SAE INDIA NORTHERN SECTION

AUTONOM INDIA 2021

AUTONOMOUS VEHICLES TECHNOLOGY CHALLENGE

Design & development of autonomous 4 wheeled 4 seater electric vehicle for urban mobility in Indian context

Rule Book

1. Overview

1.1. Introduction : AUTONOM INDIA 2021 is a first-of-its-kind autonomous vehicle technology challenge for engineering students in the country. India's biggest futuristic mobility student competition will be based on Indian traffic situations, and will require student teams to design and develop autonomous four-wheeled, four-seater electric vehicle for urban mobility.

1.2. Objective : Objective of the competition is mainly to provide a platform to young budding engineers of the country to explore themselves in the field of next generation ADAS and Autonomous Technologies. The prime objective of the event is to design and develop Autonomous 4 Wheeled 4 Seater Electric Vehicle for Urban Mobility based on Indian Traffic Scenario. During the competition the teams are tasked

1.2.1. To Generate different typical unsafe Indian Driving Scenarios with all relevant driving objects /actors using IPG car maker simulation tool by each team

1.2.2. To Generate 10 edge case which are difficult for a conventional ADAS System to function in Indian driving condition

1.2.3. To apply the most relevant ADAS sensors to ensure object deduction and identification of collision warning and collision avoidance in the identified unsafe driving scenarios.

1.3. Competition Summary – Autonom India 2021 is first of it's kind event for the next generation engineers in the field of ADAS and Autonomous Vehicle Technology. During the competitions the team members along with the faculty advisor will be exposed for the upcoming technologies of Autonomous Vehicles. The event will be a platform for the students to interact with Industry Experts from different domains like Vehicle Dynamics, Sensor Algorithm, ADAS / Autonomous Vehicle overviews and functionalities, Control Technologies , IPG Car Maker and related simulations and related technologies. The students will be provided license from IPG to generate the vehicle scenarios on different conditions, place sensor as per their requirement create sensor model and complete control system and check the performance of the vehicle virtually. The Event flow along with timelines are mentioned below in the respective sections.

2. Autonom India Rules and Organizing Authority

2.1. Authority of the rules :. The Autonom India 2021 Rules are the responsibility of the Organizing Committee and are issued under the authority of SAE NIS. Official announcements from the Autonom India 2021 shall be considered part of rules and shall have the same validity as rulebook even if these were not initially included in the rulebook but communicated separately. Ambiguities or questions concerning the meaning or intent of these rules will be resolved by the Organizing Committee only

2.2. Rules Validity : The AUTONOM India 2021 Rules posted on the event website and dated for the calendar year 2021 of the competition are the rules in effect for the competition

2.3. Rules Compliance : By entering Autonom India 2021 competition, the team, members of the teams as individuals, faculty advisors and other associated personnel agree to comply with and be bound by these rules, all the rule interpretations or procedures issued or announced by SAE NIS or Autonom Organizing Committee . All team members, faculty advisors and other associated representatives are required to cooperate with and follow all instructions from competition organizers, officials and judges

2.4. Understanding of Rules : Teams are themselves responsible for reading, interpretation and understanding the rules of the competition. To seek the clarifications regarding the rules, teams should contact the organizing committee. Teams must keep the records of all such email communications ready for reference during the evaluation round.

2.5. Official Communication : All teams must pay attention to the official announcement made by the Organizers. All official announcements will be posted on website and/or social media channels alongwith communication through email.

2.6. General Authority : SAENIS and the competition organizers reserve the right to revise the schedule of the competition and/or interpret or modify the competition rules at any time and in any manner that is in their sole judgment, required for the efficient and smooth operation of the event.

3. Eligibility for participation

3.1. Eligibility Limit for Team Members:

3.1.1. **Student Status:** Team Members willing to take part in the competition must be enrolled in as engineering student from the same campus of a college, institute or university situated in India only. Team members who have graduated during the Twelve (12) month period prior to the competition remain eligible to participate if they are having +1 membership.

3.1.2. **Team Size:** A group of minimum 5 to maximum 10 students members can register as a team. The team may contain students from any engineering discipline.

3.1.3. **SAE Membership :** Team members must have +1 Student Membership SAEINDIA. Proof of membership, such as membership card , is required for participation in the competition .

Note: Students can join SAEINDIA online at: www.saeindia.org

3.2. Faculty Advisor

3.2.1. **Requirements and Eligibility :** Each team is expected to have Two Faculty Advisor from Interdisciplinary Engineeirng Branches, appointed by the university. The Faculty Advisors must have a valid SAEINDIA Membership

3.2.2. **Responsibilities :** The Faculty Advisors will be considered by competition officials to be the official university/institute representative. Faculty Advisors may advise their teams on general engineering and engineering project management theory and act as guide of team. The Faculty advisors are allowed to attend the training programme offered by the organizing committee and are invited to attend the evaluation presentation of their team but will not be allowed to provide answers or justifications for any question on behalf of team.

3.2.3. **Limitations:** Faculty Advisors should not design any part of the vehicle nor directly participate in the development of any documentation or presentation. Faculty advisors are restricted to answer on behalf of teams during any evaluation . They are supposed to encourage teams to explain the answers by themselves. He/she can also not perform in event on behalf of the team members. It is also recommended that all documentation of team should be verified by the Faculty Advisor

4. Registration Procedure

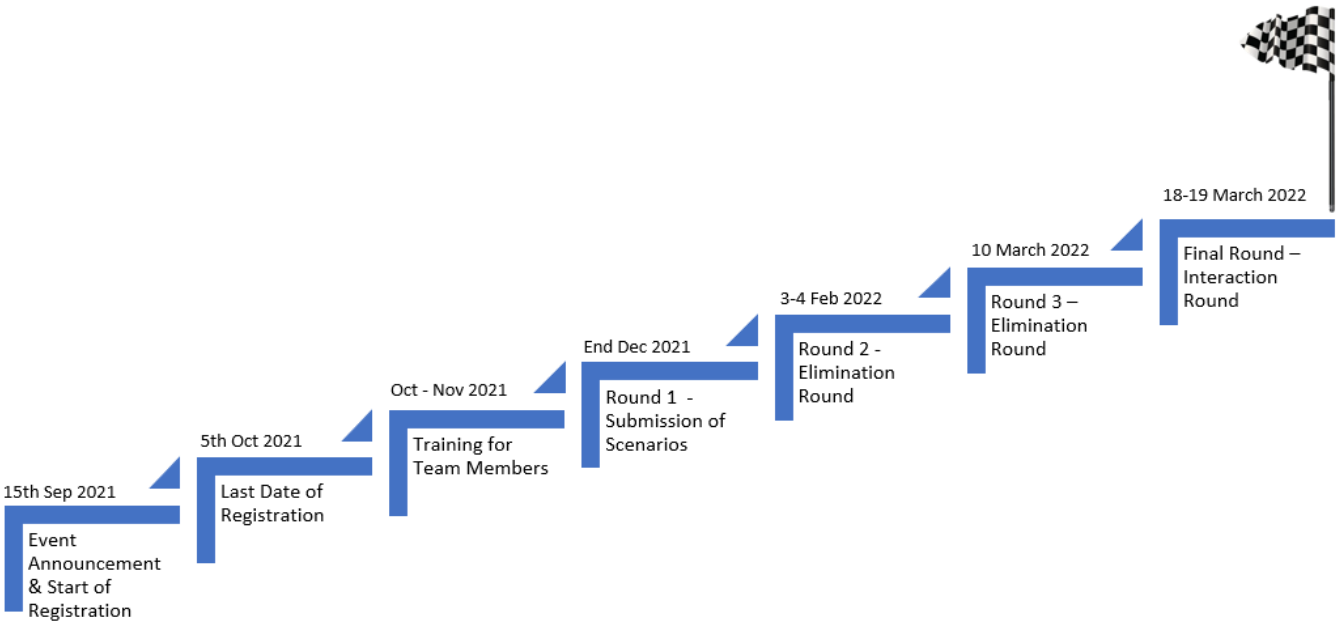
4.1. **Team Registration for Participation :** Team registration will be through online portal after the announcement of event

4.2. **Change in Team :** Any changes in the team will not be allowed once the final registration is done through portal . However, any critical issues related to team structure, captain or faculty advisor at any stage of the event may be brought in the notice of Organizing Committee with prior approval from institute authorities through an official letter issued by Head of Department or Director of the Institute. These issues will be reviewed by Organizing Committee for further decisions. Please note that this letter is required to only put up the issue in consideration of organizing committee and the Organizing Committee reserves its rights to disregard such requests.

4.3. **Maximum Entries per college :** Multiple teams from any college/university may register for the event. Multiple teams cannot have any team member or faculty advisors in common.

5. **Event Timelines**

The event will start with opening of registration on 15th September 2021 with the final event proposed on 18-19 March 2022



6. **Industry Expert Interaction with Teams (6weeks , 8hrs per week : Total 48hrs.)**

The details of interaction which will be provided to all the team members along with faculty advisor is mentioned below. Few exposure will be in self-learning mode and few will be in workshop mode

6.1. Vehicle Dynamics: Overview of Vehicle Dynamics. Concepts and working of braking, steering, acceleration and necessary parameters to be considered.

6.2. IPG Car Maker and related simulations: Usage of Car Maker, configurations, interfacing and simulations of vehicle as well as scenarios

6.3. ADAS / Autonomous Vehicle overviews and functionalities: Basic Concepts, principle and levels of autonomy, system architecture basics and case studies. ADAS features in the vehicle and overview of Active Systems.

6.4. Sensing, Perception and Control Algorithm: Overview of various sensors, their usage and applications. Concepts of fusion, overview of AI/ML, application of algorithms and controls interfaces.

6.5. Scenario Creation and Data Acquisition: Complexities of scenarios, parameters to be captured during data collections and their usage. Overview of Data Acquisition systems and communication protocols.

7. Event Outline – The competition is divided into 4 rounds

- Round 1 – Scenario Generation: Each team has to generate minimum 10 simulation scenarios based on Indian Traffic conditions. There is no limit of maximum scenario generation. Minor changes will not be considered as a valid scenario. The scenario will be evaluated by the jury and grading from 1 to 10 will be given on each scenarios (1 being min. and 10 being max.) depending upon the complexity. The award winning teams will be the teams, submitting the maximum no of valid scenarios and also teams having the highest total score among +5 scores.

7.1. Round 2 – First Elimination Round: EACH TEAM WILL BE GIVEN A SET OF SCENARIOS BY THE JURY. The team is expected to model or select various sensors for use with the given scenarios. The jury will evaluate based on the best coverage by a sensor model and optimum use of their sensor fusion model, optimum use of sensor algorithm looking at the overall 3-D coverage of the surrounding of the vehicle in each scenario. Innovative thinking and out of the box ideas will be considered for awards from this round

7.2. Round 3 –Second Elimination Round: This round is a little more advanced than the previous round. In this Round the jury will evaluate the teams using a set of scenarios that will not be shared with the teams in advance. The intent to give the teams more time to work on their sensor fusion models, control algorithms based on the learnings during round 2 evaluations and interactions with the industry specialists. Evaluation criteria will be similar to round 2. Innovative thinking and out of the box ideas will be considered for awards from this round. On the basis of above evaluation top 20 teams will be selected for interaction round

7.3. Round 4 – The Finals || Interaction Round : In this round , the Jury will interact with all the team one by one and evaluate their approach, innovativeness in their technology, sensor fusion, optimal use , control algorithms, detection of false positives etc. Based on the performance of round 3 and round 4 , the final winners will be selected by the Jury.

7.4. Important Note

7.4.1. Vehicle Model will be provided by the organizing committee

7.4.2. Boundary conditions and Environment conditions will be provided by the organizing committee

8. Awards

8.1. Round 1: Scenarios Generation

8.1.1. Highest Number of Valid Scenarios from a Team : Winner , First Runner Up , Second Runner Up

8.1.2. Maximum Number of Valid Score in Terms of Validity submitted by a team (Grade greater than 5 per scenario) - Winner , First Runner Up , Second Runner Up

8.2. Round 2 : Elimination Round - No Awards

8.3. Round 3 : Elimination Round – No Awards

8.4. Final Round –

8.4.1. Overall Awards

- Overall Winner
- Overall First Runner Up
- Overall Second Runner Up

8.4.2. Best Sensor Model – Winner, First Runner Up , Second Runner Up

8.4.3. Out of the Box Approach and Innovativeness – Winner, First Runner Up , Second Runner Up

8.4.4. Optimal Use of Sensor Model – Winner, First Runner Up , Second Runner Up