AUTONOMOUS TRACK

This document contains rules and regulations for the autonomous track of the Electric Vehicle Rally V (Fifth Edition). This will be your guide on what to know before developing and designing the autonomous system. The rules contains articles on the allowed programming languages, operating system, milestones and several other informations.

AUTONOMOUS TRACK COMPETITION

The development of autonomous systems worldwide is pushing several research as well as industrial entities to invest to achieve the dream of having the autonomous vehicle. The levels of autonomy vary ranging from driver assistance systems up to full autonomy level.

Proper trajectory tracking of a specific pre-defined track as well as safe navigation in an obstacle are among the basic fundamentals of developing any autonomous system. Proper tracking guarantees that the vehicle is capable of following its reference trajectory with acceptable accuracy and time. While safe navigation guarantees the safety of the vehicle itself as well as its different environment participants.

In this track of EVER competition, these two challenges will be the main focus points for the 2024 Autonomous Track challenge. Teams will compete towards developing the most reliable system that can achieve both these tasks. Performance would be measured and scored to shortlist teams across different milestones of the challenge.

- All Teams participating in this track of the competition, must implement their work using ROS (Robot Operating System) as the main core of system development.

- Programming languages allowed are Python, C, C++ or MATLAB. (Other programming languages may be allowed after confirming with the organizers of the competition).

- Each team must utilize at least one camera and one LIDAR in their work and algorithm implementation, any extra sensors are allowed.

- Emergency Stop functionality MUST be implemented in the algorithms developed for safety precautions.

- Usage of different ready found ROS packages is allowed, as long as they are adjusted to operate for the tasks detailed below.

- The organization team reserve the right to amend any needed rule to the previously mentioned rules and announce it to all teams through its communication media.

- Each team will be required to work on three different milestones (consecutively). Upon passing each milestone successfully, the team would be promoted to the challenges of the next milestone. The three milestones cover the spectrum of autonomous systems development covered by the competition.

- Milestone (1) will require the implementation of a software simulation of the test vehicle (model will be provided along with its parameters) that presents the team capability of achieving accurate trajectory tracking.

  - Several trajectories will be required from the teams to follow to assess their vehicle performance. Straight line motion with different speeds, Circular Rotation, Infinity Symbol track re among the suggested tracks to be tested.

  - Performance would be measured in two main terms, the accuracy (how close is the vehicle performance relative to the desired trajectory, as well as the speed of the execution of the task.

  - Both metrics would be combined together to evaluate the overall score of the team in this milestone, and the successful teams would be promoted to the second stage.

- Milestone (2) two main tasks will be needed from each team.

  - Task one is the continuation along the steps taken in milestone (1), where the performance of the vehicle under different disturbances (road irregularities and actuation/sensing uncertainties) would be assessed using the same metrics explained in milestone (1).

  - The second task is related to the evaluation of environmental perception for autonomous systems.

  - In this stage simulation would still be the main operating platform. Each team would be asked to insert specific obstacles to their simulation environment at predefined locations.

  - The performance of the vehicle would be assessed through the ability of the vehicle to move in its environment while detecting these obstacles.

  - The accuracy of detections would be measured, as well as the speed of the operation of the algorithm.

3

- Different obstacles (static and dynamic) would be required to be tested by the teams in the simulated environment and the performance of the teams would be calculated and compared.

- Teams performing well in the two tasks of milestone (2) would be promoted to the last milestone.

- Milestone (3) is the competition day where the exact details to be communicated.

GET READY TO BE CHARGED