Advancing Connected Autonomous Vehicles: Trajectory Planning, Object Detection, and the Promise of 6G Networks

Aydan Namdar Ghazani

What are CAV’s?

Connected Vehicle (CV) technologies are equipment, applications, or systems that use V2X communications to address safety, system efficiency, or mobility on our roadways.

https://www.transportation.gov/research-and-technology/how-connected-vehicles-work

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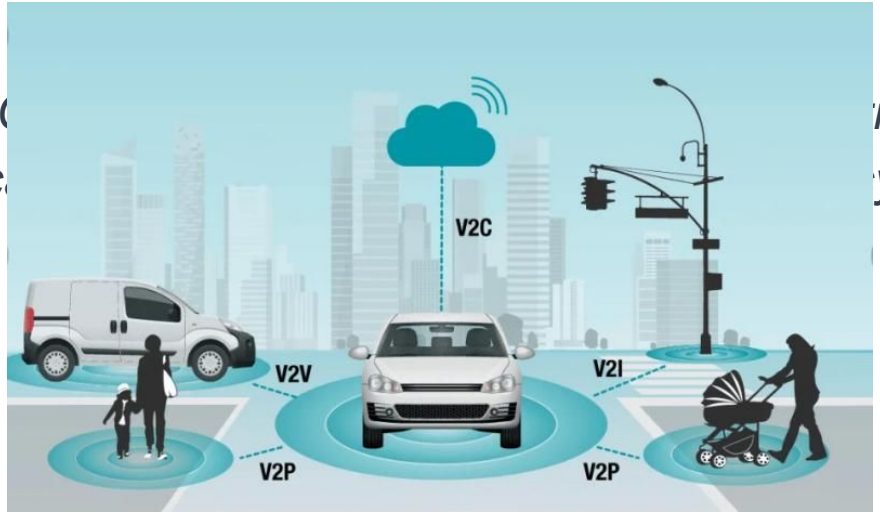

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What is Trajectory Planning?

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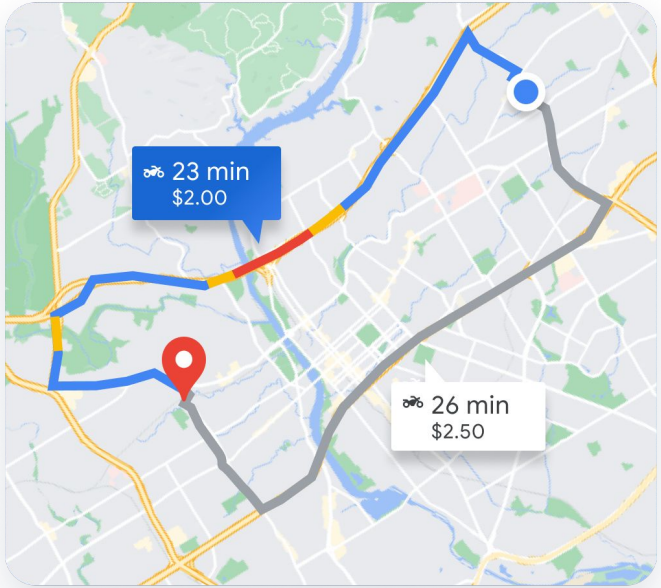

Image: google.com

Methodology

Trajectory Planning of Automated Vehicles Using Real-Time Map Updates

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Leveraging the edge and cloud for V2X-based real-time object detection in autonomous driving

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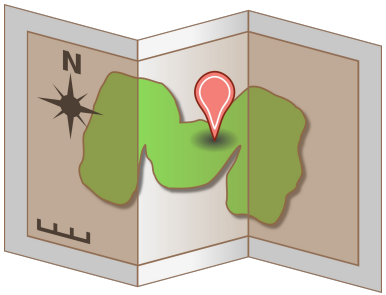
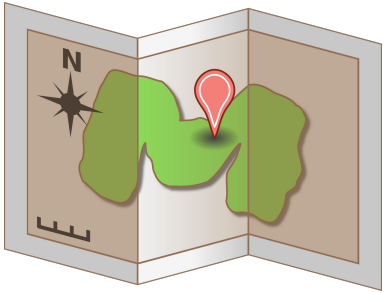
6G Cellular Networks and Connected Autonomous Vehicles

Jianhua He, Kun Yang, and Hsiao-Hwa Chen

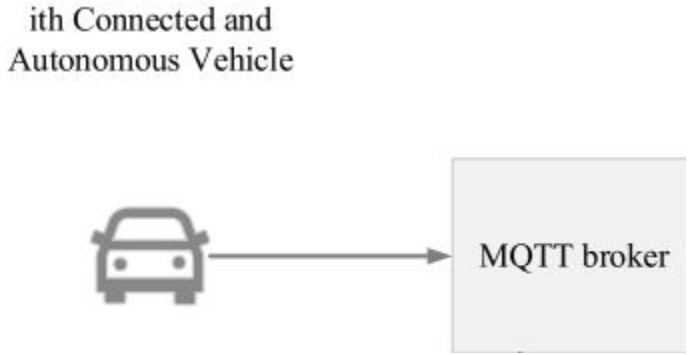
Low Latency Maps

What do we need for planning trajectories?





Map Framework



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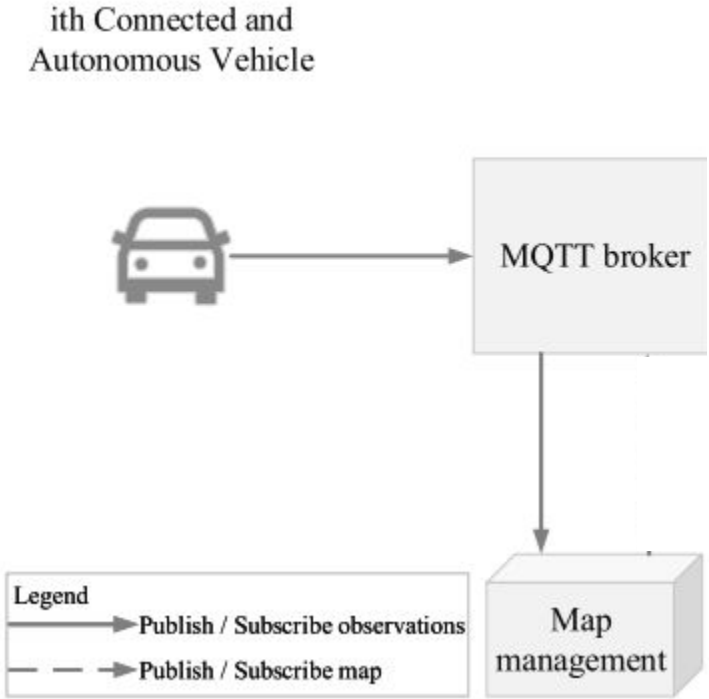
Map Framework



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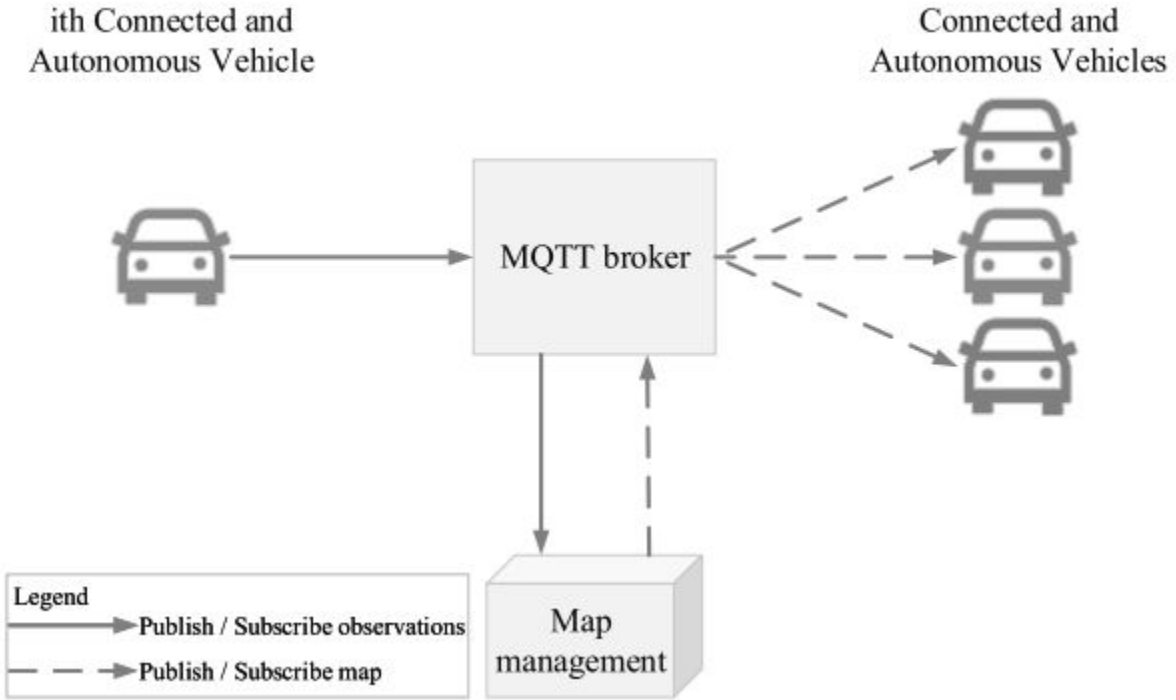
Map Framework



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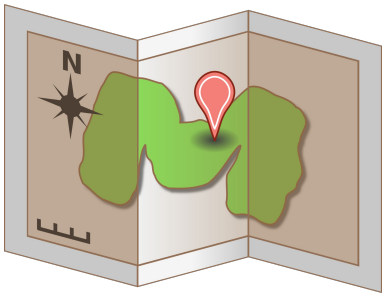
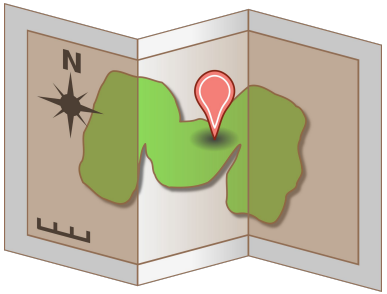
Map Framework



Candidate



Employed

Limitations

- Jitter
- Simple usecase
- Basic maneuvers
- Security / Data poisoning

Object Detection

Object Detection with compressed Images

(a) H.265-H (CRF=0); Detected: 1 pedestrian, 7 vehicles, 8 traffic light

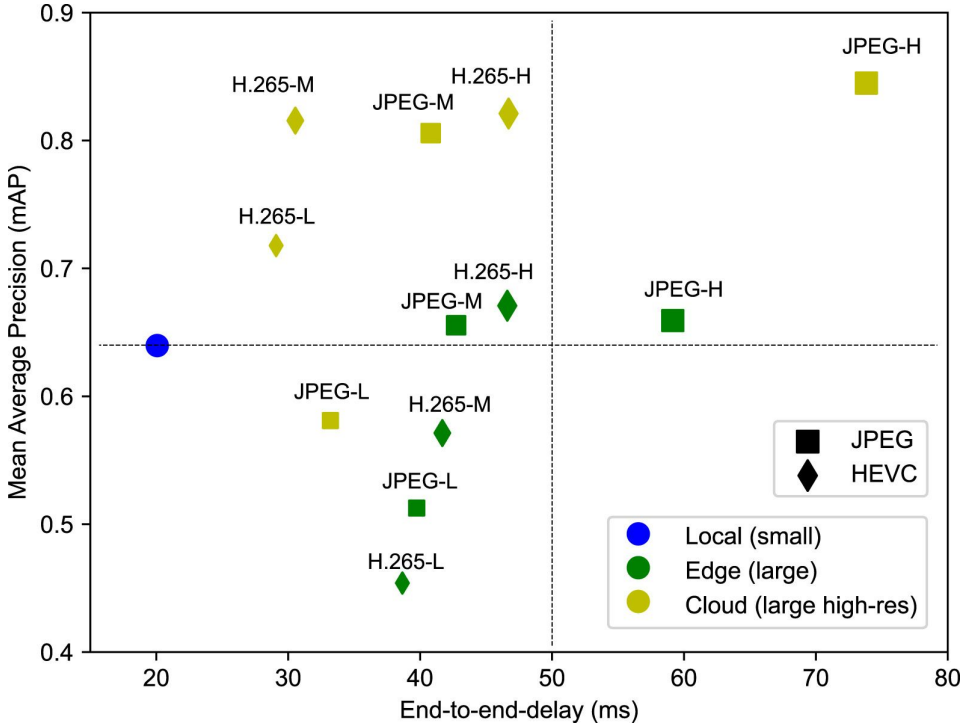
(b) H.265-M (CRF=24); Detected: 1 pedestrian, 7 vehicles, 7 traffic light

(c) H.265-L (CRF=30); Detected: 0 pedestrian, 7 vehicles, 6 traffic light

(d) H.265-VL (CRF=51); Detected: 0 pedestrian, 0 vehicles, 0 traffic light

[2]

Object Detection with compressed Images



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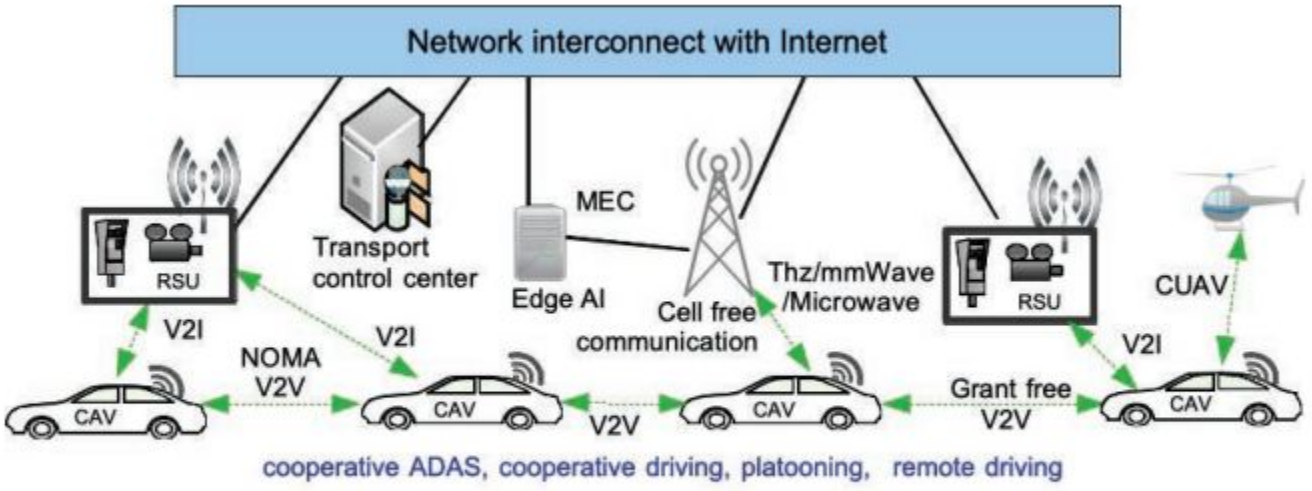
Limitations

- Reliability
- Latency
- Compression factor

The Promise of 6G

“The Future” of CAVs



MEC: mobile edge computing; RSU: roadside unit; CUAV: connected unmanned aerial vehicle
CAV: connected and autonomous vehicles; V2V: vehicle to vehicle; V2I: vehicle to infrastructure

Conclusion

- A solution for low latency shared maps
- CAV’s can offload object detection
- 6G could revolutionize CAV’s

- Unsolved Problems
- Basic scenarios
- 6G utopian and no guarantee

Q & A

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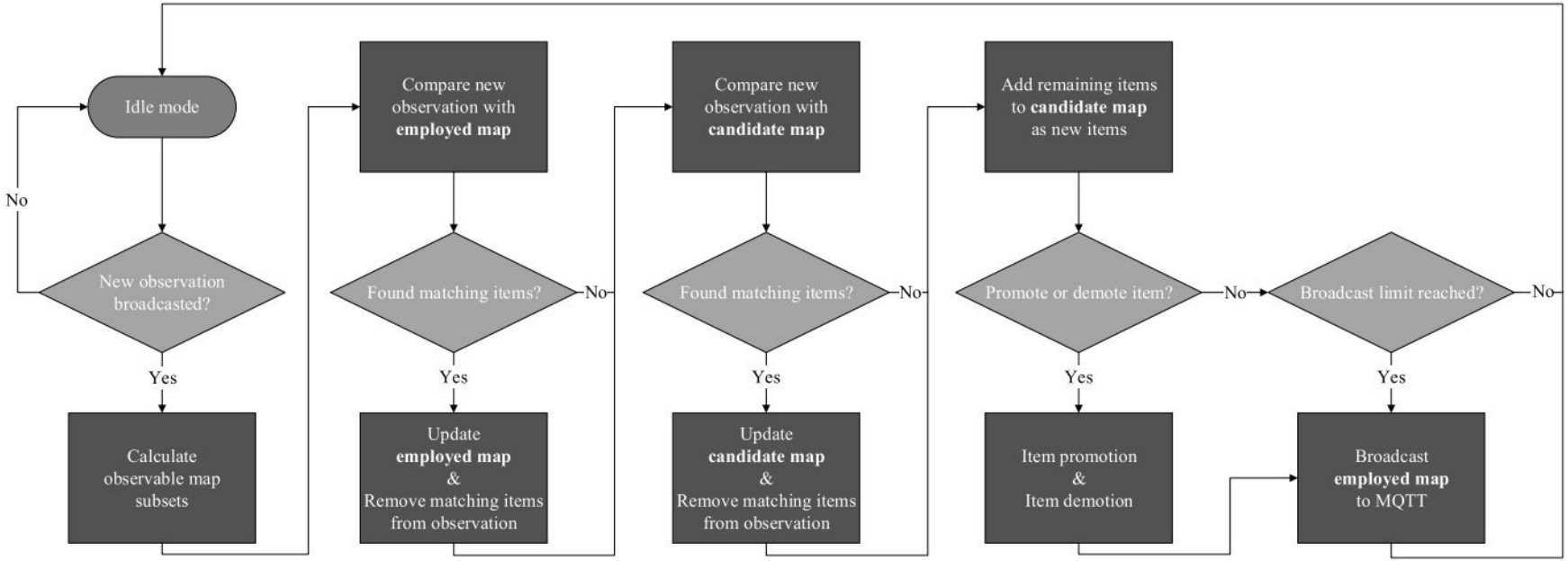

FIGURE 4. **Process flow diagram of the map management module. The diagram shows the steps the module transitions through after a new observation is received from a CAV over MQTT.**