Project summary:

The scenario represented by the project is to use a robot to "rescue" a "survivor" from a building. The "survivor" in this case is a tomato can, located on the 1st floor of a robot arena that simulates a 2-storey building.

Goal:

The goal is to design and build a robot that can locate and transport the tomato can from its current location to a new location, by following a "map" which consists of a black line on a white background. The tomato can is located on the 1st floor of the arena at the immediate end of the black line. The robot must reach the can by following the map (the black line), then grab the can, and finally drive back with the can (again following the black line) to the starting location of the robot. You are provided with a test map in the arena on which you can develop and test your solution. A secondary goal is to try to optimise your solution for speed, i.e., try to make your robot reach the can, grab it and bring it back down as fast as possible.

Conditions:

- The robot must start from a fixed starting location on the ground floor of the arena.

- The robot must always follow a track (a black line on white background) that leads all the way to the location of the tomato can.

- The robot must securely grab the tomato can so that it can be transported. For this, you must design a gripper solution. To ensure a secure grip on the can, rubber bands or other similar aids may be used to increase the friction of the grip. Note that you do not have lift the can after grabbing it, you may drag it on the floor.

Notes on implementing a solution:

- To follow the black line, you can use the available colour sensor(s). The colour sensors emit a light with fixed intensity and measure the intensity of the reflected light to determine the colour. Note that the readings of the colour sensors are affected by ambient light, so you must take this into account. One way to deal with this is to shield the light emitting part of the sensor with tape or something similar, to block ambient light from interfering with the emitted light and to ensure more stable readings.

- The center of gravity (CoG) of the robot affects the performance on the ramps. The CoG is the total weight of the robot concentrated at a single point. Heavier parts of the robot affect the CoG more than lighter parts. The CoG can be set to (roughly) a particular location along the horizontal plane of the robot by placing heavier parts (which is the NXT brick) in that location. In general it is good idea to keep the CoG as vertically low as possible, as well as to keep the CoG as close as possible to the wheel axes that are connected to the motors. This will push the wheels down more and increase grip, which is particularly important when driving up and down the ramps. Note, that the tomato can adds addition weight to the robot, which may affect the robot's movements when driving down the ramp. You may use extra wheels to increase grip.

- You may use the touch sensor to detect whether the tomato can is within the reach of your gripper.

- You are free to decide whether the robot drives backwards towards its starting location or it turns 180 degrees first and then drives back towards its starting location. Note that the risk in turning 180 degrees is that the colour sensors will not be able to see the black line while you are turning, so you will have to implement a way to "find" the black line such that you can follow it again.

- To test the robustness of your final solution, you must be able to demonstrate that it works on a different map as well, and not just on the test map. Your solution must therefore not be "hard-coded" to the test map - this applies mostly to the control architecture of your robot.

Notes on the competition:

Your final solution will be tested on a different map in the same arena as the test arena. This test will be in the form of a robot competition, where you will have to execute your solution. Note that the starting location of the robot, the location of the can as well as the layout of the black line may be different in the competition.

- The map for the competition will be revealed at least two weeks before the competition, to provide time for you to optimise your solution to the new map.

- In the competition, each team will be allowed 3 attempts at rescuing the tomato can. The execution time for each attempt will be recorded and the fastest time out of the 3 times will be considered as the best time. An attempt will be considered as failed if the robot loses the can, or if it loses the black line and is unable to find it again within reasonable time.

Dates:

The exact date of the robot competition will be announced on Itslearning, but it will likely be held in week 50 (13-16 December 2021).