

# Safe Autonomy Term Project

10 Feb



# Project timeline

Today



Feb 10

Pitch



March 2

Internal talk



April 29  
May 4

Demo



May 6



*“.... to make the unthinkable imaginable, for then it will rapidly become possible, and soon essential.”*

--- Adam Gopnik in describing the role of a particular political leader



# Outline

- GEM system
- Pitch outline
- Project ideas

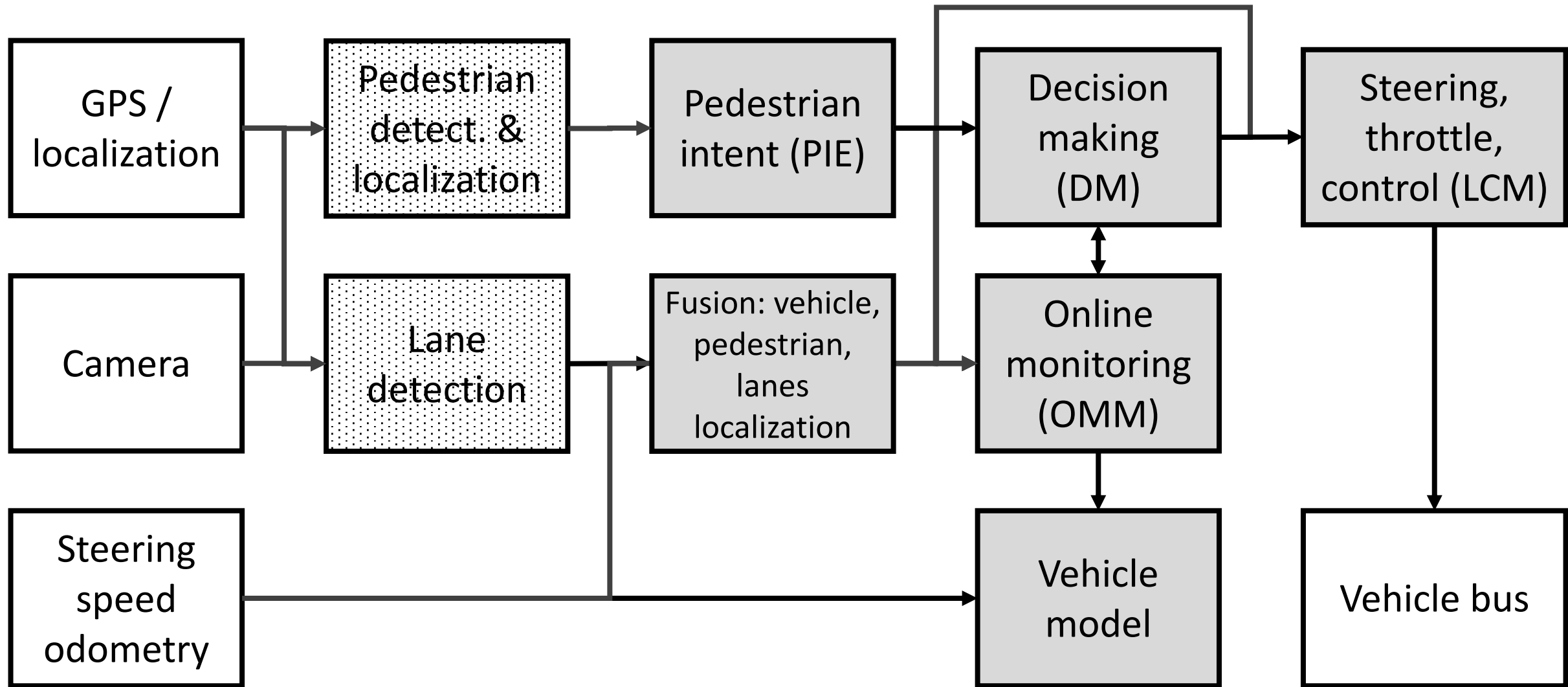


# What should the pitch proposal cover?

- **What** problem you are solving?
- **Why** is this problem important? Who cares?
- **How** is the problem solved today? State of the art
- **How** will your improvement work?
- **How** will your measure advancement?

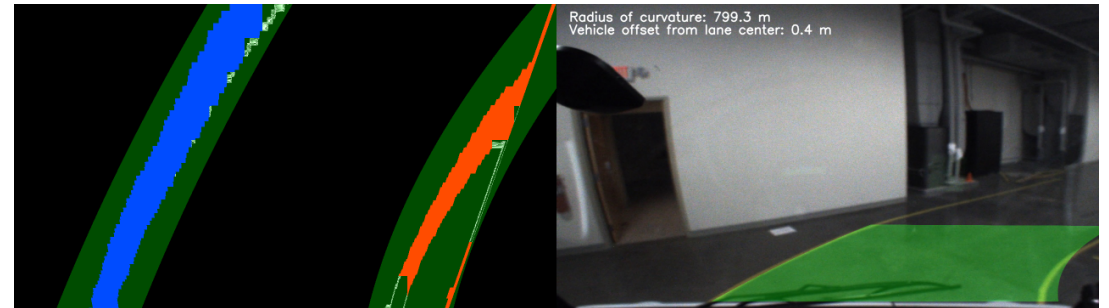
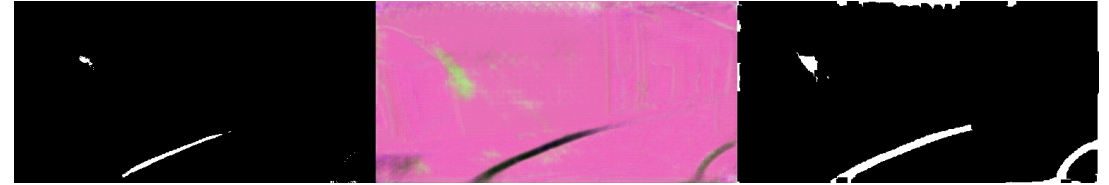


# GEM system



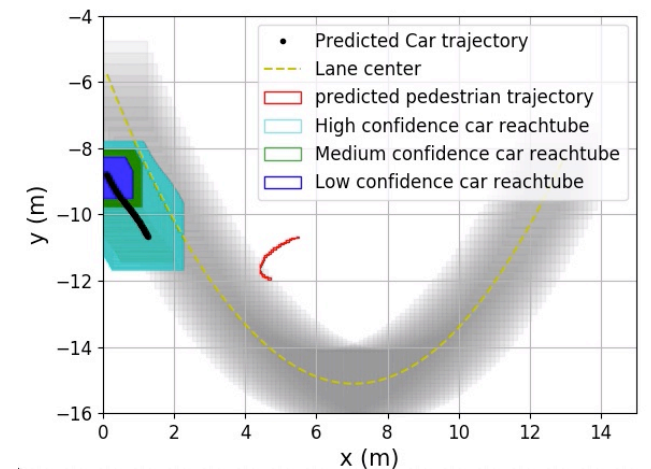
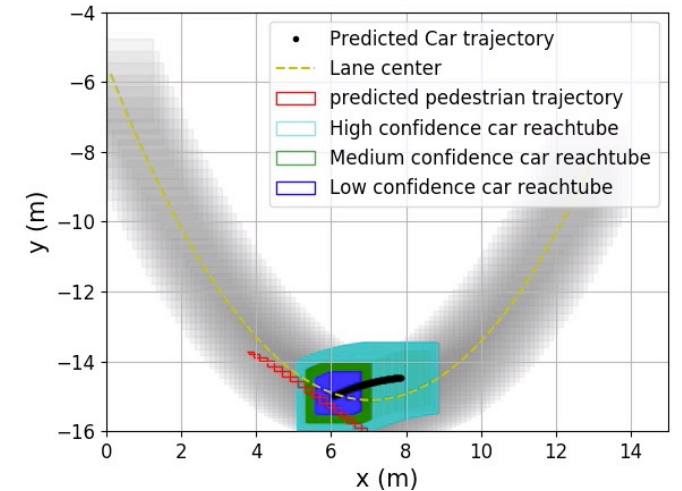
# Lane detection: traditional (MP1) versus Lane net

- We have used both approaches
- Make lane detection more robust to changes in lighting, camera position, noise
- Build a safety case: Fix scenario with vehicle, lane, pedestrian and profile the performance of lane detector w.r.t. other variables
- Possible outdoor testing; work with ROSbags
- Computational footprint of lane detection. Can it be made **real-time**?



# Reachability analysis (Lecture 10-12)

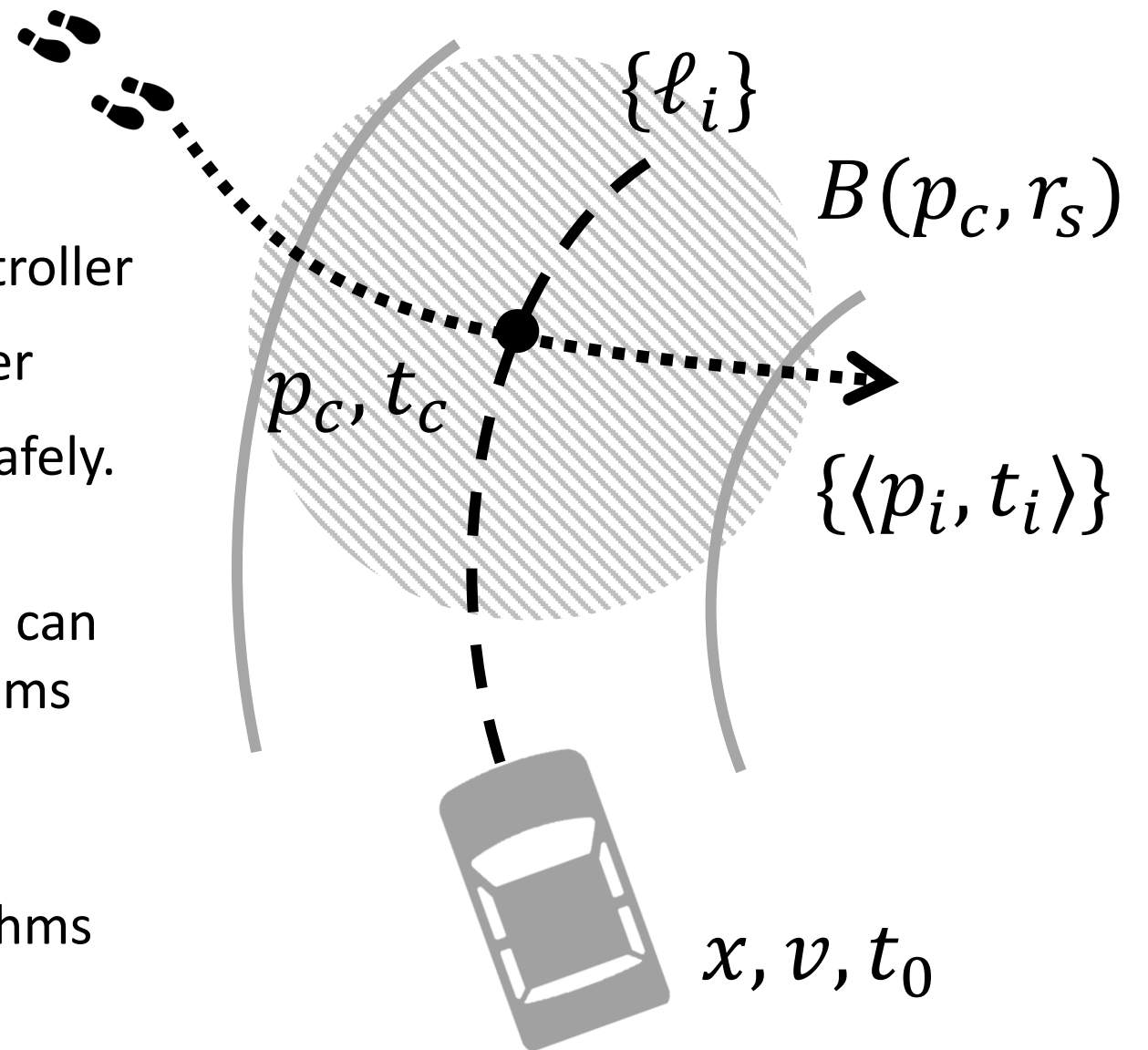
- Uses vehicle/pedestrian model to propagate uncertainty forward and check for possible unsafe/risky behavior (DryVR verification tool)
- Lots of research questions
- Can it be done really fast with many moving obstacles?
- Develop different notions of risk and responsibility [Responsibility sensitive safety]
- Interesting experiments in simulator and with real vehicle
- <https://www.intel.com/content/www/us/en/automotive/responsibility-sensitive-safety.html>





# Decision making and control

- Current vehicle uses a simple PID controller
- Improve tracking behavior of controller
- Solve hard instances of the problem safely. E.g., parallel parking, figure of 8,
- Planning and decision making module can be implemented using **search** algorithms and **optimization** algorithms (MP3)--- explore different algorithms
- Characterize robustness of the algorithms w.r.t. position error



# Pedestrian/object detection, localization, estimation (MP4)

- Current approach uses Yolo + indoor localization
- Lots of ongoing research on this topic
- Incorporate road signs, pedestrian pose estimation, more accurate position estimation, RSS
- Human subject experiments can be tricky (only professors can be subject of experiments) --- limited space
- Simulation experiments ok

