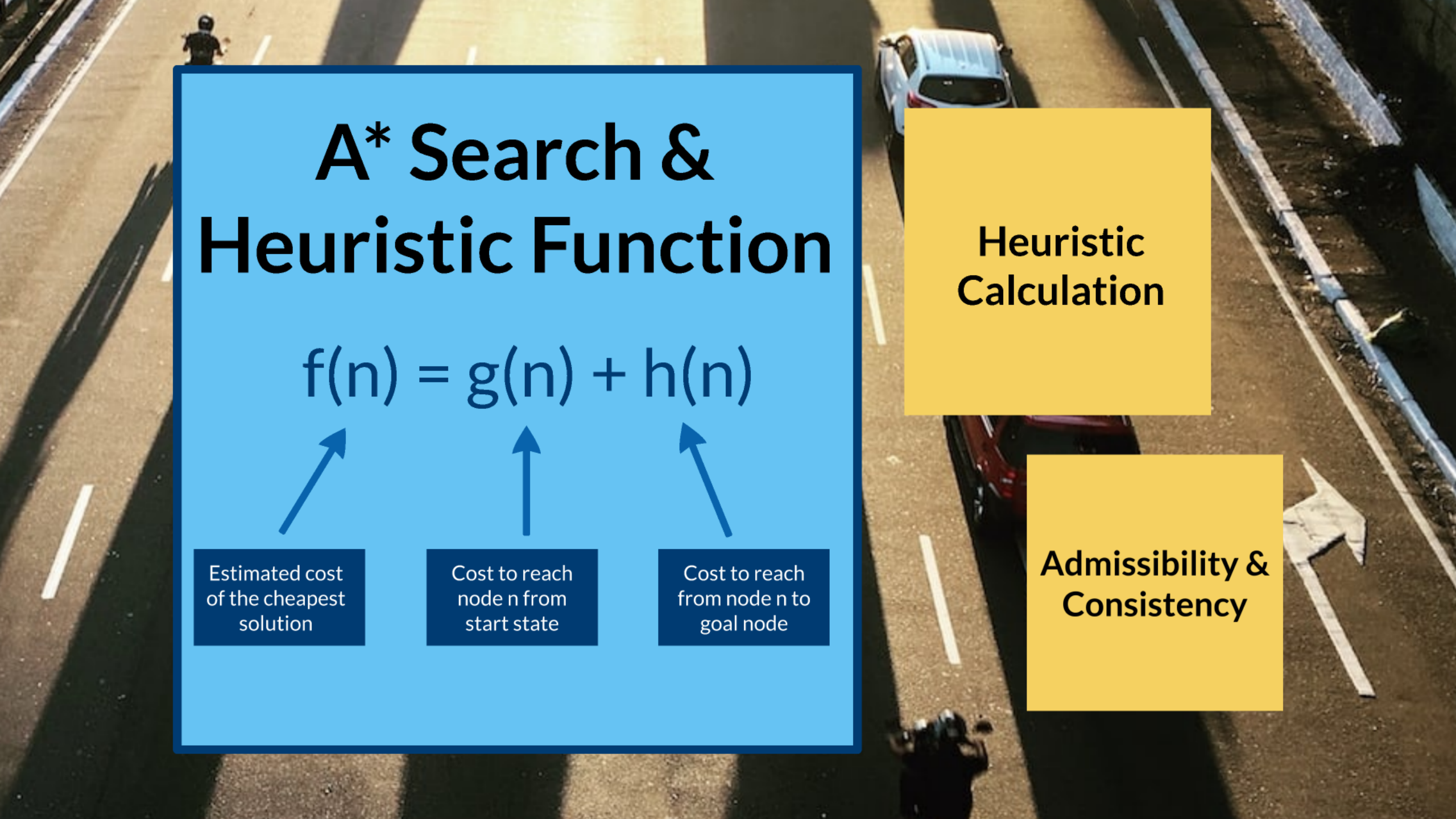
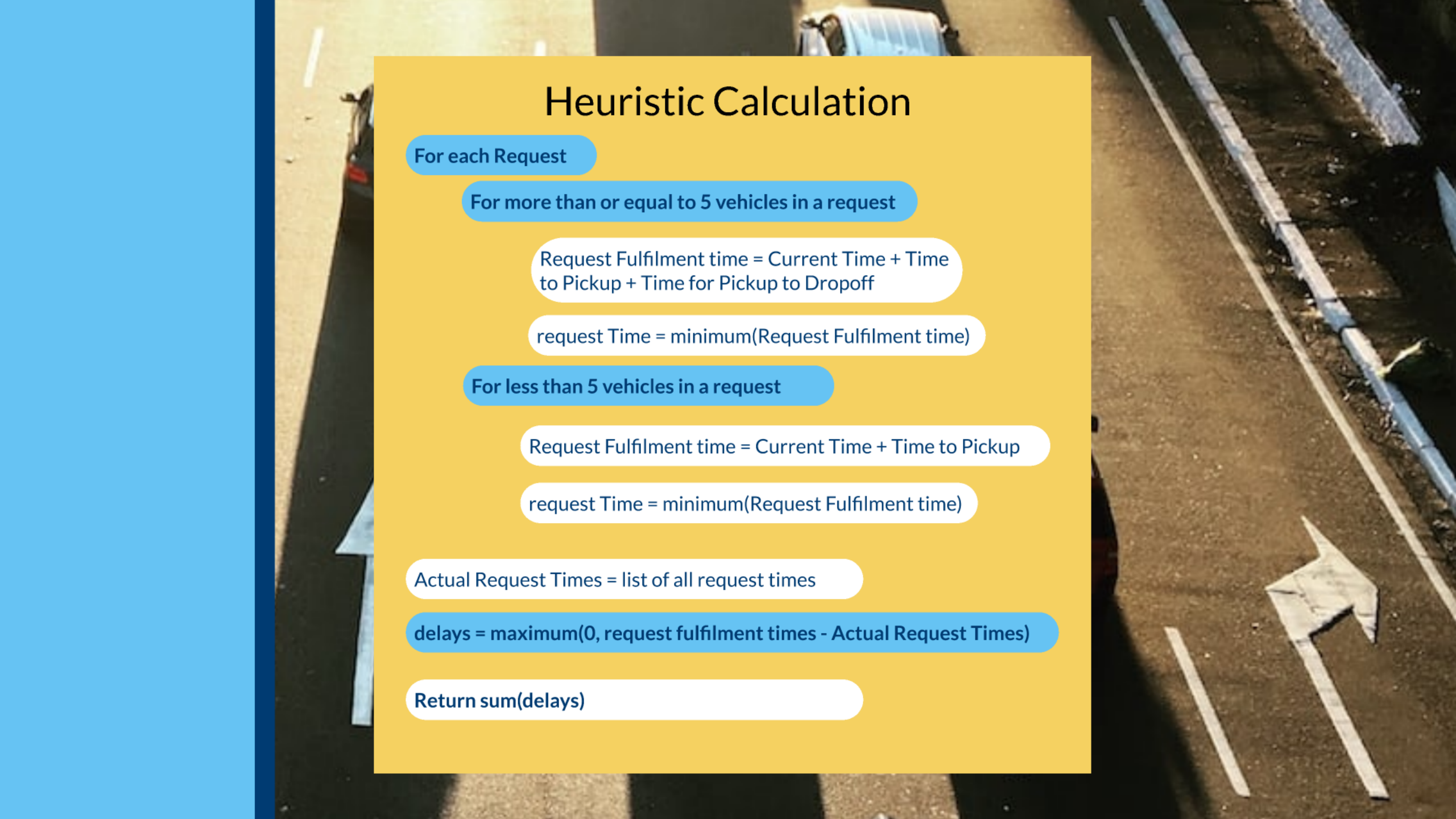

A* Search &
Heuristic Function
f(n) = g(n) + h(n)
Estimated cost of the cheapest solution
Cost to reach node n from start state
Cost to reach from node n to goal node
Heuristic Calculation
Admissibility & Consistency



Heuristic Calculation

For each Request

For more than or equal to 5 vehicles in a request

Request Fulfilment time = Current Time + Time to Pickup + Time for Pickup to Dropoff

request Time = minimum(Request Fulfilment time)

For less than 5 vehicles in a request

Request Fulfilment time = Current Time + Time to Pickup

request Time = minimum(Request Fulfilment time)

Actual Request Times = list of all request times

delays = maximum(0, request fulfilment times - Actual Request Times)

Return sum(delays)

Admissibility & Consistency

Admissible Solution for less than 5 vehicles

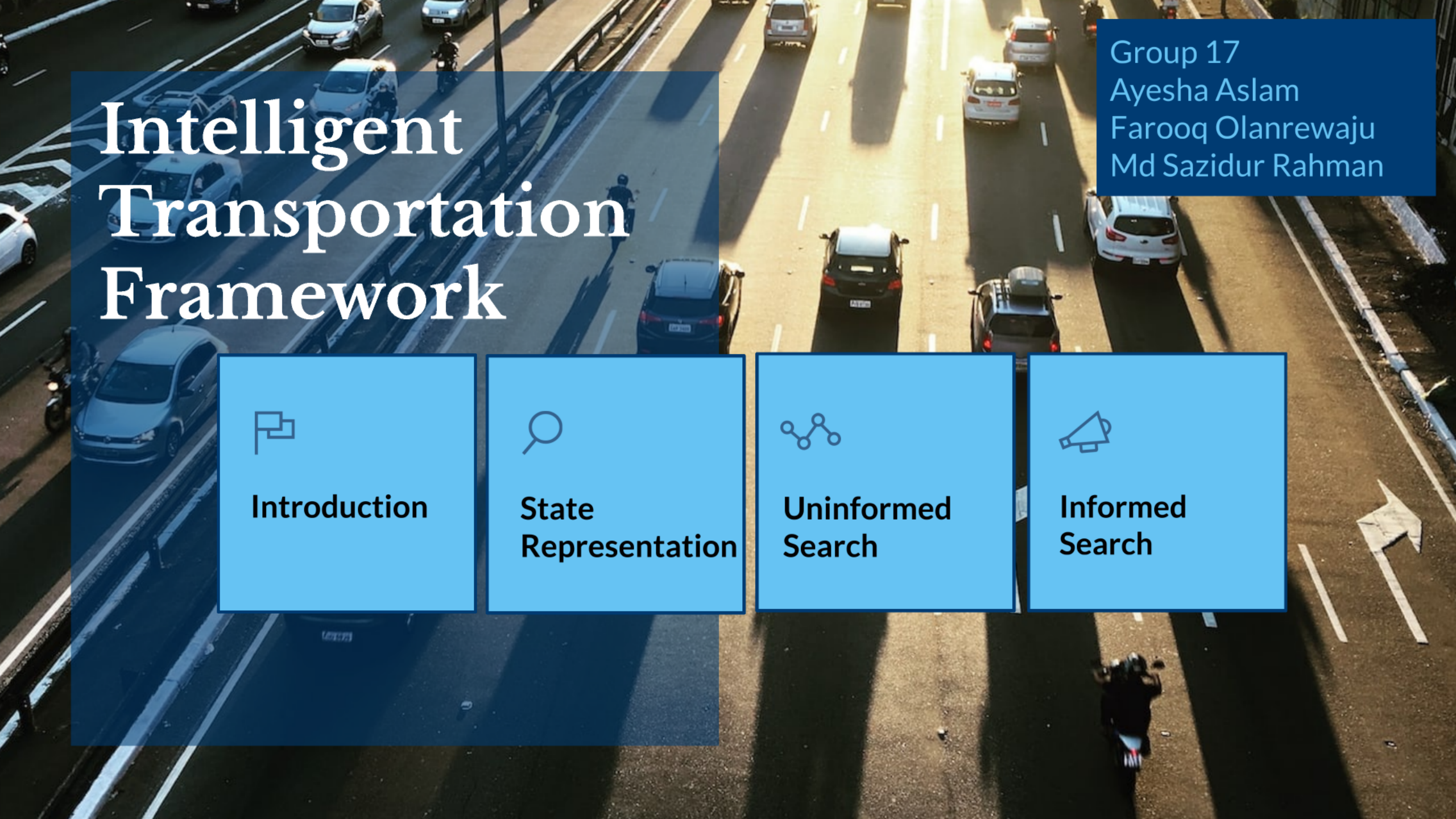
```
================================================
Number of Points: 4.
Number of Requests: 5.
Number of Vehicles: 2.
================================================

2121 paths have been expanded and 3731 paths remain in the frontier
Cost: 144.0
Goal Estimates: [39.0, 39.0, 39.0, 99.0, 99.0, 99.0, 99.0, 99.0, 104.0, 144.0]
```

Inadmissible Solution for more or equal to 5 vehicles

```
================================================
Number of Points: 4.
Number of Requests: 5.
Number of Vehicles: 5.
================================================

24 paths have been expanded and 68 paths remain in the frontier
Cost: 87.0
Goal Estimates: [317.0, 247.0, 187.0, 137.0, 87.0, 87.0, 87.0, 87.0, 87.0, 87.0]
```



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