HEADSTART SCHOOL ROBOTICS COMPETITION
WHERE MACHINES MEET

Drone Racing Competition
(HS-DRC-2020)

INTRODUCTION

The 2020 HSRC will kick off this year with: TheDrone Racing Competition (DRC).

The future of flight is evolving and so are STEAM-based competitions. The 2020 Drone Racing Competition (DRC) will include students representing schools, colleges and universities from all over the country. These teams of students, led by mentors and teachers will design, fabricate, and demonstrate the flight capability of an unmanned, electric powered, radio controlled multi copter. To demonstrate knowledge about multi copters in the different constraints set in the demonstration event and show piloting skill.

Drone Racing Competition (DRC) is one of the advanced occasions of HSRC. Talented and experienced students from all over Pakistan pit their racer drones against each other. In this, the contender's drone needs to perform different basic and advanced tasks, keeping a close eye on clenching the cup.

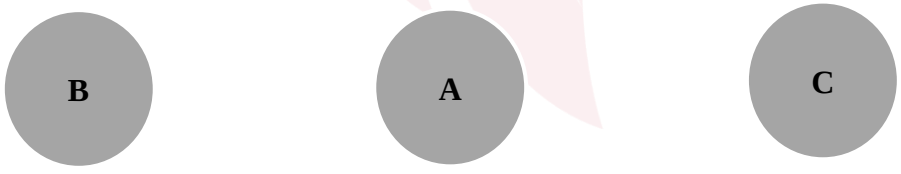
MODULE STRUCTURE

HS-NDRC consists of five stages.

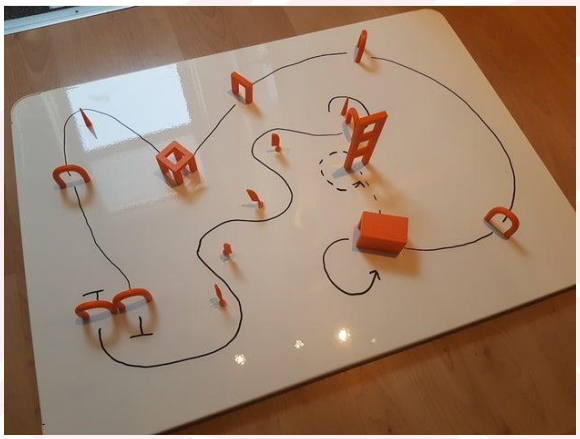
- In the first stage each team will have an interview and inspection of the racer-Quad with the inspection team.
- In the second stage the teams (that qualify the first stage) must fly the racer-quad to show the judges panel; stability, basic maneuvering, and fixed-point hovering. This requires the competitors to fly their drones in a specific imaginary 3d box at a specific altitude in front of the judges. The pilot must then let go of the stick. Drones will be judged o their stability and balance in several ways:
    - The drone's ability to stay at the same altitude.
    - The drone's ability to keep the direction fixated.
    - The drone's ability to stabilize itself with least amount of clutter.
    - No rolling to the sides or leaning front or back.
    - Drone that will lock its position in the 3d space will get the most points as per the judging criteria given below.

  Teams that qualify the second stage will compete in the third stage.

- In the 3rd stage the drone must take off from the center spot(Spot A), then land on the secondlocation (Spot B). It must take off and flyoff to the third location (Spot C) and then come back to (Spot A). The scoring will be based ontime of completion as well as theproximity of the drone to land closerto the center of each location.



- The fourth stage will consist of drone racing that will compete individually on the basis of time taken to complete lap and the checkpoints earned in the lap. Each lap has a specific time to complete. The checkpoints consist of hurdles, loops and some element of surprises. Pilots who advance from the fourth stage will compete in finals, with best complete race time, finishing order or a points-based system based on finishing order deciding results. The track below is only an example.



- The Final stage will consist of one on one race. Top teams will compete with one another and the team finishes first will be considered as winner.

JUDGING CRITERIA

GENERAL CONSIDERATIONS

- In each race, each pilot will be scored by a judge. The judges are in charge to check all aspects of the pilot's racing on the circuit and to complete the scoresheet after the race.
- Normally, an electronic timing system is used; in that situation, it is not necessary that thejudgestake attention to do a manual timekeeping.
- The judge mustbe equipped witha video device (video screen or headset) allowing them to follow the flight of his(her)assigned pilot.
- It is recommended that the judge prepareshis own document with the circuitpattern in order to better memorize the track with position of air gates, obstacles and turns.

JUDGING

- All races will be managed by an appointed team of judges.
- All races will follow the general rules and regulations of amateur competition.
- Each race will be monitored by judges, cameras, timing/lap systems and/or module heads to maintain fair and accurate competition.
- In the event of a mid-air collision, pilots can resume the race if they are able to take off again without intervention, otherwise their heat is considered a DNF (Did not Finish).
- Any practice or behavior deemed unsafe, (i.e. flying above the max ceiling height) will result in an immediate disqualification.

PILOT RESPONSIBILITIES

- Pilots are responsible for operating and maintaining their own equipment.

RACE COMMENCEMENT

- Premature start before the official tone: Pilot will lose 1 Lap.
- Non launch on starting tone, arming timeout, flip, etc. – DNF (Did not Finish), no rerun.
- Collision with another aircraft before first gate constitutes a re-run: DNS (Did not Start)
- Collision with another aircraft after first gate- DNF (Did not Finish), no re-run

DISCRETIONARYRERUNS

- Pilots may request a reschedule to another heat due to technical difficulties if the pilot notifies the judges prior to the start of his or her heat. Maximum one requests per event.
- The Judge has absolute discretion over approval or denial of request listed above.

DISQUALIFICATIONS

- Any pilot not physically present on the flight line fully prepared to race at the time of their scheduled heat will receive a DNF (Did not Finish) for that heat and will not receive a rerun. Two or more DNFs for no-shows will result in disqualification of the

event.

- Missing a gate, flag or required obstacle: If a pilot misses a gate or obstacle, pilot will receive a DNF. Pilots may have one attempt at retrying the gate or obstacle while race is active.
- Flying out of bounds: any pilot flying out of bounds, including maximum ceiling height will receive a DNF for the current run.
- Pilots receiving two infractions will be completely disqualified.
- No celebration laps or excessive displays of celebration while race heat is still active. Any interference caused by a pilot or airframe will result in a DNF for that heat. Two or more DNF's will result in disqualification from the event.
- Un-sportsman like conduct will not be tolerated.
- All decisions made by the Judges are final.

CONSTRAINTS/ RESTRICTIONS

AIRFRAME GENERAL GUIDELINES

All airframes must pass a safety and airworthiness inspection. Once the airframe has been checked and approved, it must not be modified or changed, or it will require to be re-inspected. Airframes should be repaired with equivalent parts that were originally used during check-in. The judge has the final decision on whether an airframe is accepted and/or requires changes or modifications in order to be approved for racing.

TECHNICAL SPECIFICATIONS

- Craft Size may be up to 300mm maximum diagonally across the motors (center to center)
- Multirotor craft with minimum 3 motors
- No more than 4S maximum LiPo battery, maximum 4.2 volts per cell.
- Must be capable of up to 3-minutes race durations.
- Aids like gyroscope, accelerometer, altimeter and GPS position lock can be enabled if needed.
- To avoid any radio interference, we recommend a 2.4GHz (continuous switching) system, as interference might cause a crash, jeopardizing audience safety.
- In case of frequency locked FM/AM system, bring two sets of crystals in case of clash.

GENERAL PILOTING GUIDELINES

- Unlawful flight, such as flights near an event at locations where flying is prohibited, can result in disqualification from the event.
- All pilots must attend a general safety briefing and sign the appropriate waivers from the race organizer and venue.
- All pilots must be able to demonstrate effective Fail-Safe procedures defined by the NDRC module head.
- All pilots must have an "ARMING" position switch or sequence on their radio. The aircraft should not power up by any accidental controls from the radio. Aircraft arming must be executed via a control switch.
- All pilots must demonstrate an airworthy airframe and pass a general mechanics and electronics test. All testing will be executed by the judges.
- All batteries must be transported in and stored in LiPo-safe bags.
- Pilots cannot use FPV to pilot aircraft.
- Venue operations Pilots must adhere to all rules within the competition venue and will not fly in any other part of the venue unless it is a designated flight zone.
- Pilots must contain all equipment and, airframes within the designated pilot pit area.
- A public charging area will be available and 120V outlets will be supplied. It is recommended that racers bring personal chargers and extension cord.
- General charging of electronic devices including radios or any device with a self-contained power supply is permitted.