2022 Skills Canada Alberta – Qualifying Competition

Robotics

QUALIFIER EVENT: Robotics	**LEVEL:** Secondary
PROJECT SUBMISSION DEADLINE: January 19, 2022 at 4:00PM	**PROJECT SUBMISSION LINK:** Link to be provided to registered teachers (competitors) once registration has commenced.
EVENT FORMAT: Once registered online, competitors will follow the contest description and submit their projects via the link to the above by the listed deadline. Questions regarding the contest description can be sent to whitneyk@skillsalberta.com. **Please note, late submissions sent after the date and time specified above will not be accepted.**	**REGIONALIZED:** In order to participate at the Provincial Skills Canada Competition a competitor must qualify through the Qualifying competition or their Local Regional Skills Canada Competition, if the event is hosted.
Please visit the following link for more information regarding "Qualifying Events": https://skillsalberta.com/regions/province-wide/	

CONTEST DESCRIPTION

Autonomous robotics is a growing part of the robotics industry, requiring increasingly complex skill sets and programming abilities. In this competition, robotics teams from across the province will prepare a document outlining a robotic solution to a problem, detailing the structure and programming used to accomplish the task. This report will be submitted to the Robotics Provincial Technical Committee. More information can be found in the detailed competition description section.

SKILLS AND KNOWLEDGE TO BE TESTED

- Report Writing Skills
- Planning and problem solving skills
- High level programming i.e. flow diagram, process planning
- Electrical wiring diagrams

DETAILED COMPETITION DESCRIPTION

You are tasked with designing an autonomous robotic platform that can manipulate objects based on orders made by customers. There are 3 specific types of objects that must be delivered: Red cubes, black circles, and green cylinders. Each piece can be differentiated by color, but each piece will also carry a unique QR code per type of object. Additionally, there are QR codes above each unique piece's pick up zone to help the robot understand what zone it is near to.

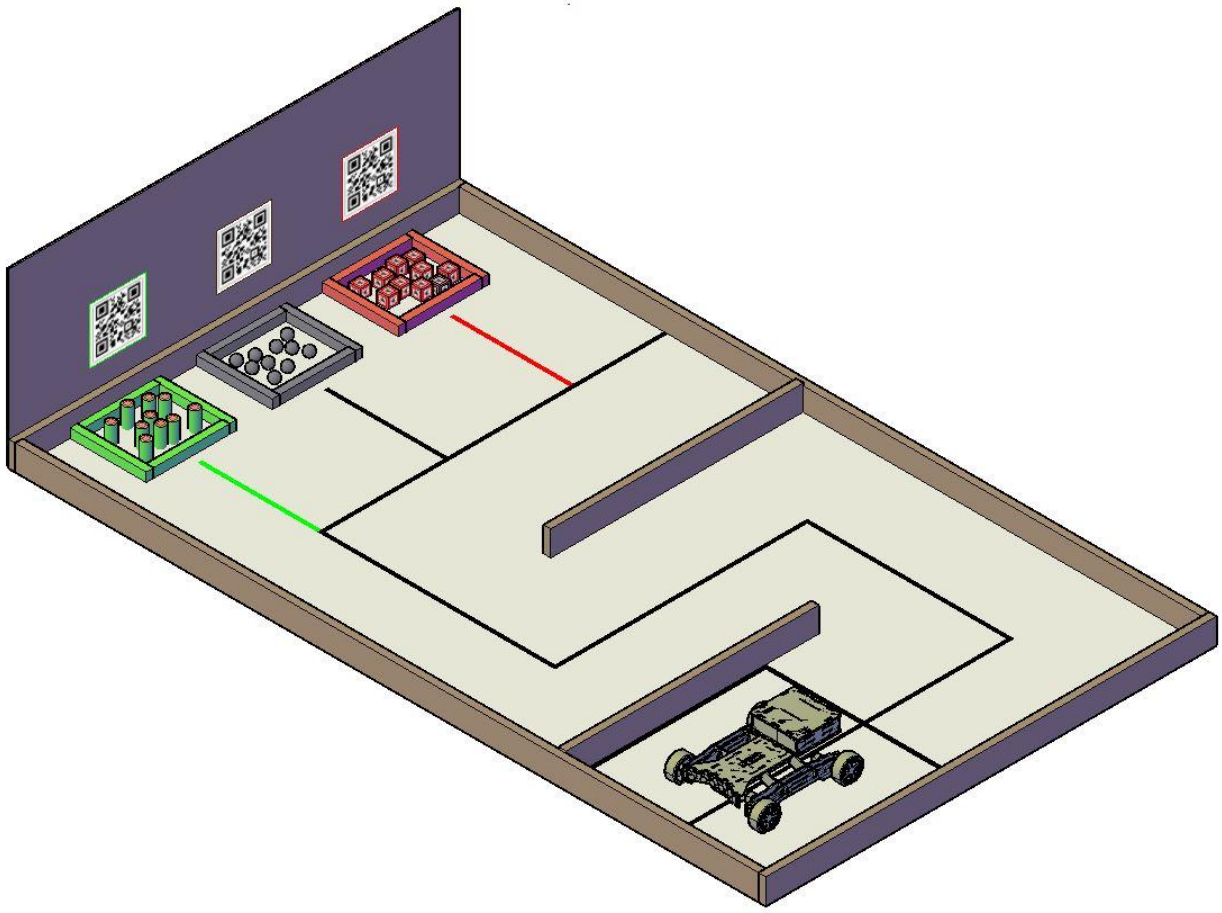

Figure 1: Overall Court Layout

At the start of a round, the robot will receive a customer's order via a printed QR code given to the student for the robot to read which will tell the robot to go and pick up a certain amount of pieces from each bin, then deliver all pieces to the starting area. As an example, a customer may give the robot an order of 3 green cylinders, 2 black spheres, and 5 red blocks. Once the order is received, the robot must travel to each individual pick up zone and pass through the center driving slalom, pick up the required amount of pieces from each zone, then deliver all of the pieces all together at once back to the starting zone (Outlined in Figure 2). The delivery will be considered successful only when the

robot confirms it is fully within the delivery zone. At that point it can be assumed the customer manually picks up the pieces out of the robot. Once the delivery is complete, the round is over.

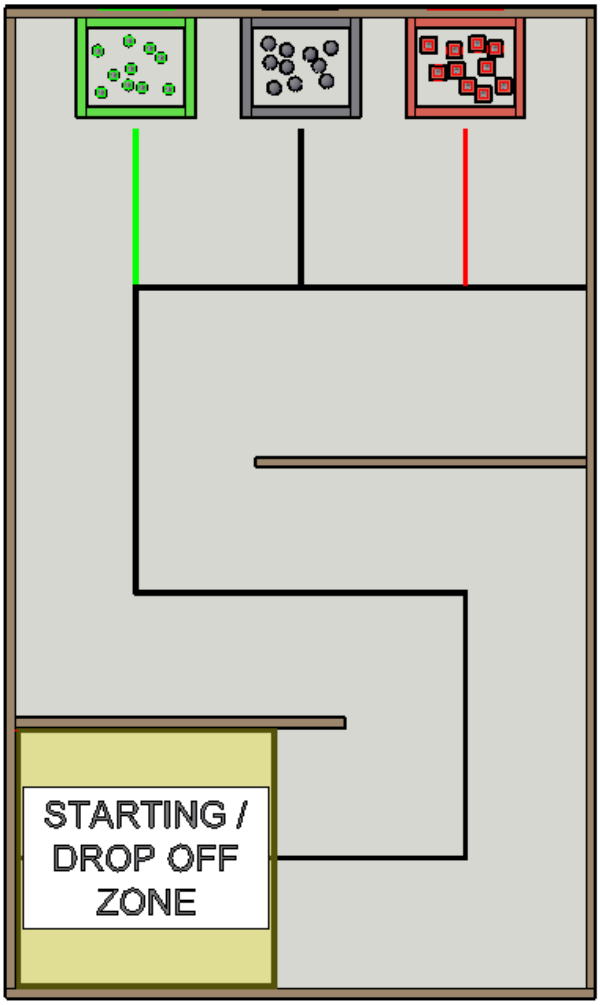

Figure 2: Starting/Drop Off Zone

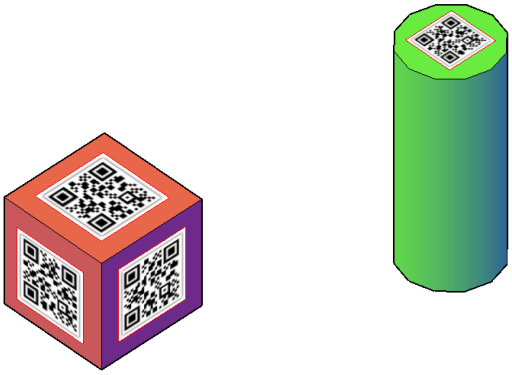

Figure 3: Example Game Pieces Complete with QR Codes

For this competition, assume your robot starts fully within the starting/drop off zone.The above figures outline a typical court layout, but the amount of objects required by the customer, as well as the number of objects in each colored pick up zone may vary. However, the flow chart you create should be able to solve any court with any number of objects in a single customer's order.

As this is a virtual competition, you should personally be able to follow your flow chart, and complete the project acting as if you are the robot.

COMMON ASSUMPTIONS

The following assumptions can be used to formulate the submission requirement for this virtual competition:

1. The robot's visual system is 100% accurate when recognizing colors, and can perfectly read QR codes when required by the programmer.
2. The robot has access to all crucial telemetry sensors all at once. This may include, but not limited to, line following sensors, ultrasonic distance sensors, onboard cameras to read colors and QR codes, etc.
3. The tape lines on the floor denoting where the robot should follow are denoted utilizing common black electrical tape. Assume the robot can clearly distinguish when it is in or out of the starting/drop off area
4. The robot can handle any number of objects, so it can be assumed to have an infinitely sized volume of storage space to store pieces before delivering all pieces to the drop off zone.
5. Robots are able to complete the task in whatever time is required to pick up pieces and deliver them to the delivery zone.
6. "Delivery" of all pieces can only be considered successful if the robot can confirm it is fully within the drop off area. Concurrently, this means that the robot must also fit fully within the drop off area at the start of the round.
7. The robot is able to understand any commands given to it via the QR code given at the start of the round.
8. Assume there are only 3 types of game pieces: red blocks, green cylinders, and black spheres.
9. The robot can only travel in 2 dimensions - the X and Y axes. The robot must always be in contact with the floor.

EVALUATION

1. Flow Chart (50%)
    a. For this part, you are required to design a flowchart to inform the provincial judges how you would solve the problem using an autonomous robot with the parts listed in the parts section.
    b. Projects will be assessed based on completeness, organization, and usage of standard flow chart blocks. Students should include a legend to denote different types of blocks so it is clear as to how the flow chart should flow. A standard legend can be fould in the following link: https://bit.ly/3A2Zh60

    c. Each "Do" statement in the flow chart must be the simple control of a robot's device. E.g. turn on right wheel motor forward, stop right wheel motor, etc. The goal of this is to create a larger, more complex subroutine from simple, easy to interpret commands.

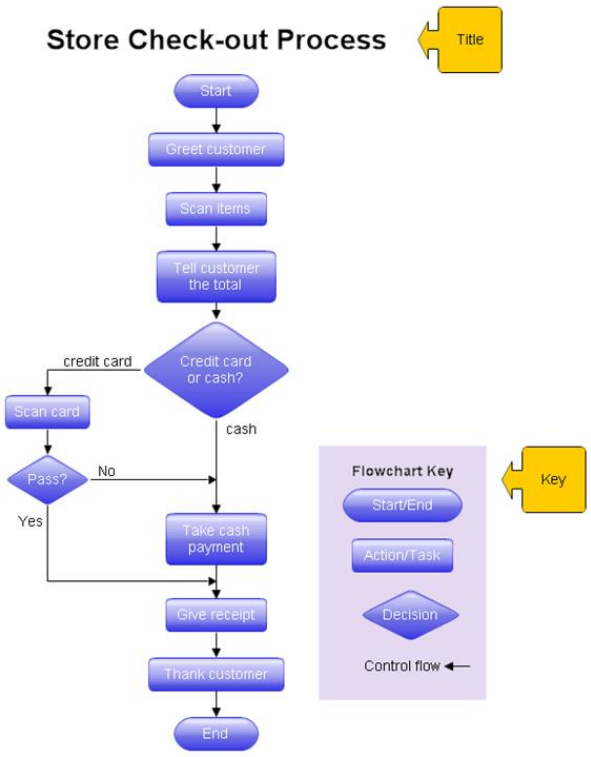

Figure 4: Example Flow Diagram

2. Electrical Wiring Diagram (30%)

a. The judges will also be assessing the electrical and control layout of the robotic platform.
b. A legend must be included that illustrates the meaning of the symbology used.
c. The diagram should include the power source and it's connections, the current in each section of the circuit, and all control signals.

3. Robotics System Sketch (10%)
    a. Using your imagination and creativity - draw, sketch, paint, or with any other method, a drawing of how the robot looks and performs, including clearly noted locations of each part on the robot.

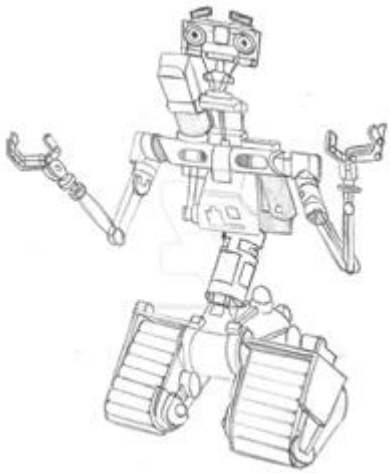

Figure 5: Example Robotic System Sketch

4. High Level Description of how the students plan on solving the problem (7.5%)
    a. It is expected for the students to provide a 3 paragraph written description of how they plan on solving the outlined task. This description will be very high level, so it shouldn't be too detailed. It should be made very clear to the PTC how the students plan on solving the problem.

5. Assumptions for the Robot (2.5%)
    1. Document assumptions for your robot, such as:
        1. Robot's type of locomotion (4 wheels, track system, etc.)
        2. The Sensing range of your sensors
        3. Personal assumptions of how the court area is constructed, and a general description of your robotic system
        4. Additional information required to describe the overall function of your robot
        5. Object capturing device robot will employ

VIRTUAL EQUIPMENT AVAILABLE TO THE ROBOT

You are limited to using the following types of devices and sensors on your virtual robot:

Sensors

Type of Device	Qty.	Description
Ultrasonic Distance Sensor	3	Tells you how far away objects are from the robot
Simple Momentary Switch Button	1	A robot mounted push button that can be activated by the robot touching something or human activated outside of the maze.
Heading Sensor	1	Can provide information on the orientation of the robot in the room. Can read 0 to 360 degrees. Assume the heading sensor works like a compass.
Robot Microcontroller	1	Can store memory of locations and sensor data and can be programmed in any programming language.
Claw and/or capturing device	1	Any device used to pick up single objects. It is assumed that once the robot has picked up an object, it can manipulate the object into it's storage bin automatically.
Visual and IR Sensing Camera	1	Camera that can take and transmit pictures to the microcontroller for processing. Assume it can read QR clearly 100% of the time. It can also interpret colors and transmit that information to the controller as well.
Line Following Sensor	2	Line following sensor used to navigate the robot utilizing

		the black electrical tape lines on the floor.

Electrical Parts

Type of Equipment	Qty.	Description
Motor Controller	1	Used to receive input signals, and control power output to up to 4 motors.
Low RPM and/or stepper motors	4	Means of locomotion for the robot platform
12V Battery	1	Energy source for robot
Fuses/breakers and/or fuse blocks	As Required	Safety devices to protect robot from overloading
Disconnect Switch	As Required	Safety Disconnection for entire robot platform

ADDITIONAL INFORMATION

- **Scoring:** Once all submissions from students have come in, the PTC judges will judge each submission, and determine the top teams. Please note: The judges' decisions are final and binding and cannot be contested through a formal grievance process.
- **Ethical Conduct:** We recognize that participants will be competing individually in their own unique environments and therefore not all competition conditions can be monitored. However, we expect all competitors to compete fairly, respecting and abiding by the established rules in the true spirit of Skills Canada Alberta.

- The top 16 teams in the qualifying contest shall be accepted to the provincial competition in Edmonton, Alberta. Registered teachers will be notified once the rankings have been completed.

- Only one team per school will be accepted past the qualifying contest. As an example, if 3 teams from a single school enter the qualifying event, only the highest ranked team at that school will move on to the provincial competition.

- Registration opens online through SCA portal – **October 20, 2022 at 8:30AM**
- Deadline for students work to be submitted to SCA – January 19, 2022 at 4:00PM

- Teachers will be notified if their students earned a position at Provincial Skills Canada Competition – by February 9, 2022
- Provincial Skills Canada Competition May 4-5, 2022
- Regional Regulations & Policies: A copy of the Skills Canada Alberta Regional Regulations and Policies can be found at the following link: http://www.skillsalberta.com/policies-and-procedures

COMMITTEE MEMBERS

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