

## **Introduction**

A concert will be held in the town square and an automobile factory has decided it is the perfect time to demo its newest autonomous car.

The car will go from the town's entrance to the square, while picking up people waiting at pre-designated places. As it won't be able to fit all the people at once, it will have to make multiple trips.

## **Main Goals**

The participants will have to build a robot that is able to travel the town streets, picking up symbolic people waiting at the predesignated stops, and drop them at the town square.

1. Traversing the town:

Many dead-end streets can be found in the town layout, and there are no signals indicating which street is a dead-end. However, each intersection contains a colored tile. The color indicates in which direction the robot should travel, so as to avoid dead-ends.

The relation between colors and directions are not known to the robot. Initially, the robot will have to explore different directions. By learning the relation between colors and correct directions, it will be able to improve its decisions when encountering the same color in the future.

The map between a color and the good direction to traverse will be fixed throughout a trial.

Black tiles will signal dead-ends, where the robot will have to turn back and return to the intersection.

2. People pickup:

People will be at the stops, waiting to be taken to the concert at the main square.

The robot must be able to pick up to four people, take them to the town square and drop them there. Once it drops all current passengers, it can go back to pick up more.

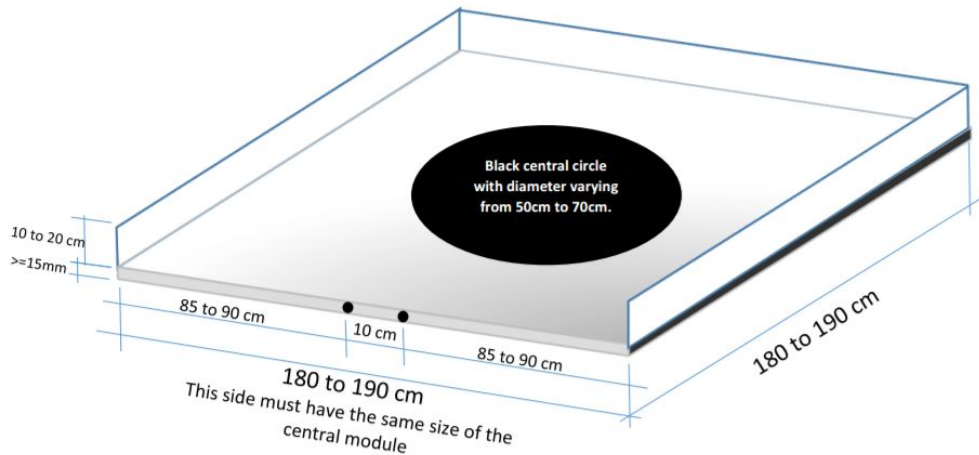
## **The Town Layout**

The town model contains two main modules: the Plaza module, and the Streets module.

### **Plaza Module:**

This module is the same as used for the CAVE MODULE - SEK 2015/2016.

It consists of a white wooden platform of MDF with a thickness greater than 15mm necessarily. This module can be square or rectangular. This module can range from 1,80m x 1,80m to 1,90m x 1,90m. The sides have a wall of 10cm to 20cm high and the side that joins the street has a gate in the wall of 30cm. This module must have a central black circle, made of black paper, painted with black ink or black tape. The diameter of the black circle must be between 50cm and 70cm.



### Streets Module:

This module consists of streets, intersections, stops and dead-ends.

- Streets  
Each street is formed by a white MDF, 15 mm or more thick, 300 mm wide and variable length.
- Intersections  
The intersections are formed by tiles made of the same material as the streets. Each tile is 300mmx300mm. They can be colored with paint, or by sticking color paper on top of them. The possible colors are red, blue and green.
- Stops  
The stops are made of the same MDF as the streets and intersections. They are 200mm wide and 300mm of length.
- Dead-ends  
The dead-ends are the same tiles used for the intersections, and colored black.

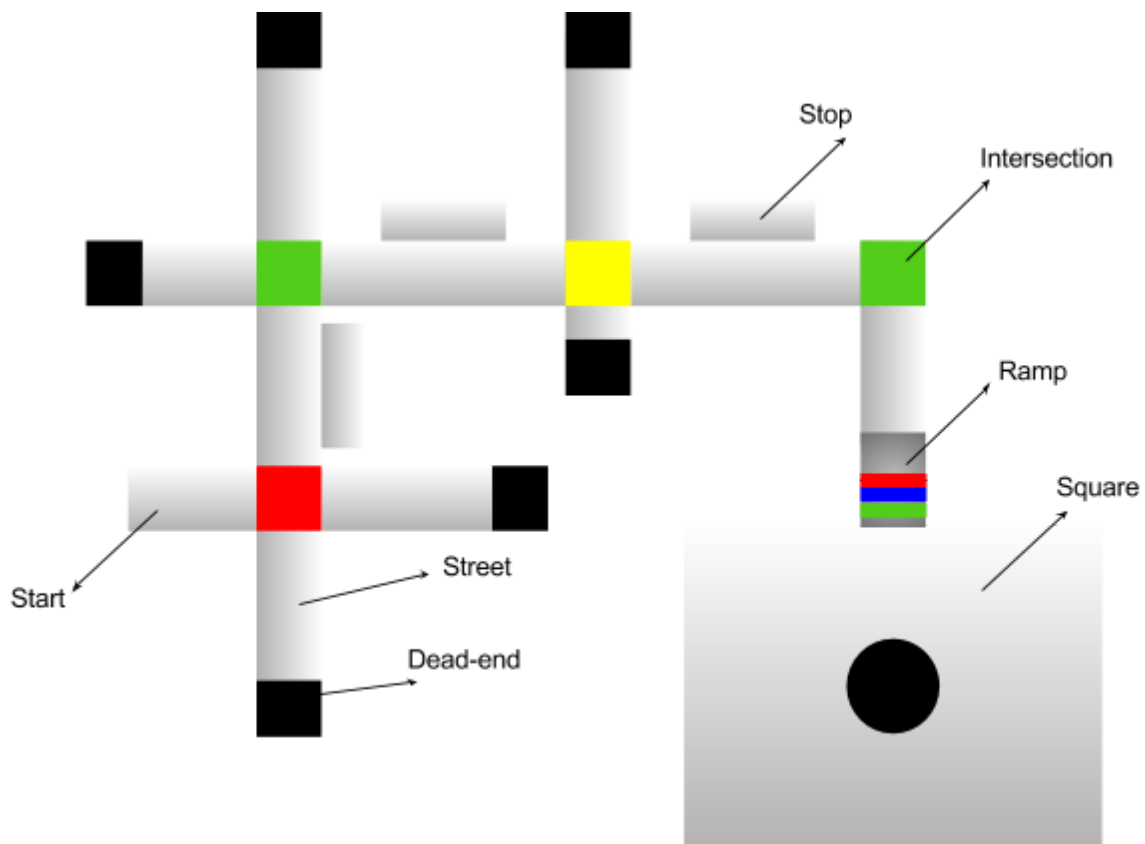
All these components should be at least 50mm above the floor. A ramp will connect one street to the plaza. The ramp should form an angle of 10 to 15 degrees with the horizontal.

The ramp contains a three-stripe mark. Each stripe is 36mm wide. The stripes should be colored red, blue and green, starting from the closer to the streets.

The layout of the streets module, including the length of the streets and their connectivity changes from round to round. It does not change upon restarts.

A correct path from the start to the plaza must contain at least two of each color (at least 6 intersections).

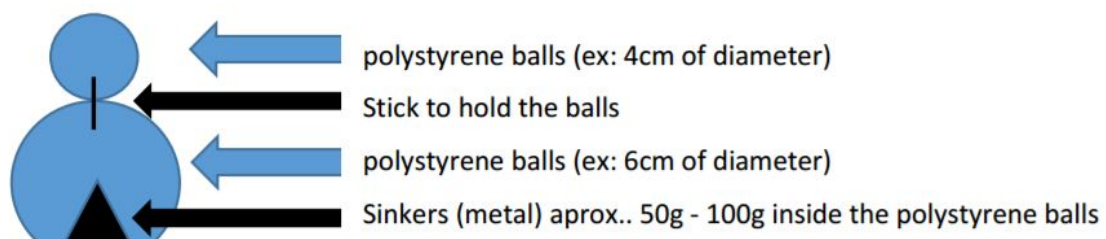
An example scenario is shown below. For simplicity, only 3 intersections are included in the illustration:



### People

The model person from SEK 2016 is used for the people.

Humanoid shape about 10cm high, ranging from 8cm to 12cm, made of polystyrene balls, a smaller one on top and a greater one underneath. Different sizes of polystyrene balls may be used. The rule is that the beneath ball is greater than the upper ball, and that the doll is greater than 8cm and smaller than 12cm in total height. The base of the humanoid will have a metal of approximately 50g - 100g in order to prevent the doll from falling when touched by robots.



### Robots

There is no limit to the amount of motors and sensors that each robot can use during its mission. However, its size shall not exceed 30cm wide and 30cm long, when all parts are fully extended. There is no limit to the height.

Another limitation is that ALL robot parts and accessories must belong to a unique ROBOTIC KIT.

For example, a robot made with LEGO parts should have in their constitution just official PIECES and ACCESSORIES of LEGO®, such as motors, sensors, rubber bands, plastic parts, etc., even if they are sold in different kits. Other kits are Vex®, pETe® and FischerTechnik®.

Pieces from a third-party company that is regulated or certified by the original company are also allowed. An example is the Hitechnic company that fabricates certified pieces of LEGO® robotic kit. Not all pieces of Hitechnic company are allowed, but only the LEGO® certified ones.

Only one robot per team is allowed.

### Points

- A team starts with 0 points
- Each person well delivered: +100.
- For each person that is not at the plaza or a stop without touching the robot, for more than 10 seconds: -50
- For each restart: -100
- For each model person touching the robot at restart: -50
- For each additional 30 seconds ( $t_{\max} - t_{\text{completion}}$ ): +25
- After having navigated an intersection in the right direction:
  - +50 points for having navigated the right direction (only the first time)
  - For each incorrect direction taken: -25

### Observaciones:

- The robot start at the start location, as marked in the town model
- A round might finish for any of the following reasons:
  - Timeout
  - Upon the team's request
  - Successful completion: all people have been successfully delivered.
- El tiempo máximo por round es de 10 minutos. Este tiempo cuenta los reinicios.
- One person can be considered well delivered, if it is touching the black circle in the center of the plaza and there is no piece of the robot touching the person. Only in this case the person can be retrieved from the plaza and the points can be awarded.
- Only the referee might retrieve people from the town
- An intersection is considered to be navigated in the right direction after the robot leaves the intersection and the whole robot is laying entirely on a street different from the one used to arrive to the intersection.
- A robot is considered to be on a street if at least two of its wheels are touching the street.