

## WRO Future Innovators Category – information for teams

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### Introduction

In the WRO Future Innovators category your task is to develop a robot solution that helps solve real-world problems. You will present your project and your robotic solution to the public and to the judges on the competition day.

There is a new theme for the competition every year, often connected to the UN Sustainable Development Goals. After research into the theme your team develops an innovative and functioning robotic solution.

The Future Innovators category is completely open source. The robot solution may be controlled with any type and number of controllers (e.g., Arduino, Raspberry Pi, LEGO, etc.). To build and program your solution you can use any materials and programming languages you want.

This guideline is written from the perspective of an international tournament. In a national competition the expectations are largely the same. However, there can be slight differences. For example: it might not be a requirement to make a video. Please check with the organizer in your country and follow their guidelines.

## Timeline

### Publication of the tasks

At the start of the season the theme and specific challenges for Future Innovators will be published. Internationally this is on January 15<sup>th</sup>.

### Research and development

Based on the season challenges your team will select a problem that you want to solve. You will collect information and come with an idea for a robotic solution.

### Building and programming the robot solution

You will then develop and build your robotic solution. In this process you will do a lot of testing and improving to come with the best solution.

### Project Report and Video

You need to make a report about your project and your solution. For the international final you will also need to make a video. This will help the judges (and the public) understand your project better.

### Developing materials for your exhibition

At the competition day your team will have a booth (or other dedicated area) to present your project and robotic model. In this booth you will present information about the project. You can use posters, drawings, displays, etc. You can get creative with the design, there are no limits to the use of materials.

### Preparing for the competition day

At the competition day your team will need to give a five (5) minute presentation to the judges. Make sure you prepare for this and practice. A tip: Present your project in advance to a school class, your friends or parents and let them ask you questions.

### Competition day

On the competition day you start with installing your robot solution and exhibition. You will have at least two presentations in front of the judges. During the event you will also explain and demonstrate your solution to the public.

## Age Groups

The WRO Future Innovators category is divided into three age groups: Elementary (8-12), Junior (11-15) and Senior (14-19).

Younger children have a different way of working and of looking to the world than older students. They come with different ideas, and their skills are less developed than older students. This is completely fine. Elementary teams do not have to perform at the same level as Senior teams. The judges will always look at the performance of the team compared to teams of a similar age.

## Three scoring rubrics

WRO has developed a scoring sheet with three scoring rubrics. But for each age group there is a slightly different scoring sheet. The scoring criteria have a slightly different weight / importance in each age group. In Elementary there is a little more focus on the presentation and teamwork. In Junior and Senior there is a little more focus on technical engineering and innovation.

Below a brief description of the rubrics, there is a separate chapter describing all judging criteria.

### Rubric “Project and Innovation“

In this rubric it is all about the overall project idea and implementing the idea in real life. Do you understand the overall objects of this robotic solution? How have you developed your project idea? Have you thought about people that would use the idea or potential customers? What is special about your idea? The report that you have submitted will be considered too.

For the Junior and Senior age group there are some extra criteria that will be graded. Junior and Senior teams are also required to present one additional business model aspect. Your team can choose which aspect you want to present.

From 2022, there is a new focus on innovation & entrepreneurship in this category.

Teams in the older age groups that want to think about their project as a real prototype, could use the ideas of a “Business Model Canvas” concept. (Not mandatory!) This concept helps you to think about relevant business aspects.

<https://www.strategyzer.com/canvas/business-model-canvas>.

But if your project is not the perfect start-up idea (yet), it is not a problem. Then try to talk to people, get feedback and just think what you would do if you wanted to bring your idea into reality.

### Rubric “Robotic Solution“

This scoring rubric captures the mechanical and other technical aspects of the project and the software implementation. The judges will assess if you have developed a robotic solution that is in line with our general rules (look at chapter 5 for a definition) They will also judge if you are making proper use of coding. Efficiency is important here. Bigger robots or more code is not automatically better.

### Rubric “Presentation and Team Spirit“

This scoring rubric is about the presentation of your project and about how you function as a team. The judges will look at the complete presentation of your project (report, video, live presentation, booth). Are all aspects of the project explained in a good way? They will also look at how you work together and if your team can work independently.

## WRO Ethics Code

WRO has three important guiding principles and an ethics code that all participants and coaches need to follow.

The three WRO Guiding Principles are:

- Teams are encouraged to learn and master new skills while having fun together.
- Coaches, mentors, and parents are there to guide the teams, not to do the work for them.
- Participating and learning are more important than winning.

All teams and coaches are required to undersign the WRO Ethics Code. The international version of the code is attached to this document as an example.

The WRO judges all need to follow the guidelines for judges.

## Judging process at an International Final

In this part we describe the process for judging at an International Final. At other events the process could be slightly different.

### Preparing:

- Make sure that you have uploaded your report and video in time.
- Each team + coach needs to support and undersign the WRO ethics code.
- Make sure you read all the last-minute information that the organizers have sent.

### The competition day(s)

- Set up your booth
- Check the schedule for judging and make sure your robot is ready and that you are all at the booth to present your project.
- Explain your project to visitors of the event during the day.
- Don't forget to have fun...

### The judging rounds

- The judges will visit your booth on the competition day.
- You have 5 minutes to present your idea and demonstrate your robotic solution. (The judges will time this.)
- The judges then have 5 minutes to ask you questions.
- They will also look at what you have presented in your booth.

At the international final there will always be at least two (2) people in each judging group, and you will be visited by at least two (2) of these judging groups.

### Grading

After the visit the judges will grade your team on all the criteria on the scoring sheet. You will be judged on your project idea, your robotic solution, and the overall presentation of your team. The grading is similar to what a teacher would do: how well does your team perform on this aspect? The judges look at different criteria when they grade your team. The scoring sheets and explanations are attached to this document.

The judges give you a score from 0-10 for each criterion within the scoring rubric.

0 means: very poor, very bad, very insufficient, not existing

10 means: perfect, excellent, nothing to improve

*Example: The judges give your Elementary team a grade of "6" for "Idea, Creativity & Innovation". The maximum for this criterion is 30 points. The scoring system will automatically calculate the points. (The team will get:  $30 * (6/10) = 18$  points (60% of 30).*

### The final ranking

After all teams have been visited there will be a judge meeting. The Age Group Head Judge will present the teams with the highest scores. All judges have the possibility to propose another team is also part of the deliberations. The judges will then discuss the ranking. If needed they will decide to visit one or more teams again. After that the final ranking is determined.

### Can teams be judged by judges from their own country?

As WRO Association it is our responsibility to make sure that the competition is perceived as fair to all teams. To avoid any doubt, we try to allocate judges in such a way that they do not have to judge a team from their own country. But this is not always possible.

The judges have guidelines on how to act when they are visiting teams from their own country. From all teams and coaches, we expect that they do not put pressure on judges that come from their own country. Just like in an international sports competition the judges are there to do their work unbiased. They are there for the international competition, not to advocate for teams from their own country.

## Judging criteria WRO Future Innovators

### Project & Innovation

#### *Idea, Quality & Creativity*

Your project should connect to the season theme and to the challenge as described in the season rules. *(Described in part 3 of the General Rules & Season Theme document.)* Your robotic solution should help solve one or more of the problems that are connected to the season theme. Creative thinking is important in your project, so try to find a new approach and think of new ways to solve the problem. The design of your solution should also be innovative and imaginative. Can you think of new uses for materials and resources? Think outside the box!

#### *Research & Report*

Before you can build your robotic solution, you need to do research. Which problem do you want to solve and how? You will also do research to find out the best way to build your robotic solution. What materials will you be using? What is the best way to program your robot solution? Talk to other people to find out what they think of your idea. You will produce a report that is a documentation of the development of your project and the research you have done. *(Check article 6.4 of the General Rules & Season Theme document.)*

#### *Usage of the idea (Elementary teams)*

You should think about who would use your robotic solution. Who would be helped with your idea? Talk to at least two (2) other people about your idea. (Not your coach or parents) What do they think about it? Do they have some good tips for you?

#### *Social Impact & Need (Junior & Senior teams)*

You should think about who would use your robotic solution. Who would be helped with your idea? What is the (social) impact of your idea? Is it important for individuals or for your community or country? Would it benefit people from other countries too? Discuss your idea with at least three (3) other people to get further input. (Not your coach or parents)

#### *Key Innovation & Slogan*

You should be able to explain what is unique about your idea. Are there potential competitors? What makes your idea better? You should also present a slogan about your idea - something that will help the public remember your robotic solution.

#### *(Junior & Senior teams only) Extra element of entrepreneurship*

You need choose one of the following aspects to explain your idea further.

- a) Cost structure: Explain which costs are associated with producing and developing a real prototype of your idea.
- b) Revenue Stream: Explain how you could generate income through offering your idea to the market. It could be a social business model as well.
- c) Key Resources: Explain what key resources are needed to work on your prototype (e.g. staff, materials, know-how etc.).
- d) Partners: Explain what partners are needed to make your idea a reality (e.g. local partners, institutions, investors, etc.).

#### *(Senior only) Next Steps & Prototype Development*

You need to present the logical next steps that are needed to develop your idea into a real prototype/product. Think of what you would need to do in the next 6-18 months. You can choose to use the Lean Start-up approach and present how your idea can be rolled-out in this way. For more information visit: [https://en.wikipedia.org/wiki/Lean\\_startup](https://en.wikipedia.org/wiki/Lean_startup). (But you can also use a different approach.)

## Robotic Solution

### *Robotic Solution*

Your robotic solution should have several mechanisms, sensors and actuators and is operated with one or more controller(s). It should be able to do more than a machine that is only repeating a certain workflow as it should make autonomous decisions. Your robotic solution can replace certain parts of human tasks or make it possible to do things we could not do before. *(Check item 5.1 of the General Rules & Season Theme document for the definition of a robotic solution.)*

### *Meaningful use of engineering concepts*

You need to use (technical) materials and components in a sensible and efficient way. Your robotic solution should be well constructed. You should show proper use of engineering and mechanical concepts/principles, for example, in the way you build your robotic solution or use gears, pulleys or levers. You should be able to explain the choices you made.

### *Code Efficiency & Software Automation*

Your robot solution should use inputs from sensors/controllers to run specific routines in a smart and appropriate way. The automation and logic should make sense for your project idea and should be structured and functional. You should be able to explain your code and explain why you have used certain routines and programming languages.

### *Demonstration of Robotic Solution*

You need to demonstrate your robotic solution and it should be reliable. This means that the demonstration can be repeated multiple times. You should be able to explain how the solution works and what could be improved in the future. Your robotic solution is a prototype - not everything will be perfect. If an error happens during the demonstration, you will have an opportunity to solve it or you need to be able to explain why the error happened.

## Presentation and Team Spirit

### *Presentation & Project booth*

You need to present your project to the judges in an interesting 5-minute presentation. This presentation should include the demonstration of your robot solution. Your project video is an addition to this presentation and judges will view the video before the judging. *(Check article 6.5 of the General Rules & Season Theme document.)* You should also decorate your booth in such a way that it is informative and attractive to the public. People that visit your booth should be able to get clear information about your project and robotic solution. You can use all kinds of materials to make your project booth look interesting. (Do remember that the goal is to present your robotic solution, not to have the best decorations...)

### *Technical Understanding & Quick Thinking*

You need to be able to explain why and for who your project idea is relevant, how your robot solution works and how you have developed and coded it. You will explain this in your presentation, but you also need to be able to answer questions about your project. This way you demonstrate that you have a good understanding of your solution.

### *Team Spirit*

As a team you show that you value each other's work and the different team roles you have defined for yourself during preparation for the tournament. You are enthusiastic about sharing your idea with others. You also show that you can work on your own, without help from adults, not only during your project, but also when installing your booth or solving technical problems.

## Scoring sheets

### WRO Future Innovators - Elementary

**Project** \_\_\_\_\_

**Team** \_\_\_\_\_

**Judge** \_\_\_\_\_

Criteria

Score max  
0-10\* points

PROJECT & INNOVATION	Idea, Quality & Creativity		30
	Research & Report		15
	Usage of the idea		15
	Key Innovation & Slogan		10
<i>TOTAL</i>			70

ROBOTIC SOLUTION	Robotic Solution		30
	Meaningful use of engineering concepts		10
	Code Efficiency & Software Automation		10
	Demonstration of Robotic Solution		15
<i>TOTAL</i>			65

PRESENTATION & TEAM SPIRIT	Presentation & Project booth		30
	Technical Understanding & Quick Thinking		15
	Team Spirit		20
<i>TOTAL</i>			65

<b>Maximum Points</b>	<b>200</b>
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Comments:

\* Judges give a score from 0-10. For example, if a judge scores "Idea, Quality & Creativity" with a 5, then the team will get 5/10 \* 30 = 15 points for this criterion.

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## WRO Future Innovators - Junior

**Project** \_\_\_\_\_  
**Team** \_\_\_\_\_  
**Judge** \_\_\_\_\_

	Criteria		Score max 0-10* points
PROJECT & INNOVATION	<b>Idea, Quality &amp; Creativity</b>		<b>30</b>
	<b>Research &amp; Report</b>		<b>15</b>
	<b>Social Impact &amp; Need</b>		<b>10</b>
	<b>Key Innovation &amp; Slogan</b>		<b>10</b>
	<b>Extra element of entrepreneurship</b> a) Cost structure, b) Revenue Stream, c) Key Resources, d) Partners		<b>10</b>
	<i>TOTAL</i>		<i>75</i>
ROBOTIC SOLUTION	<b>Robotic Solution</b>		<b>30</b>
	<b>Meaningful use of engineering concepts</b>		<b>15</b>
	<b>Code Efficiency &amp; Software Automation</b>		<b>10</b>
	<b>Demonstration of Robotic Solution</b>		<b>15</b>
	<i>TOTAL</i>		<i>70</i>
PRESENTATION & TEAM SPIRIT	<b>Presentation &amp; Project booth</b>		<b>25</b>
	<b>Technical Understanding &amp; Quick Thinking</b>		<b>15</b>
	<b>Team Spirit</b>		<b>15</b>
	<i>TOTAL</i>		<i>55</i>
<b>Maximum Points</b>			<b>200</b>

Comments:

*\* Judges give a score from 0-10. For example, if a judge scores "Idea, Quality & Creativity" with a 5, then the team will get 5/10 \* 30 = 15 points for this criterion.*

## WRO Future Innovators - Senior

**Project** \_\_\_\_\_  
**Team** \_\_\_\_\_  
**Judge** \_\_\_\_\_

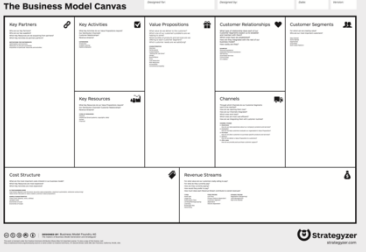
	Criteria		Score max 0-10* points
PROJECT & INNOVATION	Idea, Quality & Creativity		20
	Research & Report		15
	Social Impact & Need		10
	Key Innovation & Slogan		10
	Extra element of entrepreneurship a) Cost structure, b) Revenue Stream, c) Key Resources, d) Partners		10
	Next Steps & Prototype Development		10
<i>TOTAL</i>			75
ROBOTIC SOLUTION	Robotic Solution		30
	Meaningful use of engineering concepts		15
	Code Efficiency & Software Automation		10
	Demonstration of Robotic Solution		15
<i>TOTAL</i>			70
PRESENTATION & TEAM SPIRIT	Presentation & Project booth		25
	Technical Understanding & Quick Thinking		15
	Team Spirit		15
<i>TOTAL</i>			55
<b>Maximum Points</b>			<b>200</b>

Comments:

*\* Judges give a score from 0-10. For example, if a judge scores "Idea, Quality & Creativity" with a 5, then the team will get 5/10 \* 20 = 10 points for this criterion.*

## Template Project Report

- PDF, max 15 MB
- Max. 20 pages single sided (10 pages double sided), including attachments, not including front-page, table of contents and list of sources.
- *Please note: longer reports cannot be taken into consideration for the judges scoring!*

	Elementary	Junior/Senior
Front page (Age group, Team name, country, Picture of project)		
Table of Contents		
Team presentation	max. 1 page	max. 1 page
Let us know a bit more about your team. Who are in the team? Where are you from? How have you divided the tasks in the team? Add a picture of your team.		
Summary project idea	max. 1 page	max. 1 page
Describe your project and solution in an “executive summary”. If someone would only Share all the information your readers and important stakeholders need to know. <ul style="list-style-type: none"> <li>• What is the problem your project is solving and why did you choose this problem?</li> <li>• How is the robotic solution going to solve the problem you established?</li> <li>• What is the value of your robotic solution? What would happen if it would be used in real life?</li> <li>• Why is your project important?</li> </ul>		
Presenting robotic solution	max. 15 pages	max. 12 pages
Describe your robotic solution and how you have developed it. General aspects: <ul style="list-style-type: none"> <li>• How did you come up with this idea? What other ideas did you investigate?</li> <li>• Did you find similar ideas being available? What is different about your solution?</li> </ul> Technical aspects: <ul style="list-style-type: none"> <li>• Describe the mechanical construction of the solution</li> <li>• Describe the coding of the solution</li> <li>• Did you face any challenges during the development process?</li> </ul>		
Social impact & Innovation	max. 3 pages	max. 6 pages
Describe the impact of your solution for society. <ul style="list-style-type: none"> <li>• Who will it help? How important is it?</li> <li>• Give a concrete example of how/where your idea could be used.(Think about who would use and ow many people would benefit from it.)</li> </ul>		
Junior & Senior age group only: <ul style="list-style-type: none"> <li>• Describe more about the innovation and entrepreneurship aspects of your project (see scoring criteria).</li> <li>• You could use the concept of a business model canvas to explain aspects of your project as a start-up idea. It is not important that you fill all parts of this canvas, you could only fill the parts where you feel they are most relevant for your project. <a href="https://en.wikipedia.org/wiki/Business_Model_Canvas">https://en.wikipedia.org/wiki/Business_Model_Canvas</a></li> </ul>		
List of sources		
Make a list of the documents and – reliable - websites you have used for your research and the people you have spoken with.		

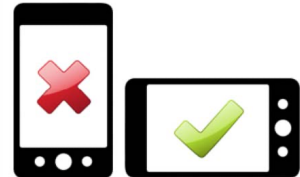
## Tips for your video

The main goal is to present your robotic solution to the public and to demonstrate how your robotic solution works. The video will also be watched by the judges. You can see it as some extra minutes to present all the cool things of your robotic solution!

Maximum length: 90 seconds (1.5 minutes)  
File type: .avi .mpeg .wmv .mp4  
Maximum file size: 100 MB

### What you need to think of first:

- Shoot your video in landscape mode.
- Sound is even more important than image!  
Start with a test video to see if people can hear you on the video. Try to use an external microphone if possible.
- For the WRO International Final, the video must be done in English.
- English subtitles can be used to help with understanding, but these are optional.



### Make the video with your team.

- The video should be made by the team, not by the coach or others.
- A coach or others may only help or guide with regard to any technical issues that teams have while preparing the video (especially for younger students).
- We do not expect a professional video production.

### What should be in the video?

#### Briefly introduce your team

- Take a few seconds to introduce your team. Who are you? Where are you from?

#### Briefly introduce your project idea

- Explain the idea for your robotic solution in a few words. How does it connect to the season theme?

#### In the video you will need to show your robotic solution while it is running.

- You do not have to repeat everything you have written in your report, focus on showing how your robotic solution works when running.

#### The team can do show the robot in the real-world environment.

- If it is possible, you can put your robot in the real-world environment. So, if your robot is supposed to work in a forest, why not make a video in the forest?

## WRO Ethics Code for Teams



### The WRO Ethics Code for Teams

**“It is not whether you win or lose, but how much you learn that counts.”**

#### As a team we follow these principles:

We are participating in a competition.  
We like to win. We want to learn.  
And we also want to have fun.

We want to play fair.  
We design our own robot and we write our own software.  
It is not fair if someone else does that for us.

We can only learn if we try things ourselves.  
Our coach can teach us things and guide us.  
And we can also get inspired by others.

But our coach should not do the work for us.  
And we do not simply copy a robot or software from someone else.  
We use the examples we find to design our own robot and programming.

Sometimes we fail and that is OK.  
Original ideas come from failing.  
Winning is nice but failing is part of our journey.

Team name: \_\_\_\_\_

Name & signature of Coach: \_\_\_\_\_

Name & signatures of Team members: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## What is OK and what is not OK in World Robot Olympiad™?

OK	Not OK
<b>All competitions</b>	<b>All competitions</b>
We search for information online and share ideas with other people. We learn from the examples and use what we have learned in our own robot. (hardware and/or software)	We buy a solution online or we use a direct copy of another person. We use that solution in the competition. (hardware and/or software)
Our coach/mentor/parent advises us on different ways to program things.	Our coach/mentor/parent programs the software (or parts of the software) for us.
Our coach/mentor/parent shows us different ways of constructing things.	Our coach/mentor/parent builds the robot (or parts of the robot) for us.
Our coach/mentor/parent lets us find out what to do ourselves if things don't work.	Our coach/mentor/parent fixes it for us if things don't work.
Our coach/mentor/parent lets us handle things ourselves on the competition day.	Our coach/mentor/parent discusses with the judges about the rules and decisions on the competition day.
We want to win the competition, but not by cheating or having someone else do the work for us.	We want to win the competition, it does not matter how we win it.
We adapt our strategy ourselves and repair / adapt our robots ourselves.	Our coach/mentor/parent suggests or tells us how to change our strategy and repairs / adapts our robots for us.
<b>RoboMission</b>	<b>RoboMission</b>
We try to solve the surprise rule and 2 <sup>nd</sup> Day Challenge ourselves, because we have learned all the basics and can find a solution as a team.	Our coach/mentor/parent tries to give us the instructions to solving the surprise rule and 2 <sup>nd</sup> Day Challenge after it has been announced.
<b>Future Innovators</b>	<b>Future Innovators</b>
Our coach/mentor/parent only helps us with preparing our Robot model or Future Innovators booth if it is needed. (For example, if things are too heavy, if we need to learn new skills, or if something is too dangerous for us to prepare on our own.)	Our coach/mentor/parent decides what our robot model and/or our booth will look like and builds things for us even if we could make it on our own.