



Autonomous Mobile Robot Design

Topic: Research goals for Autonomous Cars

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Autonomous Cars will change our society

- ▶ Autonomous cars are not a “technology gadget”.
- ▶ Autonomous cars will change how we commute, what we own, how we share resources as a community, how we experience intelligent machines – robots in our everyday lives.
- ▶ To achieve autonomous driving we need to work in every possible field: from control to perception, from path planning to multi-robot collaboration, from robot-human interaction to robot-city integration.
- ▶ Don't miss this opportunity. Get involved!



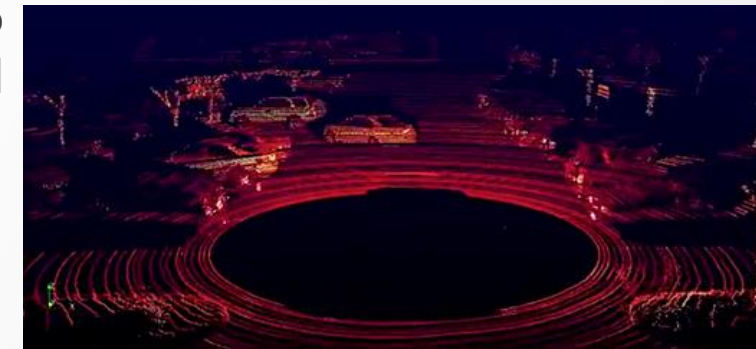
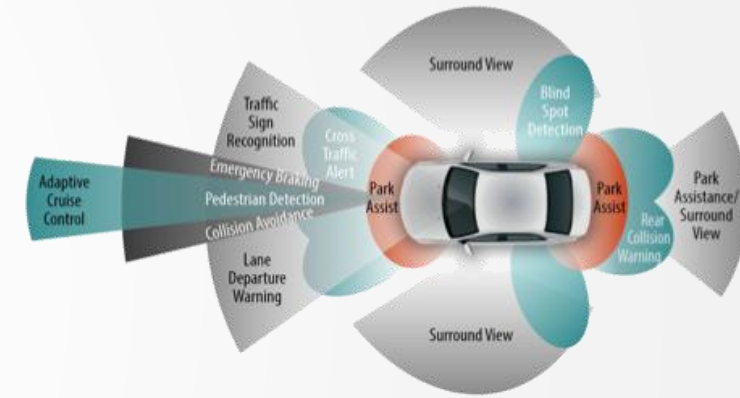
What we want to achieve here?

- ▶ We want to contribute into automating mass commute vehicles.
- ▶ We want to contribute into key challenges such as long-term localization, non-cooperative vehicle avoidance, pedestrian detection and intent recognition.
- ▶ We want to establish a long-term Education & Research Module in autonomous driving in order to train the required workforce in the field.



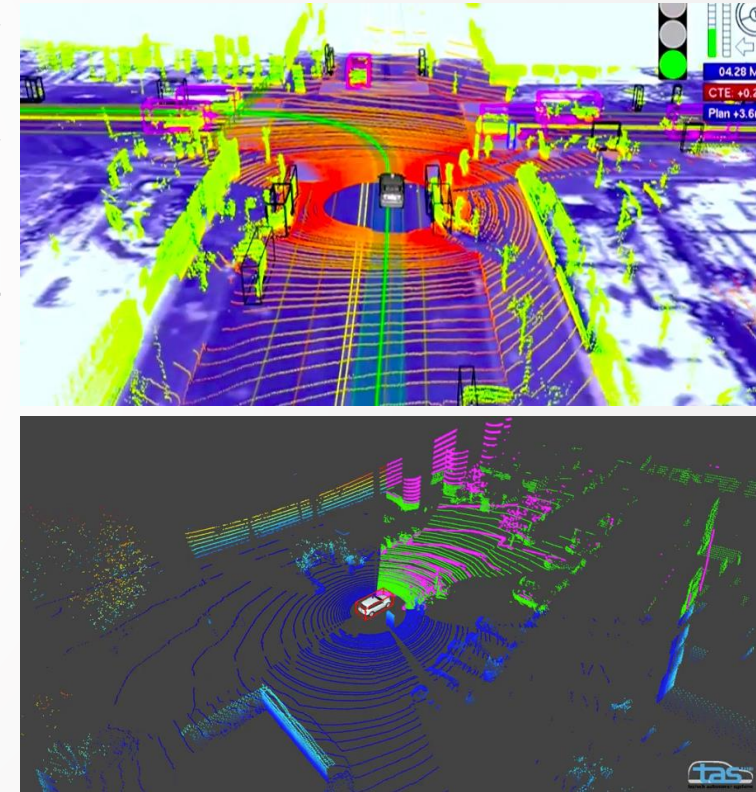
What are the short term goals?

- ▶ To support our broader goals, two challenges are identified to be addressed in short-term:
 - ▶ Challenge 1: Multi-modal sensor fusion for robust long-term navigation.
 - ▶ Challenge 2: Pedestrian detection and intent recognition.
- ▶ To address these challenges, we seek to develop a skillful research team with the required capacity in terms of background and workforce.



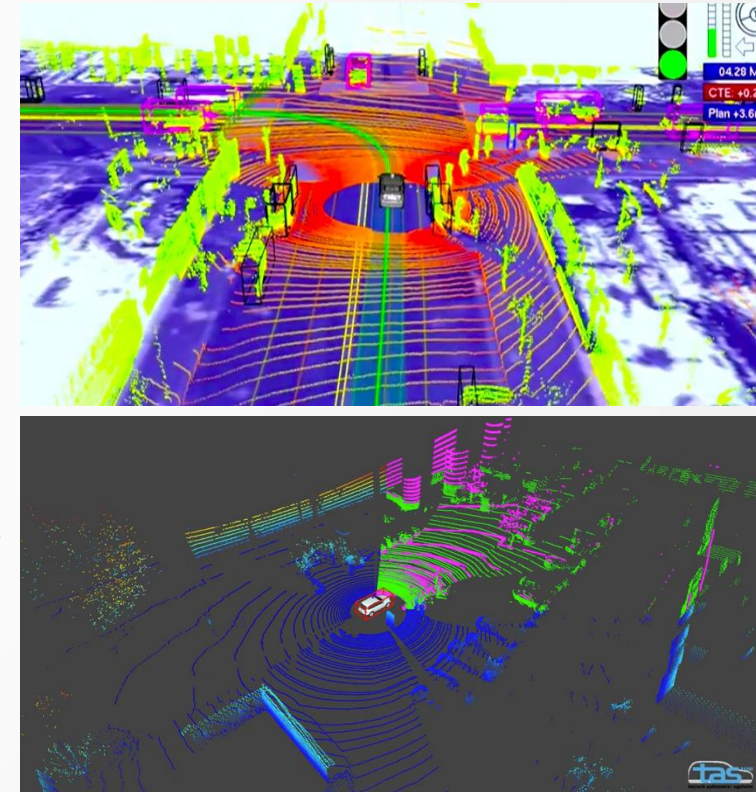
Challenge 1: Long-term Navigation

- ▶ The capacity of a perception module to robustly localize the robot pose relies on its capacity to accurately infer this information within any environment.
- ▶ To derive a solution to this problem, sensing multi-modality is the key.
- ▶ We aim to develop a sensing module integrating:
 - ▶ LiDAR rangefinders
 - ▶ Multi-camera system
 - ▶ Inertial sensors
 - ▶ GPS



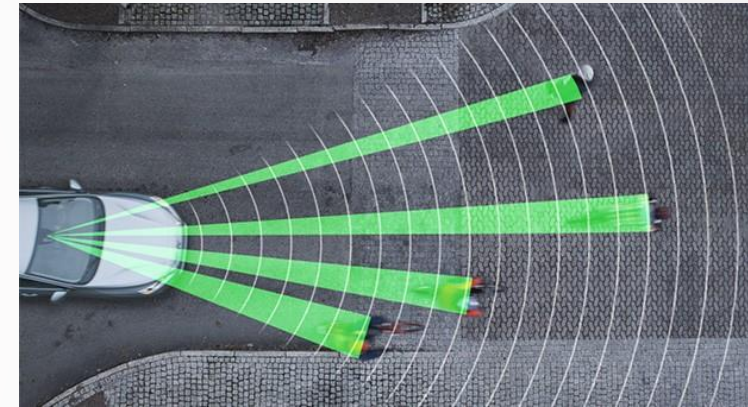
Challenge 1: Long-term Navigation

- ▶ Within our research we will:
 - ▶ Develop the multi-modal sensing module emphasizing on time synchronization issues.
 - ▶ We will work on the fusion of visual, inertial and LiDAR information as well as GPS.
 - ▶ We will emphasize on enabling long-term navigation subject to different light conditions and different places.
 - ▶ We will emphasize on validation through labeling of the datasets.



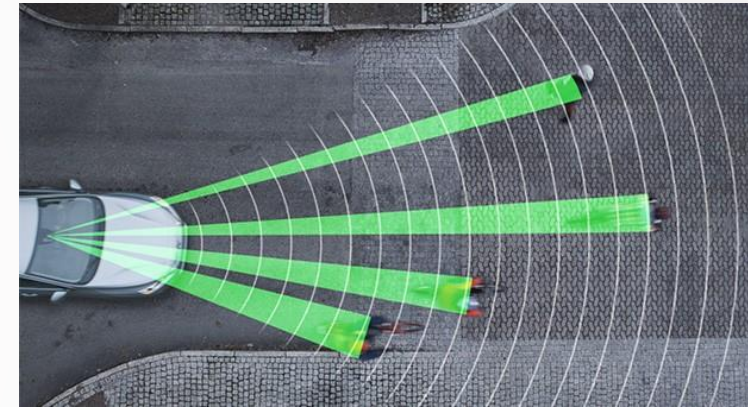
Challenge 2: Pedestrian Perception

- ▶ Safe autonomous driving demands autonomous pedestrian avoidance.
- ▶ Pedestrian detection may be insufficient and provide very limited reaction time. We as human beings, not only detect but efficiently predict the motion of the pedestrian.
- ▶ Within our goals is to enable pedestrian *intent* recognition: the challenge of estimating the possible trajectory of the pedestrian based on the body motions, eye-inferred intent and more.



Challenge 2: Pedestrian Perception

- ▶ Pedestrian detection and intent recognition corresponds to a major challenge in the fields of computer vision, broadly robot perception and machine learning.
- ▶ Again, multi-modality will be one of the key avenues to approach a robust solution.



Projects at UNR

- ▶ A variety of research projects will run at UNR, including:
 - ▶ Autonomous Campus Cart
 - ▶ Automating public transportation systems
- ▶ Get involved!
- ▶ What about a student competition? Inform about your possible interest and share your thoughts!
- ▶ Interested? Send an e-mail at kalexis@unr.edu



A black and white photograph of a drone flying in the foreground. The drone is a quadcopter with a white protective cover over its camera. In the background, there is a construction site with several large cranes and a building under construction. The scene is slightly blurred, suggesting motion or a shallow depth of field.

Thank you!

Please ask your question!