

14th IEEE UAE STUDENT DAY, 2019

Saturday 27th, April 2017

Industrial Design Project (IDP) Competition Autonomous Vehicle Race

General Information

- Undergraduate engineering students within the UAE are eligible for this competition.
- Each institution can participate with a maximum of two teams in this competition.
- Each team shall consist of a maximum of 5 IEEE student members.
- Project cost must not exceed AED 2000.
- Make sure you avail Zero Ohm Electronics special discount for IEEE members for your electronics purchases. Enter the following code into the website for discounts “**ieeesd**”.
- This is an annual competition, the institutions are allowed and encouraged to develop their existing platform from the previous year(s). Please refer the last section for hints.

Projection Definition

Background

The global industries’ vision towards self-driving/autonomous cars has dramatically increased in the last few years. We can see big companies such as Google and Tesla taking big leaps in this particular field.

On one hand, the idea of this Industrial Design Project (IDP) is to increase the students’ knowledge and experience in this field and to prepare them for the market. On the other hand, it will provide the industry with competent engineers in this field.

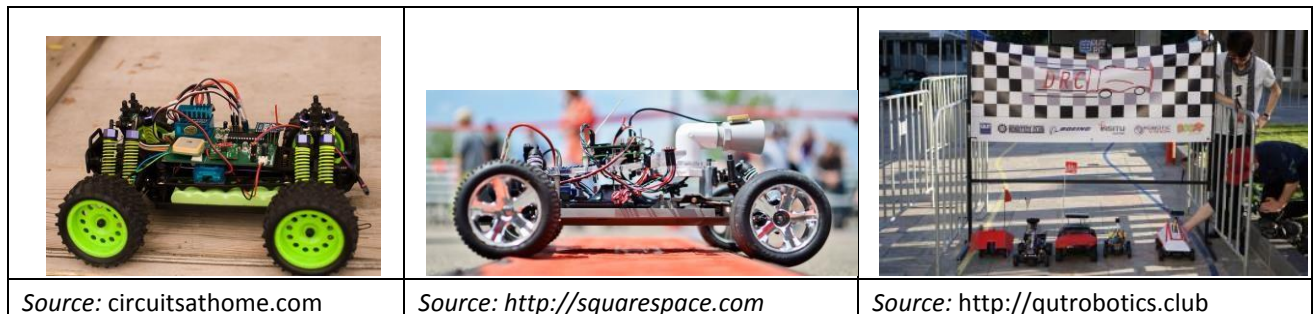


Figure 1 - Autonomous Vehicles and Racing

Competition Description

- An autonomous vehicle must be built using the platform in [this link](https://goo.gl/tqr9rh) (<https://goo.gl/tqr9rh>). The robot is shown in “Figure 2 - Robot Platform”

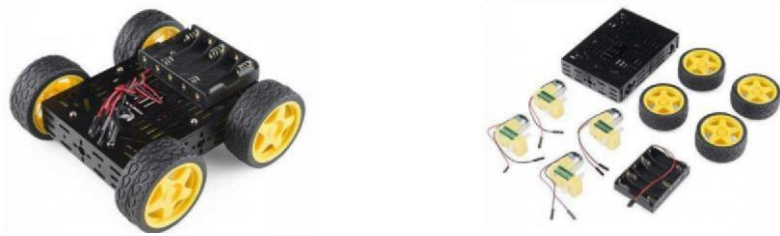


Figure 2 - Robot Platform

- A racetrack will be built, it will contain outside guiding walls and white lines on the ground (depicting an actual road). “Figure 4 - Individual Racing Race Track” shows a general idea of the race track. The actual track shape will remain anonymous. Students must build a navigation system that works in all environments.
- The teams will build their own self-driving vehicles keeping in mind obstacle detection and avoidance mechanisms to reach to the “Finish” line with minimum violations.
- The students will be free to develop their own methods to achieve the self-driving goal of this competition; however, the vehicle must be autonomously driven with no human intervention.
- The vehicle should start upon the traffic signal’s green signal. The traffic signal changes in sequence from Red -> Yellow -> Green. Demonstrations of the traffic signal setup as well as the dimensional specifications are shown below in Figure 3.

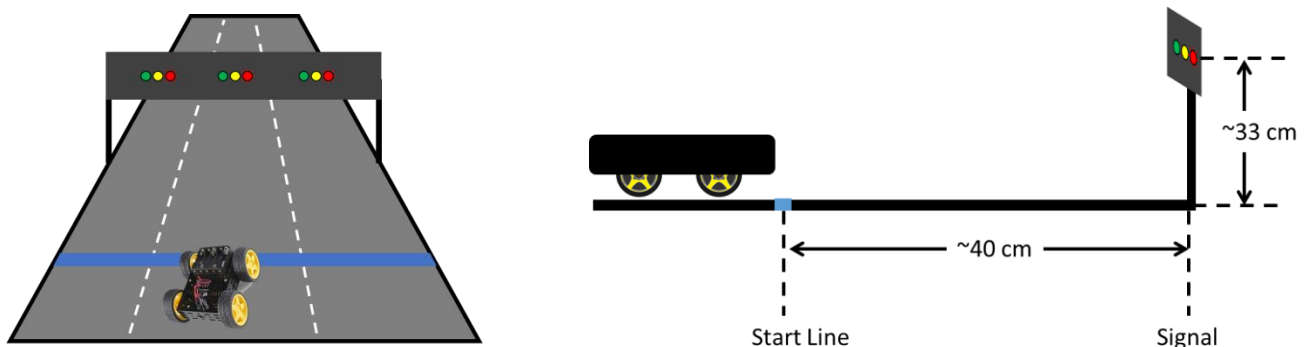


Figure 3 - Traffic Signal Demonstration

- The vehicle must not cross its lane unless if there is an obstacle.
- The vehicle must be equipped with a “Kill” switch which will completely turn off the power from the vehicle when toggled.
- The competition will consist of two races as described in the following two sections.

Race 1 – Individual Racing

- “Figure 4 - Individual Racing Race Track” shows an illustration of the race track.
- The teams will go one by one on the race track.
- Some obstacles will be placed randomly on the track.
- Each team will be allowed to replace the vehicle (in case it gets stuck) twice. Negative points will be marked for each collision.
- The cars should autonomously stop at the finish line (marked with a 4cm yellow line on the track as shown in Figure 4).
- The evaluation will be according to “Table 1 - Evaluation Criteria”. Distance, time, lane crossing and the number of collisions are used in the evaluation.

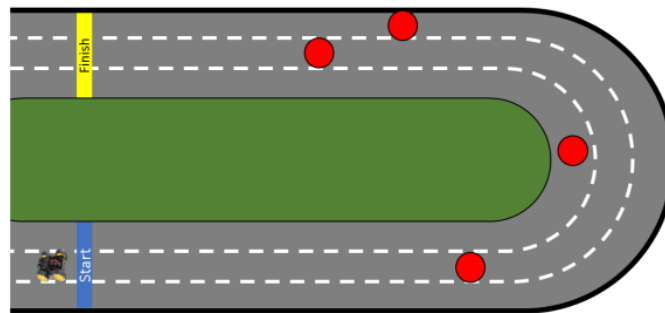


Figure 4 - Individual Racing Race Track (Demonstration only, the actual track may differ)

Race 2 – Team Racing

- The teams will go in groups of two.
- Some obstacles will be placed randomly on the track.
- The cars should autonomously stop at the finish line (marked with a 4cm yellow line on the track as shown in Figure 5).
- The evaluation will be according to “Table 1 - Evaluation Criteria”. Distance, time, lane crossing and the number of collisions will be used in the evaluation.

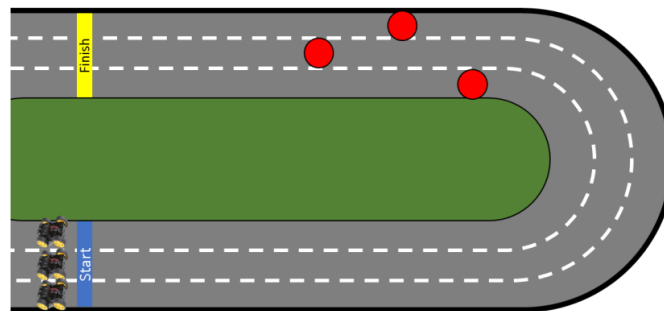


Figure 5 - Team Racing Race Track (Demonstration only, the actual track may differ)

Constrains and Requirements

- The vehicle must be built based on the given platform.
- The vehicle must reach the end line within 4 minutes.
- The motors should not be operated at more than 5v.

- For safety, the vehicle must be equipped with a “Start” command, and a “Kill” switch as described above.

Evaluation Criteria

#	Evaluation Criteria	Score (%)
1	Poster + Documentation * Poster and Presentation Quality = 2.5% * Documentation Quality= 2.5%	5%
2	Race 1 – Individual Racing * 1 st Place = 50% (Fastest time or farthest distance if no finisher) * 2 nd Place = 44% * 3 rd Place = 39% * Each collision = -7% * Lane Crossing = -8% (except when bypassing an obstacle)	50%
3	Race 2 – Team Racing * 1 st Place = 45% (Fastest time or farthest distance if no finisher) * 2 nd Place = 40% * 3 rd Place = 35% * Each collision = -7% * Lane Crossing = -9% (except when bypassing an obstacle/other vehicle)	45%
Total		100%

Table 1 - Evaluation Criteria

The Annual Competition:

The competition aims to enhance the engineering capability and professionalism of the participating students. Each team should keep in mind that they will hand over the vehicle for further development by another team on the following year. Therefore, the participating teams are encouraged to focus on the below aspects while designing their vehicle:

- **Forward Thinking:** Think of what will the following teams require from their precedents.
- **Documentation:** Make sure you properly document your work, this includes: design choices, experiments and their results, code sectioning and comments, schematics, datasheets.
- **Versioning:** Use version control system tools to maintain the history of your project and track changes.
- **Concurrency:** Avoid using old technologies. They will be phased-out most probably, and you will be losing on performance.
- **Flexibility:** The robot platform currently used in the competition or the electronics (CPU, Sensors, etc....) you are using might not be available next year (e.g.: obsolete), you do not want to struggle for spare parts. Avoid this by making your design flexible.