

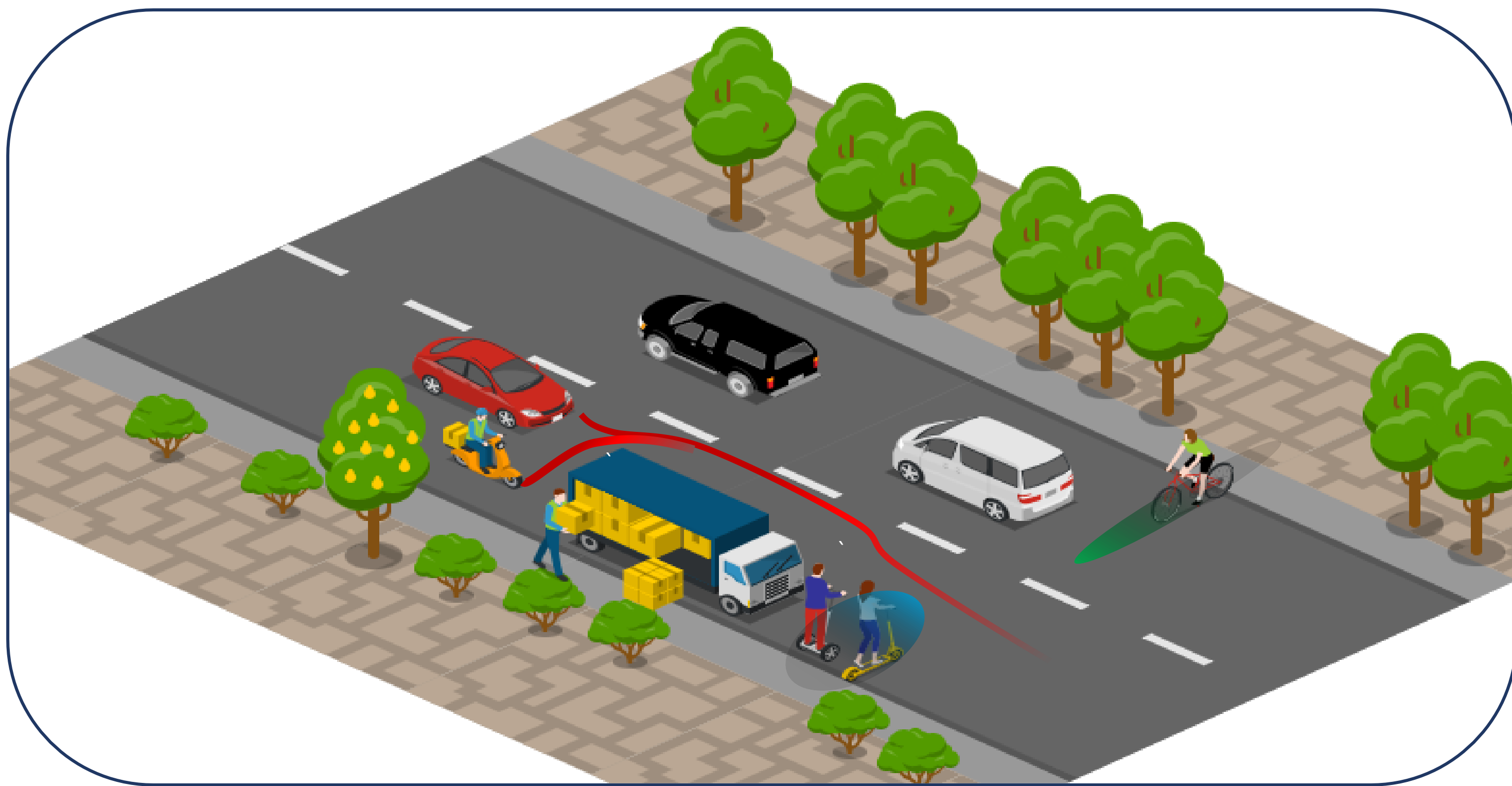
A Multi-Risk Assessment and Management Approach for Autonomous Driving in the Presence of Uncertainties introduced by PLEVs

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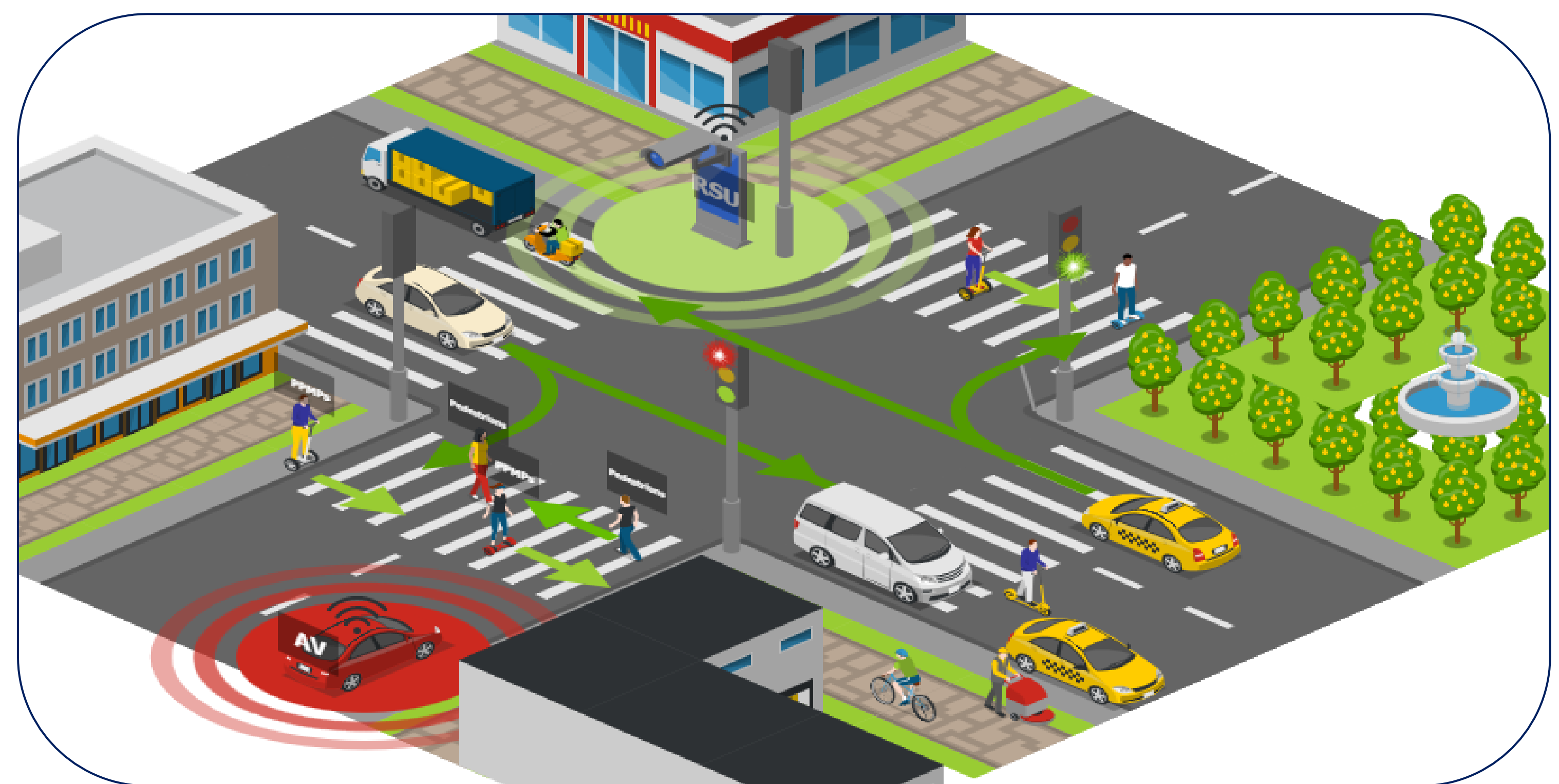
Objectives

This research work proposes a method for Autonomous Vehicles (AV) to navigate safely on Urban Roads in the presence of uncertainties resulting from the increase in **Personal Light Electric Vehicles (PLEVs)** such as gyropods and scooters. Our method performs a continuous risk assessment and management using a Fusion of Predictive Inter-Distance Profiles (F-PIDP) and a stochastic MPC algorithm while taking into account adaptive constraints.

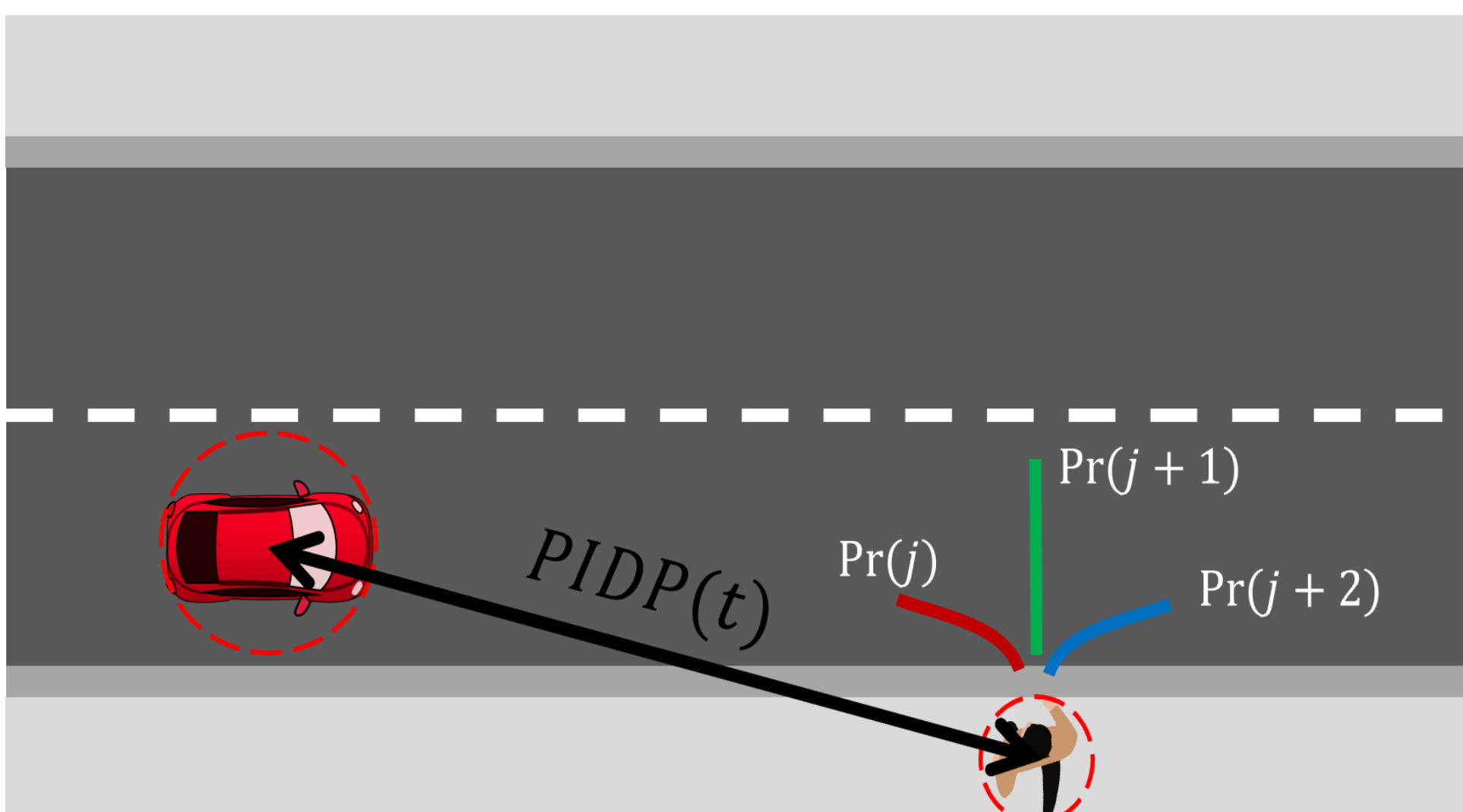


Challenges

- How to perform risk assessment and management in the presence of uncertainties of the PLEVs' future trajectories.
- How to compute a safe and smooth trajectory amidst PLEVs with Passenger comfort.
- How to incorporate information from external source such as Road Side Units (RSU) and V2X Communication.
- How to perform an evasive maneuver for situations with high risk of collision.

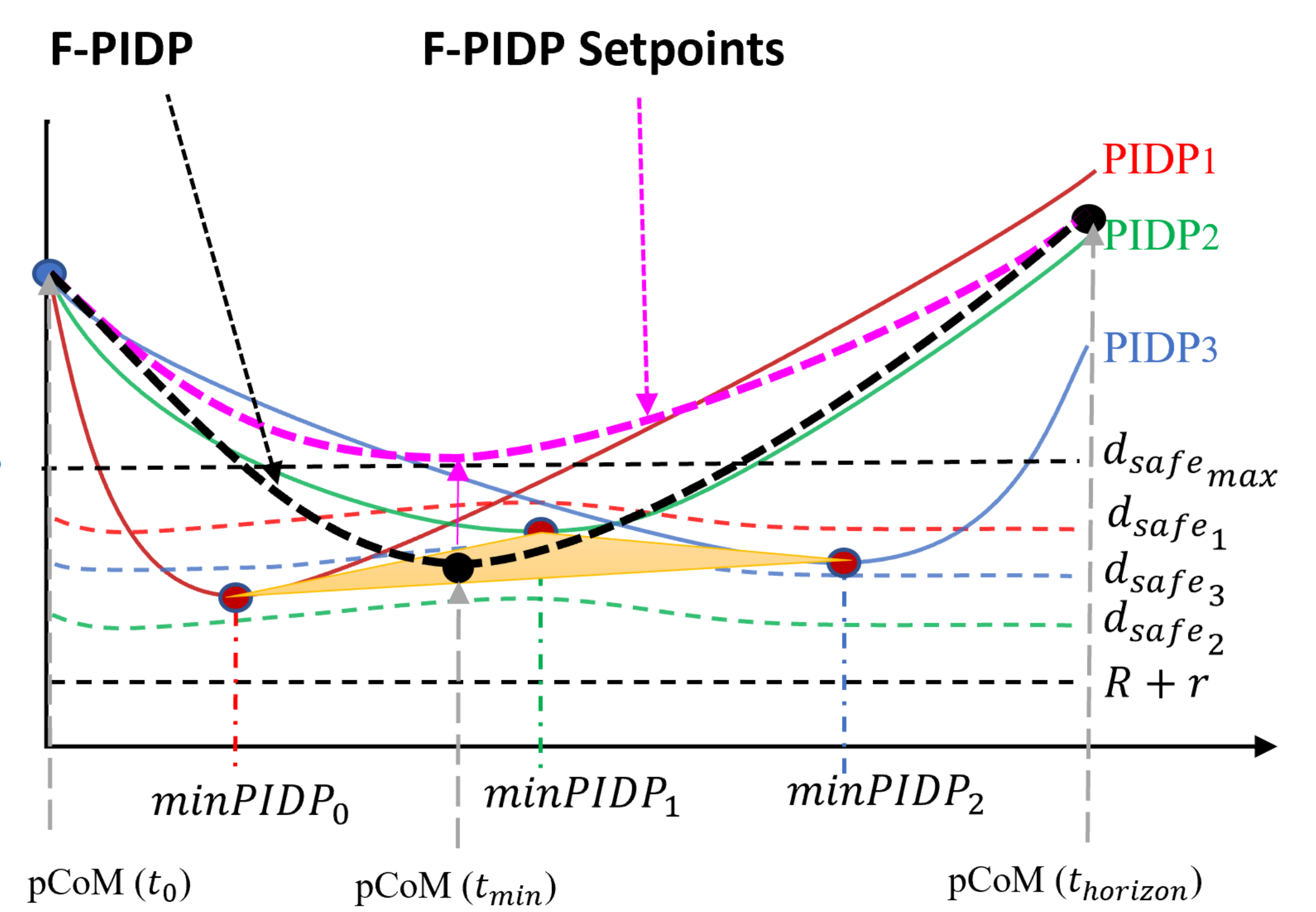


Proposed Methodology



1. Compute **Predictive Inter-Distance Profile (PIDP)** for each trajectory of the PLEV
2. **PIDP fusion** using probabilistic weights to get **Fusion of PIDP (F-PIDP)**
3. **PIDP Setpoint** based on Safety Distance **F-PIDP Setpoints**
4. **Stochastic MPC** for Risk Management using **F-PIDP Setpoints**

Ego vehicle and a Jaywalking PLEV with multimodal trajectories: each trajectory has its own probability



Fusion of PIDPs (F-PIDP) of an ego-vehicle and a PLEV with multi-modal trajectories

Research Benefits

- Safe navigation of AVs around pedestrians and PLEVs.
- Reduce traffic congestions created by conservative (stop-and-go) behavior of existing algorithms.
- Efficient fuel consumption and improved air quality.
- Accelerate the deployment of AVs in urban centers via wireless communication with RSU .

References

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- [2] D. Iberraken, L. Adouane, and D. Denis. "Multi-Controller Architecture for Reliable Autonomous Vehicle Navigation: Combination of Model-Driven and Data-Driven Formalization." In IEEE Intelligent Vehicles Symposium (IV), France, 9-12 June, 2019.

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