IEEE Ottawa Robotics Competition
Compétition de robotique d'Ottawa d'IEEE

LRT Detour Challenge
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Disclaimer
It is your responsibility to read and understand this document on a regular basis because we may update it from time to time.

If you have questions, please contact our Arduino Team at orcarduino@gmail.com.

LRT Detour Challenge

Many road detours are appearing in Ottawa due to the construction of a new LRT (light rail train) system, which will be featured in this year's LRT Detour Challenge. Your task is to program a self-driving robot that can navigate through road closures, sinkholes, and other detours within the City of Ottawa. All road closures will be represented by 3D printed blocks.

The number and location of road closures will change, so your self-driving robot should be able to navigate no matter what detours arise.

Approved Parts

Unlike in previous years, the choice of robot is completely open to the user. Bonus points will be awarded in the presentation by teams that have constructed a custom robot. However, there are certain restrictions in acceptable components. The tables below list approved types of components. Teams can have one range finding sensor to find the distance to the obstacles, one line following sensor (or a pair) and one controller. So long as each component falls in this category it is acceptable.

| Part Type	Examples
Range Finding Sensors	Ultrasonic Sensor
	Infrared Range Finder
	Time of Flight Sensor
Line Following Sensors	IR Reflectance Sensor
Controller	Arduino UNO
	Raspberry PI
	Mbed
	Beaglebone
Battery Pack	6AA

Please note that the specific examples and store links given in the tables above are not binding. Specific decisions about chassis, motors and wheels are left to the contestants. The only restriction being the size. So long as the robot is not unreasonably slow, speed will make little difference.

Prebuilt Robots

For teams that do not wish to make their own robot, there is an option to buy a kit. In general, any prebuilt robot conforming to the above specifications will be allowed. Care must be taken to avoid a robot with a wireless device on it, as this is prohibited.
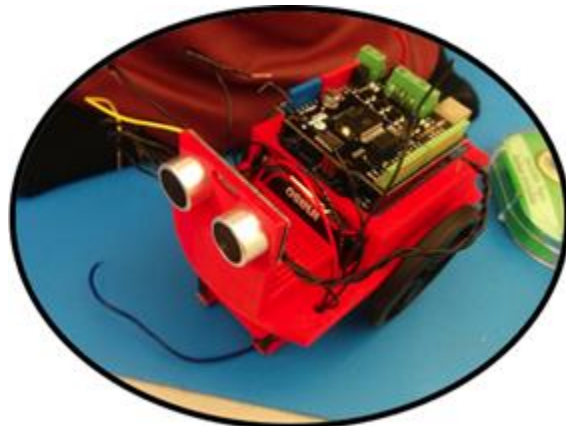
Recommended Robots

CARL Robotics Learning Platform
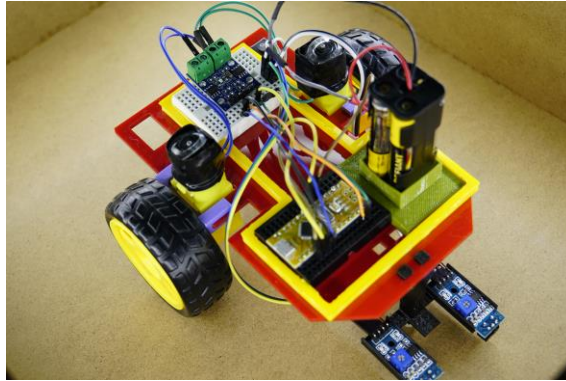
The CARL robot is a low-cost ($25) robot platform designed for high schools. They can be purchased at a2delectronics, which is an Ottawa based electronics supply shop. There are several different versions of CARL, all are acceptable.

ORC 3D Printed Robot

Above is an image of the robot that ORC was providing for the competition two years ago. This robot is still acceptable for teams that have them. The 3D print files and BOM are available on our website if you wish to make one. The team will be responsible for assembling this robot.

Makeblock mBot

This robot is a bit larger then what is idea for the competition, but it is still useable. However, ensure the Bluetooth module is removed for the competition.

Pololu 3pi Robot

The Pololu 3pi lacks a range finding sensor; however, one can be easily soldered onto the front. The advantage of the 3pi is that it can turn in place, making it easier to program to turn around tight corners.

Challenge Rules

1. At the start of the challenge, you and your team will have come to the contest area, and you may not change your robot's program while you are competing.

2. Your robot will be placed in the START area in a specific position.

3. We will start timing your run when the team captain starts the robot.

4. Locomotion can only be done on wheels.

5. The robot must be less then 6 inches by 6 inches and its height can be no more then five inches tall.

6. Your robot will have 2 minutes to finish the city. Your robot must follow the black lines and avoid obstacles while going through the maze

7. There will be several different city layouts that your robot will go through. Each layout will have a different level of difficulty.

8. After your robot starts, the team captain will be the only one who can:
   a. Restart the robot from the START area when it hits an obstacle.

    b. Restart the robot from the START area if a judge thinks your robot has gone too far from the black lines.

9. The robot is only allowed one reset for each round. If the robot deviates from the line or hits an obstacle a second time, the round is ended and a time of two minutes is recorded.

10. Seventy percent (70%) of your final score for the challenge will be based on the <u>average</u> time it takes for your robot to run through the city successfully (to the END area). Teams must also [present](#) in front of judges (30% of the final score).

Bonus Objectives

In addition to the regular challenge, we are adding a bonus objective this year. After the robot successfully navigates the city, it will run through it again without modification. The goal being for the robot to remember the path through the city.

1. It is recommended that the robot has a button or a switch to set the robot into playback mode.

2. The score for the bonus objective (shortest average run) will be judged separately and will not affect the score for the main competition.

3. If the judges notice the robot simply repeats the same behaviour on both runs through the city (i.e. it hasn't learned or remembered anything) you will be disqualified from the bonus objective.

Judging & Scoring

1. The runs with all the obstacles will be modified on the day of the competition. There can be up to 10 obstacles at a given time.

2. All teams will gather at the competition area and remain there for the remainder of the round.

3. Judges will time and score your match.

4. All robots have 2 minutes to complete the maze. If the robot is unable to complete the maze within this time, a time of 2 minutes will be recorded for that particular trial.

5. The winner of the Challenge will be determined by your robot's average completion time and the mark you receive on the presentation. The team with the highest combined score will be the winner of the Challenge.

6. Decisions of the judges are final.

LRT Detour Challenge Starting Position

All robots will start at an intersection of the arena. The IR sensors will start after the intersection and the wheels will be behind the intersection.
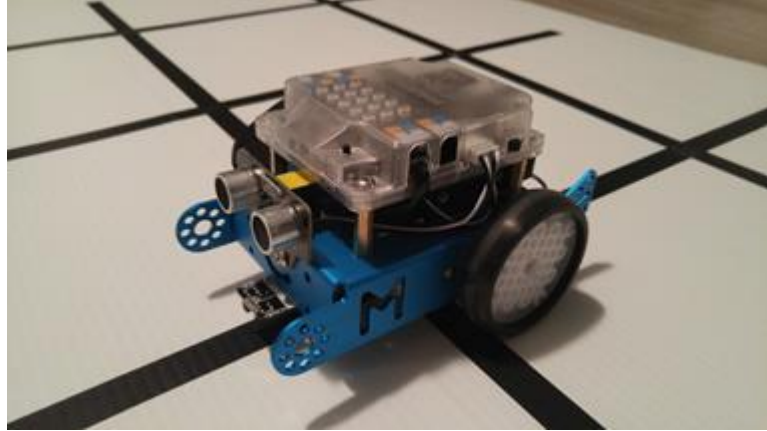
LRT Detour Challenge Diagram

The dimensions of the entire challenge area are 96" by 48". The maze will be represented by black electrical tape which has been cut in half (3/8th inch) arranged in a grid of 14" by 14" squares. Obstacles will have an approximate size of 4" by 4" by 4". One inch (") = 2.54 cm and one foot (') = 30.48 cm.
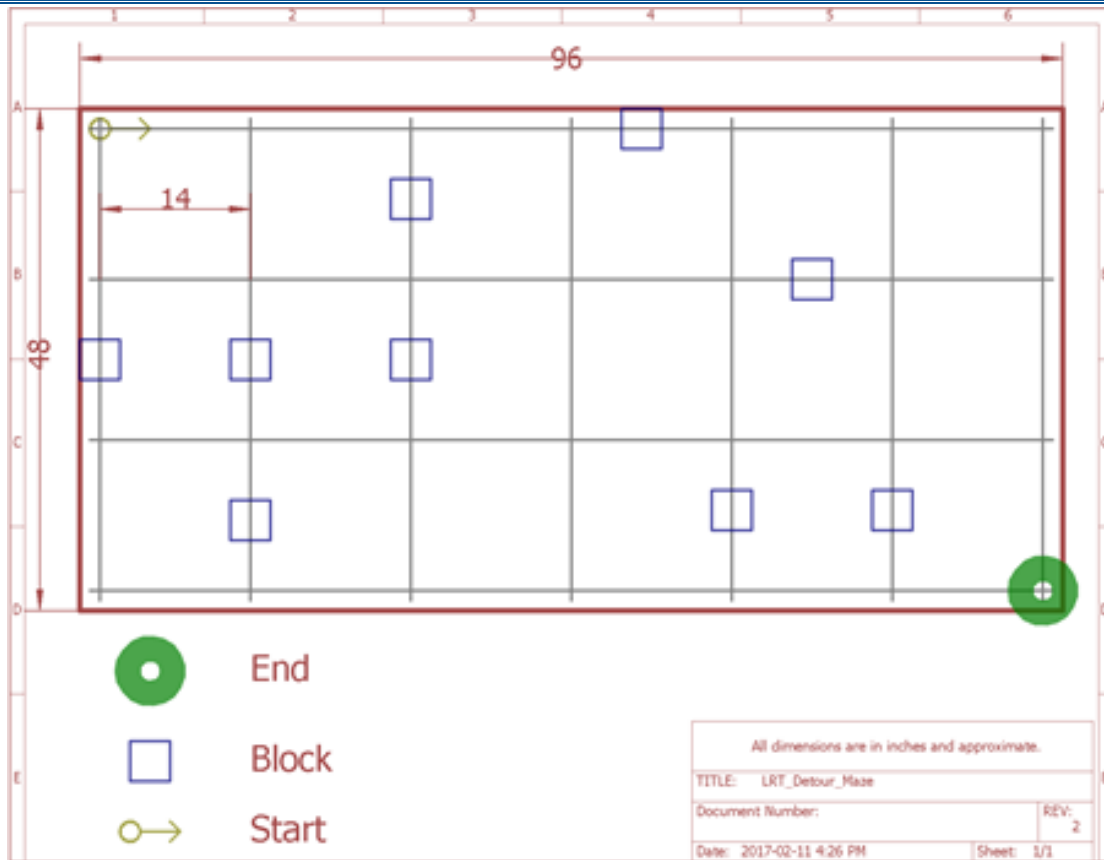
Please note that these diagrams represent a model of the challenge and does not reflect the exact number and location of obstacles, which are subject to change on competition day.