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Autonomous Multi-Robots Lab
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MSc. Project Proposal
Title: Decision making for self-driving cars in urban environments

Brief description: Globally, over 3000 people are killed every day in vehicle-related accidents and over one hundred thousand are injured or disabled on average, and over 90% of the accidents are due to driver error.
Two connected projects are available:

A) In this work you will develop a method for safe motion planning in urban environments, which accounts for the interaction with other road users. The planner could be a model predictive controller and the coordination with other vehicles could be done via consensus, where cars communicate their intentions with minimal communication requirements.
B) Perception and systems integration for a mobile robot. You will implement the map building, localization and object detection for a mobile robot, as well as the basic motion planning capabilities. In this project good C++/ROS skills are desirable.

You will test your approach in experiments with a mobile robot (Clearpath Jackal) and onboard sensing (VLP16 Lidar) at the TUD esplanade. Experiments could also be done with a highly automated Toyota Prius.

Related video from past work: https://youtu.be/jik-zxGhPIA

Desired qualities:
- Motivated and independent
- Good problem solving skills
- Experience/interest in motion planning, model predictive control and/or consensus algorithms
- Experience in C++ programming and Robot Operating System (ROS)

To apply please send me an email with:
- Why are you interested in this project? What would you like to achieve?
- What is your experience relevant to this project? This could be past projects, past courses; theoretical knowledge or practical experience, related to constrained optimization, planning and/or robotics.
- When would you like to start and which courses will you have left by then?
- Is your motivation to do algorithmic work or applied research?
- Your transcript of record with past courses.
- Available day/times to meet within one/two weeks.

References:
[1] W. Schwartig, J. Alonso-Mora, L. Paull, S. Karaman and D. Rus, "Parallel Autonomy in Automated Vehicles: Safe Motion Generation with Minimal Intervention", *Proc. of IEEE Int. Conf. Robotics and Automation, 2017.*
[2] E. Galceran, A. G. Cunningham, R. M. Eustice, and E. Olson, "Multipolicy Decision-Making for Autonomous Driving via Changepoint-based Behavior Prediction," *Proc. of Robotics: Science and Systems (RSS)*, pp. 1–10, 2015.