Cooperation of Connected Vehicles

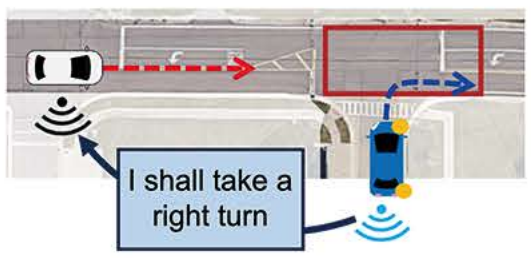
Decentralized Approach for Safe & Efficient Maneuvers

Background

Increasing numbers of automated vehicles on roads must have a standard way of sharing and coordinating their motion in merges, intersections and roundabouts.

- Decentralized approach is needed for scenarios w/o infrastructure.

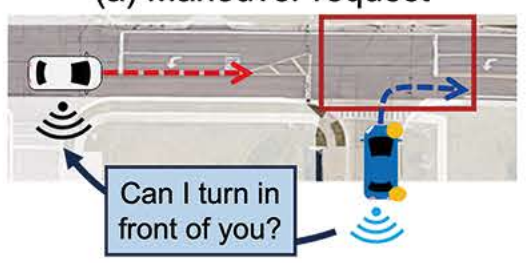
Intent-sharing



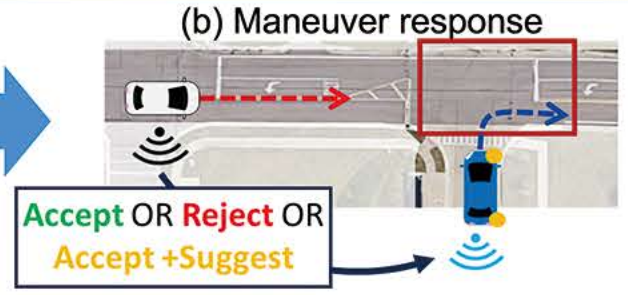
Enhances awareness of surrounding vehicles' plans.

Negotiation

(a) Maneuver request



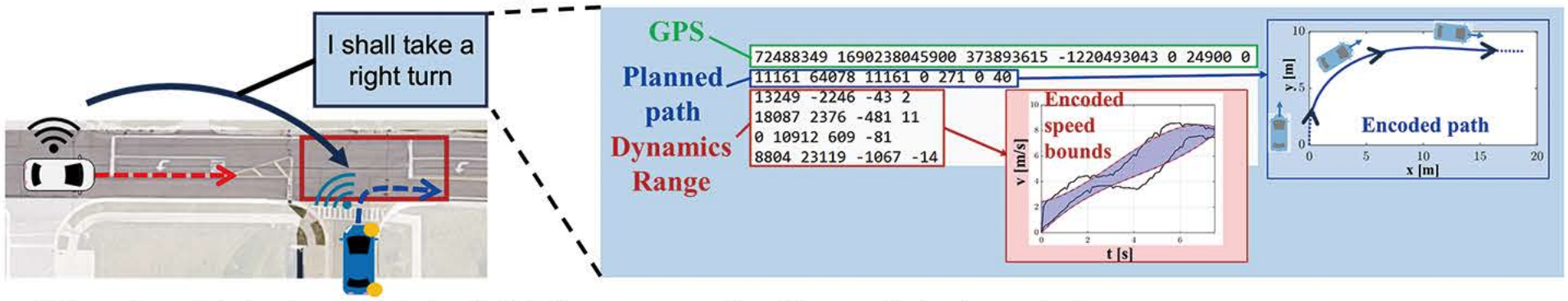
(b) Maneuver response



Enables automated vehicles to work together on complex maneuvers.
Prevents deadlocks between automated vehicles.

Technology & Service

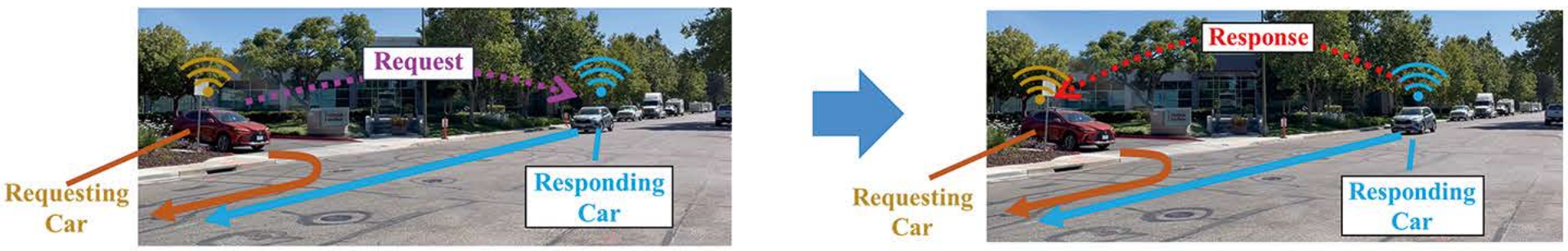
Toyota developed compact (<100 Bytes) messages and protocols for decentralized maneuver coordination amongst vehicles and infrastructure.



- Direct vehicle-to-vehicle (V2V) communication minimizes latency.
- Our framework allows for decentralized intent-sharing and negotiation.

Experimental Evaluation

Tested intersection and merging scenarios.



- Our conflict analysis guarantees safety of coordination.
- Vehicle-to-vehicle negotiation (request to response time) takes 60 [ms] or less.

Future Action

- Test intent sharing and negotiation using multiple communication technologies.
- Develop cooperation partner selection algorithms for maneuver coordination.
- Share our insights with the relevant standards organizations.

TOYOTA