Életre tervezve

BOSCH

Labyrinth Competition
„Mobile robots in the labyrinth"

Date: 26 April 2024.
Location: ÓE-KVK Tavaszmező 14–18., Building G Zsibongó

Robert Bosch Ltd, the Kandó Kálmán Faculty of Electrical Engineering, the Bánki Donát Faculty of Mechanical and Safety Engineering, the Neumann János Faculty of Informatics and the Kandó Kálmán Special College of Advanced Studyes 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 BÁNKI NiK

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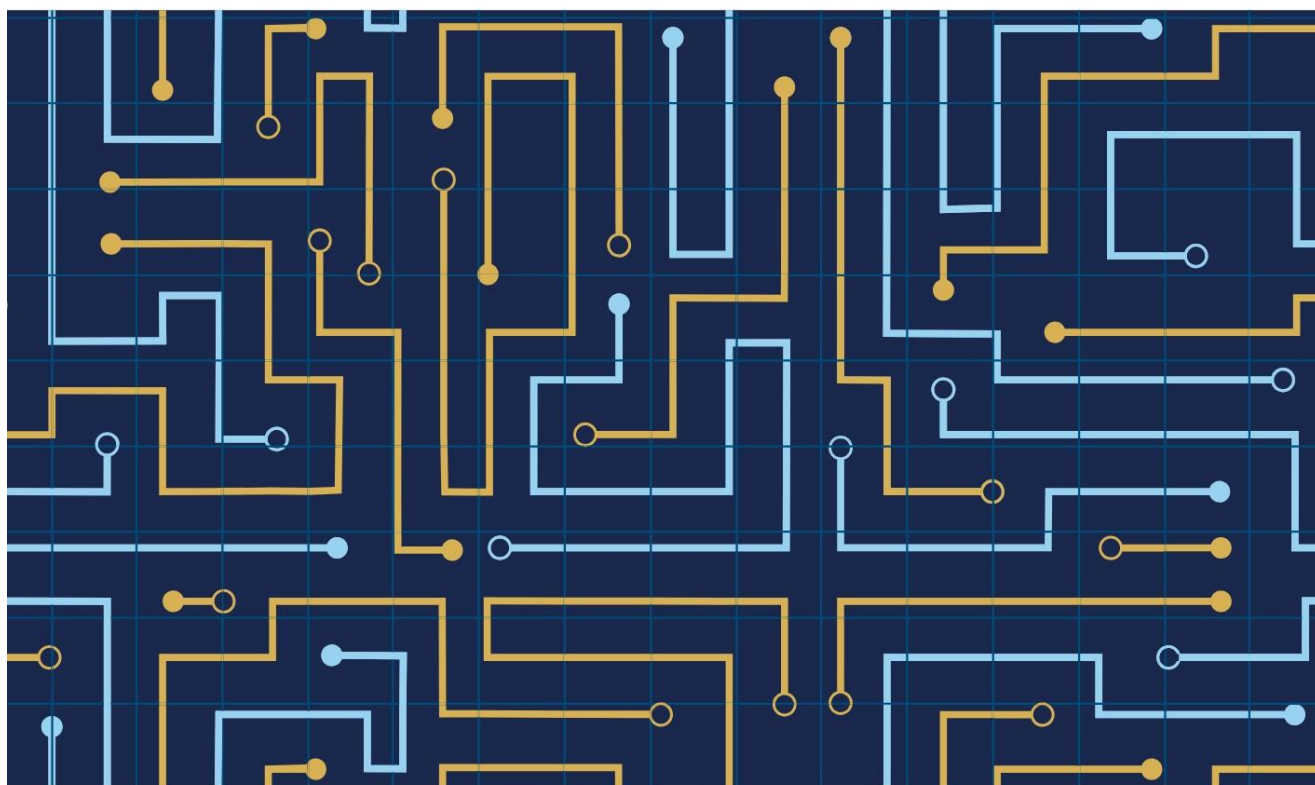
You have the fastest robot
or the best construction,
or outstanding design?

This is your place!

Rules of the competition - 2024

1. 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.

2. 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.

3. 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.

4. 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
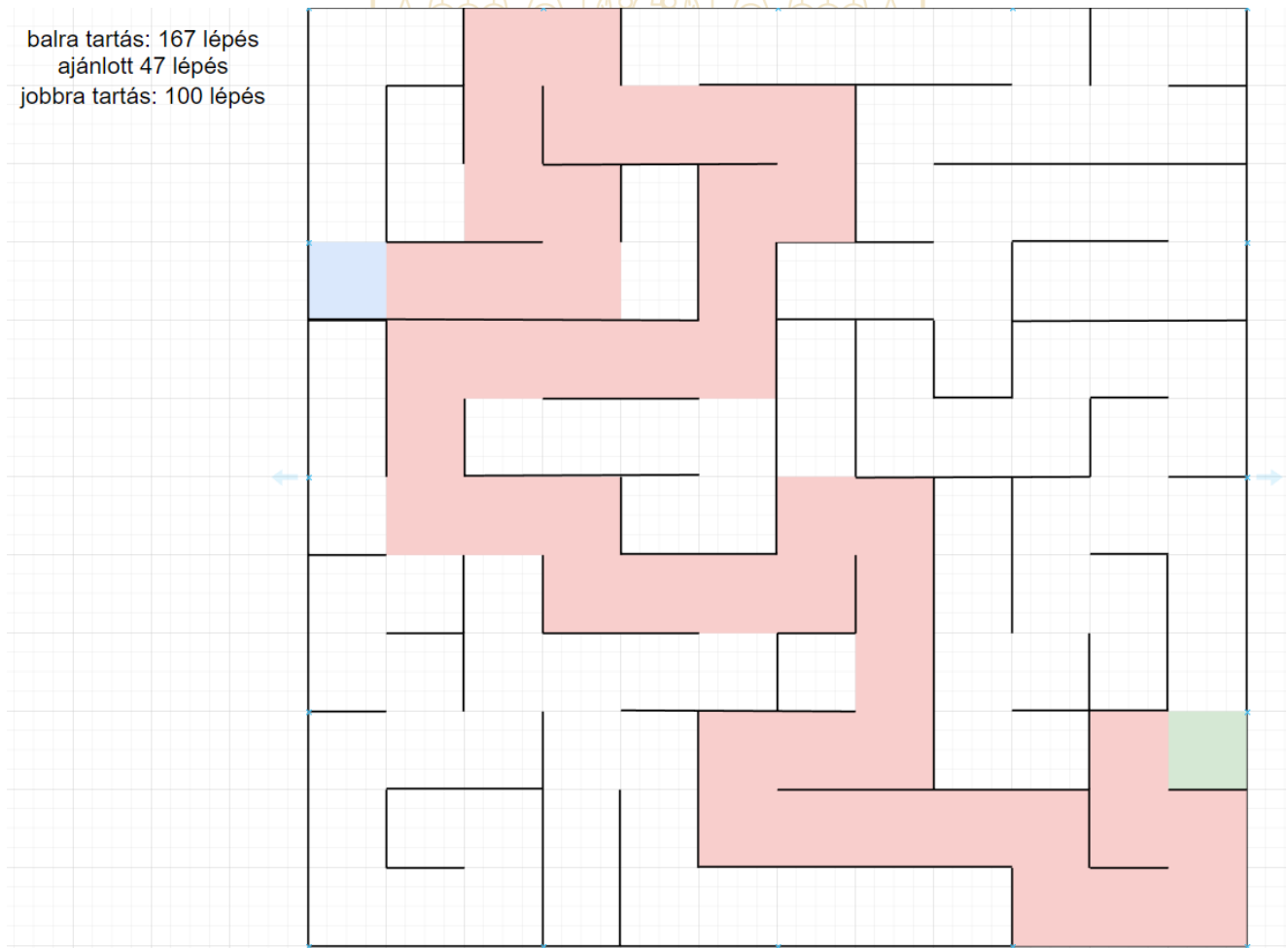
1. Figure -Course with example route, without RFID or pictograms

5. Orientation – round 1

- During the 1st round, 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

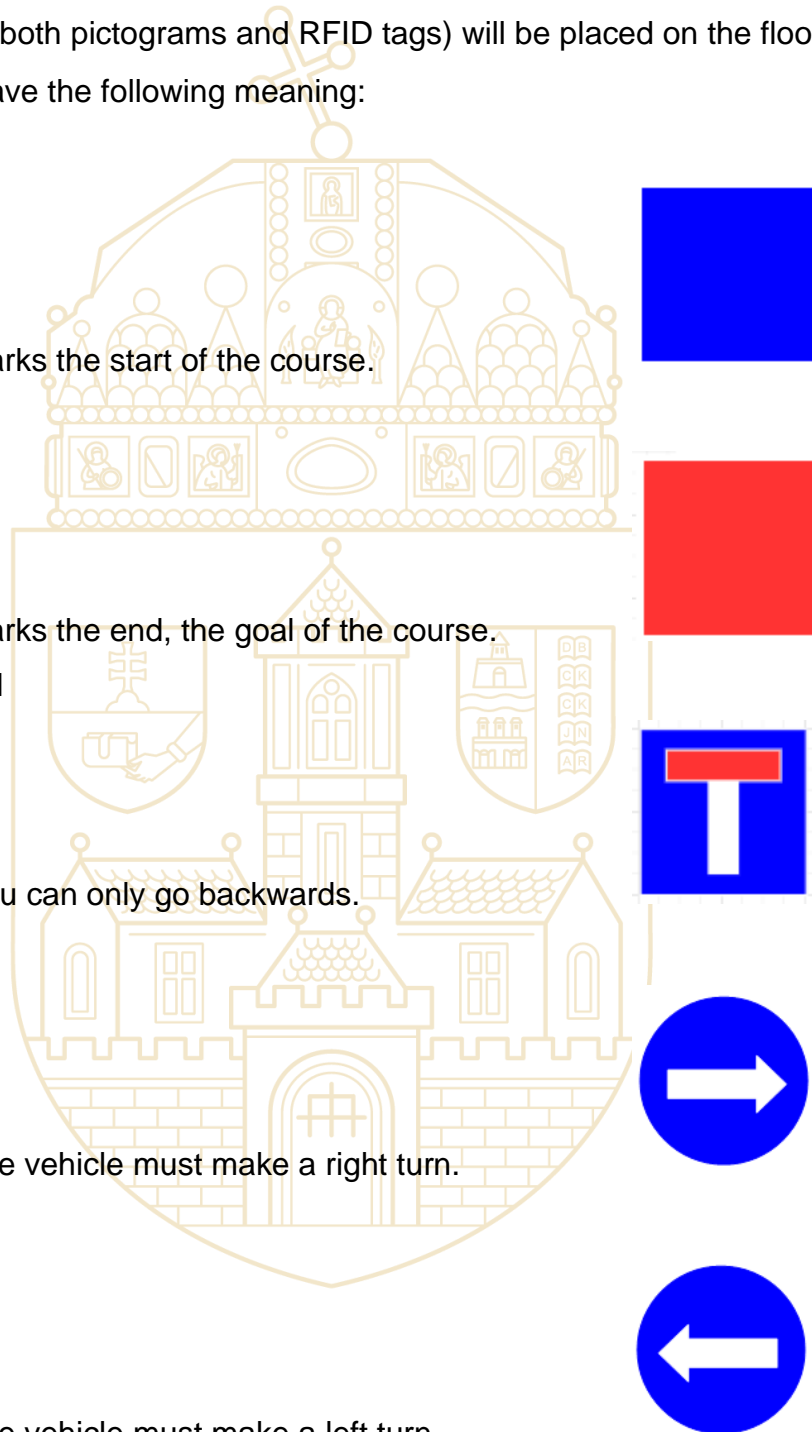   - You can only go backwards.
  - Right

    - 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
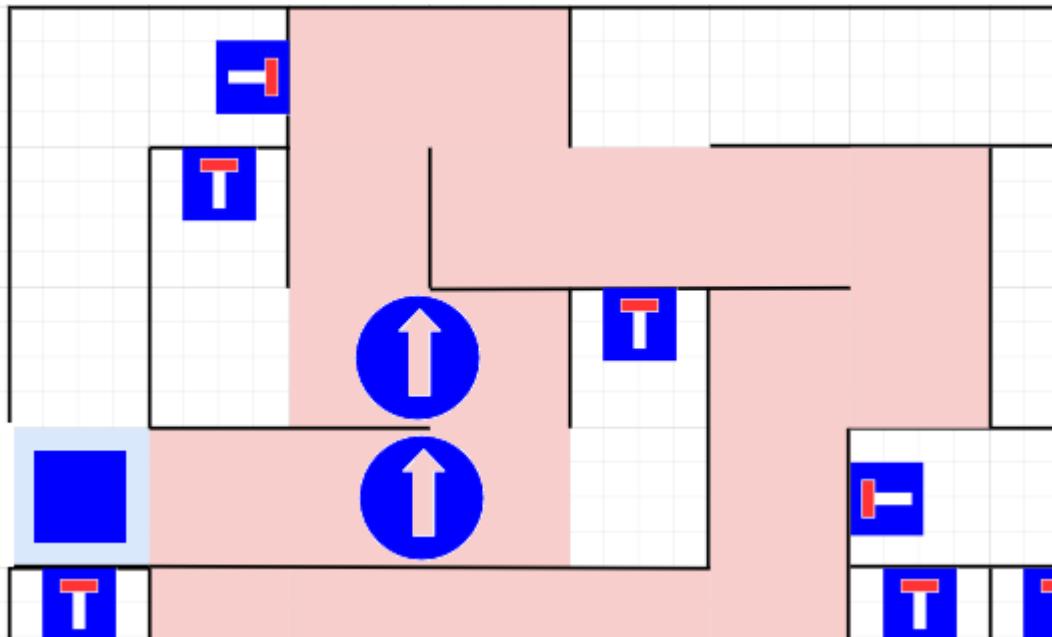
shortest path, there will be no road signs placed.

- Those teams, that can complete the course according to the rules of the 1st round, can advance to the 2nd round.

- Every team will have 2 tries and the better time will be taken into account.

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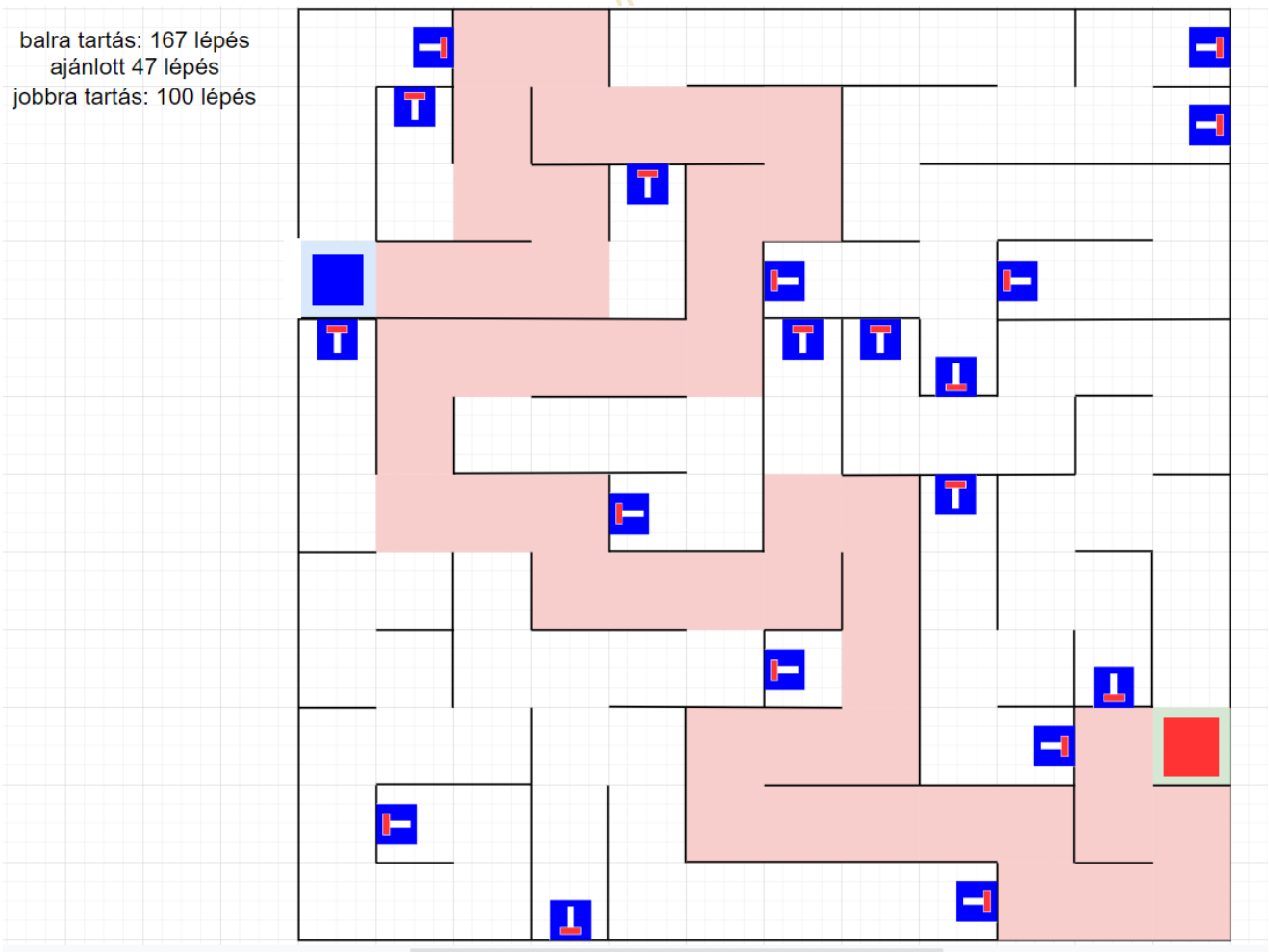
2. Figure - START, STOP, dead ends marked on a possible course

3. Figure -1ˢᵗ round example

6. Orientation – Round 2

- In the 2nd round, the signs carry complex information. These signs will show 3-4 turns.
- The signs (both RFID tags and pictograms) will be placed on the floor.
- The signs will carry the following information:
  - START
    - The starting position of the course.
  - STOP
    - The end, the goal of the course.
  - Dead end
    - Marks a section, where you can only go backwards.
  - Complex 1

    - Forwards, right, right, left
  - Complex 2

    - Forwards, left, left, right
  - Complex 3
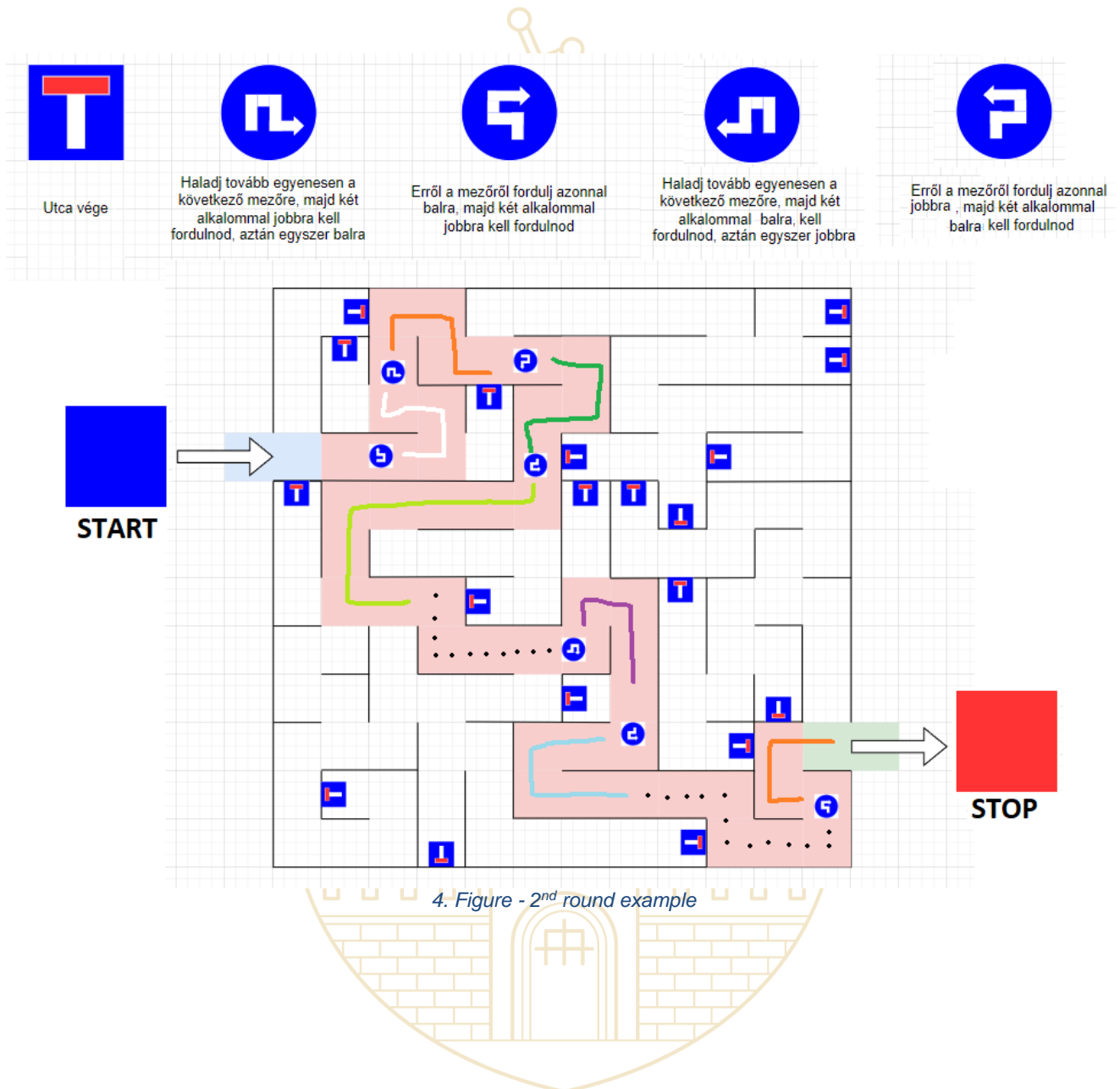
    - Left, right, right
  - Complex 4

    - Right, left, left

- In case if there is another intersection, but the robot should not turn in order to follow the shortest path, there will be no sign placed there.

- Every team will have 2 tries, and the better time will be taken into account.
- Those who cannot complete the 2nd round, will be able to participate in a new competition on the course of the 1st round.

|				
Utca vége	Haladj tovább egyenesen a következő mezőre, majd két alkalommal jobbra kell fordulnod, aztán egyszer balra	Erről a mezőről fordulj azonnal balra, majd két alkalommal jobbra kell fordulnod	Haladj tovább egyenesen a következő mezőre, majd két alkalommal balra, kell fordulnod, aztán egyszer jobbra	Erről a mezőről fordulj azonnal jobbra , majd két alkalommal balra kell fordulnod

4. Figure - 2nd round example

7. 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.
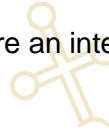- Please obey the basic behavioral norms.
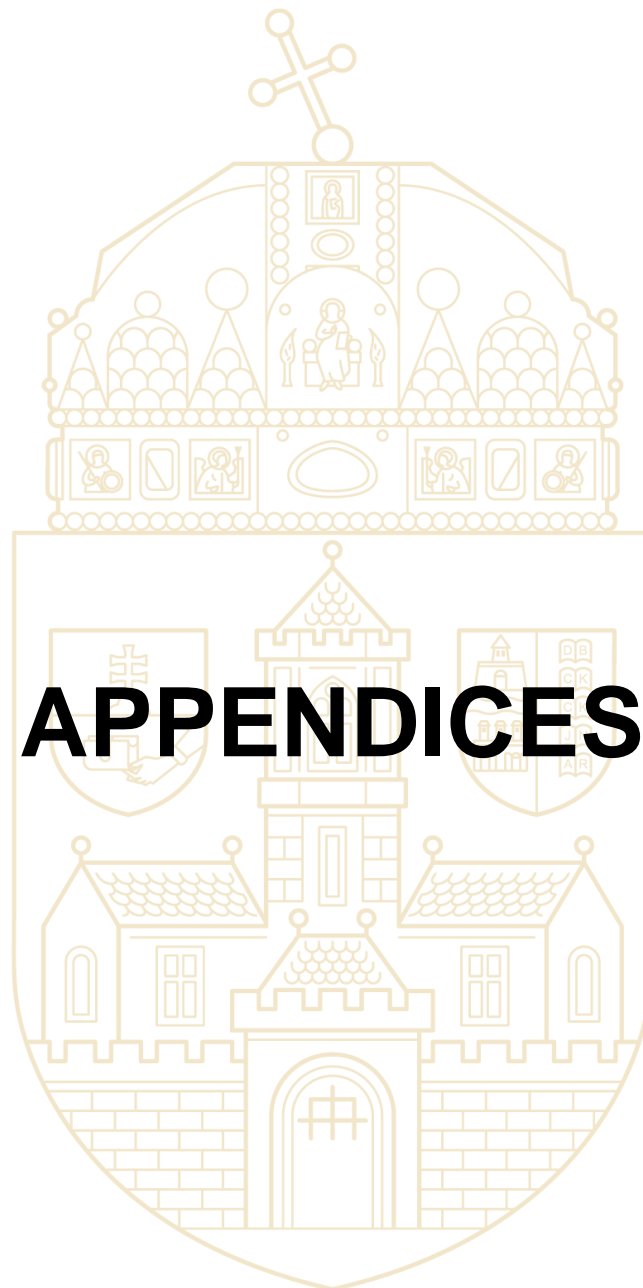
APPENDICES

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.

25mm

5. Figure- RFID tag

Level-1

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

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**	

Level-2

- 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 Complex 1
    - Straight, right, right, left. (SRRL)
- o Complex 2
    - Straight, left, left, right. (SLLR)
- o Complex 3
    - Immediately left, right, right. (LRR)
- o Complex 4
    - Immediately right, left, left. (RLL)

6. Table - SRLL UIDs

SRLL	UID	BC 90 - BC 9F
		BC A0 - BC AF
1	04 **BC 90** 1A 2F 15 90	
2	04 **BC 91** 1A 2F 15 90	
3	04 **BC 92** 1A 2F 15 90	
4	04 **BC 93** 1A 2F 15 90	
5	04 **BC 94** 1A 2F 15 90	
6	04 **BC 95** 1A 2F 15 90	
7	04 **BC 96** 1A 2F 15 90	
8	04 **BC 97** 1A 2F 15 90	
9	04 **BC 98** 1A 2F 15 90	
10	04 **BC 99** 1A 2F 15 90	
11	04 **BC 9A** 1A 2F 15 90	
12	04 **BC 9B** 1A 2F 15 90	
13	04 **BC 9C** 1A 2F 15 90	
14	04 **BC 9D** 1A 2F 15 90	
15	04 **BC 9E** 1A 2F 15 90	
16	04 **BC 9F** 1A 2F 15 90	

7. Table – SLLR UIDs

SLLR	UID	BC A0 - BC AF
		BC A0 - BC AF
1	04 **BC A0** 1A 2F 15 90	
2	04 **BC A1** 1A 2F 15 90	
3	04 **BC A2** 1A 2F 15 90	
4	04 **BC A3** 1A 2F 15 90	
5	04 **BC A4** 1A 2F 15 90	
6	04 **BC A5** 1A 2F 15 90	
7	04 **BC A6** 1A 2F 15 90	
8	04 **BC A7** 1A 2F 15 90	
9	04 **BC A8** 1A 2F 15 90	
10	04 **BC A9** 1A 2F 15 90	
11	04 **BC AA** 1A 2F 15 90	
12	04 **BC AB** 1A 2F 15 90	
13	04 **BC AC** 1A 2F 15 90	
14	04 **BC AD** 1A 2F 15 90	
15	04 **BC AE** 1A 2F 15 90	
16	04 **BC AF** 1A 2F 15 90	

8. Table – LRR UIDs

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

9. Táblázat - RLL UIDs

RLL	UID	BD 60 - BD 6F
		BD 60 - BD 6F
1	04 **BD 60** 1A 2F 15 90	
2	04 **BD 61** 1A 2F 15 90	
3	04 **BD 62** 1A 2F 15 90	
4	04 **BD 63** 1A 2F 15 90	
5	04 **BD 64** 1A 2F 15 90	
6	04 **BD 65** 1A 2F 15 90	
7	04 **BD 66** 1A 2F 15 90	
8	04 **BD 67** 1A 2F 15 90	
9	04 **BD 68** 1A 2F 15 90	
10	04 **BD 69** 1A 2F 15 90	
11	04 **BD 6A** 1A 2F 15 90	
12	04 **BD 6B** 1A 2F 15 90	
13	04 **BD 6C** 1A 2F 15 90	
14	04 **BD 6D** 1A 2F 15 90	
15	04 **BD 6E** 1A 2F 15 90	
16	04 **BD 6F** 1A 2F 15 90	

APPENDIX II. - PICTOGRAMS

Size of pictograms: 5x5cm

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

Level-1

- 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

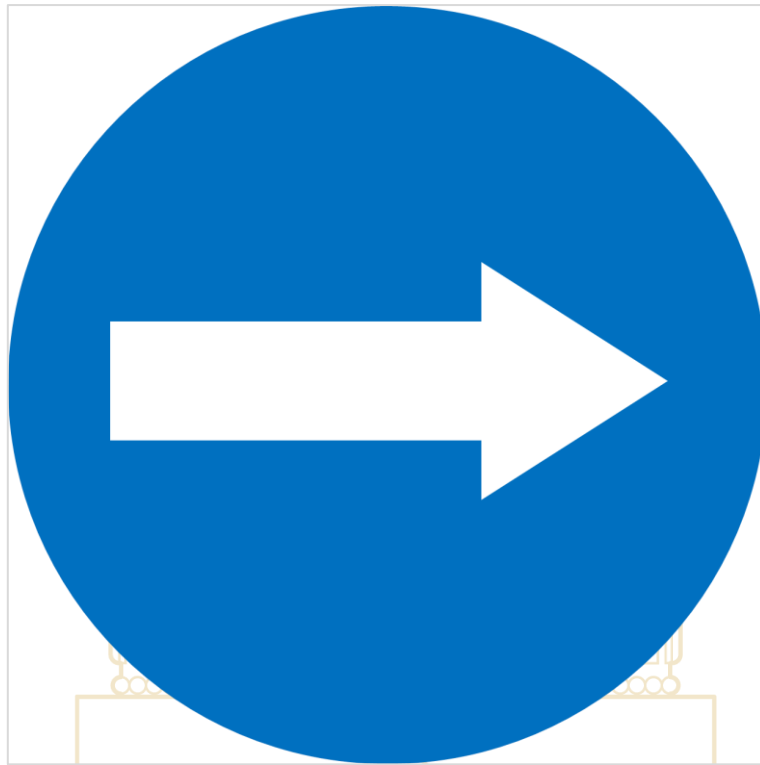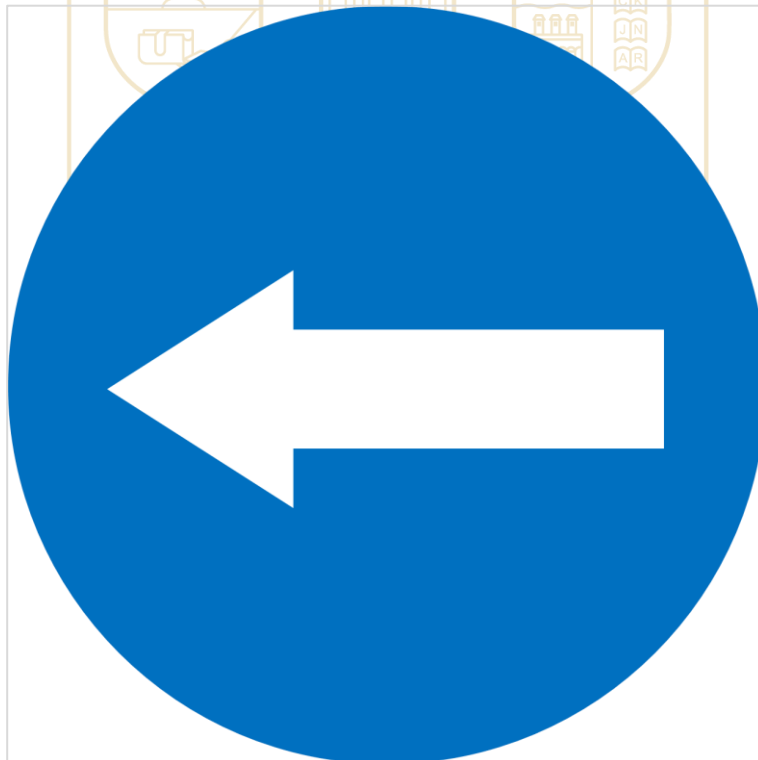 - The vehicle should turn right.
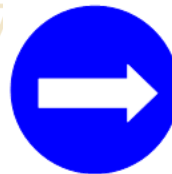
- o Left

  - The vehicle should turn left.

6. Figure – Start

7. Figure – Stop

8. Figure – Right

9. Figure – Left

10. Figure – Dead end

Level-2

- ○ START
  - ■ Indicates the starting point of the course.
- ○ STOP
  - ■ Indicates the end of the course.
- ○ Dead end
  - ■ You can only go backwards.
- ○ Complex 1

  - ■ Straight, right, right, left. (SRRL)
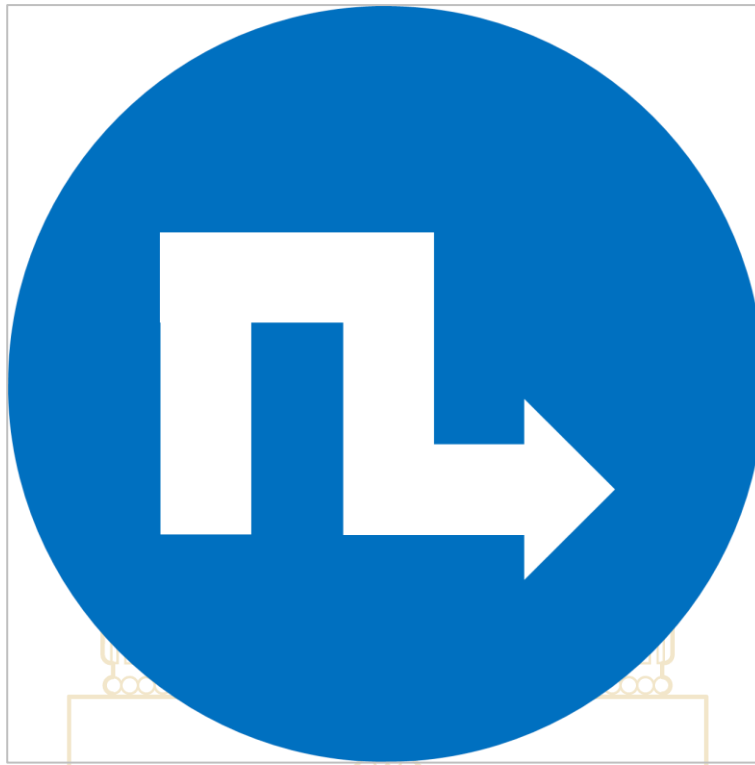- ○ Complex 2

  - ■ Straight, left, left, right. (SLLR)
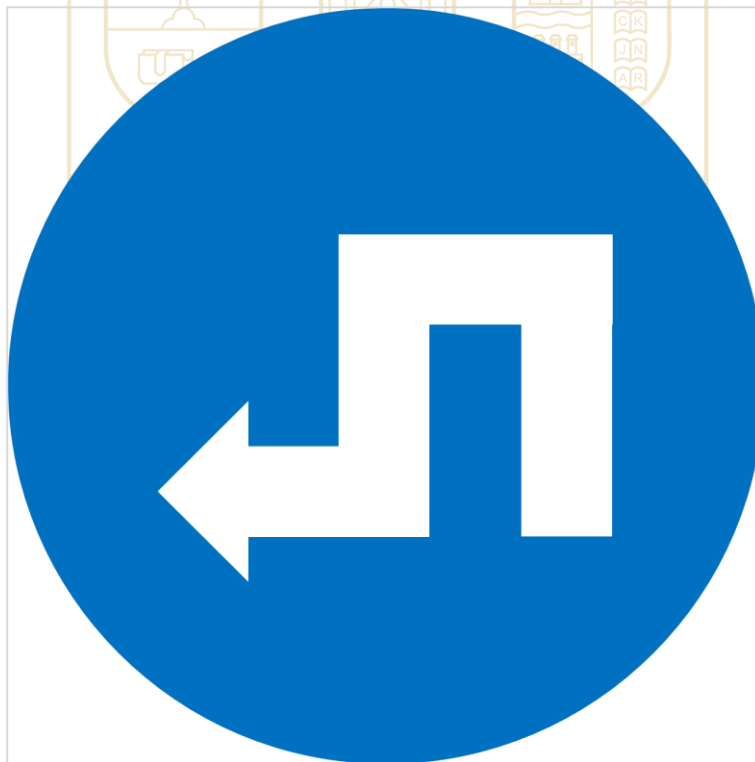- ○ Complex 3

  - ■ Immediately left, right, right. (LRR)
- ○ Complex 4
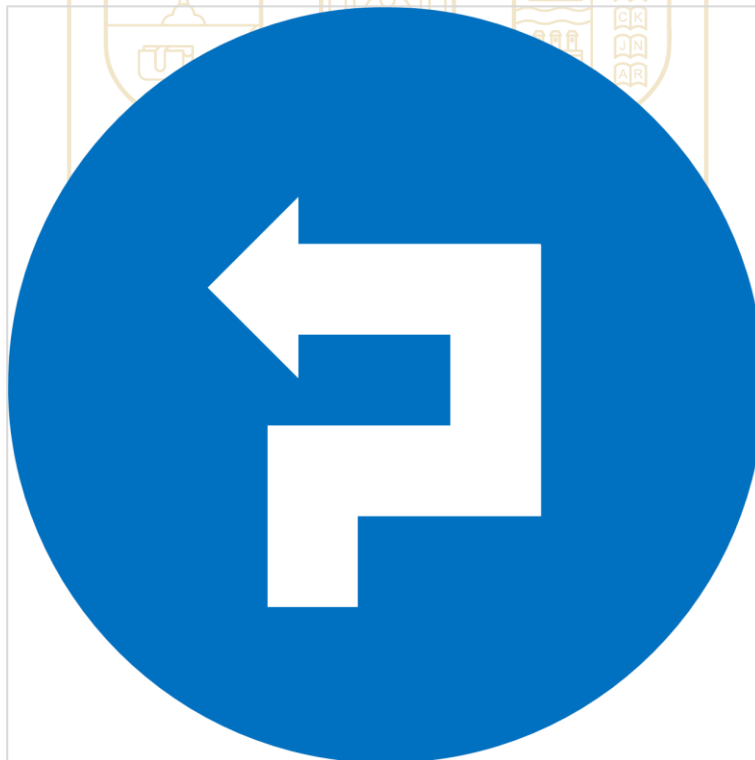
  - ■ Immediately right, left, left. (RLL)
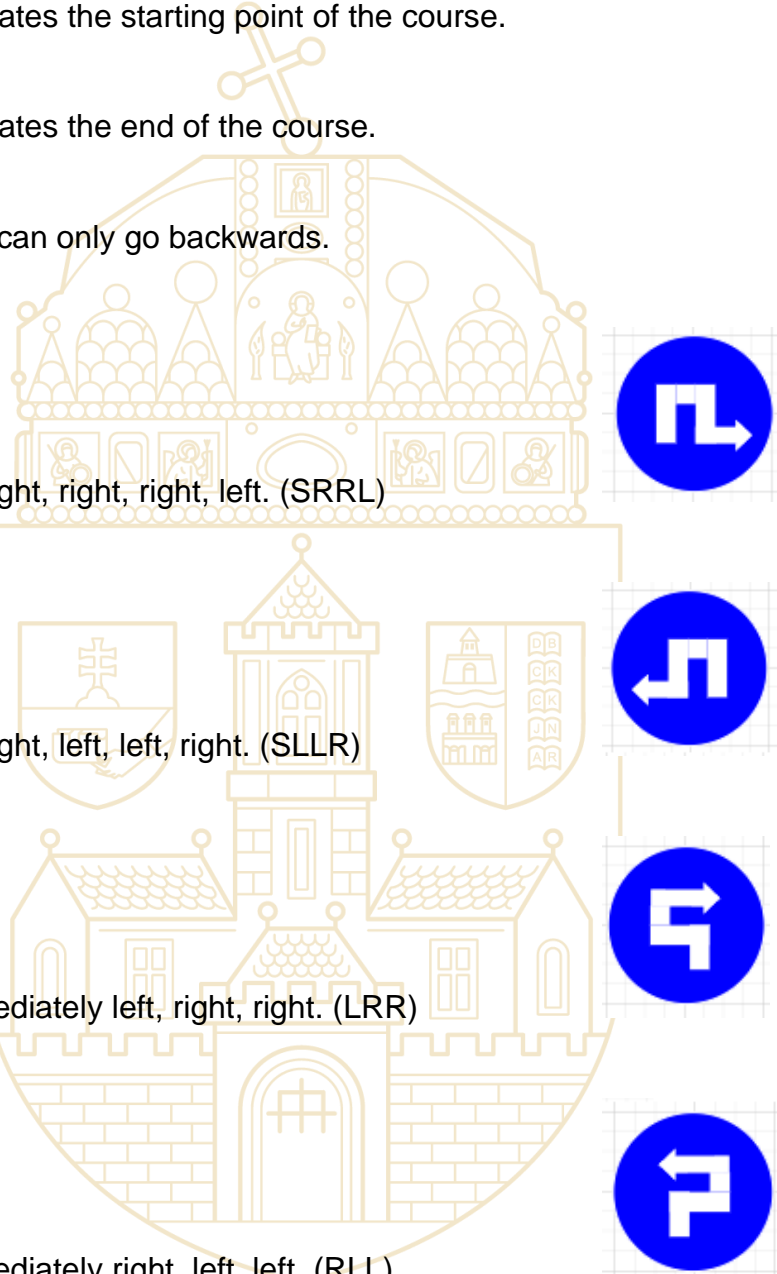
11. Figure *– Complex 1: Straight, right, right, left. (SRRL)*

12. Figure *– Complex 2: Straight, left, left, right. (SLLR)*

13. Figure – Complex 3: Immediately left, right, right. (LRR)

14. Figure -Complex 4: Immediately right, left, left. (RLL)

APPENDIX III. - PARTS BASE

PARTS					
Category	**Title**	**Piece**	**Link Hestore**	**Link ElektRobot**	**Comment**
Developer Board	Arduino UNO	1,0	link	link	
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	1,0	link	link	
Omniwheel	Mecanum Wheel 60mm Y - *új*		link	link	Optional
Motor Controller	H-Bridge meghajtó, max 2A	1,0	link	link	
Motor Controller	Arduino Shield motorvezérlő	1,0	x	link	
RFID reader	RC522-MFRC	1,0	link	link	
RFID TAG	NTAG213-STCK27	3,0	link	x	
Distance meter	UH távolságmérő HC-SR04-4P	4,0	link	link	
Distance meter	IR távolságmérő	3,0	x	link	
Supply	Akkumulátor - NCR18650B	3,0	link	x	
Supply	Elemtartó - 2 X 18650 W	1,0	link	link	
Supply	Töltő modul - TP4056-1A-USBC	1,0	link	x	
Supply	Töltő - XTAR-18650-MC2	1,0	link	x	
Prototype panels	Próbapanel - BB-005-S	2,0	link	link	
Prototype panels	Arduino Prototípus pajzs	1,0	link	link	
Prototype panels	Univerzális NYÁK - DPCB-57	1,0	link	link	
Supplements	Tápegység modul - XL6009-STEPUP	1,0	link	link	
Other	Szalagkábel - RC-40-20/MF	0,5	link	link	
Other	Szalagkábel - RC-40-20/MM	0,5	link	link	
Other	Szalagkábel - RC-40-20/FF	0,5	link	link	