Skills Canada BC ~ 2024

GEARBOTS Coding Challenge Scope Document

Target audience:
Ages 9-15 – coeducational – ALL participants on a team **MUST** be from, registered and attending the same school.

Duration:
Total of 4 hours working on the mission (does not include a one hour lunch break)

Purpose of the challenge:
To build and program a fully autonomous robotic device that can complete a number of themed missions in a set time period.

Tested skills and knowledge:
Students will apply the engineering process using effective iterative design to complete a number of missions within a set time period.

Equipment supplied by the each team: (consisting of up to 3 students per team each)
- Teams are responsible for bringing their own robotic equipment & laptop computer
  - One laptop computer (this will be strictly enforced), tape measure(s), extra batteries, + (**NO** extra / 3ʳᵈ party sensors/attachments allowed)
  - EV3/Spikle Prime Mindstorms kit OR one FisherTechnik Robo kit OR one VEX IQ kit OR one MakeBlock kit
  - It is recommended that teams pre-build a robotic device prior to attending (Mindstorms REMbot's dimensions are ideal for this type of challenge).
  - All robotics devices must be fully autonomous (no radio/bluetooth controls)
  - Contact info@gearbots.org directly if you have any questions about these options or another platform.

Supplied by the committee:
Themed challenge mats, 4'x8' testing table and supporting equipment, paperwork and other related materials to complete the themed missions

Skills Canada BC supplies:
Adequate space for approximately 24 teams / 72 participants, tables, chairs, lunch, water, electrical requirements, awards for the Sr. Engineering Level participants, event t-shirts, handling of all registration of teams and participants

Judging criteria:
- The competition is designed for teams wanting to compete for the traditional Gold, Sliver and Bronze awards judged and ranked total missions completed, total points for total missions completed and lowest accumulated time.

Team size:
Each team will consist of up to three (3) people - co-educational is encouraged / **MUST BE** all registered at the same school verified by the registering email address. Only school / district officiated email addressed will be accepted – no personal email addresses will be accepted.

Maximum number of teams entered:
Teams are registered on a first come, first serve basis (see next section for further details). All registration is through Skills Canada BC. Skills Canada BC will determine the actual number of teams. Teams must be made up of students from the same school and registered through a teacher from that school – registering email addresses must be from a K-12 public / private institution.

Registration process:
- The GearBots Coding Challenge is now an invitational event – Districts/schools that are promoting ADST/Coding will be provided an opportunity to register several teams from their programs.
- Registration deadlines are two weeks prior to Provincial Competition dates.
- Teams that are interested in participating, must send ddirom@gmail.com an email – registration instructions will be sent along with a link and password.
- Visit and complete the google form - hhttps://www.gearbots.org/rsvp-event/
- Students are not in the competition until their teacher has been notified by the event organizer that they have been accepted into the event.

Equal distribution of teams policy:
- **School Affiliation:**
  Teachers (or school staff) are to affiliate their school with Skills BC first. Following school affiliation, teachers may register students into contests in their Region at the appropriate secondary or post-secondary level. The affiliated school must be within the boundaries of the region that the student wishes to compete.

- **Student Registration:**
  Only teachers (or school staff) may register as many students into any given contest as they like in order of priority, prior to the registration deadline. Two scenarios will result. There will be either too many students registered into the contest, or there will be remaining space available by the deadline.

- **If Registration "is full" scenario:** The Skills BC office will select the first priority student, one from each school, if space is still available, then a second from each school, then the third priority student until the maximum number of students is reached. In the event that there are an uneven number of students from each school, schools with a larger number of registrants will take priority; or if this number is equal, the school that registered students first will take priority. Teachers will be notified following the deadline of which students have and have not been accepted into the competition.

- **If Registration "is not full" scenario:** In this scenario all of the students that are registered prior to the deadline will be accepted into the competitions. Teachers with students already registered will be notified of their students' acceptance and will be notified that there is available space. The remaining available space will be given on a first come first registered basis.

- When registering your school and teams, you are required to rank them (your first team you enter has the highest priority and would have the best chance of getting in). You can sign up other teams but depending on demand, they may or may not get in. Cut off is two week before the event so we will have a better picture then.

Paying (fee) for the event:
Once you receive the registration link and password, you will be asked to pay a registration fee for the event.

Mission statement:
The purpose of the challenge is to provide an opportunity for students to work together in engineering teams to creatively solve problems using coding programmable, (autonomous) lightweight robotic devices.

Origin of the GEARBOTS Engineering (now called Coding) challenge:
The type of challenge is loosely modeled after the First Lego Leagues international competition. However, the GEARBOTS Coding Challenge only focuses on the effective robotic engineering design and programming aspects.   This type of themed challenge was developed and adapted by GEARBOTS Educational Recourses (Robotics 9 course requirement at Yale Secondary School and the GearBots engineering summer camp) to create a one-day challenge.

The idea is simple; students that are training on a number of lightweight robotic devices attend a one-day event where they participate in a themed challenge. The challenge has a number of missions from two bases. The object of the event is to work together in their engineering teams, effectively apply the iterative design process, and complete as many missions as they can while accumulating the most points with the fewest penalties and lowest accumulated time.

Event philosophy:
This themed challenge has been chosen deliberately by GearBots Educational Resources. We wanted to create a challenge that focused more on the process rather than just the outcome of an event.

Assessment philosophy:
Teams are judged using a clear / concise assessment rubric.   Teams will be assessed / ranked by the total number of missions completed (total number of points scored per mission and time) however, this should not be the only factor for determining success or failure.

The GEARBOTS Coding Challenge will provide students with an opportunity to...
- Direct application to the Applied Design, Skills and Technology curriculum
- Apply the practical use of math concepts (computational Thinking) and applied physics
- Solve real-world science and engineering problems, training that is transferable to all academic disciplines and career pursuits
- Gain an increased interest in science, technology, engineering, art math (STEAM Education)
- Understand what engineers do — the engineering profession is "demystified"
- Receive recognition and acclaim typically reserved for their peers in sports

As a result of these types of challenges, students have an opportunity to demonstrate:
- Abstract thinking, computational thinking, self-directed learning, collaboration, project management, decision-making, problem-solving, creativity, communication skills, critical thinking, and leadership

Overview of the GEARBOTS Coding Challenge:
- Teams can only use the EV3/Spike Prime Mindstorms®, VEX IQ®, MakeBlock® or the FisherTechnik® platforms
- Engineering teams build and program a robotic device to complete a variety of missions within a set time period. Students will learn about the specific nature of the challenge on the morning of April 17th 2024.
- Visit <http://www.gearbots.org> to see a sample challenge and additional documents / building plans needed for the event

Benefits of the Challenge:
- The event offers direct links contained in the ADST curriculum and addresses many aspects of computational thinking
- Little preparation needed - single day event (only basic programming skills required)
  - Converting cm in rotations or degrees, programming degree turns, wait for blocks, loops, and switches,
    - travelling to a location, collecting objects, pushing objects to drop zones, following lines, and avoiding lines / areas
- Goal of the challenge is to keep all teams as equal as possible at the start of the challenge
  - NO team will know what the challenge is before the event
- The purpose of the challenge is to provide an opportunity for students to work together in engineering teams to creatively solve problems (It is more about the process rather than the outcome/final results).

Target Audience: Skills Canada BC will determine the final number of teams / competitors
- Ages 9-15 (co-educational) – teams using Mindstorms®, VEX IQ®, MakeBlock® or FisherTechnik® platforms using a number of program language like NXT-G 1.0+, EV3, CMU RobotC / NI LabVIEW, Modkit, Scratch, Arduino IDE, and/or ROBOPro

Challenge Options: Skills Canada BC will determine the final number of teams / competitors
- Competition level. This level is designed for teams wanting to participate in a competitive challenge where teams are ranked on number of missions successfully completed / total accumulated points and lowest time for all recorded missions. Note that mentors, parents, and coaches **ARE NOT** allowed to interact with their teams while they are in the competition zone.

When and Where:
- BC Skills Canada Provincial Competition at the TradeX in Abbotsford BC – April 19th 2023

Registration Procedures:
- Teams (up to 3 students ages 9-15) – all registration will be through the Skills Canada BC organization (you must first register your school with Skills BC and then your teams)
- Fee includes: lunch provided by Skills Canada, event t-shirt, and sponsorship swag
- Visit <http://www.skillscanada.bc.ca/> to register school / teams and participants

Timeline:
- Interested teams should send an email to ddirom@gmail.com indicating their interest to participate
- Visit and complete this form - https://www.gearbots.org/rsvp-event/
- Registration will be available on a first come first serve basis
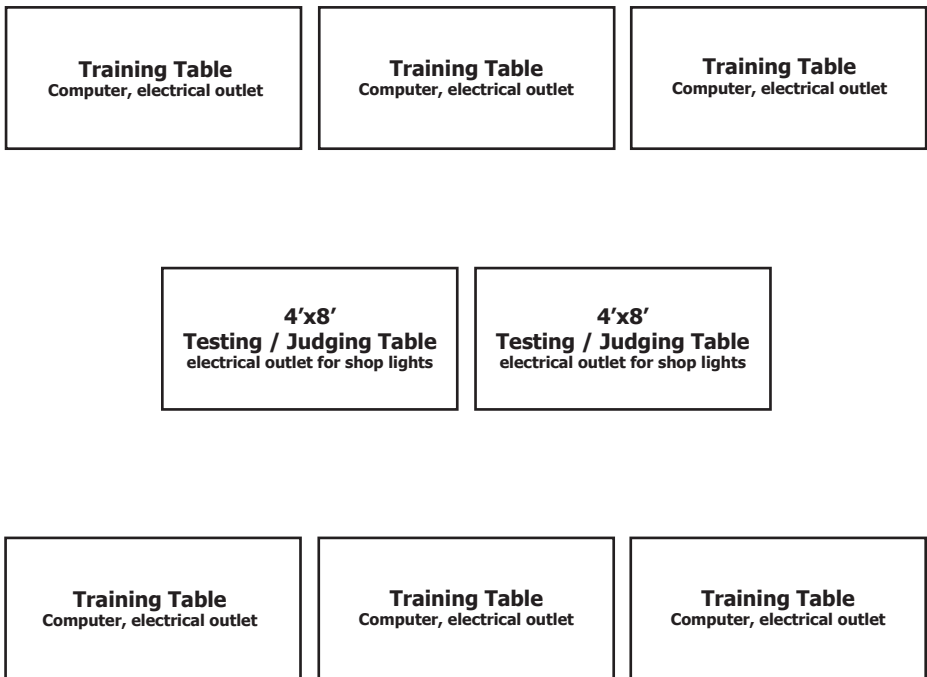- Depending on demand, teams may bring more teams if space is available

Event Agenda: (Lunch will be provided by Skills Canada – only registered participants will receive a lunch)

8:30-8:45am	Registrations / engineering teams setting up at their assigned table / orientation
8:45am-9:20am	Team captain meeting / overview of the challenge / rules / expectations
9:20am-9:30am	Official welcome and safety announcement
9:30-11:30am	Teams working on the challenge missions / judging of individual missions
11:30am-12:30pm	Lunch Break– all teams will not be allowed to work on the challenges during the lunch break. Teams are given time to explore the other events and learn more about Skills Canada events
12:30-2:30pm	Teams working on the challenge missions / judging of individual missions
2:45-3:00pm	Winners announced and concluding comments
3:00-3:30pm	Clean-up / pack-up

Sample zone layout: This may chance depending on the number of teams registered each year
Each zone will consist of up to 8 lab tables, 24 chairs, 3 - 4'x8' testing /judging tables, electrical access for 8 computers, 2 shop lights, several dedicated judge / zone leaders. (Subject to change)

Note: Diagram is not to scale – the challenge will have several zones
(number of testing table subject to change)

Training Table Computer, electrical outlet	**Training Table** Computer, electrical outlet	**Training Table** Computer, electrical outlet

4'x8' **Testing / Judging Table** electrical outlet for shop lights	**4'x8'** **Testing / Judging Table** electrical outlet for shop lights

Training Table Computer, electrical outlet	**Training Table** Computer, electrical outlet	**Training Table** Computer, electrical outlet

Expectations for the event:
- Teams are expected to demonstrate professional / respectful behaviour at all times during the competition (at their assigned lab tables, testing / judging table and around the TradeX facility)
- Participants are strongly encouraged to wear their event T-Shirt (supplied by Skills Canada BC) at all times
- Teams must wear their name tag / team identification during the competition
- Teams can take breaks, eat, or go to the bathroom when they need
  - during the lunch break, teams **MUST** leave the competition area (1 hour lunch 11:30am to 12:30pm)
- Teams are not to touch another team's robotic devices or materials (lab table supplies, computer, robot at testing/judging table, etc.)
- Coaches / mentors are there for moral support / encouragement only – no technical assistance please in the competition area.

Required Equipment and other logistics of the event:
- Teams are responsible for bringing their own robotic equipment and laptop computer
- One laptop computer (this will be strictly enforced), tape measure(s), extra batteries, + (**NO** extra / 3rd party sensors/attachments allowed)
- One EV3/Spike Prime Mindstorms kit OR one FisherTechnik Robo kit OR one VEX IQ kit
- It is recommended that teams pre-build a robotic device prior to attending (EV3 REMbot's dimensions are ideal for this type of challenge).
  - All robotics devices must be fully autonomous (no radio/bluetooth controls)
  - Contact info@gearbots.org directly if you have any questions about these options.
- It is recommended that teams pre-build a robotic device prior to attending (Lego's REM-bot is ideal for the dimensions of this type of challenge)
- There will be up to five (5) zones
- Each zone could consist of up to eight (8) teams of up to twenty-four (24) students (maximum of 3 members per team)
- Each team will have one (1) engineering table to build and program their robot
- Each zone will have three (3) designated testing/judging tables (depends on the room allocated by Skills BC)
  - testing/judging table = 4'x8' testing board
- There will be two (2) bases (Alpha and Beta). Each base will have up to eight (8) missions
- Running time for each mission
  - regardless of how many attempts are made to complete each mission
- If a problem arises, teams are to communicate immediately with their zone judge for directions
- Teams can use their time however they wish, and missions can be done in any order
- All testing tables in the zone can be used for judging of the mission
  - The other teams in the zone must give priority to the team being assessed

General rules for the event:
- Robots must be fully autonomous (**NO** Bluetooth/wifi control or other remote devices allowed)
- Teams can only use the required equipment and programming languages (see section above)
- Teams are free to build whatever robotics device they need to complete the missions
- Teams are free to use whatever programming features they need to complete the missions
- Teams cannot physically touch / alter robotics path once the mission has started. Once the robot is touched it must be brought back to the starting base and a small point deduction will be assessed by the judge – the mission can be started over again or terminated – once terminated, the attempt is over, and that mission is considered complete / cannot attempt the mission again
- The robot must fit completely within the starting base (exception will be given to the wires) - Dimensions of the two starting bases will be W=12" H=12"
- Wires cannot be used to complete the mission
- The robot can touch the side boards and use the side boards to complete the missions
- On returning to base, time stops once the robot's main axle crosses into the base – teams can touch the robot once this happens (at the judge's discretion)
- If you want to abort the mission and start over, a deduction of 10 points will be assessed by the judge (running time continues until the team has completed the mission)
- Coaches / mentors are not permitted to assist their teams in completing any aspect of the missions
- When the robot is in the ALPHA BASE or BETA BASE, altering the device is permitted (i.e. changing programs or adding and removing attachments)
- No touching the judging table once a mission has been started
- Teams must allow other teams to test and train on the testing tables and take turns. This includes waiting patiently to be judged.

Assessment of missions:
- Judges' interpretation / assessment of the missions are based on an assessment rubric and are considered final
- Once a team has mastered a mission, they are to report to their zone judge for assessment
- Once a mission has been assessed, teams are to start working on a new mission
- Once a mission has been assessed, robot/program can be altered for the next mission
- **"No Touch Zones"** are one dimensional line but extend into the vertical plane. An **"No Touch Object"** could also be placed on the table.
  - a small point deduction will be assessed if your robot touches or crosses over them
  - an exception to this rule is the wires on the robot
- For each mission, teams will be awarded points for achieving the required elements of the mission.
  - time will be recorded for each mission
  - teams will be assessed on the total points awarded and their mission times

Sample Breakdown of the point system:
  - NOTE: Actual point system will vary from year to year

Starting a Mission:
- 10 points awarded for starting inside the appropriate base

Moving Blocks: (small, medium and large) – could include 3D printed object
- each small block moved or touched earns 5 points each
- each medium block moved or touched earns 10 points each
- each large block moved or touched earns 20 points

Target Boundaries:
- each block within designated boundary zone but not touching "No Touch Zone" will count
- 5 points for each of the small blocks, 10 points for each medium blocks and 20 points for the large block

Line Following:
- following line from the start/stop arrows
- line follower in only one direction is counted – in the proper direction – arrow to arrow
- must use light sensor / colour sensor programming to complete the designated mission

Ending a Mission:
- Between 20 – 40 points awarded once the robot's axle crosses the boundary of the designated base

Point Deductions:
- at any point in a mission, between 10 - 20 points (for each touch) will be deducted for any part of the robotic device (except wires) touching or crossing over the vertical plane of a "NO TOUCH ZONE" and "NO TOUCH OBJECT"
- blocks that touch the "NO TOUCH ZONES" and "NO TOUCH OBJECT" will not be counted and are considered frozen after the touch
- 20 points are assessed when retrieving the robot to restart the mission for each attempt - This will be referred to as a "RESTART" by the team and zone judge
- running time will continue until the mission has been completed

Terminating the Mission:
- touching the robot to correct its course voids (terminates) the mission
- if the mission has been terminated, the score and time will not count (no points awarded). The mission is considered scrubbed and cannot be attempted again.

"REMINDER" – Scoring Missions:
- towards the end of the competition, there is always a mad scramble to collect as many points as possible making it difficult for many teams to work on completing their missions. As a result, the following scoring rule will be applied again this year: Teams can only collect points if the robot achieves **all** the required elements [CAPITALIZED LETTERS – ie: BIOMASS DIGESTION PLANT ZONE] of a particular mission and makes it back to base successfully. No partial missions will be scored / assessed by the judges.

Ranking and final results:
Each mission will contain a set number of points. Points will be accumulated for all the missions a team completes. Total points for total missions completed will be used to rank the teams. In addition, mission completion times will be recorded and combined for a total time. If teams are tied in total points awarded for missions completed, accumulated time will be used to break the tie and rank the teams accordingly.