Életre tervezve

BOSCH

Labyrinth Competition
„Mobile robots in the labyrinth"

Date: 11 April 2025.
Location: ÓE-KVK Tavaszmező 14–18., building G Zsibongó

Robert Bosch Ltd, the Kandó Kálmán Special College of Advanced Studyes in Electrical Engineering and the Kandó Kálmán Faculty of Electrical Engineering are organising a competition for teams of 3-4 participants.

In the competition, the mobile robots have to get out of the maze the fastest using image processing or RFID identification at two different levels of difficulty. Teams have two options at each level. A test day will be provided before the all-day competition.

Registration and details:
https ://kando-szakkoli.uni-obuda.hu/labirintusverseny/

ÓE KK

Kandó Kálmán
Villamosmérnöki
Szakkollégium
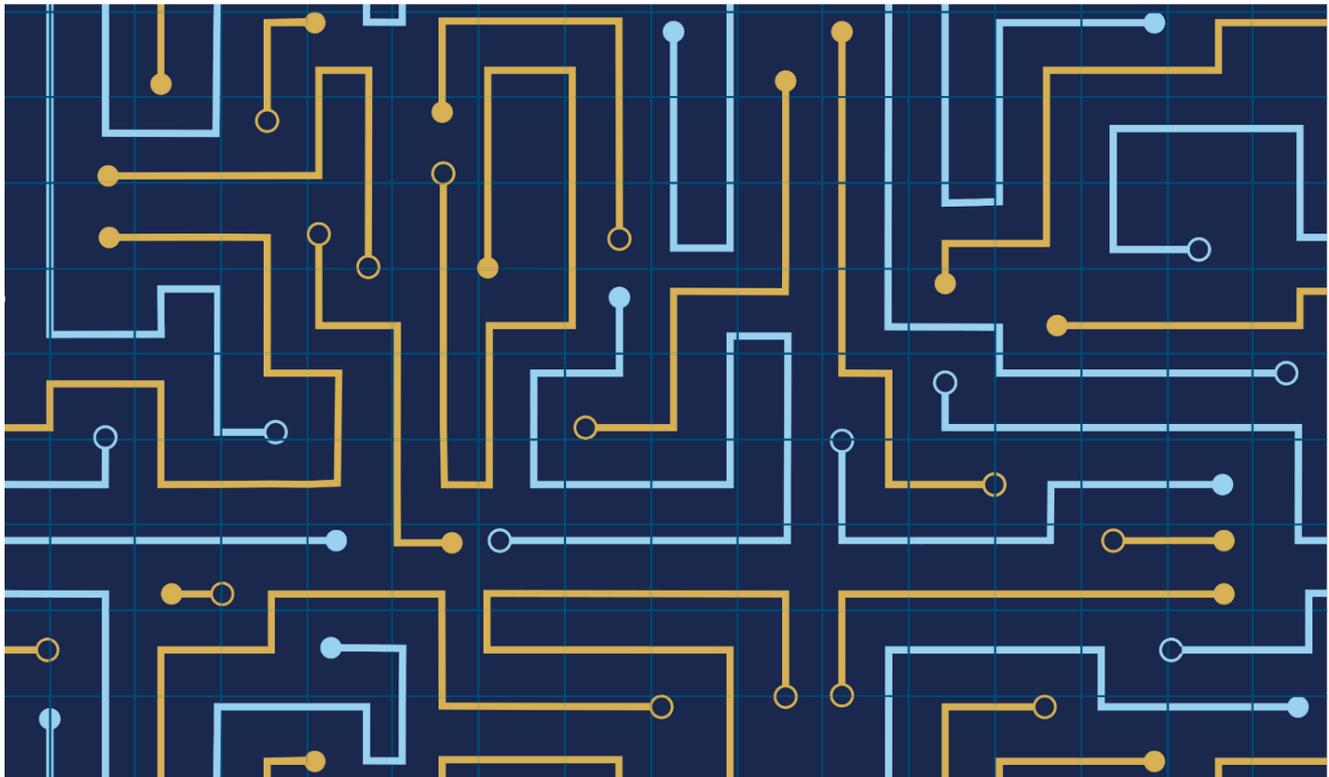
You have the fastest robot or the best construction, or outstanding design?

This is your place!

Rules of the competition - 2025

1. Organizers

- The competition is organized by the Kandó Kálmán College of Electrical Engineering.
- The main sponsor of the competition is *Robert Bosch Ltd.*

2. The goal of the competition

- The goal of the competition is for the robot to solve the maze as fast as possible from the starting point.
- The robot has several modes to orientate itself, which will be detailed later.
- Other than speed, the robots will be evaluated in the Design category, that includes the plans, the appearance and the construction of the robot.

3. Professional Evaluation Committee

- The members of the Professional Evaluation Committee are:
    - Representatives of the Kandó Kálmán College of Electrical Engineering
    - Representatives of Robert Bosch Ltd.
    - Representatives of the Kandó Kálmán Faculty of Electrical Engineering
    - Other invited guests.

4. Teams

- The competition is open to students of Óbuda University, secondary school students and Hungarian students from abroad (Timisoara). *Team members must be university or high school students.*
- Suggested number of teams: *3 persons* - Any changes are subject to the approval of the organizers.

5. Prizes, award categories

- All members of the teams that win a place or an award will receive a certificate.

- Prizes and/or vouchers will be awarded to each team.

- Categories:
  - o Overall category:
    - 1st place
    - 2nd place
    - 3rd place
  - o Design and construction:
    - Mechanical Engineering Special Prize
    - Embedded Systems Special Prize
    - Innovation "Green" Award
  - o SPRINT

- The competition organizers reserve the right to change the categories listed.

6. Vehicle

- The robot cannot be larger in any direction than the hallways of the course (280x280x150mm).

- To construct the vehicle, the parts listed in *Appendix III* can be used, complemented by smaller fastening and miscellaneous parts.

- The extra (not listed in the file) bigger parts (motor, sensors, battery, camera etc.) cannot cost more than 25000 Ft combined.

- The robot, during the competition, can only move autonomously on the course, every kind of remote control is forbidden. During the completion of the course, every kind of wireless communication between robots and the teams is forbidden.

- The components provided by Bosch and the robots built from them are the property of the university.

7. Orientation

- Both the RFID cards and the pictograms carry the information about which way the robot should go, START and STOP positions and if the robot is in a dead-end.
- There are two ways for the robots to orientate themselves:
  - RFID tags
  - Pictograms – image processing
- The robots can navigate the course without using either the RFID tags or the pictograms (other than START and STOP), but the result could be slower.

8. Registration

Application link: **https://kando-szakkoli.uni-obuda.hu/labirintusverseny/**

The parts are the property of the university (OU) and must be returned after the race!

9. *Course*

- The course is a 480x480cm square, with changeable elements, to create different labyrinths.
- The labyrinth will be redesigned between rounds, but will be left unchanged during rounds, so every team will have the same environment.
- Exact parameters: The walls are 15cm tall, 15mm thick, so the hallways of the course are 28,5±1cm wide.
- Material: OSB

balra tartás: 167 lépés
ajánlott 47 lépés
jobbra tartás: 100 lépés
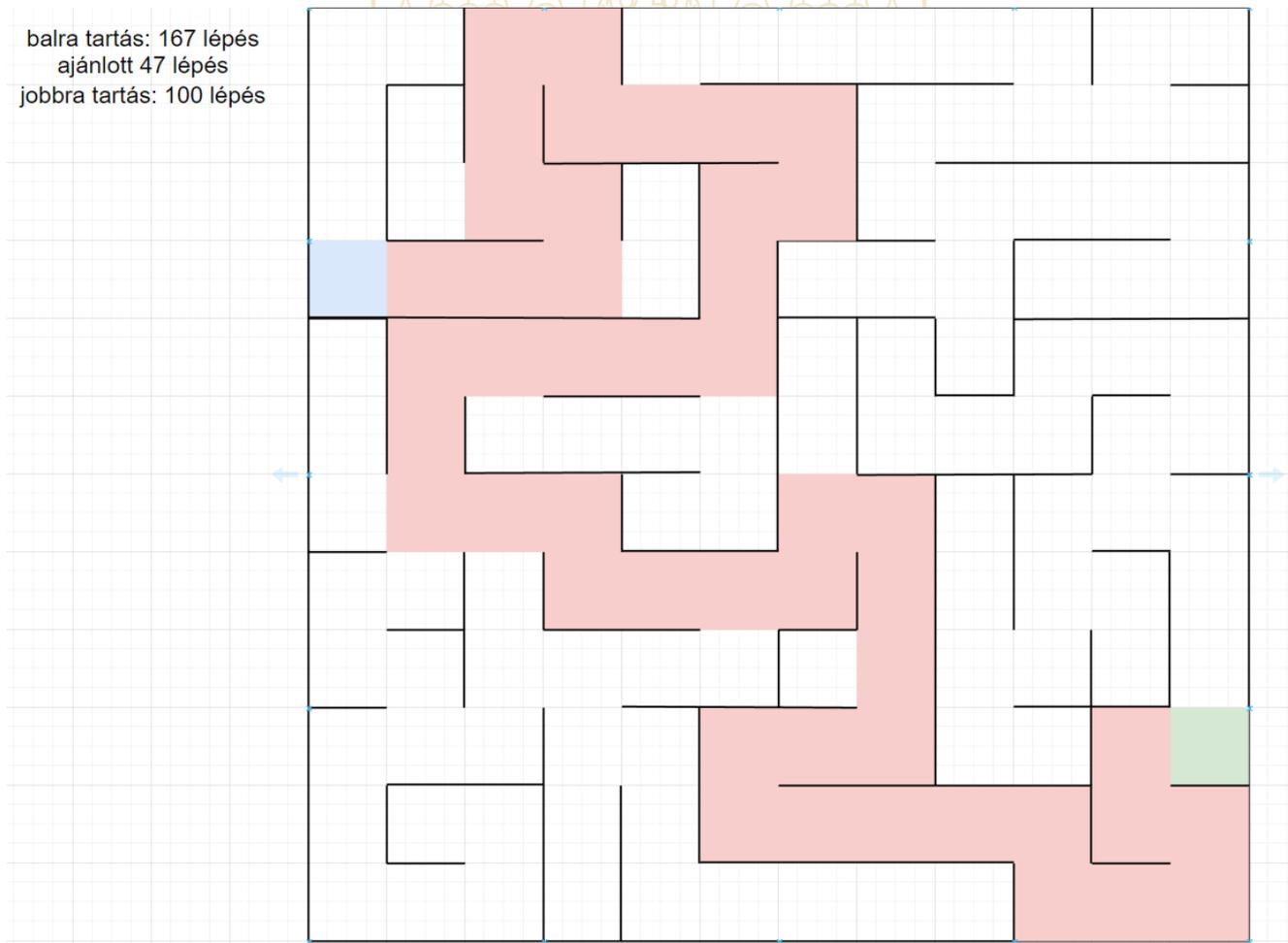
1. Figure -Course with example route, without RFID or pictograms

10. Orientation

- During the rounds, in every point where the robot has to make a turn to follow the shortest path, there will be a pictogram and an RFIG tag.
- The road signs (both pictograms and RFID tags) will be placed on the floor.
- The signs will have the following meaning:
  - START

    - Marks the start of the course.
  - STOP

    - Marks the end, the goal of the course.
  - Dead end


    - You can only go backwards.
  - Right

   - The vehicle must make a right turn.
  - Left

    - The vehicle must make a left turn.
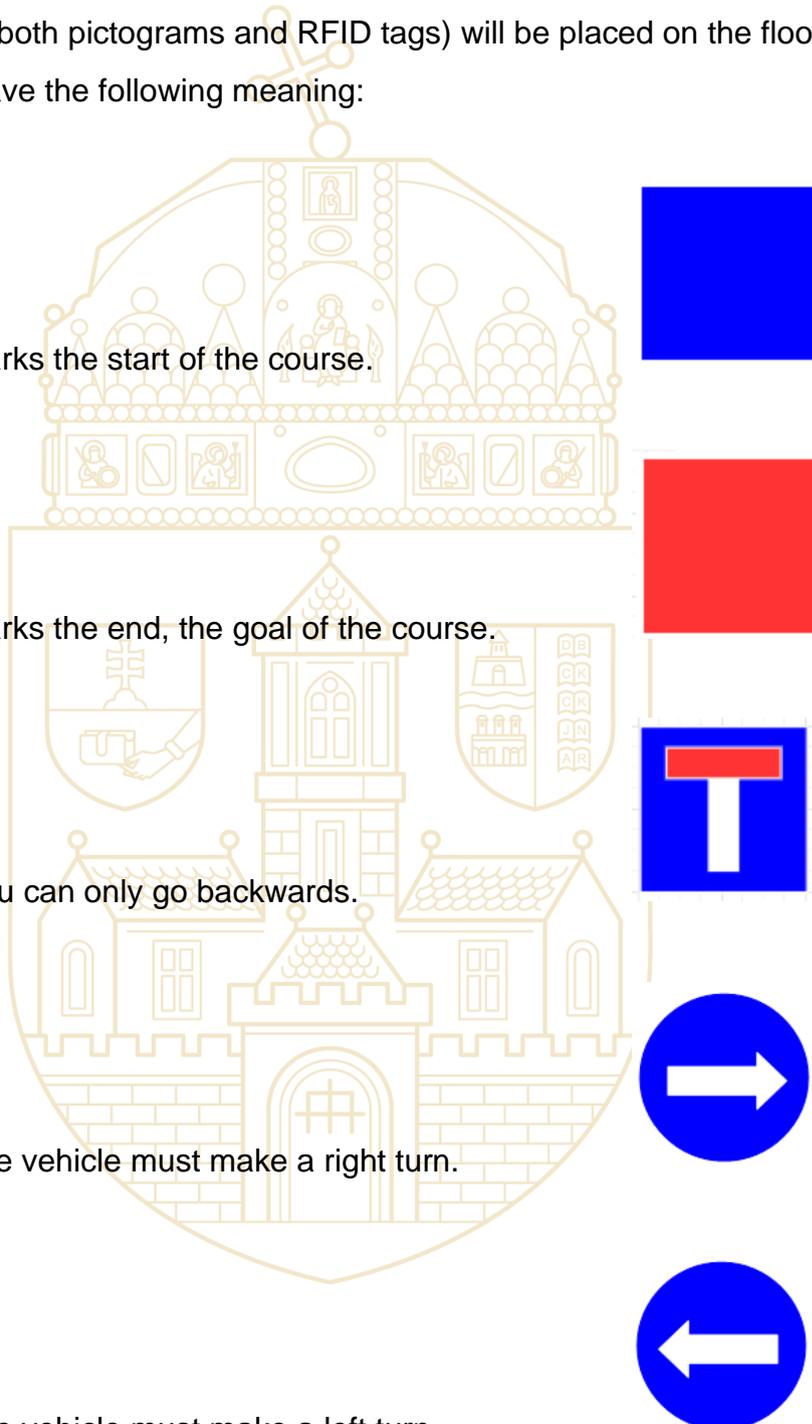
- If there is an intersection, but the vehicle does not have to turn in order to stay on the shortest path, there will be no road signs placed.

- Each team will have the opportunity to complete the course 2x2 times and the better time will be taken into account.

- In the first round, each team will be allowed to run the course 2 times. After that, during the break, there is the possibility to make minimal changes to the robots. In the second round, teams will also have 2 opportunities.

balra tartás: 167 lépés
ajánlott 47 lépés
jobbra tartás: 100 lépés
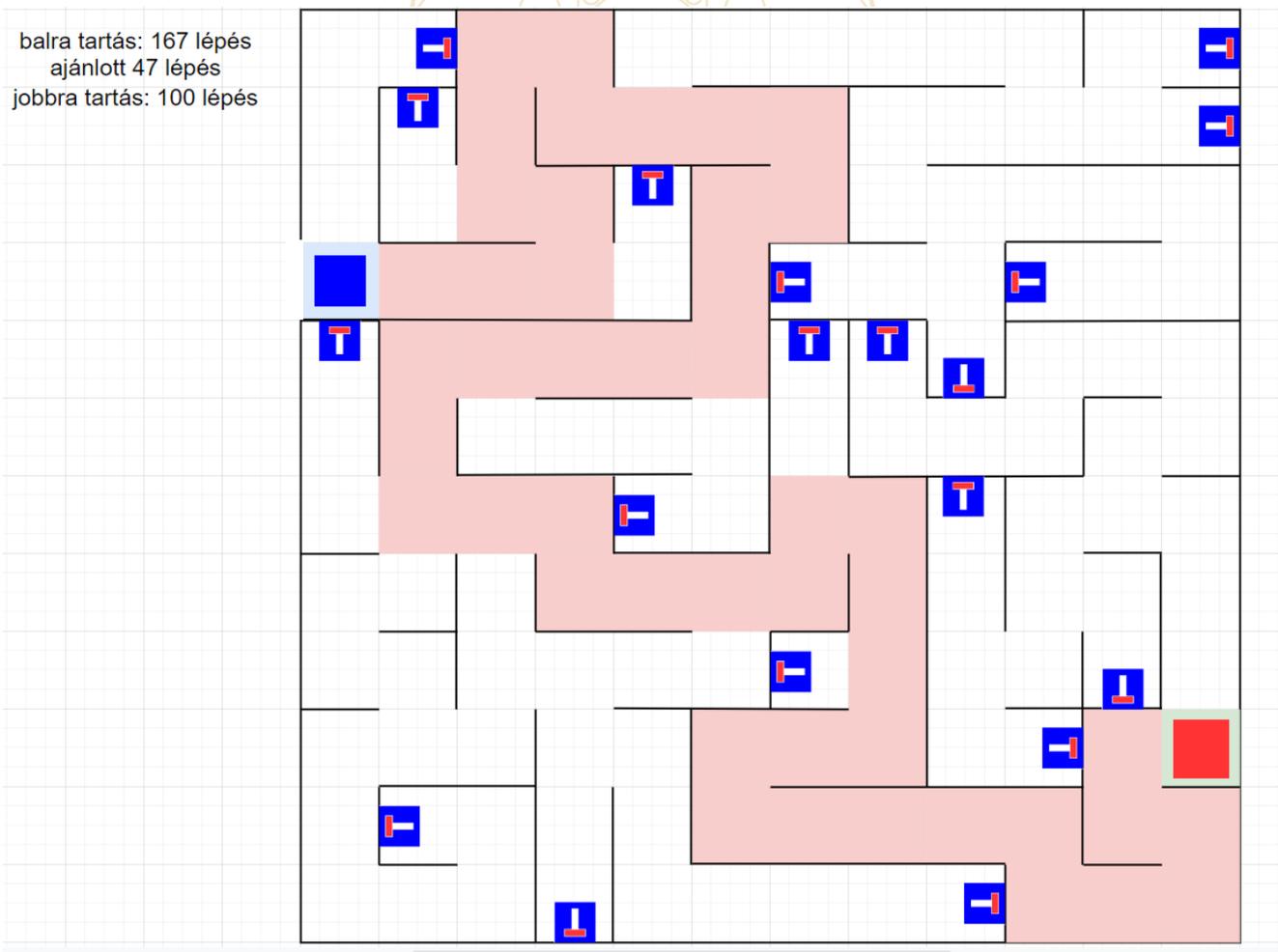
2. Figure - START, STOP, dead ends marked on a possible course
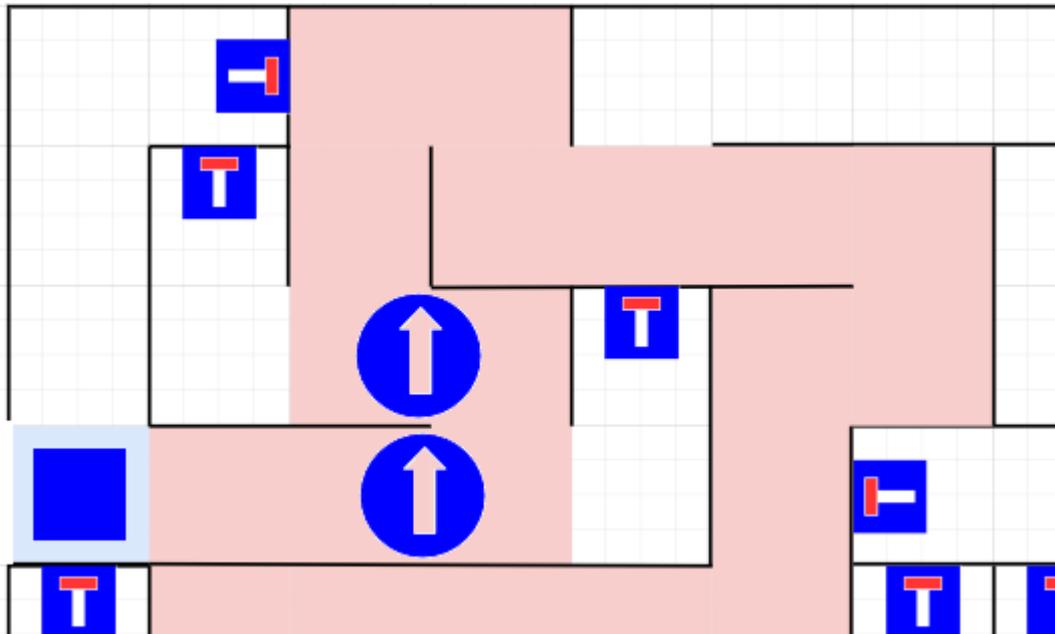
3. Figure -1st round example

- • - Based on the results of the teams, the organisers reserve the right to provide extra assistance to the teams

11. *Extra event*

- • As from last year, at the end of the rounds, teams will have the possibility to have their robots competing in the SPRINT category.

- • The extra event consists of a long, straight part of the course that the robot has to complete as quickly as possible.

- • SPRINT course parameters:
    - o 16 blocks long
    - o 1 block wide

- • Scoring criteria:
    - o Speed
    - o Wall tracking distance (How far does it go straight?)

- • Number of opportunities to try: 2 (minimum)

12. *Miscellaneous information, rules*

- It is forbidden to damage the course.
- It is forbidden to pass over the walls of the labyrinth.
- It is forbidden to damage the other teams' robots and sabotage the competition.
- Every team is responsible for their own robot, the organizers are not liable for any damage, failure or malfunction.
- Take extra care to obey the fire-, health and safety rules.
- Please obey the basic behavioral norms.

*Budapest, 11/20/2024*

Good luck!

Organizers

APPENDICES

APPENDIX I. - RFID TAGS

Size of TAGs: 2.5x2.5cm

Design of TAGs: Circular RFID sticker

Placement of pictograms: on the floor, before an intersection.
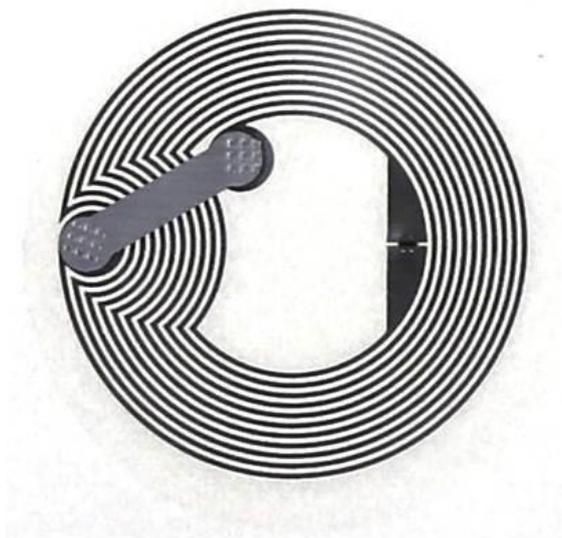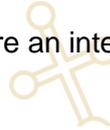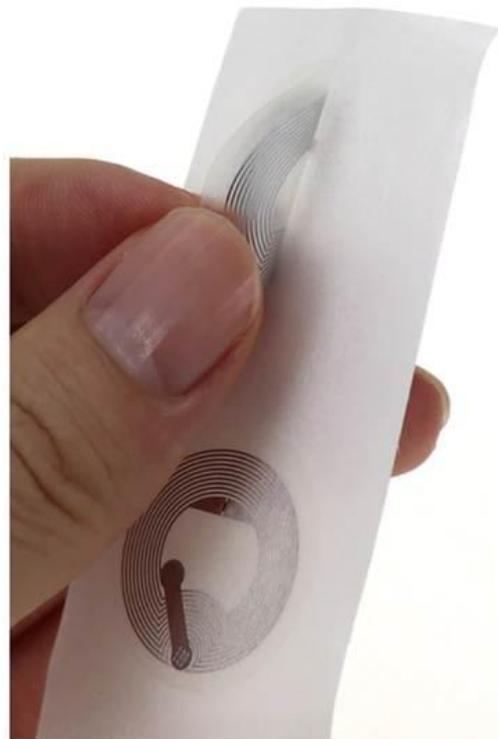
4. Figure- RFID tag

RFID tag information

- START
    - Indicates the starting point of the course.
- STOP
    - Indicates the end of the course.
- Dead end
    - You can only go backwards.
- Right
    - The vehicle should turn right.
- Left
    - The vehicle should turn left.

1. Table - START UIDs

START	UID	BC C0 - BC C4
		BC C0 - BC C4
1	04 **BC C0** 1A 2F 15 90	
2	04 **BC C1** 1A 2F 15 90	
3	04 **BC C2** 1A 2F 15 90	
4	04 **BC C3** 1A 2F 15 90	
5	04 **BC C4** 1A 2F 15 90	

2. Table - STOP UIDs

STOP	UID	BC 52 - BC 56
		BC 52 - BC 56
1	04 **BC 52** 1A 2F 15 90	
2	04 **BC 53** 1A 2F 15 90	
3	04 **BC 54** 1A 2F 15 90	
4	04 **BC 55** 1A 2F 15 90	
5	04 **BC 56** 1A 2F 15 90	

3. Table - Dead end UID-s

DEAD END	UID	BD D1 - BD FF
		BD D1 - BD DF
1	04 **BD D1** 1A 2F 15 90	
2	04 **BD D2** 1A 2F 15 90	
3	04 **BD D3** 1A 2F 15 90	
4	04 **BD D4** 1A 2F 15 90	
5	04 **BD D5** 1A 2F 15 90	
6	04 **BD D6** 1A 2F 15 90	
7	04 **BD D7** 1A 2F 15 90	
8	04 **BD D8** 1A 2F 15 90	
9	04 **BD D9** 1A 2F 15 90	
10	04 **BD DA** 1A 2F 15 90	
11	04 **BD DB** 1A 2F 15 90	
12	04 **BD DC** 1A 2F 15 90	
13	04 **BD DD** 1A 2F 15 90	
14	04 **BD DE** 1A 2F 15 90	
15	04 **BD DF** 1A 2F 15 90	
		BD E0 - BD EF
1	04 **BD E0** 1A 2F 15 90	
2	04 **BD E1** 1A 2F 15 90	
3	04 **BD E2** 1A 2F 15 90	
4	04 **BD E3** 1A 2F 15 90	
5	04 **BD E4** 1A 2F 15 90	
6	04 **BD E5** 1A 2F 15 90	
7	04 **BD E6** 1A 2F 15 90	
8	04 **BD E7** 1A 2F 15 90	
9	04 **BD E8** 1A 2F 15 90	
10	04 **BD E9** 1A 2F 15 90	
11	04 **BD EA** 1A 2F 15 90	
12	04 **BD EB** 1A 2F 15 90	
13	04 **BD EC** 1A 2F 15 90	
14	04 **BD ED** 1A 2F 15 90	
15	04 **BD EE** 1A 2F 15 90	
16	04 **BD EF** 1A 2F 15 90	
		BD F0 - BD FF
1	04 **BD F0** 1A 2F 15 90	
2	04 **BD F1** 1A 2F 15 90	
3	04 **BD F2** 1A 2F 15 90	
4	04 **BD F3** 1A 2F 15 90	
5	04 **BD F4** 1A 2F 15 90	
6	04 **BD F5** 1A 2F 15 90	
7	04 **BD F6** 1A 2F 15 90	
8	04 **BD F7** 1A 2F 15 90	
9	04 **BD F8** 1A 2F 15 90	
10	04 **BD F9** 1A 2F 15 90	
11	04 **BD FA** 1A 2F 15 90	
12	04 **BD FB** 1A 2F 15 90	
13	04 **BD FC** 1A 2F 15 90	
14	04 **BD FD** 1A 2F 15 90	
15	04 **BD FE** 1A 2F 15 90	
16	04 **BD FF** 1A 2F 15 90	

4. Table - Right UIDs

RIGHT	UID	BC F0 - BC FF
		BC F0 - BC FF
1	04 **BC F0** 1A 2F 15 90	
2	04 **BC F1** 1A 2F 15 90	
3	04 **BC F2** 1A 2F 15 90	
4	04 **BC F3** 1A 2F 15 90	
5	04 **BC F4** 1A 2F 15 90	
6	04 **BC F5** 1A 2F 15 90	
7	04 **BC F6** 1A 2F 15 90	
8	04 **BC F7** 1A 2F 15 90	
9	04 **BC F8** 1A 2F 15 90	
10	04 **BC F9** 1A 2F 15 90	
11	04 **BC FA** 1A 2F 15 90	
12	04 **BC FB** 1A 2F 15 90	
13	04 **BC FC** 1A 2F 15 90	
14	04 **BC FD** 1A 2F 15 90	
15	04 **BC FE** 1A 2F 15 90	
16	04 **BC FF** 1A 2F 15 90	

5. Table - Left UIDs

LEFT	UID	BC 00 - BC 0F (94)
		BC 00 - BC 0F (94)
1	04 **BC 00** 1A 2F 15 **94**	
2	04 **BC 01** 1A 2F 15 **94**	
3	04 **BC 02** 1A 2F 15 **94**	
4	04 **BC 03** 1A 2F 15 **94**	
5	04 **BC 04** 1A 2F 15 **94**	
6	04 **BC 05** 1A 2F 15 **94**	
7	04 **BC 06** 1A 2F 15 **94**	
8	04 **BC 07** 1A 2F 15 **94**	
9	04 **BC 08** 1A 2F 15 **94**	
10	04 **BC 09** 1A 2F 15 **94**	
11	04 **BC 0A** 1A 2F 15 **94**	
12	04 **BC 0B** 1A 2F 15 **94**	
13	04 **BC 0C** 1A 2F 15 **94**	
14	04 **BC 0D** 1A 2F 15 **94**	
15	04 **BC 0E** 1A 2F 15 **94**	
16	04 **BC 0F** 1A 2F 15 **94**	

APPENDIX II. - PICTOGRAMS

Size of pictograms: 5x5cm

Placement of pictograms: on the floor, before an intersection.

- o START

  - Indicates the starting point of the course.
- o STOP

  - Indicates the end of the course.
- o Dead end

  - You can only go backwards.
- o Right

  - The vehicle should turn right.
- o Left

  - The vehicle should turn left.
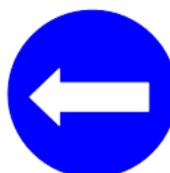
5. Figure – Start

6. Figure – Stop
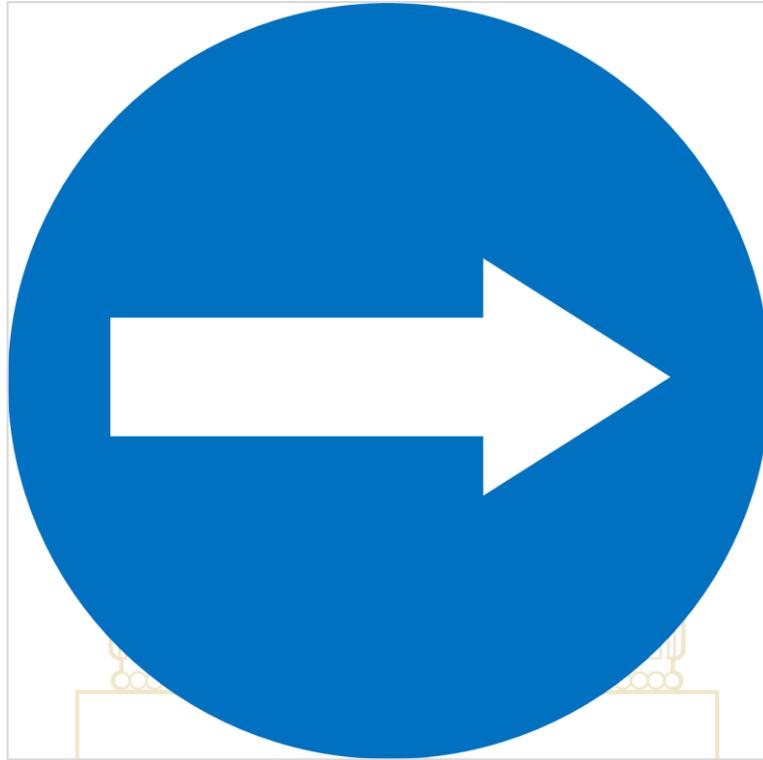
7. Figure – Right
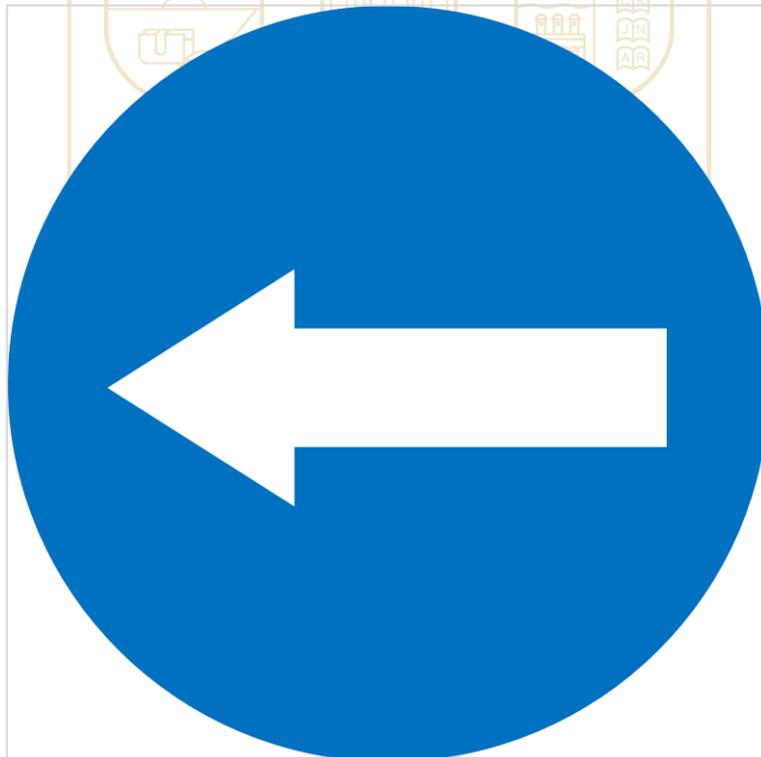
8. Figure – Left
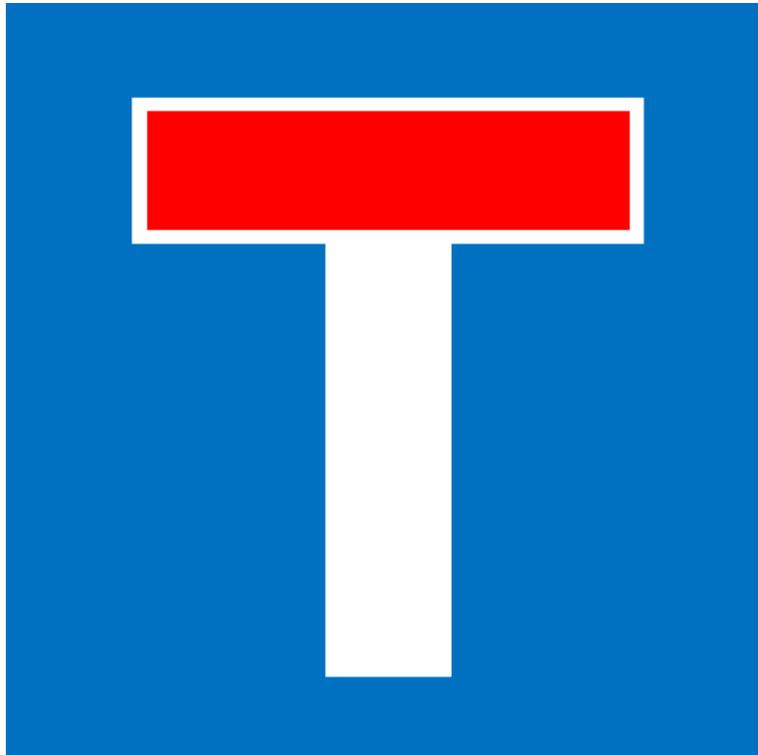
9. Figure – Dead end
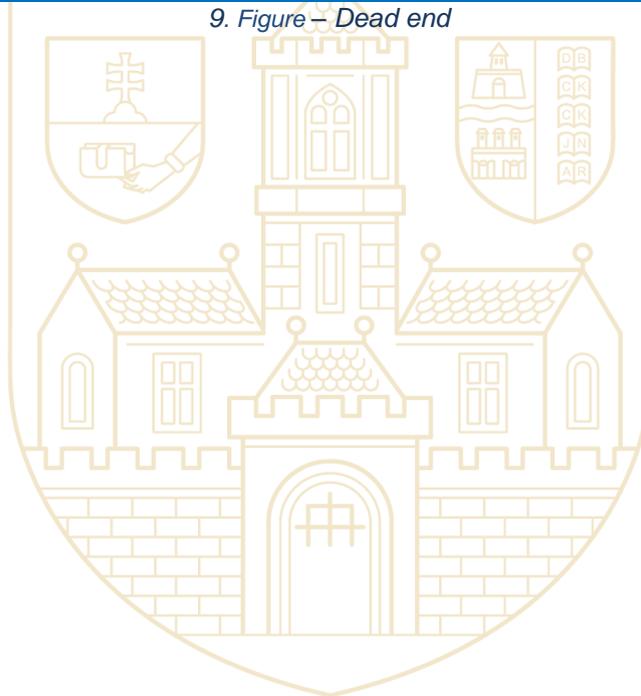
APPENDIX III. - PARTS BASE

PARTS					
Category	**Name**	**DB[1]**	**Link Hestore**	**Link ElektRobot**	**Comment**
Developer Board	Arduino UNO	1	link	link	Everyone
Developer Board	Arduino NANO		link	link	Optional
Developer Board	NodeMCU		link	x	Optional
Developer Board	ESP32-CAM		link	link	Optional
Robot platform	Robot platform, 2wd		link	link	One to be selected
Robot platform	Circular robot platform, 2 wheels, 2 motors	1	x	link	One to be selected
Omniwheel	Mecanum Wheel 60mm Y - *új*		link	link	Optional
Motor Controller	H-Bridge driver, max 2A	1	link	link	Recommended
Motor Controller	Arduino Shield, motor control	1	link	link	Optional
Encoder/Opto/Gyro	Opto LM393: HC-89-5		link	x	One to be selected
Encoder/Opto/Gyro	Optocoupler Motor Speed Measuring Counter Sensor Module Slot-type	2	x	link	One to be selected
Encoder/Opto/Gyro	MPU6050 gyroscope (6DOF): GY-521		link	link	Optional
RFID reader	RC522-MFRC	1	link	link	Everyone
RFID TAG	NTAG213-STCK27	3	link	x	3pcs per team
Distance meter	UH distance meter - HC-SR04-4P	4	link	link	Recommended quantity
Distance meter	IR distance meter	3	link	link	Recommended quantity
Distance meter	IR distance meter, 2-15 cm		link	x	Optional
Distance meter	IR distance meter, 4-30 cm		link	x	Optional
Supply	Battery - NCR18650B	3	link	x	3pcs per team
Supply	Battery holder - 2 X 18650 W	1	link	link	1pcs per team
Supply	Charger module- TP4056-1A-USBC	1	link	link	Recommended
Supply	Battery charger- XTAR-18650	1	link	x	Optional
Prototype panels	Breadboard - BB-005-S	2	link	link	Everyone
Prototype panels	Arduino Prototype panel	1	link	link	Everyone
Prototype panels	Universal PCB - DPCB-57	1	link	link	Everyone
Supplements	Power module - XL6009-STEPUP	1	link	link	Recommended
Other	Jumper - RC-40-20/MF	1	link	link	Everyone
Other	Jumper - RC-40-20/MM	1	link	link	Everyone
Other	Jumper - RC-40-20/FF	1	link	link	Everyone
Other	Switch - KCD1-101	1	link	x	Recommended

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[1] Javasolt darabszám. Tervek alapján ettől el lehet térni. A beszerzéskor figyelembe vesszük az igényeket, de törekszünk az egyenlő feltételekre.

APPENDIX IV. – DECLARATION

I, ... (name), representing the team ...., declare that I have received the III Labyrinth Competition parts package and will return it to the Kandó Kálmán College of Electrical Engineering after the competition.

No	Part Category	Part Name	☑
Part list			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
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9.			
10.			
11.			
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16.			
17.			
18.			
19.			
20.			

Budapest, 2025. ....(month)......(day)

Name   Name

Signature   Signature