ROBOFINIST

Freestyle

RoboFinist competition rules

Version 4.0 dated October 1st, 2024

1. General Provisions

A team submits one robotics project for evaluation.

1.1. Task Description

Within tha frame of the competitions in the creative category of the RoboFinist festival and in order to determine the vector of further development of creative projects, the Organizing Committee specifies the concept of a robot (robots) in a creative robotics project.

According to the festival, a robot must necessarily have 3 main components: **mechanical, electronic and algorithmic**, which are interrelated and each of which plays an essential role in the functioning of the entire project.

In view of the above, a robot is an automatic device with feedback, acting according to the loaded program, capable of independently interacting with the environment and reacting to its changes.

Interaction with the environment must necessarily cause the robot to react: the movement of its parts, the movement of itself in space, the movement of other objects by the robot.

The interaction must assume the robot's ability to analyze sensor readings, respond to the amount of the disturbing influence, and form commands for the actuators depending on the sensor readings.

The interaction must be supported by control algorithms which logic depends on the environment and is not an implementation of direct program control.

Any project that meets this definition is allowed to participate in the creative category, otherwise the project may be rejected at the registration stage or receive zero points when evaluated by the Judges.

The project is evaluated by the Judges according to the criteria laid down in these Competition Rules.

If the Judges reveal plagiarism with the attribution of authorship by the participants to themselves, such participants can receive penalty points from the Judges up to disqualification.

1.2. Restrictions

A team must meet the following requirements, unless otherwise specified by the Organizing Committee of a particular Event:

- the number of participants in the team is 3 or less (the number of coaches/team managers is not limited);
- age of participants is limited by the Age categories of the competitions (see the General Competition Rules):
  - «Junior» - teams in which in the year of the competition the oldest participant is 12 years old or less are allowed to participate;
  - «Middle» - teams in which in the year of the competition the oldest participant is from 13 to 15 years old are allowed to participate;
  - «Senior» - teams in which in the year of the competition the oldest participant is from 16 to 19 years old are allowed to participate.

2. Project Requirements

There is no mandatory or restrictive list of parts to be used in these competitions.

The project must meet fire and electrical safety requirements, comply with sanitary rules, regulations and hygienic standards established on the day of the competition.

The project can be realized by a group of participants with the help of third parties. However, the festival participants must indicate their part of the work as well as the part of the work done with the help of third parties.

For the project demonstration the teams will be provided with the following equipment:

- an exhibition stand with size in range by 1.5×0.5×2.0 to 2.0×2.0×2.0 m (W×D×H) or the appropriate place to install the project with the possibility of fixing the poster;
- a table with size of 1.2×0.6 m;
- chairs according to the number of people in the team;
- one electrical socket (220 V)

Participants may request additional equipment from the Organizers in advance, which can be provided if available.

2. Requirements for the Presented Materials

During the registration procedure each team has to present the following project materials, unless otherwise specified by the Organizing Committee of a particular Event:

- description;
- photo;
- video;
- detailed description;
- poster;
- presentation for preview.

The obligation to provide certain materials is decided by the Organizing Committee of the Event, depending on the status of the competition, its duration and the number of participants.

The required project materials must be attached to the application form by the deadline for registration, unless otherwise specified by the Organizers.

The Organizers have the right to refuse to register a team whose materials are not informative enough (video consists of photos and screenshots without a demonstration of a working project, an explanatory note that does not contain significant information about the project, etc.).

3.1. Description

The project description must contain at least 500 characters. In the description, it is necessary to specify which platform the project is based on, describe its design, tell what is unique about the robot and what is its purpose.

3.2. Photo

The photo must show an actual project placed in the center of the picture, occupying the most part of the shot and being in focus.

3.3. Video

The video must include an oral presentation of the project and demonstrate its performance. The video must include a fragment containing an A4 piece of paper or other meduim (e.g. a blackboard with writing on it) on which the team name and the date of filming can be clearly seen. The length of the video must not exceed 5 minutes 30 seconds.

3.4. Detailed Description

A detailed description may include:

- specifying the project platform;
- functional diagrams;
- description of the design;
- description of algorithms;
- description of the robot's purpose;

- history of the project;
- photographs;
- other information directly related to the project.

3.5. Poster

Each team is obliged to decorate their stand with a poster. The poster is provided by the Organizers of the Event according to the layout sent in advance, or the participants prepare the poster themselves according to the instructions of the Organizers of the Event.

The layout must be presented at registration in PDF format with a density of at least 72 pix/inch. Poster size - at least 1200×800 mm, orientation - portrait.
The poster must contain the following information:

- project name;
- keynotes;
- image of the basic design;
- functional diagram.

3.6. Presentation for Preview

The main objective of a brief presentation (not exceeding 1 minute) is to attract the interest of the audience in the project and motivate them to visit the project stand. The presentation must meet the following requirements:

- presentation format - .pdf;
- aspect ratio of the presentation slides 16:9;
- 3 slides maximum;
- without animation, video, audio.

4. Contest Procedure

During the competition, each team must present its project.

The project must be exposed to Judges, spectators and other participants at the stand during the entire time of the competition in accordance with the program of the Event.

The competition consists of the following stages:

1. Evaluation of preparation

    1.1. Preview

    1.2. Evaluation of project materials

    - video
    - photo

- detailed description
- poster

1.3. Evaluation of the presentability of the projects

- design of the project area,
- participants' look
- promotional handouts

2. Teams’ evaluation

3. Judges’ evaluation of projects

4. Evaluation of interaction
   4.1. Review of opponents' projects
   4.2. Promotion of the opponent's project
   4.3. Evaluation of the quality of team’s evaluation

All clauses, except for the Judges' evaluation of projects (3), may be omitted by the decision of the Organizing Committee depending on the status of the competition, its duration and the number of participants.

4.1. Evaluation of Preparation. 20% of the Total Score

4.1.1. Preview

Participants give a brief presentation of their projects.

The preview is an open event. The time and place of the preview is determined by the Organizing Committee and recorded in the competition program.

The preview is held for the purpose of brief presentation of the project and should arouse spectator interest to find out more about it.

The format of the preview, taking into account the requirements to the presentation and time, can be of any type. Everyone may participate in the preview.

The time of the preview must not exceed one minute, otherwise participants may be stopped by the Judges.

4.1.2. Evaluation of Project Materials

Judges evaluate the materials attached to the application:

- photo;
- video;
- detailed description (explanatory note);
- poster.

4.1.3. Evaluation of Project Presentability

Judges evaluate the aesthetics, originality and relevance, compliance of the design with the theme of the project. The handouts, uniforms or costumes of the team are also evaluated.

4.2. Teams' Evaluation. 10% of the Total Score

Teams score each project from a different age category.
Scoring order:

- senior age category teams score projects of the middle age category teams;
- middle age category teams score projects of the junior age category teams;
- the junior age category teams score projects of the senior age category teams .

In each team one member must have an up-to-date independent access to an account on the RoboFinist portal to enter points into the electronic protocol.

4.3. Judges' Evaluation. 60% of the Total Score

The speaker team defends its project in the form of a face-to-face demonstration before the Judges.
During the defense, the team is given:

- 5 minutes for oral presentation and demonstration of the project's performance;
- 5 minutes to answer questions from the Judges and reviewers.

Each project is independently evaluated by 3 or more Judges. Each Judge has the right to approach the same project several times.
Judges evaluate all projects of their category according to the established criteria.

4.4. Evaluation of Interaction. 10% of the Total Score

4.4.1. Review of Opponent's Project

Each team is a reviewer of one of the projects in its category. Which project the team reviews is be decided by lot.The reviewer team should be given sufficient time (recommended at least two hours) to familiarize itself with the opponent's project. During this time, the reviewer should familiarize itself with the project and prepare a general text review of the project. The review must contain the following:

- positive and negative aspects of the reviewed project;
- relevance and adequacy of the goals and objectives;
- the overall level of implementation of the project;
- trajectories for improvement of the reviewed project.

4.4.2. Promotion of Opponent's Project

The review team must prepare an advertisement of the reviewed project. The presentation should be a video clip or any other advertising message (a small stage play, song, poem, etc.) lasting no more than one minute.

The reviewing team must prepare all media materials of photo and video by itself.

The review team should post the materials on video hosting service, and the link to these materials should be published in the comments to the reviewed project. In addition, the review team should submit the advertising materials in electronic form for evaluation by the Jury.

4.4.3. Evaluation of the Quality of Team's Evaluation

Judges assess the quality of team's evaluation: all points and the objectivity of team's evaluation are taken into account.

5. Scoring

For each criteria, a team may receive from each Judge a number of points not exceeding the number specified in the list (the list indicates the maximum score for each criteria plus one additional point that shows the judge's special opinion, where appropriate).

If a team is unable to show that an element of the project was completed by participants themselves, the Judge may award 0 points for the relevant criteria.

Example of score calculation:

Criteria	**Judge 1**	**Judge 2**	**Judge 3**	**Median**
Criteria 1	1	**4**	5	4
Criteria 2	**2**	3	2	2
Criteria 3	1	**2**	5	2
Total			Sum of medians	8

5.1. Evaluation of Preparation - Preview, Project Materials, presentability

Each team's materials are evaluated by the Judges according to the criteria listed. Each Judge evaluates the project individually.

Criteria:

1. Preview / 3

1.1. The preview is carried out in compliance with the Competition Rules;

1.2. The preview gives sufficient information about the project;

1.3. The preview arouses a keen interest and a desire to learn more about the project.

2. Project materials / 11

2.1 Photo quality / 2

- the photo of the project is of sufficient quality and corresponds to the project theme;
- the photo is of very good quality, clear, the angle is well chosen and gives an idea of the project, corresponds to the project description.

2.2. Video quality / 3

- there is a video of the robotics project;
- the video qualitatively shows the robotics project with full demonstration
- the video demonstrates the development stages and components of the project.

2.3. Quality of detailed description / 3

- there is a description of the robotics project;
- the description exhaustively discover the essence of the robotic project, a neat layout;
- there is a developed design documentation.

2.4. Poster quality / 3

- there is a poster;
- the poster has a good balanced design, completeness and structure.

2.5. Special opinion_____

3. Evaluation of the presentability of the projects / 6

3.1. Design of the project area / 2

- the area is decorated, there are additional design elements in addition to the main poster;
- quality design, diagrams demonstrated.

3.2. Promotional Handouts / 2

- there are promotional handouts;
- handout is well designed and makes one want to learn more about the project.

3.3. Participants' Look / 2

- there are team costumes or uniforms;
- elements of robotics,eElements of electronics are used in the costume

Maximum 20 points.

The team result is determined as the sum of the medians of the Judges' scores for each item of the criteria.

5.2 Teams' Evaluation

Projects are evaluated by team members from defferent category without formalized criteria on a ten-point scale.

The maximum score is 10 points.

The team result is determined as the median of the scores of all teams.

5.3. Judges' Evaluation

The work of each team is evaluated by the Judges according to the criteria listed. Each Judge evaluates the project individually.

Criteria:

1. **Idea / 3**

   1.1. The project lacks an idea, the purpose of the project is not indicated, the meaning of the project is not clear **- 0 points**;

   1.2. The implementation of the project corresponds to the declared idea;

   1.3. The idea of the project is based on universal eternal values;

   1.4. The idea is original and innovative.

2. **Originality / 3**

   2.1. No comparison has been made with analogues or similar projects have already been presented by other authors at competitions, on the Internet, or there is no robotic of originality **- 0 points**;

   2.2. The project has significant circuit design differences from the analogues presented earlier;

   2.3. The project has significant algorithmic differences from the analogues presented earlier;

   2.4. The project has significant design differences from the analogues presented earlier.

3. **Design complexity / 5+1**

3.1. Logically related mechanical components in the project have less than 2 degrees of freedom (actuating element - gripper, welding machine, etc. - does not add a degree of freedom) **- 0 points**;

3.2. The project has a free-moving robot or mechanism (several mechanisms), providing 2 degrees of freedom;

3.3. The project has several mechanisms of different principle of operation, each of which has at least two degrees of freedom that function together and in a coordinated manner;

3.4. More than 4 degrees of freedom of the actuating element;

3.5. There is an actuating element in the form of a gripper, which ensures the movement of objects on the plane and over a distance;

3.6. Complex mechanical solutions are used, with several kinematic groups, flexible mechanisms, complex and/or non-standard kinematic pairs, etc.;

3.7. Special opinion_____.

4. Electronic complexity / 5+1

4.1. The project has only a standard controller from a robotic kit and less than two tandard sensors - **0 points**;

4.2. 2 or more sensors are used (sensors that involve the use of a hand when triggeringe.g. pressing a button, approach of the palm, etc., are not taken into account);

4.3. 4 or more sensors of different types (2 types or more) are used (sensors that the use of a hand when triggering, e.g. pressing a button, approach of the palm, etc., are not taken into account);

4.4. Non-typical sensor connection is used;

4.5. Other hardware platforms, microcontrollers, single-board computers, FPGAs, etc. used;

4.6. Self-developed electronic components (including sensors) are used;

4.7. Special opinion _____.

5. Cybernetic complexity / 9+1

5.1. All control is open loop or reduced to a single relay control - **0 points**;

5.2. Several relay controllers working together and/or there are other controllers;

5.3. The analog physical quantity (current, speed or position of the motor shaft) continuously controlled using feedback;

5.4. The control system has linear controllers (P, PI, PD, PID, etc.);

5.5. The control system has nonlinear controllers (cubic, adaptive, etc.);

5.6. Sensor readings are filtered and noise is eliminated;

5.7. The calculation of the control action is based on a integral analysis of the readings of several sensors of different types.

5.8. Complex mathematical algorithms (simulation modeling, predictive modelingcalculation of necessary trajectories, SLAM, computer vision elements, etc.) are used;

5.9. Methods of synthesis and adjustment of controllers, analytical calculation are used;

5.10. Fuzzy logic is used in the control system, methods of machine learning, intelligence are applied;

5.11. Special opinion _____.

6. **Programming quality / 9+1**

6.1. The algorithm has a linear structure, only action and standby commands and control are used; the algorithm is more complex, but the participants cannot explain it - **0 points**

6.2. Basic algorithmic structures (branch, loop, subroutine) are used;

6.3. The program processes primary measurement data and transmits it to the system;

6.4. Arrays are used in the program structure;

6.5. Operations with vectors and/or matrices and/or complex numbers are used;

6.6. The structure of the system states is presented in the project, the abstraction of state automaton is used;

6.7. Third-party libraries are connected and reasonably used;

6.8. Own libraries that increase the efficiency of the system are written, or another purpose is explained;

6.9. The program code is provided with comprehensive comments;

6.10. Friendly interface of communication with the user has been developped, the system parameters can be changed without restarting the program;

6.11. Special opinion _____.

7. **Performance / 6+1**

7.1. Participants were unable to demonstrate the performance, or there is no component - **0 points**;

7.2. Participants demonstrated the autonomous operation of one part of the project;

7.3. Participants demonstrated the autonomous operation of several project parts;

7.4. The autonomous operation of the project has been partially demonstrated;

7.5. Fully autonomous and well-coordinated work of all declared parts of the project demonstrated: mechanical, electronic and algorithmic;

7.6. There were no failures duing the demonstration of the autonomous robot behavior;

7.7. After a short-term adjustment, the project is ready to be relaunched;

7.8. Special opinion _____.

8. Technologies / 7+1

8.1. «Handmade» parts made by the authors of the project have been added;

8.2. There are self-engineered parts made on a 3D-printer, on a laser cutter;

8.3. There are self-engineered parts made on a milling machine, on a lathe;

8.4. More complex and labor-intensive technologies are used (e.g. silicone molding);

8.5. The parts are neat, post-processing is used;

8.6. A large part of the design was created in CAD, virtual models are presented;

8.7. Computer modeling technologies are used;

8.8. Special opinion _____.

9. Defense, presentation of the project / 3+1

9.1. Defense of the project was held;

9.2. The essence of the robotic project was discovered and convincingly defended;

9.3. The answers to the questions were exhaustive;

9.4. Special opinion _____.

10. Aesthetics / 3

1. The project is neat;

2. The project is designed aesthetically, all design elements are well matched with functionality of the project;

3. There are decorations, a script, and elements that support the script.

Maximum 60 (53+7) points.

The team result is determined as the sum of the medians of the Judges' scores for each item of the criteria.

5.4. Evaluation of Interaction

The work of each team is evaluated by the Judges according to the criteria listed. Each Judge evaluates the project individually.

Teams give in the text of the review on a pre-printed form for evaluation by the Judges.

Criteria:

1. Review of another project / 3

1.1. The review is done;

1.2. The review is done in a qualitative and indepth manner;

1.3. The team proposed some constructive and interesting ideas for the development of the project.

2. Promotion of another project / 3

2.1. The advertisement is made clearly, correctly and informs about the project in a fairly complete manner;

2.2. Emotive advertising;

2.3. Advertising shows the positive attitude of the creators towards the authors of the project.

3. The quality of the teams' evaluation / 2

3.1. Evaluation is done, all teams were scored;

3.2. The difference in scores for teams of different levels is visible.

4. Special opinion / 2 _____

5. Penalties for the unethical attitude of teams, their leaders, parents to other participants, judges, guests, the use of profanity, are up to the disqualification of the team.

Maximum of 10 points.

5.5. Final result

The final result of the team is calculated as the sum of the ratings of all scores.

Final result (max 100) =

Judges' Evaluation (max 60) +

Judges' Evaluation of Preparation (max 20) +

Teams' Evaluation (max 10) +

Evaluation of interaction (max 10)

If there is only Judges' Evaluation, the final rating is equal to the Judges' Evaluation.

6. Procedure for Determining the Winner

The team with the highest final result is declared the winner.

If the final results are equal, the decision on which project gets advantage is made by the Panel of Judges, including based on the scores for certain stages and criteria. When analyzing the level of projects, the Panel of Judgesl has the right to decide by general vote not to award any of the places (1st, 2nd, 3rd) or to award several identical places.

According to the results of the Evaluation, 1st, 2nd, 3rd places are determined.

At the discretion of the Judges, teams can be awarded in specific categories.