IEEE UCSD Grand PrIEEE Rules

OVERVIEW

The main goal of the competition is to design, test, and construct an autonomous vehicle that can navigate around a track in the shortest time possible. The track itself is marked by a 1”-wide white tape on dark-colored carpet. Running underneath the tape is a wire that is being driven by a 75 kHz sinusoidal signal (100 mA RMS ±10%).

THE VEHICLE

There are different approaches to build a competitive vehicle, however, **ALL** competing teams must adhere to these guidelines or face disqualification.

These guidelines are:

1. The vehicle itself must have these requirements:
    a. Must be electrically powered

    b. Have four (4) or fewer wheels
        i. Rubber tires
        ii. With wheel dimensions of less than:
            1. 4.25” diameter and 2.5” width
        iii. No other parts of the vehicle may touch the ground.

    c. The wheelbase is:
        i. Length ≤ 14” (axle-to-axle)
        ii. Width ≤ 14” (from outside of wheel/tire to outside of wheel/tire)

    d. The physical height of the entire vehicle is:

i. Height ≤ 9” (not including the flag)

e. The physical dimensions of the vehicle itself:
   i. Overall width ≤ 14”
   ii. Overall length ≤ 3’

f. A single rigid opaque flag
   i. With minimum flag dimensions of:
      1. 3” high x 6” long (when viewed from the side)
   ii. The flag’s bottom edge is 9.5” above the floor.
   iii. The location of the flag along the length of the car does not matter so long as it does not move.

2. To further elaborate on some of these requirements:
   a. The vehicle (**ALL** electronics, servos, and motors) must be powered by a **SINGLE** battery.

   b. Teams must build their own motor control circuitry control (and step-up converter circuitry if used) using discrete components and ICs.
      i. In other words, commercially available speed control units and step-up DC-to-DC converter subassemblies (e.g., “bricks”) are not allowed.
      ii. All other circuitry can be constructed from whatever components (i.e. resistors, capacitors, transistors, LEDs) or subsystems are available.
      iii. Step-down converters and voltage regulators are allowed.

   c. Tires must not be modified to improve traction (i.e. no sandpaper, studs, nails, etc.).
      i. Most RC cars come with rubber tires and are an acceptable format for the competition.
      ii. Foam tires are also an acceptable format.

   d. For safety reasons, vehicles must have an on/off switch that can be easily operated while the vehicle is in motion.
      i. Ideally, the flag can be used to connect to the switch to provide an easier time to manage the vehicle’s on/off switch.
      ii. A remote control device may be used instead of a physical switch, but if this is the case then the team **MUST GIVE THE**

DEVICE TO THE RACE ORGANIZERS to operate while your vehicle is on the course.

1. If any remote device is found to be used by anyone other than the race organizers, then the vehicle is disqualified.

INSPECTION

1. Before any team may participate or test their vehicle, there will be a brief session where the organizers will inspect your vehicle. The session will be held in the testing room and will require the team lead of the vehicle to be present to properly explain their design. In particular, this inspection will go through the above listed specs under "THE VEHICLE" to ensure that all participants follow the rules listed.

2. Any vehicle found to have violated any of the above physical constraints listed under "THE VEHICLE" will be ineligible for the competition and will not be allowed to participate in the race or be allowed to use the test tracks.

THE RACETRACK

1. The course will be marked with 1"-wide white tape on top of dark-colored carpet. The tape marks the center of the course (i.e., the car is supposed to be positioned over the tape). The tape is put down on top of a wire which is formed in a complete circuit and driven by a 75 kHz sinusoidal 100 mA RMS current (±10%).

2. In addition, small pylons may be placed at various points along the course no less than 15" away from the tape and no closer than 15" to each other. A penalty of two seconds will be added to the lap time for each pylon that is hit by a car.

3. The course may be of any length and configuration but all turns will have a radius greater than or equal to 3 feet.

4. The course may cross itself, but the crossing will never occur at an angle less than 60 degrees, although the crossing may occur in the middle of a curve.

5. The course may have sections that are parallel to each other, but they will be at least 3 feet apart.

6. At least 3 feet into a straight section of the course, the track may make a right-angle jog to the left or right of no more than 6 inches provided that the course then continues straight and parallel to its original direction for at least 3 feet.

Running the Race

1. Depending on the number of schools competing in a given year and the number of teams each school has, we may need to limit the number of teams that can compete from each school. Please contact the organizers for more information.

2. There will be one official race course and two warm-up tracks. The team on the first warm-up track is said to be "in the hole" (i.e., they are 2nd in line for the race course). The team on the second warm-up track is said to be "on deck" (i.e., they are 1st in line for the race course). No matter what happens to preceding teams (e.g., they abort their runs), each team may, if desired, have a total of at least three minutes on the warm-up tracks before being called to race. When a team is called to the race course they must report to the course and start running within one minute. After one minute, the clock will start whether or not the team is ready to run. Each team will be allowed five minutes on the course. This time includes the time used to make any adjustments to the car (within the guidelines given below). The team may make as many attempts to run the course as desired within the five minutes, but may not begin a run with less than 30 seconds remaining. The car will be allowed to complete the last run even if takes longer than 30 seconds. The best time will be recorded.

3. Adjustments may be made to the cars in-between runs, but the car may not be programmed in any way with specific information about the course. In other words, the idea is that the car runs autonomously; you may adjust maximum or minimum speeds or fix small problems, but you may not enter the configuration of the course into memory. If the car is capable of

memorizing the course for itself, you may switch it from a memorization mode to a racing mode in-between runs.

4. The car will be placed at the start of the course and turned on. The time will start when the flag on the car interrupts a light beam (the car is given a short running start). The time will stop when the flag interrupts the beam again at the end of the run. A team may pick up their car at any point during the run or a remote device may manually drive the car back to the start, but the run is deemed to be aborted the instant the car is enacted in such a way.

5. The car does not need to stay over the tape at all times but will be penalized two seconds for each pylon it hits as noted above.

6. If the car deviates from the course, the time will still count so long as the route the car takes is not shorter than the planned course. For example, a car can lose the course and come back and find it so long as it does not cut off part of the course in the process.

7. A team may abort their five-minute session ONCE so long as they have at least 30 seconds left. If they do, they will be assigned the next available start time on the course (i.e., after all other currently- scheduled competitors are done) and will either keep their remaining time or two minutes, whichever is less. Under no circumstance (e.g., if they are the last group) will they receive less than a five-minute break.

8. The initial start times will be determined by the organizers.

9. If none of the teams can successfully complete the course, a simpler course may be used at the discretion of the race organizers and if time permits.

10. Each team is responsible for providing their own batteries and chargers, but it is not guaranteed that you will have the time to recharge your batteries in between runs, so please have them ready beforehand!

11. Teams may not set up independent tracks anywhere near the competition area. This includes: the competition room, the testing room and the nearby areas surrounding these two locations. Teams found doing so will be asked to tear down the makeshift track and will be given a warning. Any team found to persist in using the makeshift track after being issued a warning will be subject to disqualification.

Judging

1. The car with the lowest total time, including penalties, will win.

2. Three timers will be used to record the run's time. The average of all three combined will determine the car's time for a single complete run through the course.