



Regular Category

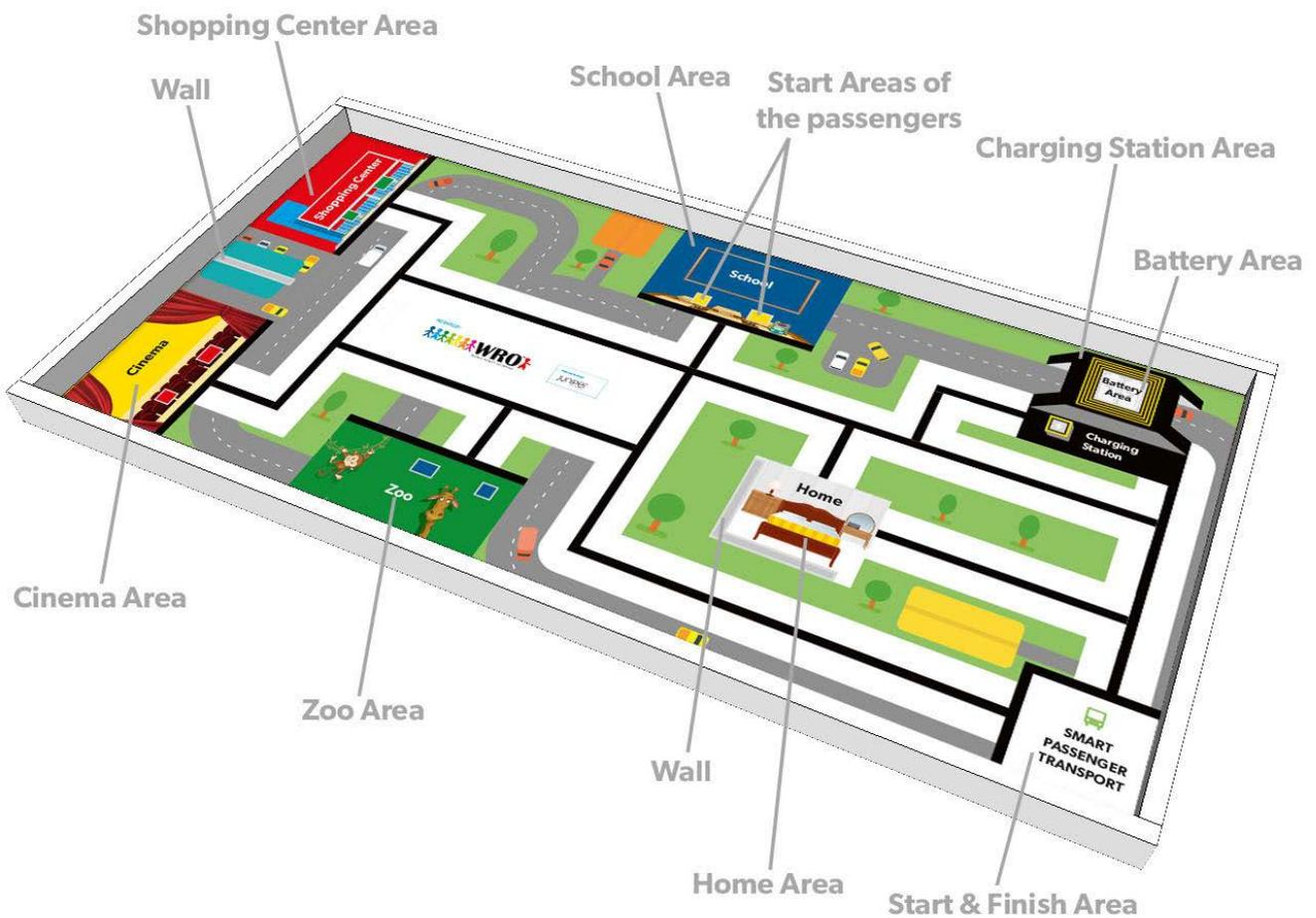
Elementary School

Description, Rules & Scoring

Smart Passenger Transport

1. Introduction

This year, it is the mission to build a robot that can act as a real autonomous, self-driving taxi that takes passengers from a starting position to a target area.



Complete field dimension can be seen at:

<http://mikrobot.com/iro2019/assets/file/Elementary%20Category%202019-Mat-Dimensions.pdf>

2. Game Objects

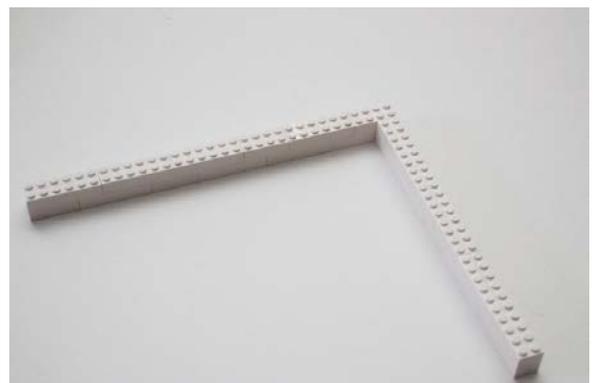
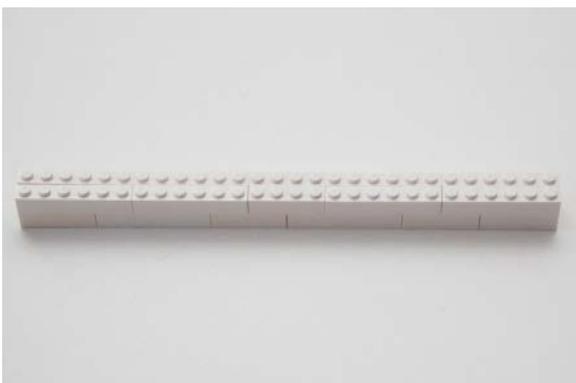
There are 8 colored passengers (green, red, yellow, blue), 4 adults and 4 children, and 2 white passengers, 1 adult and 1 child, on the field. Note: Not all passengers are used in one run, please take a look at the next chapter for randomization.



There are 2 battery blocks on the field.



There are 2 walls on the field. Movement or destruction of walls is not allowed.



Wall between the red and yellow areas

Wall surrounding the home area

3. Positioning of Game Objects / Randomization

Positioning of the passengers

Place all colored passengers (red, yellow, green and on their start areas (blue passengers in the small blue rectangle on the field, yellow passengers in the yellow rectangle, etc.). The adult passengers are always positioned with their arms pointing into the middle of the playing field.

The child passengers are positioned with their arms parallel to the black line at the edge of their area.

Passenger randomization:

1 colored adult and child passenger (green, red, yellow, or blue) will be randomly selected and replaced with 1 white colored adult and child passenger.

1 adult and child passenger will also be removed from the playing field randomly.

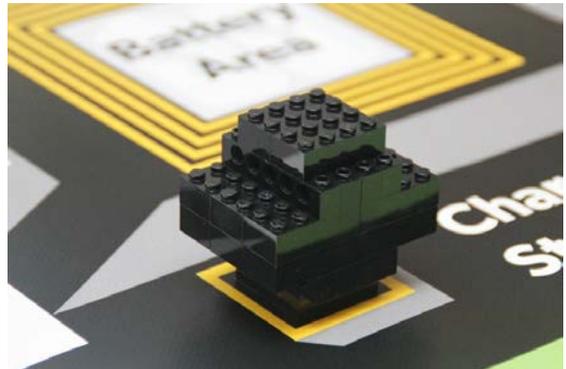
Randomization example:

- Red child passenger replaced with white
- Blue adult passenger replaced with white
- Yellow child passenger removed
- Green adult passenger removed



Positioning of Battery Blocks

One battery block is placed in the Start & Finish Area. Teams are allowed to put this battery block on their robot before the start.

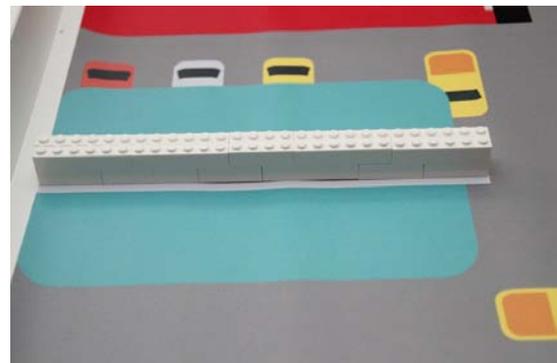


If the team puts the battery block on the robot, it has to fit into the maximum size of the robot (25cm x 25cm). If the team does not want to use the extra battery block, they can put it away.

The other battery block is placed in the small position in the black area (see photo).

Positioning of Walls

The walls are placed on the dark grey areas that are exactly the size of each wall. One wall surrounds the home area. The other wall is between the shopping center and cinema area.



4. Robot Mission

Bring the passengers to their target areas

The robot should bring the yellow, green, red, and white passengers to their target areas.

- **Yellow** passengers
 - Bring to yellow area (Cinema Area, rectangle area including red curtains)
- **Green** passengers
 - Bring to green area (Zoo Area)
- **Red** passengers
 - Bring to red area (Shopping Center Area)
- **White** passengers
 - Bring to white area (Home Area)



A Blue passenger (child or adult, depending on the draw) will stay in the zoo the whole day. This passenger should not be moved. It is ok as long as the blue passengers still touch the start rectangle.

For the scoring, only the colored area (not including the black line) counts. Please take a look at the scoring examples after the scoring table for more information.

Bring equipment to the charging station

The robot should bring one of the battery blocks to the marked Battery Area inside the charging station. The team can decide if they use the battery block in the Start & Finish Area or if they use the battery block placed in the charging station area. Points are awarded if the battery block is completely inside the Battery Area.

Penalty points (walls)

The walls must not be damaged or moved from the grey area. If the walls are damaged or moved outside the light grey area, a penalty is given but will never result in a negative score

5. Scoring

- Score will be calculated after the mission ends or when the time stops.
- Maximum score: 165 points.
- If teams have same score, rankings will be based on fastest time record.
- “Standing” means that the game object is still in upright position (like the initial position). “Not Standing” means any other position.
- “Completely” means that the game object is only touching the corresponding area (not including the black lines). “Partly” means that the game object is at least touching the area with one part.

Tasks	Each	Total
Red / Yellow / Green / White Passenger (adult or child): <ul style="list-style-type: none"> · Standing and in the correct target area · Completely in the target area 	25	125
Red / Yellow / Green / White Passenger (adult or child): <ul style="list-style-type: none"> · Not standing but in the correct target area · Completely in the target area 	15	75
Red / Yellow / Green / White Passenger (adult or child): <ul style="list-style-type: none"> · Standing or not standing but in the correct target area · Partly in the target area 	5	25
Red / Yellow / Green / White Passenger (adult or child): <ul style="list-style-type: none"> · Standing but in a different target area · Completely in the target area · that is not the start area of the passenger, not the charging station area, and not the start / finish area of the robot 	10	50
Red / Yellow / Green / White Passenger (adult or child): <ul style="list-style-type: none"> · Not Standing and in a different target area, · Completely in the target area · that is not the start area of the passenger, not the charging station area, and not the start / finish area of the robot 	5	25
Blue Passenger (adult or child, depending on draw) still standing in initial position in the green area. <i>(only if points for other passengers are assigned)</i>		15
One battery block is completely in the Battery Area.		15
One battery block is partly in the Battery Area.		5
Robot completely stops within the Start & Finish Area. <i>(only if points for passengers are assigned)</i>		10
Robot damages or displaces a wall from its initial position.	-5	-10
Maximum Score		165

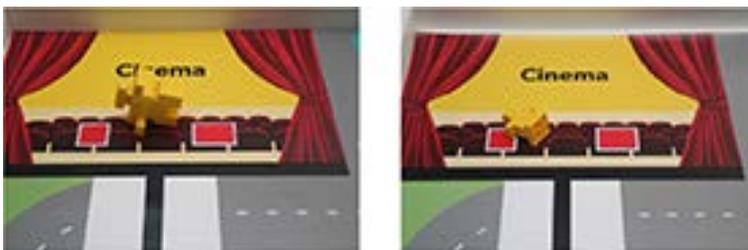
6. Scoring Interpretation

For Red / Yellow / Green / White Passengers:

Standing in the **correct** target area, **Completely** in the target area -> 25 Points



Not standing in the **correct** target area, **Completely** in the target area -> 15 Points



Standing / Not Standing in the **correct** target area, **Partly** in the target area -> 5 Points



Standing in a **different** target area, **Completely** in the target area -> 10 Points



Not Standing in a **different** colored area, **Completely** ->5 Points



Please remember: "that different area is not the start area of the passenger, the charging station area, or the start / finish area"

Incorrect tasks: in which you get no points **(0 Points)**



Not in the area



Only Touching the black line



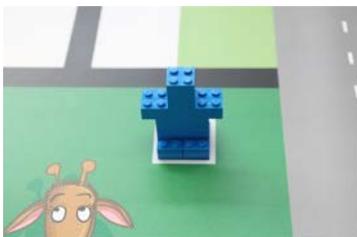
Passenger is damaged



Partly in a different area

For Blue passengers:

Still **standing** in starting position in the green area. *(only if points for other passengers are assigned)* ->15 Poin



Standing in start position



Touching the blue rectangle



Touching the surrounding grey line



Passenger is outside = 0



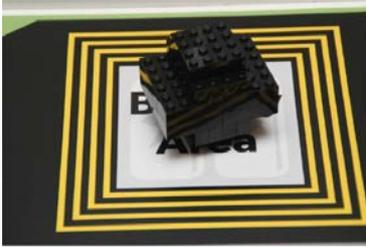
Passenger is not standing = 0



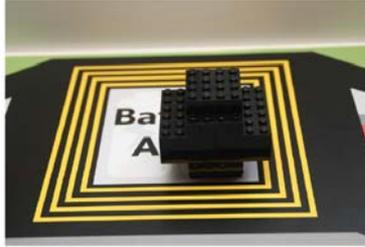
Passenger does not touch the initial position = 0

Battery Block:

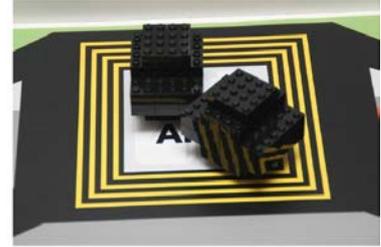
Completely inside the Battery Area ->15 Points



The Battery Area is the inner grey rectangle without any surrounding lines.



In this case "completely" means the parts of the block that touch the mat are inside the area = ok

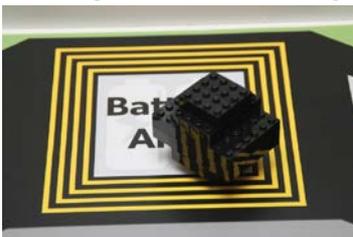


Only one block, the block with higher points, counts (in this case the one that is completely inside).



It is ok if the block is lying on the side. What is important is that all parts that touch the mat are inside the area.

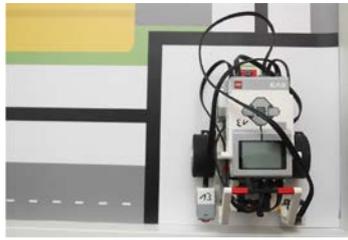
Partly in the Battery Area ->5 Points



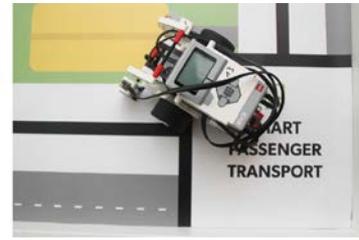
Robot completely stops within the Area Start & Finish -> 10 Point
(Only if other points for passengers are assigned)



Robot completely inside
the start/finish area



Robot completely inside
and cables are out = ok



Not all parts of the robot
that is touching the
ground is inside the
start/finish area = 0
Points

Penalty points: The robot damages or displaces the wall from its initial position -> **-5 Point**



It is OK if a wall is moved
inside the light grey area.



Penalty points if a wall
is outside the grey area.



Penalty points if a wall
is damaged.

7. Assembly of Game Objects

Passenger Assembly

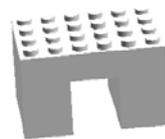
There are 5 adults, one white, one blue, one yellow, one red, and one green.

For one adult you need:

- 1 2x2 bricks
- 8 1x6 bricks
- 13 2x4 bricks



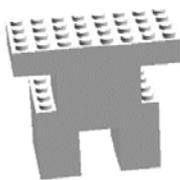
Step 1



Step 2



Step 3



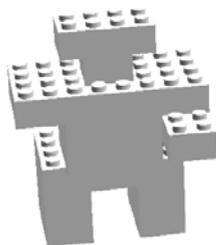
Step 4



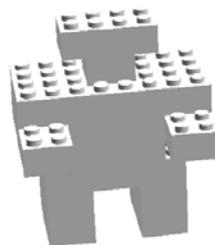
Step 5



Step 6



Step 7



Step 8

There are 5 children, one white, one blue, one yellow, one red, and one green.



For one child you need:

- 4 2x4 bricks
- 2 1x6 bricks
- 2 2x2 bricks



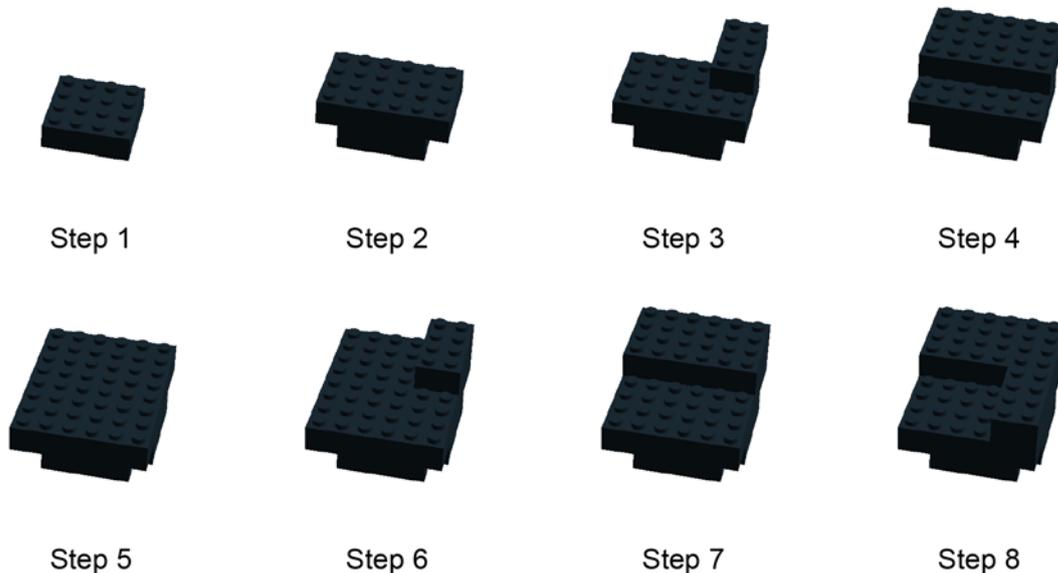
Assembly of the Battery Block

The two battery blocks are built out of black LEGO bricks.



For one battery block you need:

- 16 black 2x4 bricks
- 8 black 1x6 bricks





Step 9



Step 10



Step 11



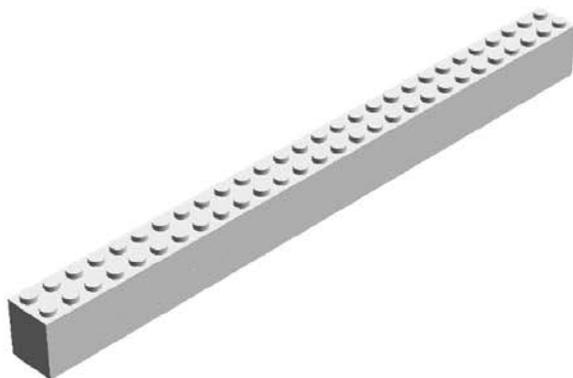
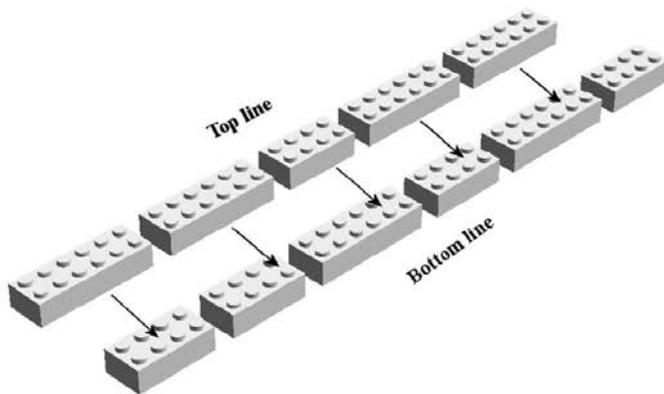
Battery Block

Walls assembly

Both walls are built out of white LEGO bricks.

Wall between the red & yellow areas.

For this wall you need 5 white 2x4 bricks and 12 white 1x6 bricks.



Wall surrounding the home area

For this wall you need 9 white 2x4 bricks, 26 white 1x6 bricks and 1 white 2x2 brick.

