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1. Game Description

Energy Saving Robot provides an opportunity for students to use their knowledge, skill and creativity to build a robot, where the robot has ability to follow the line using light source energy from the solar cells and condenser. **This game is played face-to-face only.**

2. Robot

2-1. Type of robot: No restriction

2-2. Construction (Built on-site)

The robot should be built on-site by the participant during the construction time. Parts that can be premade are controller module of robot, condenser module, wire joint connected with solar panel and wire joint connected with condenser. There is no restriction on composition.

2-2-1. Size of robot: No restriction. If participate use oversized robot such that cannot play in the assigned playground, won't be allowed to participate in this category.

2-2-2. Match is divided into Junior and Challenge

- 1) Junior league: Driving along the installed guide walls. A robot that drives the furthest wins the game during the limited time.
- 2) Challenge league: Robot must autonomously trace the line in the playfield using the program or logical circuits.

2-2-3. Power source on robot

Robots should work with an solar power supply by the artificial sunlight(halogen light) provided in playfield A; it cannot use a combustibile device. The robot does not allow to use additional battery.

2-2-3-1. Solar cells: Less than 150mm x 150mm

2-2-3-2. Condenser: It is allowed to use condenser which are less than 2 farad. If participant wants to use 2 condensers, it should be less than 1 farad.



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Otherwise, it won't be allowed. (Ex. 10mF*20 condensers)

2-2-3-3. Connector: Before the match starts, in order to completely discharge the robot, Participants must connect designated connector. If not installed, it's impossible To confirm whether robot is fully discharged or not. Therefore, will be Disqualified.

2-2-4. Operation: No restriction

2-3. Programming and control: Robot must move autonomously by the program except the starting point and it cannot be operated from outside. The course will be announced on the matchday.

3. Competition Site

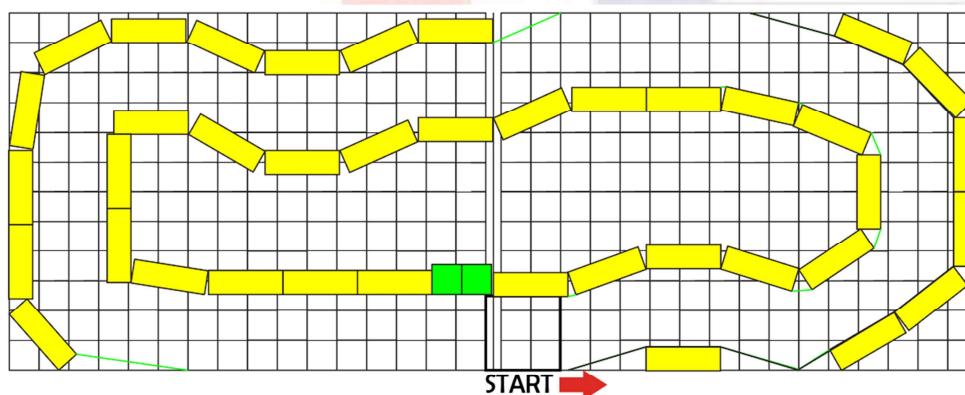
3-1. Official Playfield: Playfield approved by International Robot Olympiad committee

3-2. Size and Composition: The size of playfield must be 160cm x 12m ($\pm 10\%$) and connecting two playfields.

3-2-1. Connection: The size of bridge has to be 25cm ($\pm 10\%$) and will be connected in a straight line or a curved line.

3-2-2. Allowable range of error in the stadium: The slope that is less than 2° ($\pm 10\%$) and a gap or bump that is less than 3mm ($\pm 30\%$) is allowable.

3-2-3. Prevention for falling robot: Special structure such as acrylic wall will not be installed around the playfield. But, guide wall will be installed to indicate the route.



<Example>



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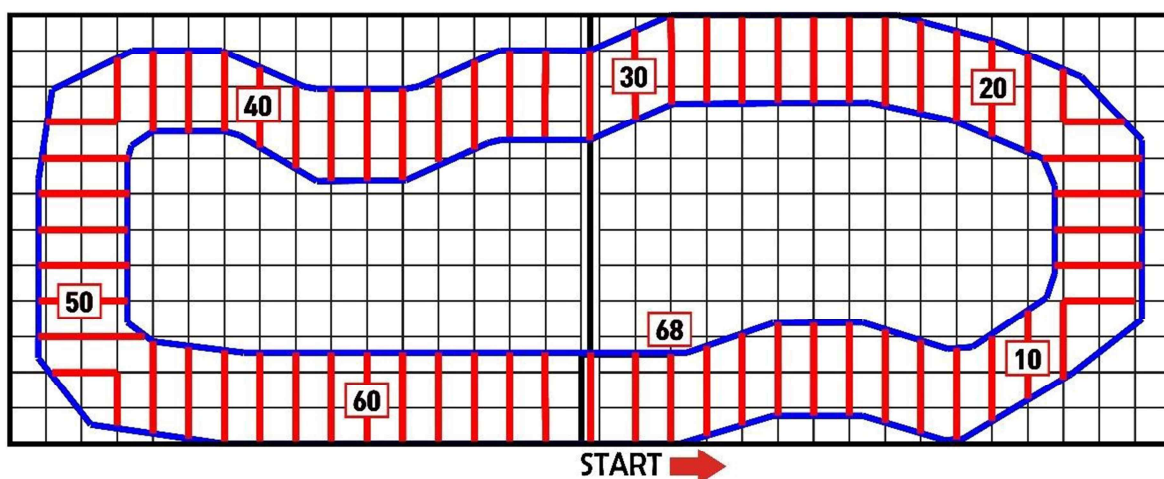
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3-3. Playfield: It is cover with matt coat polyethylene terephthalate paper which includes advertisement and logo from the organizers.

3-3-1. Mission Map: There is a mission map with 10cm square grids, and it fix with sheets and tapes in the playfield.

2019 International Robot Olympiad Committee

Energy Saving



- Whenever a robot passes the redline, it will get 1 point.
(It is calculated after the start line, If a robot runs a lap, the point of start line will be scored as well.)
- If a robot touches the redline a little anyway, the point will be scored.

⚠ Do not bring this mission paper outside the challenge field until the end of every competition

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<Example>

3-3-2. Driving course: Guide wall will be installed for indicating the driving course. It consists of connection of straight wall and curve wall and it fixes on the playfield.

3-3-3. Guide wall: The interval distance of guide walls is 25 cm ($\pm 10\%$) and height is more than 10cm($\pm 10\%$) and it will be fixed by paper sheets, tape and etc.

3-4. Artificial sunlight (halogen light): Artificial sunlight will be installed at Area A. There won't be any artificial sunlight in Area B.

3-4-1. Allocation of artificial sunlight (halogen light): lamps are fixed on the side of the stadium or are installed at the ceiling of the play field.

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3-4-2. Specifications of halogen lamp: At least 300wh and on-site notice on the day of the match.

3-4-3. Halogen lamp installed height: installation height of halogen lamps is 25 cm (Error ± 1 cm) on the floor of the play field.

4. Competition progress

4-1. Game process

Chance will be given twice. After first trial there will be repair time.

4-2. Construction and practice time

Construction and practice time is more than 30 minutes, less than 120 minutes and it will be announced on the day of match.

4-3. Allocation of playfield

It will be allocated based on number of participant and difficulty level of the game.

4-4. Construction and Practice

Participants can't practice until their playfield is assigned, after then participants can practice until announced time.

4-5. End of Production and Practice time

After production and practice time, participants must stop their robot and follow the instruction of referee and staffs.

4-6. 1st Trial

After the construction and practice time the 1st trial will begin.

4-6-1. preparation of the game

All participants must bring out the robot and wait according to the instructions of the respective referee and staff. The capacitor used as a battery must be completely discharged. Therefore, the capacitor's + and - poles should be opened to the referee for visibility, or a separate dischargeable port should be added to facilitate discharge. At the scene, the referee will completely discharge the vehicle with a low-power motor just before driving.

4-6-2. Standby after the game

When a participant finished their 1st trial, they have to line up and wait for all participants' game to be completely finished.

4-7. Repair Time

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After the end of 1st trial, all participants have 30 minutes to repair their robot and practice.

4-8. 2nd Trial

Right after the repair time, 2nd trial will begin.

4-8-1. preparation of the game

All participants must bring out the robot and wait according to the instructions of the respective referee and staff. The capacitor used as a battery must be completely discharged. Therefore, the capacitor's + and - poles should be opened to the referee for visibility, or a separate dischargeable port should be added to facilitate discharge. At the scene, the referee will completely discharge the vehicle with a low-power motor just before driving.

4-8-2. Stand by after the game

If a participant finishes their 2nd trial, they go back to their seats.

5. Competition

5-1. Performing of the mission

5-1-1. Area A: After referee's signal, participant should turn on its switch. He/she are not allowed to touch their robot. If participant push their robot physically or turn on its switch again, he/she will be disqualified. After departure, robot must get out of A playfield within 40 seconds. Robot has to accumulate as much energy as possible in the condenser.

5-1-2. Area B: Robots use only the accumulated energy in the condenser to drive the courses.

5-2. Points

Point will be recorded at the destination point where the robot stopped

5-3. Start

A participant should start the robot when the referee starts the game. Referee records the time with a stopwatch.

5-3-1. Discharge of condenser: Before starting match, participants should discharge their condenser. Referee will check their condenser using SPG GEARED MOTOR before the match.

5-4. Arrival

If a robot stops, referee will stop measuring time. After stopping, referee will count 10

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5-5. Time limit

The time limit in A playfield is 40 seconds. Including this 40 seconds, the total match time



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is 2 minutes.

5-6. Officialize of the mission

Before the game starts, the course, location of artificial lights and etc will be announced to participants in form of paper on the matchday.

5-7. End of Competition

If robot could not continue match, referee will announce the match is over.

5-7-1. Area A: If a participant exceeds the time limit (40 seconds) in the area A, the match will be over and the points will be aggregated at the end point. For Area A, referee will not declare Robot Stop even if robot stops within 40 seconds.

5-7-2. Area B : If robot stops moving in the Area B, the referee will count 10 seconds and if the robot still could not move call it a stop and count the points at the end point.

5-7-3. Points

It will be counted by the distance and time record. If counterparts got same point on distance, time record will take priority of ranking.

5-7-4. TKO (technical knockout): During the match, referee can declare of TKO without 10 counts when referee judge that the robot can't drive properly anymore. (Ex. robot had been stopped over the structure and obstacle, robot drive settled zone repeatedly).

5-8. Disqualification

Participants can be disqualified if violation is spotted by referee or staff.

5-8-1. Robot Touch

During matches, If participants touch the robot without judge and supervisor authorization, it will be declared as 'Robot Touch' and will be disqualified for that trial.

5-8-2. Repair during the match

During the match, holding spare parts, tools and batteries for the purpose of repairing the robot is prohibited, if this action is discovered by the referee, participants will be disqualified for that trial.

5-8-3. Sensor tuning

Before the competition, If participants try to tune the sensor, will also be disqualified.



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5-8-4. Disobey of seat allocation

If participant practice or play the game at the playfield that they're not assigned, participant will be disqualified.

5-8-5. False Start

If participant conduct 'False Start' twice, participants will be disqualified.

5-8-6. Miss Start

If participant conduct 'Miss Start' three times, participants will be disqualified.

5-8-7 Battery usage detected

If a participant is caught using a regular battery, not a condenser, participants will be disqualified.

5-9. Rematches

During the match if expected situation occurs, such as blackout or breakdown of measuring instrument, referee can decide to do rematch.

5-10. Referee will control all situations from and referee have authority to control participants. The judgment of game result is exclusive authorization of referee. The declaration shall be final.

6. Evaluation

6-1. Ranking decision factors

Mission points of each course and time record

6-2. Mission points

When referee declare the end of the game, point will be recorded at the destination point where the robot stopped. At this time, the highest point from the grid that is touching to the front wheel will be recorded as final point. If a robot drives more than a lap, the points will be added from first lap plus additional lap.

Ex. When we have a mission that total score of one lap is 68, participant will get 78 scores if his/her robot does a lap and pass 10 red lines. (Refer to the 3-3-1 mission map example.)

6-3. Time record

Time record is based on the referee's stopwatch when a robot stops completely. (If

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you are declared as TKO or robot falls by referee, point will be recorded at the point of



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TKO or robot fall declaration.)

6-4. Final score

Better score out of 1st and 2nd trial will be the final score.

6-5. Order of priority to result

If a robot stops at the same destination (get the same scores), the result will be decided by their time record.

6-5-1. Order of priority according to the trial

If counterparts have same result in a certain trial, referee will compare result from another trial and decide the winner.

6-5-2. Order of priority according to Tie-Breaker

If it ties even after applying rule 6-5-1, referee will decide winner from better 1st round score.

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