IEEE students

B2CI Drone Challenge Rules

IEEE R2 SAC 2020

Contents

1. Introduction

1.1. Competition Title: B2CI Drone Race Challenge

1.2. Competition Description

Each team of drone developers will design and code a drone that utilizes brainwave headsets. The drone must have a major Brain-to-Computer Interface component. The drone will be required to fly from a starting point to the finish line.

On the day of the competition the students will bring their drone and a computer or laptop preloaded with the necessary software. The student team will provide the judges with a headset that works with their drone.

Judging will be subjective, but rubric based. Teams can use any headsets they choose for their drones. Headsets can be commercial or open source. Extra points will be awarded for teams that bring equipment and/or signal processing software of their own design.

1.3. Academic Goals

Using a headset as an input device, this event should teach the pilot to focus the mind. The pilot will learn to operate and manipulate the drone using thought patterns as a replacement for hands/fingers to control conventional input devices. The skills acquired by the pilot should create opportunities to later use those skills to operate devices such as computers, wheelchairs, or prosthetic limbs.

The drone challenge developers will learn how to acquire and process data from brainwave headsets. They should also learn to appreciate different brainwave frequencies and the importance of positioning the location of the probes on the pilot's head.

1.4. Competition Coordinator: Steph Saloka

1.5. Committee Co-Chairs

- J. Max McQuighan
- Garima Bajwa
- Sherwood Olson
- Steven White

2. Participant Eligibility

2.1. IEEE Membership

All participants shall be registered IEEE student members attending the university they identified when registering for the SAC.

2.2. Team Composition

Teams shall consist of one to five participants. A team of four or five participants may include no more than one graduate student who shall be considered an advisor. Teams may have faculty and/or non-faculty advisors, who will not count toward the team size. In the case of a team of participants, it should be possible to demonstrate that each individual made a contribution to the team's entry.

2.3. Number of Teams

There is no limit to the number of teams that one university may register for this competition.

3. General Rules

3.1. Self-Containment

The goal of the event is to maneuver and control the drone based on the brain waves of the team pilot. Those signals should be processed to send commands to the drone. The B2CI interface should receive brain signals from the pilot in real-time and control the drone. The drone cannot be a pre-programmed flight operation.

Teams shall not use an energy source employing a combustion process.

3.2. Dislodged Parts

Neither the drone entry, nor any computing hardware shall scratch, cut, burn, mark, damage or destroy the interface connections, the walls, or any of the event facilities. The drone system shall not leave, drop or lose any parts or components from the drone, headset or other input devices, nor from the computer/laptop while the pilot is controlling the drone.

3.3. Drone Processor and Hardware Design

The headset itself cannot connect directly to any computing device, but must use Bluetooth or 802.11 radio communications from the headset to the computer which controls the drone. The drone software can run on a laptop that is battery powered. Direct connections to electric outlets are allowed for the laptops, but not for the headsets. The drone shall not exceed 3 feet in length and width.

3.4. Drone Course Description

The drone course will be designed so that the course and relevant boundaries are visible to both the pilot and judges while competing in the event. There will be three main components to the scoring for the race:

- The first is simply the total time taken to go from start to finish.
- The second component will be the ability of the team's pilot to maneuver the course. The drone will start on the ground and the pilot must send commands to elevate the drone to a fixed height. Then the pilot must race the drone forward to the finish line.
- The third component will be based on how much of the hardware/software of the team's entry was of their own original design, as compared to how much was commercially purchased. The more that the design and coding of the brain to computer interface is done by the team, the higher the score for that team.

3.5. Rules Violation

Any violation of these rules will constitute immediate disqualification from the contest.

4. Competition Rules

4.1. Presentation

The contestant(s) will make a brief presentation of their drone design and an explanation of their utilization of brainwaves prior to the competition (15 minutes maximum), if time allows. Students will present their drone, equipment, and software pre-installed on their own computer. The students will provide the judges with a headset that works with their drone.

The students must designate one student as the "pilot" of their team. That pilot will use their headset to fly their drone from the starting point to the finish point.

4.2. Time

Each team is allocated a total of 15 minutes of access to their computer from the moment the contest administrator acknowledges the contestant(s) and grants access. Once a contesting team is in place, they will be given one short test run to ensure that their hardware connections are correctly made. A run-time is recorded for each run, with a maximum time for a run limited to 20 minutes.

If it happens that a drone becomes immobilized, the judges may allow the owner to manually intervene to correct the problem. This includes checking wires and cables, checking the headset, and the checking the done. Teams will be allowed to reboot their computers, but they must do so within the time limits established by the judges. The frequency of such corrections will be considered by the judges in the final ranking of contestants. All decisions of the judges are final.

4.3. Stopping/Removing the Drone

Any team operator may abort a run at any time. The judges may abort a run at their discretion and declare a given run void. Multiple runs are not expected, however the judges can allow a second run by one or more teams solely at their discretion.

4.4. Reprogramming After Reveal

After the competition event is started, the pilot shall not reprogram the drone software or hardware.

4.5. Room Conditions

The illumination, temperature, and humidity of the room shall be those of an ambient environment. (40 to 120 degrees F, 0% to 95% humidity, non-condensing).

4.6. Ambient Light and Radio Interference

Teams should not make any assumptions about the amount of sunlight, incident light, or fluorescent light that may be present at the contest site. Nor should teams have any expectations concerning wind or breezes in the arena. Student teams should also assume that there might be electromagnetic interference from devices in the room, such as radio emissions from wi-fi, fluorescent lights or the equipment of competing teams.

5. Judging

5.1. Run Timer

The judges will start a run timer when they signal the start of the event.

5.2. Judges Discretion

The judges reserve the right to ask the pilot for an explanation of the team's drone entry and its actions. The judges also reserve the right to stop a run, declare disqualification or give instructions as appropriate (e.g., if the structure of the event is jeopardized by continuing operation of that team's entry).

5.3. Changes During the Competition

Changing ROMs or downloading programs is NOT allowed once the competition has started, however, with the permission of the event judges, contestants are allowed to:

- Change switch settings (e .g. to select algorithms)
- Replace batteries between runs
- Adjust Sensors
- Change speed settings
- Make repairs within the time limits of their event

The judges shall arbitrate and will always be the final authority.

5.4. Recognitions

For this event there will be recognition of a first-place team, a second-place team, and third place in each of the three categories:

- All students from the same 4-year institution
- All students from the same 2-year institution
- Mixed teams with students from both 4-year and 2-year institutions

Teams will be competing for awards within their category. Teams will be recorded and evaluated only against other teams competing in the same category.

If a category has fewer than two teams, then those teams will be combined with the next smallest category.

5.5. Requesting Breaks

If requested, a break will be provided for a team. The judges shall arbitrate, and be the final determinant on the granting of such breaks.