IROS-SB-2 The 2nd Self-Balance Robot Competition for Young Students

SECTION I: BRIEF DESCRIPTION:

This competition is the second edition of the IROS-SB Self-Balance Robot Competition for Young Students that took place in IROS-2022 Kyoto, Japan. The main motivation for this competition is to attract and encourage the high school students from the MENA region and developing countries in Africa to get involved in IEEE RAS events which would help in shaping the attention of the future generations towards creating innovative solutions in robotics. In this edition, we will adapt the same tasks, rules and regulations from the previous edition. Additionally, we added a new task to the current edition. Competing teams are consisted of a minimum 4 and a maximum 6 high school students (ages 14-17 years old) per team.

HERE IS THE BRIEF DESCRIPTION OF THE TASKS:

TASK 1:

In this task, the robot should be able to balance its weight with additional payload of 500 grams (500 ml bottle water) on a flat horizontal surface while remaining at rest for a period up to 3 minutes. Each team will be granted 2 opportunities (rounds) to perform the task. The score is calculated with one point per second of successful balancing within the period of 3 minutes.

TAKS 2:

In this task, the robot should balance itself on an inclined ramp of 15 degrees with the bottle. Each team will have two trials to balance their robot for total time up to 3 minutes. The score is calculated with two points per second of successful balancing within the period of 3 minutes.

TASK 3:

In this task, the robot should be able to deliver a payload of 500 grams (bottle of water) for 1 meter on a horizontal surface. The task should be completed within a period of 100 seconds. The score is calculated with one point per second of the remaining time until the completion of the 100 seconds.

TASK 4:

In this task, the robot should be able to deliver a payload of 500 grams (bottle of water) for 1 meter on a inclined surface of 15 degrees. The task should be completed within a period of 100 seconds. The score is calculated with two points per second of the remaining time until the completion of the 100 seconds. There will be one obstacle in a random (to prevent hard coding) place along the 1 meter path. The robot must avoid it and return again to the path to get 10 extra points.

TASK 5:

Task will be announced three-days before the final round.

The referees are consisted of the competition committee or people working under the committee's supervision (i.e. volunteers from universities, or IEEE RAS SAC). The referees will be responsible to control the starting times and calculating the effort time for tasks 1 and 2. For tasks 3 and 4, the referee is responsible for calculating the remaining time and the distance achieved in case the total distance is not covered.

SECTION II:

Rules and Assessment: 2.1 Robot's Hardware and Software:
The following points describes the main rules and regulations regarding the hardware and the software of robot that will be accepted to participate in the competition:

1. The height of the robot is measured from the floor surface. The minimum allowable height is 250 mm (not included the bottle height).

2. The bottle will be placed upright on the surface at the maximum height of the robot.
3. The robot's weight must be between a minimum weight of 0.5 kg and a maximum weight of 1kg (excluding the bottle).

4. The maximum dimensions for Length and Width should be L150 mm x W150 mm, including the wheels.

5. Up to 2 motors and 2 coaxial wheels with a width of up to 2 cm each are allowed to move the robot, which are the only points where the robot touches the ground.

6. All wheels should move freely.
7. No restrictions on the microprocessors and sensors to be used.
8. No restrictions on the material in which the robot will be built from.
9. The robot should be absolutely free, without something to keep it on the ground or keeping the weight on it e.g. glue, outriggers, construction, etc.

10. It is not allowed to use any technology to change the weight of the robot or to attach the robot to the ground.

11. Before the match the robots will be homologated. During the homologation, following adhesion test will be performed: the robot will be laid on a sheet of paper. It will pass the test, if this paper stays on the ground when the robot is lifted with its adhesion technologies turned on.

The referee will check whatever concerns the requirements set by the tasks.

2.2 THE CONTEST

TASK 1

the robot should balance its weight immovable, carrying an additional weight of 500 gr
(a plastic bottle of water) on a completely flat surface. The following are the rules and regulations for the contest of Task 1:

1. If robot fails to balance, it will have another attempt.
2. The total time of every effort could be up to 3mins.
3. The inclination of the surface should be 0 degrees.
4. The bottle should weighs 500 gr altogether (bottle and content)
5. The score is 1 point for every successful second of the same effort.
6. After the 3 mins the effort doesn't count.
7. If a robot doesn't balance even in the second attempt, it takes no point (zero 0).
8. The committee gives the signal for the start and puts on the chronometer.
9. After putting on the chronometer, no communication is allowed with the robot or the trial is canceled.
10. The committee gives the signal for the end.

TASK 2

the robot should be balanced immovable on an inclined ramp, at least 15 degrees, with the bottle. The following are the rules and regulations for the contest of Task 2:

1. If robot fails to balance, it will have another attempt.
2. The inclination of the surface should be at least 15 degrees.
3. The total time of every effort could be up to 3mins.
4. The score is 2 points for every successful second of the same effort
5. After the 3 mins the effort doesn't count.
6. If a robot doesn't balance even in the second attempt, it takes no point (zero 0).
7. The committee gives the signal for the start and puts on the chronometer.
8. After putting on the chronometer, no communication is allowed with the robot or the trial is canceled. The committee gives the signal for the end.
9. The bottle should weighs 500 gr altogether (bottle and content)

TASK 3

Task 3: the robot should carry a bottle of 500 gr at a distance of 1m, on a completely flat surface. It has 100 seconds to complete the task. The following are the rules and regulations for the contest of Task 3 .

1. If robot fails to balance, it will have another attempt.
2. It earns one point per second, for the remaining time until the completion of 100 seconds.
3. On the surface should be stacked a measuring tape of 1 meter with the measures visible.
4. The inclination of the surface should be 0 degrees.
5. The bottle should weighs 500 gr altogether (bottle and content)
6. The total time of every effort is up to100 secs.
7. After the 100 secs the effort doesn't count.
8. The starting and ending point will be marked on the ground.
9. If a robot doesn't balance even in the second attempt, it takes no point (zero 0).
10. The committee gives the signal for the start and puts on the chronometer.
11. After putting on the chronometer, no communication is allowed with the robot or the trial is canceled.

TASK 4

the robot should carry a bottle of 500 gr at a distance of 1m, on a completely flat surface. It has 100 seconds to complete the task on an inclined surface of 15 degrees. The following are the rules and regulations for the contest of Task 4

1. If robot fails to balance, it will have another attempt.
2. It earns one point per second, for the remaining time until the completion of 100 seconds.
3. On the surface should be stacked a measuring tape of 1 meter with the measures visible.
4. The inclination of the surface should be at least 15 degrees
5. The bottle should weighs 500 gr altogether (bottle and content)
6. The total time of every effort is up to100 secs.
7. After the 100 secs the effort doesn't count.
8. The starting and ending point will be marked on the ground.
9. If a robot doesn't balance even in the second attempt, it takes no point (zero 0).
10. The committee gives the signal for the start and puts on the chronometer.
11. After putting on the chronometer, no communication is allowed with the robot or the trial is canceled.

TASK 5:

Task will be announced three-days before the final round.

2.3 SCORE CALCULATION AND WINNER ANNOUNCEMENT

The Score is calculated as the following equation:

= Task 1 Score + Task 2 Score + Task 3 Score + Task 4 Score + Task 5 Score

TOTAL SCORE:

The team with the highest score wins the competition. In case of a draw, the team with the lighter robot will have the advantage. In case of another draw, the robot with the best score in tasks 2 and 4 wins.

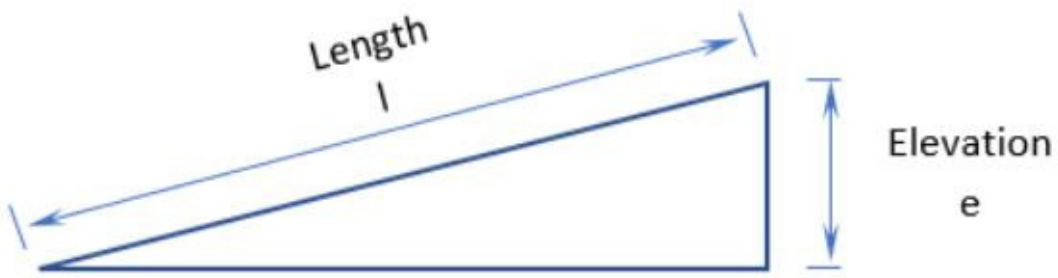
2.4 PLAYGROUND

The playground is consisted of two surfaces, one surface for Tasks 1 and 3 (Horizontal Surface), while the other surface is for Tasks 2 and 4 (Inclined Surface).
Horizontal Surface:

1. The horizontal surface can be the floor with markers that indicates the starting point and the ending point.
2. The distance between the start and end points is 1 meter with clear marks for every 5 cm. 3. The width of surface is 50 cm.

INCLINED SURFACE:

1. The inclination of the surface should be at least 15 degrees.
2. The width of the surface should be apr. 50cm
3. In order to achieve the 15 degrees inclination of the surface, the dimensions according to figure below are l=130 cm and e=33.6 cm
4. The surface of the playground must be completely smooth, without protrusions, little bumps or other configurations that help the robot to be attached on it.



2.5 POWER OF OFFICIALS AND LIABILITY

1. If a robot or a participant violates the rules, the referee may disqualify them from the task. He may also disqualify the participant or the robot for further tasks.
2. No objections against the decisions of the referee or the organizers are allowed.
3. The decision of the referees is not subject to appeals. Complaints must be submitted during or immediately after the match. Any later complaints will not be accepted. In case of any conflicts or disputes, the final word will be said by the referees and the organizers
4. Regulations may be updated without prior notice and therefore you should be in constant contact.
5. The participants are responsible for their robots and their safety and will be liable for all damages caused by them, their robots or their equipment.
6. The organizers will not be under any circumstances held liable or responsible for any accidents of the participants or any damages caused by the participants, their robots or their equipment.