RoboCupJunior Soccer TDP form

Welcome to the RoboCupJunior Soccer Technical Documentation Form!

This form will guide your team through writing a clear, complete report of your robot and your work.

1. **Who fills this out?**

   • Every team member must help—your work here counts toward your competition score.

   • If a section doesn't apply to your robot, just write "N/A."

2. **Why does it matter?**

   • It help us to do more efficient interviews

   • Future teams will learn from your design and ideas.

3. **Tips for success:**

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

this form much faster.

• Write in short, clear sentences—focus on the key facts.

4.
What happens next?

• Your completed form is private until competition time.

• After the event, it will be published alongside your poster.

Helpful links
• Past years' reports: https://github.com/robocup-junior/awesome-rcj-soccer
• RoboCupJunior Discord: https://discord.gg/eA4fwnN5
• RoboCupJunior Forum: https://junior.forum.robocup.org/
• Scoring rubrics (read before you start): https://robocup-junior.github.io/soccer-rules/2025-soccer-draft-rules/scoring.html

kovacr@gmail.com Prepnúť účet

Keď nahráte súbory a odošlete tento formulár, budú zaznamenané meno, e-mail a fotka prepojené s vaším účtom Google

* Označuje povinnú otázku

E-mail *

☑ Zaznamenávať **kovacr@gmail.com** ako e-mail, ktorý bude uvedený spolu s mojou odpoveďou

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

For any question while filing this form or in general about RCJ use our Discord server or the RoboCupJunior Forum

RCJ Discord

What is your team's name? *

LNX Robots

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

What league do you participate in? *

- (●) Open League
- ( ) Lightweight League

Where are you from? *

Bratislava, Slovakia

If other teams have questions about your robot, now or in the future, what email address(es) can we publish along with this document for people to reach you? *

(You can put in multiple email addresses, like multiple team members, an email for the whole team or both. Feel free to share other ways of communication like Discord handles)

lnxrobots@gmail.com

Team Social Media Links (if you have any)

https://www.instagram.com/lnxrobots
https://www.youtube.com/@lnxrobots9860
https://lnxrobots.github.io
https://github.com/lnxrobots

Upload a photo of your whole team with your mentor and robots

Note: This is not mandatory and will be published along with your TDP if you choose to upload something

Nahrať 1 podporovaný súbor: image. Max. 10 MB

LNX Robots - Te... ×

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

What are the names of the team members and their role(s)? *

example:
John Doe: Circuit and PCB design
Jane Doe: Programming
...

Tomáš Kováč – Programming, PCB and Mechanical design
Matúš Mišiak – AI training, Programming and Mechanical design
Michal Imrišek – Strategy and Programming
Radko Bábíček – PCB and Mechanical design
Radoslav Kováč – Team Mentor

How often did your team meet? *
(e.g. 90 minutes once per week or a day every weekend.)

work individually from home, meet biweekly

Where did you meet to work on your robot? *
(e.g. a robotics room at school, at some other place, one of your homes, school library etc.)

computer room at school, at someone's hous

When did your team start working on this year's robot? *

8/2024

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Which RoboCupJunior competitions have you competed in and in which leagues? *

Example:
German Open 2023: 1v1 Soccer Entry Standard Kit
German Open 2024: Lightweight League
European Championship 2024: Lightweight League
...

RoboCup Junior Slovakia 2023: Soccer Open
European Championship 2023: Soccer Open
World Championship 2023: Soccer Open
RoboCup Junior Slovakia 2024: Soccer Open
RoboCup Junior Croatia 2024: Soccer Open
European Championship 2024: Soccer Open
World Championship 2024: Soccer Open
RoboCup Junior Slovakia 2025: Soccer Open
RoboCup Junior Croatia 2025: Soccer Open
European Championship 2025: Soccer Open

Which parts of your work received the most contribution from your mentor? *

Example:
We couldn't manage to get our I2C compass to work, so our mentor helped us fixing the code

Our mentor provided invaluable support in securing sponsors, enabling us to fund the construction of our robots and cover travel expenses for competitions. Since we primarily work from our individual homes, our mentor assisted us by helping coordinate the logistics of delivering hardware parts between team members. Additionally, the mentor helped us maintain focus by guiding project planning and establishing clear priorities.

How did you manage the workload? *

Tools you used to break the work down, assign the work and communicate.
Example:
We communicated through a WhatsApp group and assigned the tasks using monday.com. We also used GitHub for issues and code.

We have a Discord server which we use to communicate with each other. It helps us to keep motivated by seeing each other working hard. During each meeting, we track our progress by setting new tasks and marking already completed ones in a spreadsheet.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Which AI tools did you use? *

It's not only fine to use AI for some of your work, it is also recommended to learn to use it well.
Think of things like your code, your poster, your mechanical and electronic designs to remember what you used.

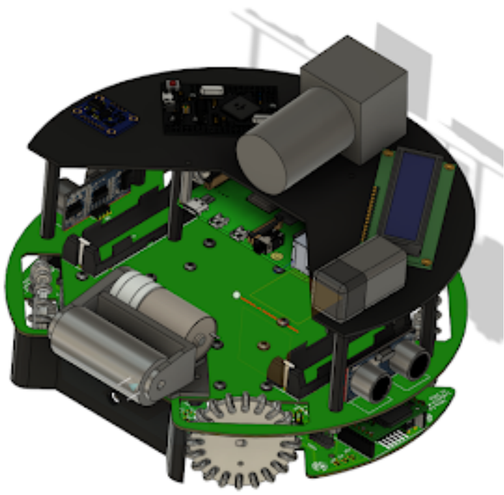
We used ChatGPT as a learning and support tool for electronics. Since we're all self-taught in this area, it was especially helpful for understanding concepts and debugging hardware issues. We also used GitHub Copilot to speed up coding, helping us write and complete functions more efficiently, which boosted overall productivity. Additionally, we used ChatGPT to improve the grammar and readability of both our poster and this TDP.

Robot 1

The photos of the first robot

Robot 1 Overall View *

Your entire robot in one photo

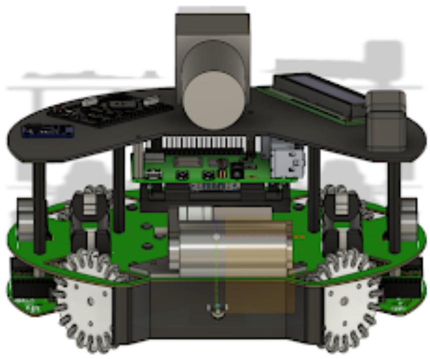


Nahrať 1 podporovaný súbor: image. Max. 10 MB

LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Robot 1 Front view *



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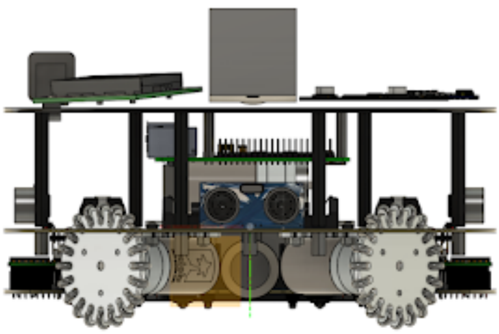
LNX Robots - Ro...

Robot 1 Back view *



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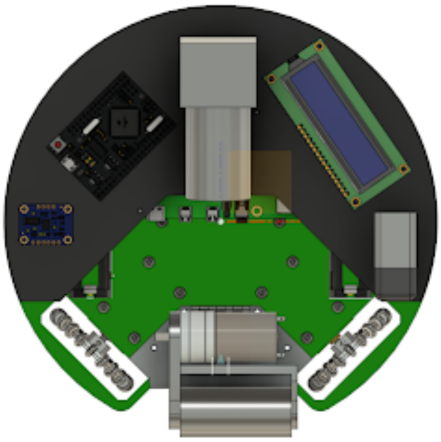
LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Robot 1 Top View *



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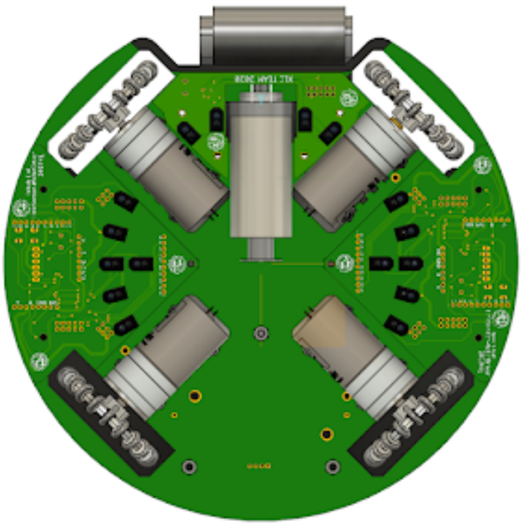
LNX Robots - Ro... ×

Robot 1 Bottom View *



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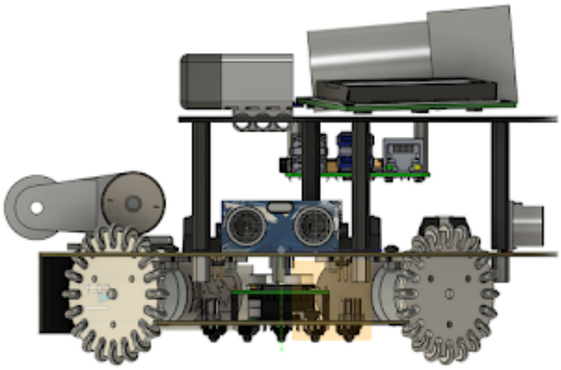
LNX Robots - Ro... ×

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

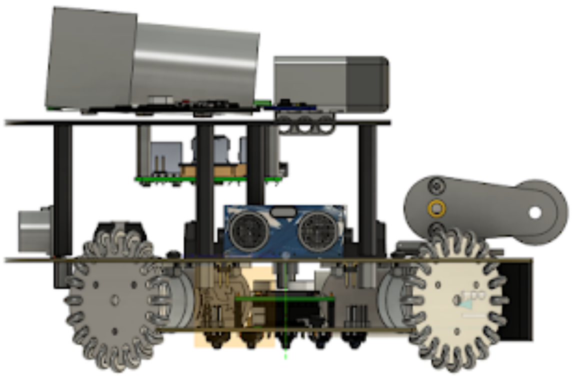
Robot 1 Right View *



Nahrať 1 podporovaný súbor: image. Max. 10 MB

LNX Robots - Ro...

Robot 1 Left View *



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LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How do you find your position inside the field and how do you use that position to move your robots around? *

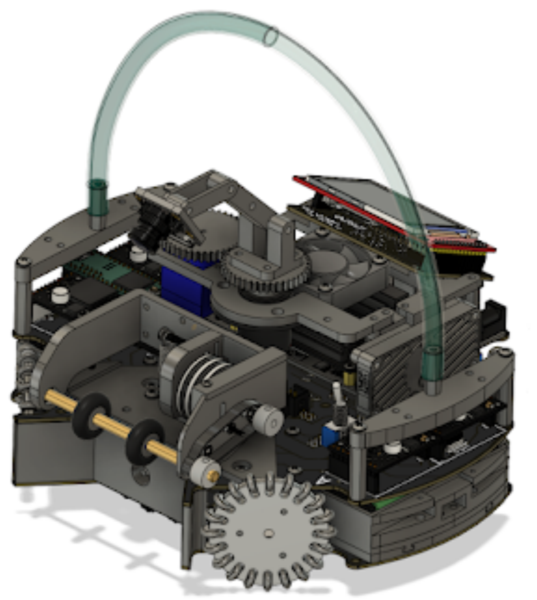
We use a LiDAR sensor to determine our robot's position on the field. The LiDAR provides a point cloud of the surroundings, which we rotate based on the robot's real-time heading to align it with the field's orientation. We then apply a Hough transform to detect the field walls and estimate the robot's exact position.
Once the current position is known, we calculate the direction and distance to the target location. From that, we compute the angle and speed needed to move the robot efficiently toward the destination.

Robot 2

The photos of the second robot

Robot 2 Overall View *

Your entire robot in one photo



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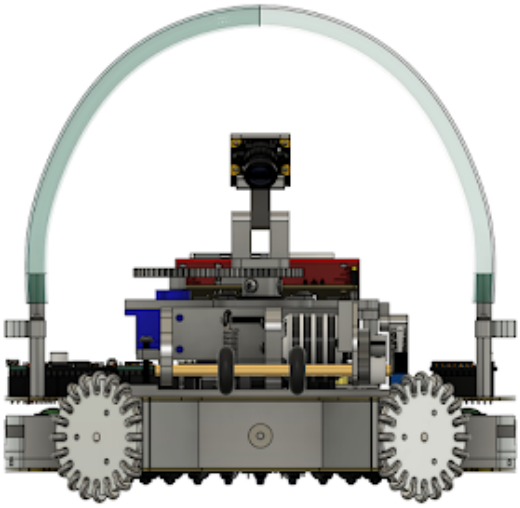
LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Robot 2 Front view *



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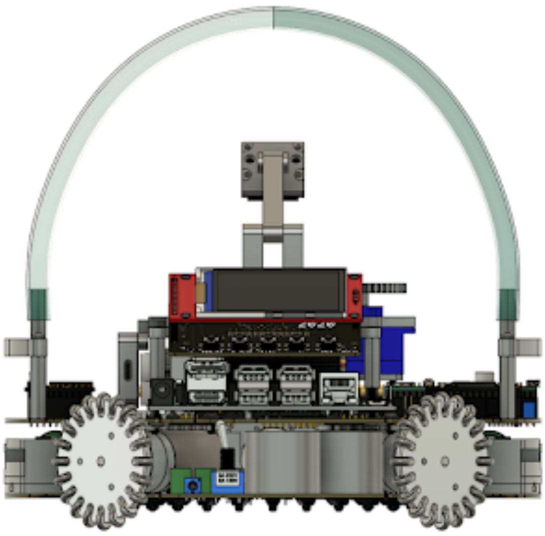
LNX Robots - Ro...

Robot 2 Back view *



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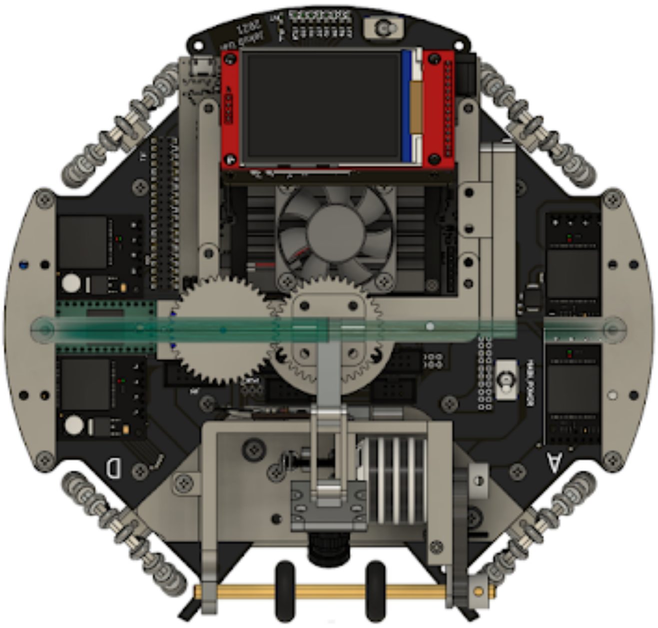
LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Robot 2 Top View *



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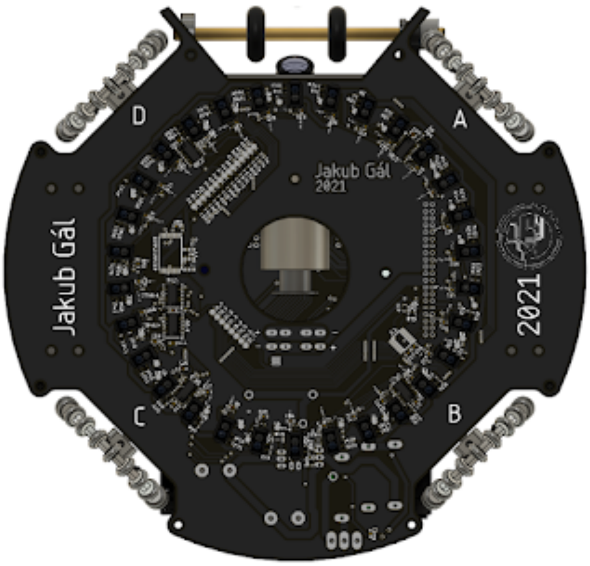
LNX Robots - Ro...

Robot 2 Bottom View *



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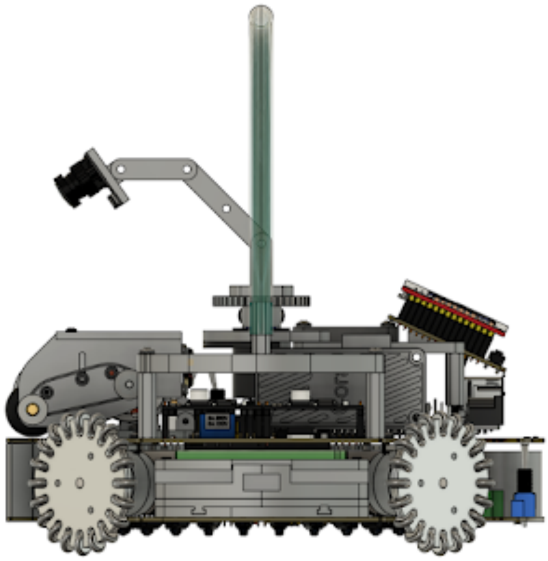
LNX Robots - Ro...

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

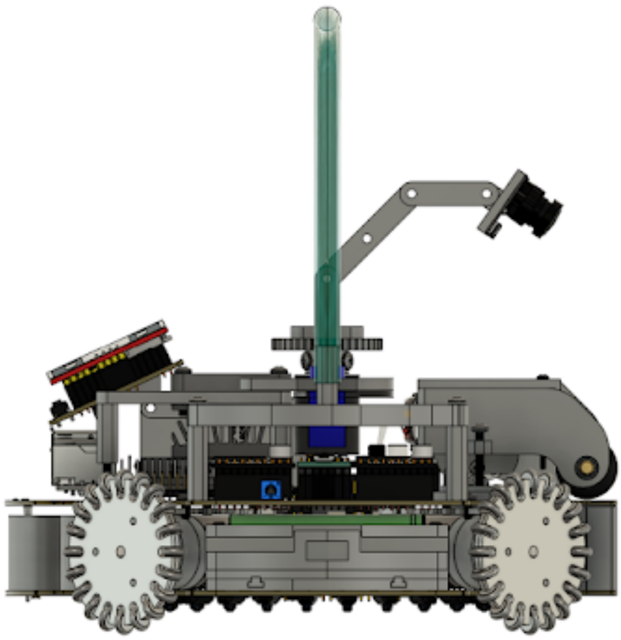
Robot 2 Right View *



Nahrať 1 podporovaný súbor: image. Max. 10 MB

LNX Robots - Ro...

Robot 2 Left View *



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Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How did you design the mechanical parts of your robots? *

Explain which programs you used and how you came up with this design.
Explain what different things you considered to come up with the design.
Explain what you needed to change to make the design better.

We used Fusion 360 to make our design and Eagle for our PCBs.
Firstly, we created a 3D model of the part in Fusion 360. We have our whole robot designed there so it's pretty easy adding new things to our robot since the rest of it is already precisely modeled. Later we got them made from aluminum or we 3D printed them ourselves.
There are countless hours and versions behind the way our robots look now from material selections to the actual parts placements.
Last year we had lots of cable breakages which made maintaining the robots a complete nightmare. This year we really wanted to improve this part of our hardware, and we managed to do so quite nicely. We shrunk the number of cables from around 150 down to only 20 thanks to using board-to-board connectors for everything, even our motors.

How did you build your design? *

Explain which machines you used to build the design.
Explain what services of companies you used to have parts manufactured (e.g. PCBs and mirrors are often made externally)
Explain any changes you needed to make to your design to make it work.

To build our design, we began by 3D printing all parts of the chassis. This allowed us to quickly prototype and identify design weaknesses. For instance, we found that the undercarriage supporting the motors was structurally too weak and prone to breaking. As a result, we redesigned this part to be made from aluminum for improved durability.
All plastic components were printed in-house using PET-G filament. The aluminum chassis parts were laser-cut by idilna.cz, and we carried out the subsequent processing (sanding, bending, and gluing the pieces) ourselves. The solenoid plunger was manufactured by a local machining company through steel milling.
For the 360-degree mirror, we worked with a local company that used vacuum forming with laminated polystyrene. Prior to that, we experimented with DIY vacuum forming using a vacuum cleaner, but the pressure was too uneven. We also attempted to machine the mirror from aluminum on a lathe. While the result was usable, it required excessive polishing and was ultimately not worth the effort compared to the vacuum-formed version.
Our PCBs were manufactured externally by JLCPCB, but we soldered some of the components ourselves.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How many motors have you used and why? *

This part is for describing how many motors your team used and why you chose this many motors for your robots' movement. If you have built your own wheels, it's also recommended to explain why and how you designed the wheels. Please mention any part numbers of parts you used here as well as in the Bill of Materials (BOM) form.

We have five motors.
Four motors are used for movement, these are the "Maxon EC45 flat 70W" (with encoders, for better speed control in lower speeds). We chose four motors because in combination with the right placement, all of them will always contribute to the robot's movement, regardless of the direction (if we only had three motors, one would be stationary when going in certain directions), hence making the robot stronger in robot-to-robot duels. We also made our own omni wheels, as we needed 6cm diameter ones (so our drive motors fit there, as they have a diameter of 43mm) and weren't able to find any suitable on the market.
Each omni wheel consists of two 3D-printed halves, a circular iron wire axle (1 mm thick), and 24 small idler rollers. The rollers are also 3D printed and fitted with O-rings for improved traction. To form the axle, we bent the iron wire around a PVC pipe with a slightly smaller diameter than the final wheel, ensuring a precise circular shape. The rollers were mounted onto this ring, then enclosed between the two printed halves and secured using a Pololu motor mounting hub. The hub is glued to the iron axle using Loctite 638 (green) for a reliable hold.

If your robot has a **kicker**, explain how you designed and built the **mechanics** of the kicker

Our kicker is a high current solenoid which we designed ourselves. To save space we also made it a flat solenoid as it's commonly possible to see in the Small Size League (SSL).
To calculate the exact values of our solenoid we first set a hard weight limit since we were working on it before the weight limit was lifted and our last years robot was only 100g lighter than the limit and we tried to keep it as light as possible. To keep the solenoid powerful while keeping it light, we came to the conclusion that increasing the number of turns is a bad idea, hence we have to increase the current which we kick with. To approximate the coil strength, we calculated the strength of the TIGERs Mannheim SSL team's front kick solenoid with info we gathered on discord and from their TDPs. We then tried to get 1/3 of this power by playing around with the variables. We came to the numbers of kick current of 28A and coil winding specs we customised to our needs.
We then designed the plunger of the solenoid consisting of aluminum non-magnetic part and iron magnetic part which we got machined. All this theory proved to be well calculated as we stuck with the first wound solenoid as it had proven to be strong enough to satisfy the rules limits.
We also experimented of the displacement of the ball from the plunger and different rubber and springs to pull back the plunger.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

If your robot has a **dribbler**, explain how you designed and built the **mechanics** of the dribbler.

We experimented quite a lot with different designs and silicones for our dribbler. However, we found out pretty fast that stationary dribblers are not great at holding the ball (the dribbling bar is not moving).
Then there are 2 options for a point mounted dribblers high mounted and bottom mounted - one has the point of rotation above the dribbling bar which dribbles the ball the other has it lower.
The bottom mounted were found superior since they didn't push out the ball before actually getting into the dribbling position. (Linear sliding dribblers are a good alternative however they are quite hard to finetune in our opinion)

CAD design files

Upload all the design files you have of your robot to a GrabCad/GitHub repo and put the link down here. the link must be accessible for anyone when you submit this form. The link will not going to be shared with other teams before the competitions and it's **not mandatory** to provide these files. However, based on the rubrics, you will get **extra points for sharing design files.**

https://github.com/lnxrobots/hw-rcj-soccer-o

Mechanical Innovation *

Think about the parts of your robot's mechanical system that you are most proud of and try to explain what innovations you came up with that makes you proud. Explain those innovations with as much details as you want.

We try not to overcomplicate our hardware since we prioritize consistent design over flashy ones. However, we had at least 7 cable breakages on our maxon motors last year since they are brushless with encoders and each has around 20 cables. We managed to create our own pcb that is directly soldered onto the motor and has board-to-board connectors coming from it ensuring a stable and rigid connection. Also we are really proud of our dribbler however they havent changed much from last year we only made them wider to capture the ball easier.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

Photos of your mechanical designs highlights

Add up to 5 photos from your mechanical design that you are most proud of. It can be a CAD design screenshot, or a real photo from the finished part.

Nahrať najviac 5 podporovaných súborov: image. Max. 10 MB na súbor.

LNX Robots - Me... ×

LNX Robots - Me... ×

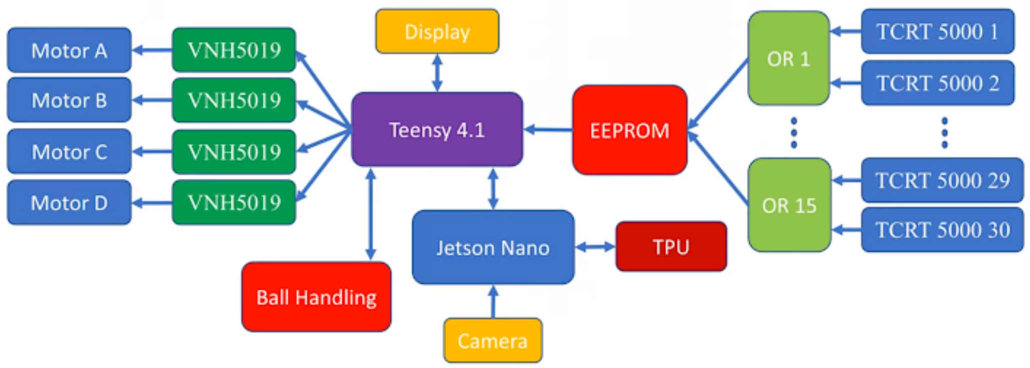
LNX Robots - Me... ×

LNX Robots - Me... ×

Pridať súbor

Provide us with a block diagram of your robot's electronics

This part is like a whiteboard drawing that shows others how your electronics are built. You don't need to go too much into details. Imagine you are drawing this on a whiteboard to explain to a friend what different electronics parts your robot has. The following photo is an example of what you need to make.



Nahrať 1 podporovaný súbor: PDF, document, drawing, image alebo presentation. Max. 10 MB

LNX Robots - Ro... ×

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How does your power circuits work? *

What voltage levels does your robot use and how do you create them (Linear regulators, buck/boost converters etc...)
Example: Our robot has a 14.4V battery pack that is regulated to 5V for our Arduino and used directly by the motor drivers.

Our power system is based on two 3S LiPo batteries (11.4 V each) connected in series to provide a total voltage of 22.8 V, which supplies power directly to our motor drivers and motors. We use a 5 V, 5 A buck converter to step this voltage down to 5 V for the Raspberry Pi 5. From there, we further regulate the voltage down to 3.3 V using low-dropout regulators (LDOs) to power our STM32 microcontrollers.
For the kicker, we employ a 47.5 V boost converter that charges large 4.4 mF capacitors to store the required energy. A dedicated 15 V LDO powers the MOSFET gate driver to ensure fast switching, minimizing the MOSFET's time spent in the linear region and improving efficiency.
All converters were carefully selected from Mouser and integrated directly onto our custom PCBs, which helps reduce space and simplifies wiring.

How do you drive your motors? Explain the circuits you use for that *

We drive our motors using Maxon ESCON 24/2 motor drivers, which operate in a closed-loop configuration for precise control. Each motor is equipped with an encoder that provides position feedback at a resolution of 1024 counts per revolution. This enables accurate speed and position control, even at low velocities, and is essential for maintaining smooth omni-directional movement and executing fast directional changes. The ESCON motor drivers receive PWM control signals from our STM32 microcontroller and then adjust motor output accordingly using PID control, leveraging the encoder feedback in real time.

What kind of micro controller or board do you use for your robot? Why did you decide to use this part for your robot? If you have more than 1 processor, explain each one separately. *

Our robot uses three main processors: two 32-bit STM32 microcontrollers and a Raspberry Pi 5 paired with a Hailo-8L AI accelerator.
The Raspberry Pi 5 serves as the central processing unit. We chose it because it offers high computational power and supports easy integration with the Hailo-8L module, which accelerates our neural network inference for real-time computer vision. Its multi-core architecture allows us to run separate processes for each peripheral (e.g. camera, communication, sensors), enabling efficient parallelism and more real-time responsiveness. Additionally, its compatibility with Python allows us to iterate quickly and take advantage of a wide range of community-developed libraries. The Raspberry Pi also hosts various hardware components such as the camera, Wi-Fi/Bluetooth connectivity, and storage, making it a compact and flexible mainboard.
The “top” microcontroller, an STM32F767, handles all time-critical control tasks. It is responsible for the motor control, kicker, IMU, light gate, and user interface. We chose this model for its speed, rich feature set, and large number of GPIO pins, which are essential for directly interfacing with multiple components in real time.
The “bottom” microcontroller, an STM32G474, manages lower-level sensing tasks. It processes data from the line sensors and LiDAR, pre-filtering and formatting the data before passing it to the Raspberry Pi. This division of responsibilities ensures fast and reliable sensor feedback without overloading the central processor.
We chose STM32 microcontrollers over 8-bit alternatives like Arduino due to their significantly higher performance, wider peripheral support, and widespread use in industry. They also offered a learning opportunity, as we wanted to explore more advanced embedded platforms.

How does your ball detection sensors and/or camera[s] work? *

Our vision system uses two cameras, both connected to the Raspberry Pi 5. One camera faces forward and is used for precise ball detection in front of the robot. The second camera is angled upward toward an omnidirectional mirror and is used to estimate the ball’s broader position on the field.
We access the camera feeds using the Picamera 2 interface, with each camera handled by a separate process. This allows us to run them in parallel and access fresh frames with minimal delay.
The front-facing camera stream is sent to the Hailo-8L AI accelerator, where a custom-trained neural network detects the ball and outputs its position relative to the robot.
The mirror camera is currently processed using traditional computer vision methods, as we haven’t yet implemented AI-based detection for it. Instead, we use OpenCV to isolate the ball’s color, find contours, and identify the largest one as the ball by drawing a bounding box around it.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How does your line detection circuits work? *

At the bottom of our robot, we have 8 IR sensors with IR LEDs next to them. LEDs light up the field and the IR sensors measure how much light reflects back. White lines reflect more light than the green field, so they will have a higher value. However, these sensors are more of a backup option – the robots stop near edges based on the distance from the walls acquired from the lidar, described below.

What sensors do you use for navigation and how are these sensors connected to your processor? What sensors do you use to find your position in the field? What about the direction your robot faces? *

As described in an earlier answer, we use the LD19 LiDAR to determine the robot's position on the field. It provides a 2D point cloud that we process to detect the field walls and calculate our location. To determine the robot's orientation, we use a BNO055 IMU, which provides real-time heading data.
The LiDAR is connected via UART to the bottom STM32 (STM32G474), which handles sensor preprocessing. The IMU is also connected over UART, but to the top STM32 (STM32F767), which manages motion control and orientation tracking.

How do you drive your kicker system? How does the circuit make the kicker work? *

We have a fairly complicated circuit to kick our solenoid. We use 47.5V boosted which charges our 4.4mF capacitors. However, we found out that during kicks and at the start of the robot there are huge current surges for charging the capacitors. Hence the current had to be limited which we solved by finding a high wattage smd resistors which we put 2 in parallel to further distribute the load and limit the charging current (without them our diodes kept being burnt even after putting high current ones there).
As for the actual kick we try to turn on the MOSFET as fast as possible since we are kicking with 28A and slower start up could mean the solenoid starts with lower current then needed for maximum power. To enable this we have 15V supply which is being used to charge the mosfet gate. This is controlled by a gate driver. We kick for 10ms if we kicked for longer our solenoid would be at risk of being damaged or the circuit would be at risk of being completely burned.

How does your dribbler system work? What components and circuits did you use to drive it? *

Our dribbler system is driven by a single high-RPM motor, capable of spinning up to 10,000 RPM, though we typically operate it at around 4,000 RPM for effective ball control. The motor drives a silicone-covered bar that maintains contact with the ball to keep it under control.
The dribbler is bottom-mounted, meaning the pivot point is below the bar. As the ball enters the dribbler, the entire mechanism is pushed backward slightly, allowing the bar to maintain consistent pressure and contact with the ball surface.
For the silicone, we found that the Shore hardness plays a key role, and it highly depends on the type of ball used. In our testing, A60 shore silicone provided the most reliable and consistent dribbling performance. We manufacture our own silicone bars by pouring silicone into a 3D-printed mold around the dribbler rod and allowing it to cure in place, resulting in a custom fit and optimal grip.

Schematics of your robot

If you designed schematics (circuit diagrams) for your robot, upload a PDF or picture of the schematics here

Not mandatory but helps community to grow and will get you some extra points for documentation that counts into final score.

Nahrať najviac 5 podporovaných súborov. Max. 10 MB na súbor.

- Bottom_board_v...
- Dribbler_board_v...
- power_board_v2...
- Top_board_v10.p...

Pridať súbor

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

PCB of your robot

If you designed a PCB for your robot, upload a PDF or picture of the PCB here

Not mandatory but helps community to grow and will get you some extra points for documentation that counts into final score.

Nahrať najviac 5 podporovaných súborov. Max. 10 MB na súbor.

Bottom_board_v... ×
Dribbler_board_v... ×
power_board_v2... ×
Top_board_v10.p... ×

Pridať súbor

Innovations *

What part of your electronics are you most proud of? Explain these parts in details and explore any innovation you came up with make this designs work

We are really proud of our kicker since it allows us to shoot really powerful shots with the benefit of still being compact and not taking up a lot of space. When we compared our kick strength with other teams we found out that our solenoids volume was fraction of theirs while giving the same amount of power or more. Thanks to the plunger shape, the kicks are also precise, which was a huge issue we faced last year.

Photo of your circuit boards highlights *

Add up to 5 photos from your finished and soldered circuits that you are most proud of. It can be a CAD design screenshot, or a real photo from the finished part.

Nahrať najviac 5 podporovaných súborov: image. Max. 10 MB na súbor.

LNX Robots - PC... ×
LNX Robots - PC... ×

Pridať súbor

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How do you use your processor to move your motors? *

The Raspberry Pi 5 is responsible for high-level motion planning. Based on sensor data and camera input, it calculates three key movement parameters: the direction of movement (angle), the speed (magnitude), and the spin (rotation around the robot's center). These values are then used to compute the individual wheel velocities required to achieve the desired translational and rotational movement using an omni-directional drive model.
The calculated wheel velocities are sent to the STM32 microcontroller, which generates PWM signals for each of the four Maxon ESCON 24/2 motor drivers. Each motor driver operates in closed-loop mode using encoder feedback to ensure smooth and accurate motor control.
The dribbler motor runs at a constant speed and is also controlled by the Raspberry Pi 5, STM32 and ESCON driver as well. It is temporarily turned off during a kick to prevent

How do you find where the ball is? How do you read the data from the ball detection sensors or camera? *

Our cameras are connected to the Raspberry Pi 5, which captures image data using the Picamera 2 interface. The front-facing camera feed is streamed to the Hailo-8L module, where a custom-trained neural network detects the ball and outputs its bounding box. For the mirror camera, we use OpenCV to detect the ball based on its color, then extract the bounding box of the largest detected contour.
Since the ball is a standard golf ball with a known physical size, we use the apparent size of the ball in the image – combined with the camera's known focal length and pixel size – to estimate its distance from the robot using the pinhole camera model. We also calculate the horizontal angle to the ball using the ball's pixel offset from the image center and the camera's field of view. We use this approach for the bounding box acquired from the front camera.
For the mirror camera, we use linear interpolation of the detected ball from the center of the mirror, since the reflection is sufficiently consistent with the real field image.
These calculations allow us to convert camera observations into real-world distance and angle measurements, which are then used by our strategy system to navigate toward the ball accurately.

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How does your algorithm work to catch the ball? Is there a difference between your robots in how they move towards the ball? Explain the differences. *

Our robots switch between two possible roles: attacker and goalkeeper.
Attacker has two different approaches of getting to the ball:
- If it is near the left, right or back side of the field, it rotates to the ball and goes straight to it, catching the ball with dribbler.
- If it is in the center area, it is rotated to the opponent's side and catches it staying rotated in that direction, going around the ball if needed. This ensures that no significant maneuver is needed before striking.
Goalkeeper doesn't actively try to catch the ball, unless it is very near. Then it approaches it in a similar way to the attacker on the sides of the field.

How does your robot find the lines to stay inside the field? What algorithms do you use to avoid going out of bounds? *

We use LiDAR and IR sensors to detect lines and obstacles. The LiDAR sensor allows us to detect walls or obstacles in advance, enabling the system to decelerate smoothly before getting too close – this helps prevent the robot from crossing the line too quickly, which could cause the IR sensors to miss it. If the IR sensors detect a line, the robot backs up a short distance to stay on the field.

What algorithms do you use to score goals? How do you use your kicker and dribbler to handle the ball? *

As described in the section about catching the ball, the attacker is rotated to the opponent's side when in the center of the field, otherwise it is rotated to the ball.
When it catches the ball in dribbler, it rotates with it to the center of the opponent's goal – based on where it should be based on the robot's position on the field. Then, it kicks the ball.
When it detects that it's positioned in one of the corners near the opponent's goal, it goes a little towards our side, until it can strike.
If it catches the ball near the side of the field and is rotated to it, it takes advantage of the situation and rolls with the ball along the sideline to the opponent's corner, then rotates and strikes. This strategy ensures that the ball is less visible for the opponents, having a

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

What algorithms do you use to avoid the opponent team scoring? How do your robots defend your own goal? *

The goalkeeper robot uses a control algorithm designed to keep it positioned between the ball (or enemy robot) and the goal. It constantly updates its behavior based on camera input, LIDAR, and Bluetooth data, making real-time decisions to block shots or go for the ball.
How it Works:
Sensor Input and Tracking
- The robot uses front and mirror cameras to detect the ball. If the ball isn't visible, it falls back to Bluetooth-shared data or its internal tracker.
- LIDAR is used to detect all robots on the field, including their coordinates and estimated positions. The robot cross-references this with the position of its teammate (shared via Bluetooth) to avoid false detection. Enemy positions are then inferred from the remaining LIDAR data.
Positioning Strategy
- If the robot has the ball or is close to it, it enters a kickoff routine to attempt a goal.
- Otherwise, it calculates the best position between the goal and the ball or enemy using position_between.
- If the ball is close to the goal, it switches to a tighter position along a predefined ellipse

Do your robots communicate with each other? How do you use this communication to your advantage?

Our robots communicate with each other using Bluetooth. They share key information such as the position of the ball, their own current positions on the field, and use this data to coordinate roles, dynamically deciding which robot should act as the striker and which as the goalkeeper.

Innovations *

Tell us about any specific code or algorithm you build that you are the most proud of. Explain how you came up with this innovation and how it helps you win more games.

One of the innovations we're most proud of is our opponent detection algorithm. It processes the LiDAR point cloud by filtering out known structures such as the field walls, goals, our own robot, and our teammate. The remaining unexplained points are then grouped into clusters, which are treated as potential opponents.
This system allows our robots to estimate the positions of opposing robots on the field without relying on visual data. It provides a major advantage for both roles: the goalkeeper can track and react to opponents even when the ball is not visible, and the attacker can perform basic opponent avoidance while attempting to shoot.

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GitHub link

Give us a link to your GitHub repo containing all your firmware/software.
Consider making one if you don't have one.
(Based on the rubrics document, you can get extra points if you publish your code)

https://github.com/lnxrobots/rcj-soccer-open-gen3

Bill of Materials (BOM) *

List all **the main parts** (e.g. your processor, motors, wheels, sensors, cameras, major electronics and mechanical parts) used in your robots with their count and unit price

Use the following template for the parts:

[Template Link @David]

Nahrať 1 podporovaný súbor: PDF, document alebo spreadsheet. Max. 10 MB

LNX Robots - Bill...

How much did it cost you to build your robots? *

Please provide three numbers, one for the final components which went into your robot, one for money you spend for trial and error building your robots and finally the cost of getting the environment ready to build your robots (building the field, the carpet, soldering iron, oscilloscope, etc). Please provide the currency you used in your calculations and the exchange rate to US Dollars at the time of filling this form.

Example:
Robots (cost of components that are in your robots right now): 3000 Euro each
Experiments (failed builds, broken hardware etc.): 2000 Euro
Environment (fields, balls, etc.) : 1000 Euro
1 Euro= 1.14 USD

Robots: 2360 Euro each
Experiments: 600 Euro
Environment: 1100 Euro
1 Euro = 1.17 USD

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.

How did you gathered the funds to build the robots? *

Example:
30% sponsors
20% school
50% parents

65% sponsors
35% school

How affordable was it to compete in RoboCupJunior Soccer? *

	1	2	3	4	5	6	7	8	9	10	
Very Expensive	○	○	◉	○	○	○	○	○	○	○	Very Affordable

Have you checked all of your answers? *

◉ Yes!

We publish TDPs and posters during or after the competition as described in the beginning *

◉ Yes, we acknowledge everything submitted in the above form can be published.

Ďalej

Vymazať formulár

Vaša odpoveď je príliš veľká. Skúste niektoré odpovede skrátiť.