Ninth
Robotics Exhibition Game

Wednesday, May 6 2026

Toronto District &
Adjacent School Boards

Contents

1. Mission Statement

This robotics competition is designed for students enrolled in Computer Engineering, and/or other technological disciplines. The aim of this challenge is to build an autonomous line-following robot and showcase the capability of students.

Students who participate in this challenge will be drawing from several skill sets. The building of robots requires knowledge and skills in both mechanical and electrical design. Also, students will be required to program the robot to accept sensory information and respond appropriately so that it efficiently completes the challenges. Students must demonstrate good communication skills.

The competition has been designed so that students at all levels can participate and share their knowledge and understanding of robotics and autonomous control systems.

2. Place and Time

The 9th Toronto District And Adjacent School Board CETA Robotics Exhibition Game may be held on **Wednesday, May 6, 2026 at York Mills Collegiate Institute, Toronto District School Board, 490 York Mills Rd, North York, ON M3B 1W6. (416) 395-3340. Double Gymnasium.**

Outlined below is the day's tentative timetable.

Time	Activity
8:15 – 8:45	Check in robot and get labels to put on robot
8:45 - 9:30	Teams verify the functionality of the robot Calibration should be done before the competition
9:30 – 9:45	Opening message and review of rules
9:45 – 11:40	**Challenges:** **1. Running the Fairway,** **2. IoT & Collision avoidance** **3. Bucket Challenge**
11:40 – 12:20	Lunch
12:20 - 12:40	**Showcase Challenge**
12:40 – 2:45	Unfinished challenges if any
2:45 - 2:50	The Awards Ceremony may happen earlier if finished.
2:50 - 3:15	Clean up of the Gym

Application Deadline: Friday, Apr 24, 2026

Miss it and you may not have a spot.

Note: A school can enter one primary team and up to 1 alternate team. If spots are available after the registration deadline, a draw will be made to accommodate those schools that have submitted more than 1 alternate team.

Schools can register extra students and send more than one robot. (Suggested minimum fee $40 per school per team of maximum 4 students, $40 for any additional team of maximum 4 students, towards administrative costs of the game)

Organizing Committee:

- Connie Yung, SATEC@W.A. Porter C.I.
- Marie Karimizadeh, York Mills C.I.
- Narges Shams-Hakimi, George S. Henry Academy
- Raj Nachimuthu, STEM outreach c[illegible]r, IEEE London Section

3. The Challenges

Every participating student will be awarded with a certificate.
There are three challenges: In all the three challenges, the robot (the sensors) has to start behind the line and go to the other end, turn around, and come back crossing the line. The Robot has to traverse the track twice. The sensors have to cross the lines at both the ends.

1. The **first challenge** is called "**Running the Fairway"**. This is a simple line following challenge where the robot must manually start at one end of the track and race to the other end of the track, turn around and then race back. The robot must complete the course twice. The footprint of the robot must start just behind the "T". The winner will be the first robot whose sensors cross the starting "T" after the second run AND must come to a complete stop. Here is a practice example: https://youtu.be/caq2jWLe0xA.

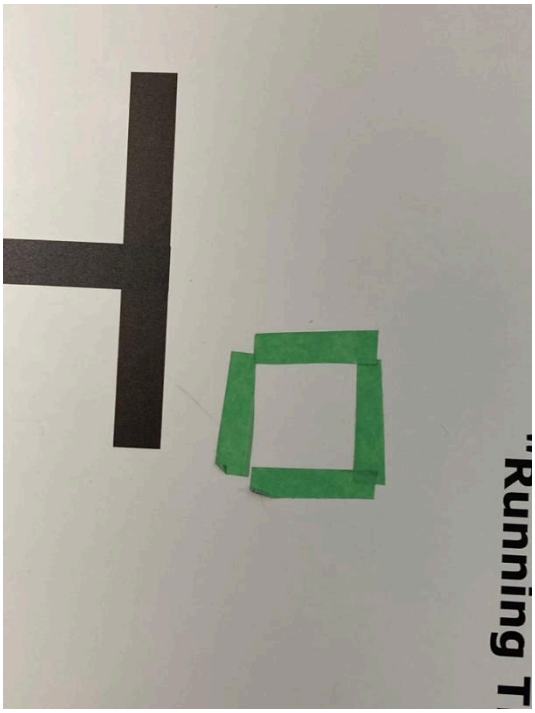
2. The **second challenge** is called "**IoT & Collision Avoidance**"; it is also on the "**Running the Fairway"** track. This time, the robot will be started remotely by IoT to start. It is also a simple line-following challenge. There will be a small cardboard box (the packing box for the robot chassis) placed at the other end of the track before the far T. The robot has to measure the distance and turn around within 10 cm of this obstacle. An ultrasonic ranging sensor can be used to measure the distance of this obstacle; be sure to buy the sensor that works at 3.3V. If the robot hits the box, the robot will be disqualified. The robot must start at one end of the track, race to the other end, turn around within 10 cm of the obstacle, and then race back. Wifi access will be provided; however, we recommend using your cell phone as a hotspot to provide a reliable connection. The rules are that the team must connect to Adafruit IO via a WiFi connection on the robot. The robot (line sensors) must start just behind the "T". The winner will be the first robot whose sensors cross the starting "T" after the run, AND comes to a complete stop. If your robot is experiencing throttling at the beginning of the heat, you will have 30 seconds to diagnose and repair it on top of the calibration time. Please refer to Appendix A for tips on how to deal with throttling on Adafruit IO.

3. The **third challenge** is called "**Bucket Challenge**". This challenge will test your ability to add an additional actuator to your robot chassis. In this challenge, the robot will continuously race to the other end of the track and pick up a small bucket containing some coins and successfully return to the start and drop off the bucket. **The robot that retrieves the most buckets in 1-minute wins the heat**. In the event of a tie, the robot that returned the buckets quicker will be declared the winner.

    a. refer to Appendix C for a demonstration of the challenge:

b. The bucket shall be constructed using 2, 2oz condiment cups (type: "Genpak F200") and will contain the equivalent weight of 2, $2 coins ("loonies"). Refer to Appendix C to see how buckets are constructed:

c. During the challenge, one member of the robotics team may be present to position buckets in a favourable pick-up position **beyond the end tee** before the robot arrives. To encourage creative technical solutions, there is no limit to the number of buckets that may be retrieved in a single run, as long as they are all placed **beyond the starting tee**. Lessons will be provided on www.cool-mcu.com LMS to construct the solution shown above (including hardware connection diagram and example sketches), **however, students and teachers are encouraged to pursue other methods**. The bucket(s) may be placed anywhere beyond the end tee. The photo below shows the most favourable pick-up position for the robot pick-up arm implementation shown in the video (**Note: there will be no markings allowed on the challenge track**).



4. Each race consists of three heats, with teams swapping tracks for each heat. In the event that neither robot finishes the challenge, the winner of the heat will be determined by the judge on which robot has completed the most of the challenges.

5. For each race in the first round, the winner stays in the winner's bracket; the loser will go into the consolation bracket. After that, it is just a single elimination until the final two in each bracket are placed. The winner of the winner's bracket will take first place. The loser of the winner bracket will face the winner of the consolation bracket; whoever wins will be

awarded second place. The other will be awarded third place, and the loser of the consolation bracket will be eliminated.

6. The champion of the game will be the school with the most points based on the following criterion:

Points	**First place**	**Second place**	**Third place**
Running the Fairway	10	5	2
IoT & Collision Avoidance	11	6	3
Bucket Challenge	12	7	4

7. Teams will be allowed to perform a calibration procedure of the robot prior to the game for 30 seconds.

Reminder: The judge's decision is final.

4. Showcase Challenge

This challenge is **student-driven**. Teams will be provided a 15-minute time slot to set up, then run a custom robot demonstration of their choosing in **two minutes**. The demonstration must run within a prescribed 15ft x 15ft area on the ground and should not run for more than two minutes. The robot has to adhere to the same robot design constraints as prescribed for the main challenges.

The demonstrations will be judged by student vote at the competition that will determine the first, second, and third places..

5. Design Constraints and Equipment

For the competition to remain equitable and to foster an environment of ingenuity and creativity, the following restrictions are in place.

1. The robot battery pack voltage shall not exceed 6.4V, equivalent to 4 fresh Alkaline batteries.

2. This year we are introducing the SparkFun XRP Beta robot into the competition. This kit is available from SparkFun Electronics. However, the following robot platforms can also be used in the competition:
    a. CETA IoT Robot (based on Raspberry Pico W)
    b. CETA IoT Robot (based on Arduino Nano 33 IoT)

3. The footprint (chassis, wheels, motors, breadboard and line sensors) of the robot base may not exceed 19 cm wide x 19 cm long (not including any actuator extensions). Note that a smaller robot will have the advantage of better maneuverability.

    Note: You are encouraged to design your own 3D-printed chassis within size limits.

4. The motor and wheel used in the CETA IoT Robot are available from Abra Electronics:

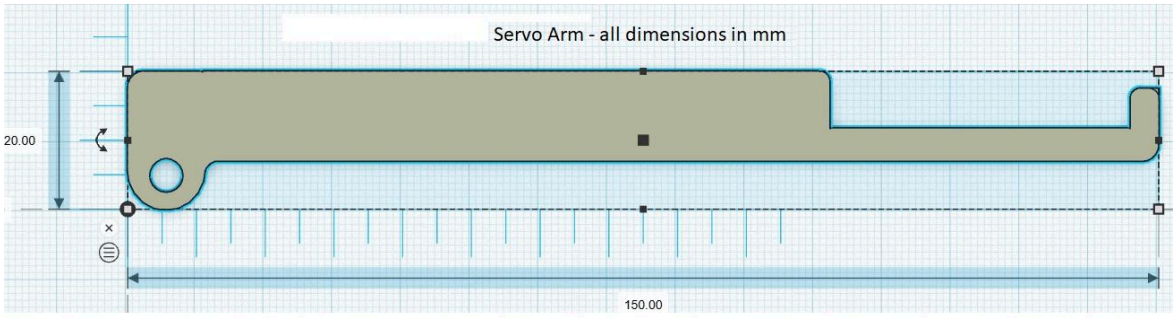
    https://abra-electronics.com/electromechanical/motors/dc-motors/fm90-dc-motor-in-micro-servo-body.html

    https://abra-electronics.com/electromechanical/motors/servo-motors-feetech/fs90r-w-wheel-for-feetech-fs90r-micro-servo-608mm-black.html

5. The Bucket Challenge (new for this year) requires a servo motor and lift arm. These are included in the XRP Robot kit, but are not provided in the CETA IoT Robot kit. The servo motor can be purchased from Abra Electronics:

   https://abra-electronics.com/electromechanical/motors/servo-motors/sg92r-micro-servo-9g-2-5kg-torque-90-degrees.html

   Servo arms may be constructed using popsicle sticks or 3D-printed using the following dimensional model as a guide:



Hole diameter - 5 mm, thickness - 3 mm

6. The following alterntive chassis are available from Abra Electronics:

   https://abra-electronics.com/robotics/robot-kits-en/ft-dc-002-2wd-robot-chassis-kit.html

   https://abra-electronics.com/robotics/robot-kits-en/ft-2wd-kit-mini-robot-rover-chassis-kit-2wd-with-dc-motors.html

   Student teams can use L293D or TB6612 motor drivers to drive these motors.

7. A team may use a single robot for all challenges. Alternatively, a different robot may be used on different challenges. A maximum of one robot is allowed per track. Whichever robot the team begins with must remain the same one for that challenge, no substitution nor modification is allowed. Each robot must meet the above requirements and will be inspected as part of the registration process.

8. There are no weight restrictions.

9. There are **no restrictions on the microcontroller** used on your robot.

10. The choice of numbers of motors will be left up to the robot team. However, the microcontroller must be mounted on the robot (not tethered by a cable or wireless).

11. The number and type of line-sensors used is also up to the robotic team. The sensors should be able to read a black line printed on a white foam board. NOT black electrical tape as in the past.

12. The "Running the Fairway" track can be ordered via this link:

    https://www.cool-mcu.com/pages/robot-tracks

13. Materials provided by robot team:
    - Robot - that is fully functional, no major modifications are allowed.
    - Properly labelled for easy recognition with school name and team name .
    - Must bring your own extension cord (must be CSA certified) if you want to use any electronic device at the competition to calibrate the robot at the site.
    - All calibration must be done in the morning before the challenge.

14. Materials provided by the organizers is:
    - Tables, Chairs, and the robot tracks for the challenges
    - Wall power outlets
    - Wireless connectivity for the IoT challenge. It is a good idea to test the connectivity BEFORE the day of competition!

15. For IoT-related challenges, Adafruit IO is the main infrastructure to be used, however, teams may run a local MQTT broker along with a smartphone dashboard app to trigger their robots in these challenges. These local network alternatives must be approved by the judges.

16. Any unforeseen changes by the organizing committee will be emailed to the teams' teacher-advisor.

6. Before the Competition

As you prepare for the competition there are a couple of items that you must do:

- Make sure that you hand in your physical media consent form (page 15) on or before the game day (**May 6, 2026**). Please register your team using the Google form before the deadline **Apr 24, 2026.** If you miss this date, your team may not be able to attend: Toronto-Computer-Engineering-Teachers-Association-CETA/registration
- Arrange a time to implement a "calibration procedure" in their sketch, which is triggered by pressing the buttons on the robot in this particular sequence:

- **Calibration procedure:**
  - press-hold microcontroller's reset button
  - press-hold user pushbutton
  - release microcontroller's reset button
  - release user pushbutton
    - calibration procedure runs – now, place sensors over white track for 10 sec. When the LED changes blinking rate, then place it over black line for 10 sec. The LED blinking pattern will change again indicating the calibration is complete.
    - opto-sensor optimal trip values saved into mcu's flash memory.
  - Before running any challenges, someone will need to run this calibration procedure once to accommodate the changes in lighting.
- On the day of the competition, you need to make sure your robot is calibrated and tested.

7. Day of the Competition

On the day of the competition, there are several things that you must do to help make things run smoothly. They are as follows:

1. Register your team and sign in at 9:00 am at the big gym.

   CETA Robotic 2026

2. Identify your robot so that the dimensions and specifications can be checked. Any robot that does not meet the requirements as outlined above will not be allowed to compete on the track.
3. Your teacher must be here to assist. No student will be allowed without their teacher!
4. Make sure a name tag is on the robot. No one likes to lose their robot. Make your robot "visible" with identification tapes, labels, or ribbons etc. It then becomes easy to spot your robot on zoom videos.
5. Set up your IoT and prepare for the challenge. Wifi access will be provided, however we recommend the use of your cell phone as a hotspot to provide reliable connection. The rules are the team must connect to Adafruit IO via Wifi connection on the robot.
6. Assign someone to keep an ear out when your team is called. You don't want to miss out because you didn't hear your team being called.
7. Teams must be responsible for knowing when and where they compete. Teams that fail to show up, will lose that match by default.
8. The coach/teacher may not be involved in building or programming the robot. It should be totally a student-built robot. Helping any aspect on the day of competition will forfeit the team.
   - Coaches are not permitted to assist students or interfere in the judging in any way during the competition.
   - The goal of this competition is to challenge students to think, adapt to changing environments, and be successful.
   - Students must learn to advocate for themselves.
9. Expect the unexpected:
   - The game boards will be provided and may be different from what you're used to. Your robot needs to adjust to these changes.
   - Expect inconsistent lighting; varied dark and light zones. Calibration of the robot must be done prior to the challenge, before the competition.
10. The judge has the last word.
11. Lastly, have fun!

8. Appendix A - Throttling on Adafruit - Tips

Dealing with Throttling on Adafruit IO

When testing your Adafruit Dashboard with your robot, you may see a "Throttling" message appear in your browser. This means that you have exceeded the data bandwidth limits for your account, and you will be locked out for several seconds until it is restored.

The "Free" account tier on Adafruit IO allows 30 data points per minute of bandwidth. This breaks down into 1 data point every 2 seconds. Any feed that is written to or read from counts as a data point per minute:

Each MQTT Publish Message counts as 1 data point

Each MQTT Subscribe Message received counts as 1 data point

Tips for reducing throttling:

- Make sure only 1 robot is connected to your Adafruit IO Service. Create additional separate accounts/dashboards for each robot.
- Reduce the number of MQTT Publish and Subscribe Messages
- The default line follower sketch publishes an MQTT message every 2 seconds.
    - Update the sketch to increase the publish-message spacing to 5 seconds or longer.
- Do not trigger more than 1 MQTT subscribe message to the robot every 2 seconds
- Purchase additional bandwidth as explained below:

Upgrade your membership to IO+ (US$10/month)

This doubles your bandwidth to 60 points/minute (1 per second)

This data rate can additionally be boosted in 10 points per minute increments for $2/month

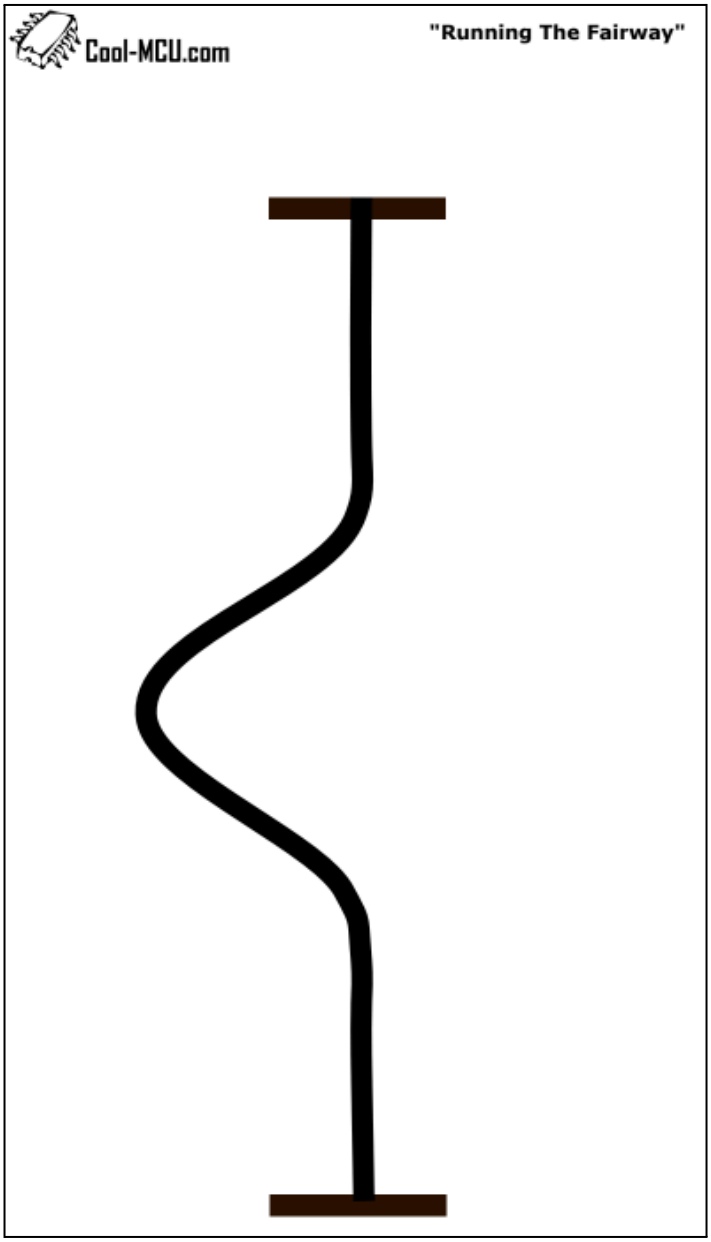
Example:

One month before the competition, upgrade to IO+ (+$10) and then boost it to 120 points/minute for an additional $12. You can then cancel/revert back to the free account after the competition.

9. Appendix B - Layout of the tracks

The following pages show the layout of all the boards used in this competition.

Competition: Running the Fairway

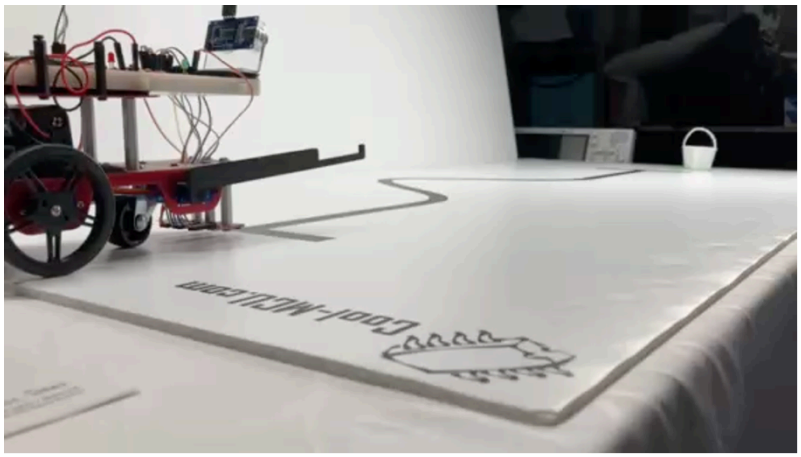


Order boards for Competition: Running the Fairway

https://www.cool-mcu.com/pages/robot-tracks

10. Appendix C - Demonstration of the Bucket Challenge

Click on the following image for a demonstration of the challenge:



Click on the image to see how buckets are constructed:

11. Application Form

The 9th TORONTO DISTRICT AND ADJACENT SCHOOL BOARD CETA ROBOTICS EXHIBITION GAME - Wednesday, May 6, 2026

Deadline for registration online using Google form and submit the Media consent form by Friday, Apr 24, 2026

Miss it and you may not have a spot. ☹ **or mail to:** Marie Karimizadeh, marie.karimizadeh@tdsb.on.ca or Narges Shams-Hakimi, connie.yung@tdsb.on.ca

(PLEASE PRINT CLEARLY)

Toronto District School Board

Student Media Release Consent Form

Form 529B
Revised Jun 15, 2010

Please ensure one box is checked for Part 1 and one box is checked for Part 2 of this form.

Part 1– Events

I, _____, hereby agree and give my permission for the Toronto
(Name of parent/guardian if student is a minor, under the age of 18.
Name of student if an adult, 18 years of age or older.)

District School Board and/or partners to record, film, photograph, audiotape or videotape my/my child's name, image, student work, and performance (hereinafter collectively referred to as "Works") and to display, publish or distribute these Works for the purpose of publishing, posting on the TDSB website, posting in schools, posting on social media sites and/or for broadcasting on television or radio as determined by the TDSB.

I hereby waive any right to approve the use of these Works now or in the future, whether the use is known to me or unknown, and I waive any right to any royalties related to the use of these Works.

I understand that the Works may appear in electronic form on the internet or in other publications outside of the TDSB's control. I agree that I will not hold the TDSB responsible for any harm that may arise from such unauthorized reproduction.

☐ Please mark this box if you **AGREE** that your child may participate in recorded TDSB/school events and TDSB hosted events as described above. (See Part 2 below)

☐ Please mark this box if you **DO NOT WISH** your child to participate in recorded TDSB/school events and TDSB hosted events.

Part 2 – Media Specific

I also understand that external media organizations may attend school events. I give permission for my/my child's name, image, student work, and performance to be photographed, filmed, audio-taped or videotaped for the purpose of being published and/or broadcast on-line, on television or radio.

☐ Please mark this box if you **AGREE** that your child may participate in media events that may be published or broadcast by organizations external to the Toronto District School Board.

☐ Please mark this box if you **DO NOT WISH** your child to be photographed, filmed, audio-taped or videotaped at media events.

I have read this Student Media Release Consent Form and I fully understand the contents and meaning of this release. I understand that I am free to contact the Principal with any questions regarding this release.

Student's Name: _____ Grade: ___

School: _____

Student's Signature (If 18 years of age or older) _____

Parent's/Guardian's Name: _____

Parent's/Guardian's Signature (If student is a minor – under the age of 18): _____

Date: _____

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