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Smart Farmer	Division	Team	How to Create
	Junior / Senior	1 person (individual)	Preproduction

## 1. Description

Smart Farmer is a game where players control a humanoid to move blocks, plant a field, and pick fruit according to a given mission. It's a record-breaking game that requires gameplay strategy and skillful control of the robot to complete missions quickly.

## 2. Robot

2.1 Types of robots : Humanoid

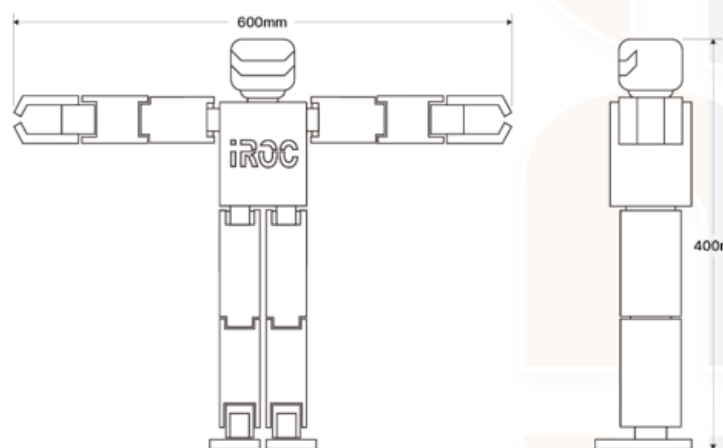
2.2 Robot's Configuration

2.2.1 **Fabrication:** The robot must be pre-built prior to the competition, and no additional build time will be allowed at the competition site. There are no restrictions on the construction or use of parts, except for motors, and all humanoids are eligible.

2.2.2 **motor** specification to 12.0V / 1.50Nm / 60rpm / Cored / TTL or less

2.2.3 **Parts:** Except for the motor, the rest of the parts can be used freely. (sensors, etc.)

2.2.4 **Size of the robot**



<Figure 1> Size of the robot

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**2.2.5 Sole length:** Limit the diagonal length of the sole to no more than 15 centimeters.

## 2.3 Power

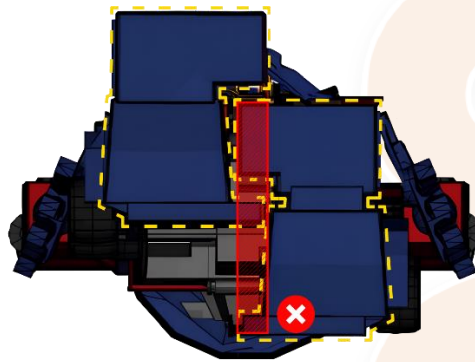
**2.3.3** Autonomously mobile with an independent power source and cannot use a combustion engine.

**2.3.4** The voltage of the robot is not limited.

## 2.4 Driving the robot

**2.4.1** Multi-jointed bipedal walking with no linkage structure.

**2.4.2** No crossing of the feet is allowed in the upright position. (The soles of the feet must not overlap each other as shown in Figure 2).



<Figure 2> Overlap of robot soles in upright position

## 2.5 Programs and controls

**2.5.1** It is allowed for the robot to be self-powered or to be controlled by a controller.

**2.5.2** Communication Standards for Piloting

**2.5.2.1** Zigbee / Bluetooth / 2.4Ghz wireless communication only

**2.5.2.2** The use of a smartphone as a controller is allowed, but it must be in flight mode while in the competition area, otherwise it will be disqualified for any reason.

**2.5.2.3** No wired controls are allowed.

**2.5.2.4** If there is any miscommunication, the team that fails to change channels will be disqualified.

## 2.6 Spare robots

**2.6.1** A competitor may have a spare robot in addition to the main robot for use in the match, but both the main and spare robots must be verified by the referee before

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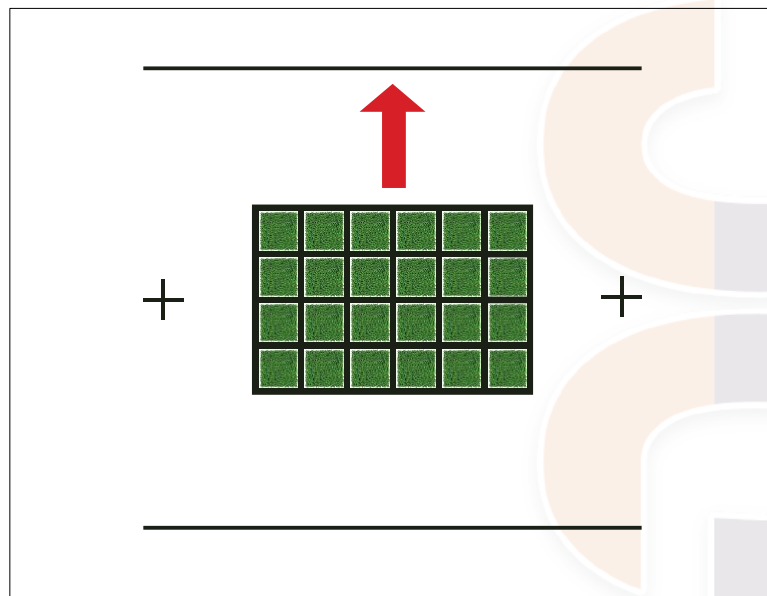
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the match.

- 2.6.2 The use of a spare robot must be verified by the referee before the start of the competition is declared.

### 3. Playfield

- 3.1 Authorized venues Use authorized venues as defined by the International Robotics Olympiad Committee.
- 3.2 **Playing field dimensions and configuration:** Each participant will use one playing field top measuring 160 cm x 120 cm ( $\pm 10\%$  tolerance).



<Figure 3> Example of a stadium map

- 3.2.1 **Tolerance of the playing field:** The playing field can have a slope of no more than  $2^\circ$  ( $\pm 10\%$  tolerance) and bumps or gaps of no more than 0.3 cm ( $\pm 10\%$  tolerance).
- 3.2.2 **Robot fall protection:** There will be no separate arena walls to prevent robots from falling.
- 3.2.3 **Distance between stadiums:** The distance between stadiums must be no more than 50 centimeters from each other, based on the stadium dividing line.

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**3.3 Stadium field:** The floor is made of sheeting and is white in color, and may be partially covered with sheeting for advertising or the organizer's logo.

**3.3.1 Mission Map**

**3.3.1.1 Field:** A checkerboard of 4 squares by 6 squares with one grid square measuring 7 cm by 7 cm ( $\pm 10\%$  tolerance) is placed in the center.

**3.3.1.2 Trees:** Trees are placed per mission on a dividing line 20 centimeters from both sides of the arena.

**3.4 Stadium Accessories**

**3.4.1 Block**

**3.4.1.1 Shape:** Hexahedron

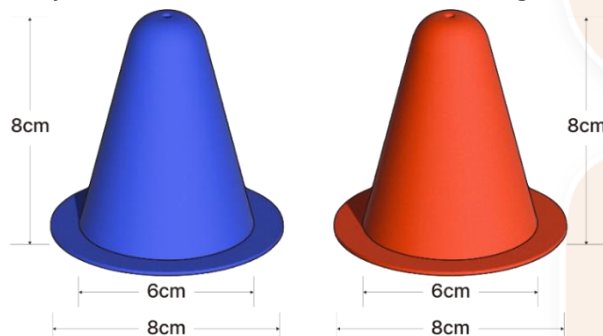
**3.4.1.2 Weight:** 20 grams or less ( $\pm 10\%$  tolerance)

**3.4.1.3 Size:** 5 cm x 5 cm x 5 cm (W x D x H,  $\pm 10\%$  tolerance)

**3.4.1.4 Type**

- 1) Red Block: Apple
- 2) Orange Block: Orange
- 3) Yellow Block: Mango
- 4) Purple Block: Grapes
- 5) Black Block: Rock

**3.4.2 Fire Extinguishing Cone and Flame Cone:** These are cones made of flexible PVC. They measure 8 cm x 8 cm (diameter x height,  $\pm 10\%$ ) and weigh 15 grams ( $\pm 10\%$ ).



<Figure 4> Fire extinguishing cone and flame cone specifications

**3.4.3 Obstacle** 10cm x 10cm x 10cm (L x D x H)  $\pm 10\%$

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## 4. Match progression

- 4.1 How the match is played:** The match is a record match, with a total of two chances, with a correction period between each attempt.
- 4.2 Practice time:** Robots will have a minimum of 2 hours to practice, which will be announced on the day of the competition.
- 4.3 Assign playfield:** Assign playfield based on the number of players and difficulty level of the competition.
- 4.4 Practice:** Participants may practice in their assigned playfield until the end of the announced practice time, and may not begin practicing before their playfield assignment.
- 4.5 End of Practice Time and Corrections:** When time is up, stop your robot and follow the instructions of the moderator to your seat.
- 4.6 1<sup>st</sup> trial:** The first period will be played immediately after practice. If there is a lunch break, this can be adjusted.
  - 4.6.1 Match Preparation:** All competitors must come out with their robots and wait as directed by the referees and officials at each venue.
  - 4.6.2 Waiting after a match:** All participants take their turn to play and wait in a queue until all participants have finished playing, rather than returning to their seats.
- 4.7 Modification Time:** At the end of the first period of competition, all competitors will be given time to modify or practice their robot. The modification time will be announced on the day of the competition.
- 4.8 2<sup>nd</sup> trial:** The second period of the match will be held immediately after the correction period.
  - 4.8.1 Preparation** All competitors must come out with their robots and wait as directed by the referees and officials at each venue.
  - 4.8.2 Waiting** All players take their turn to play and return to their seats to wait.

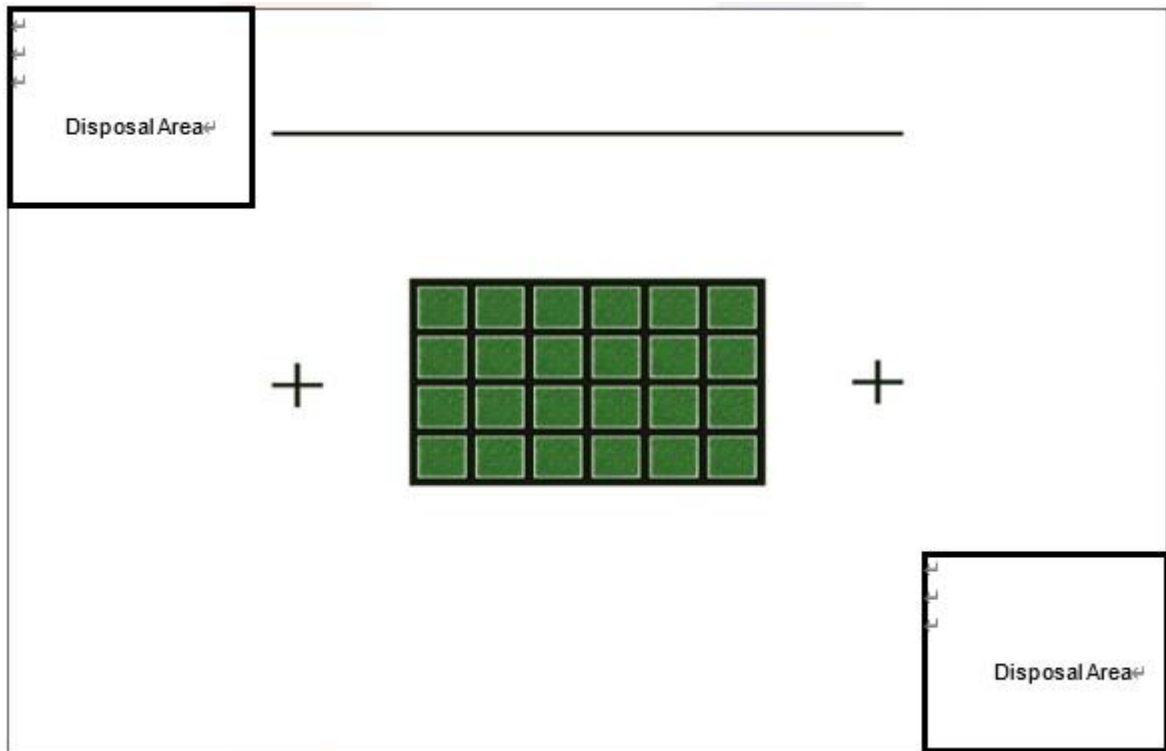
## 5. Match

- 5.1 Missions:** Move blocks to cultivate fields, plant or grow trees, and complete farms based on the day's missions.
  - 5.1.1 Plow the Field:** Move rocks from the Field to the Rock Disposal.
    - 1) The location and size of the rock disposal varies by mission.

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- 2) When moving stone and grass to the disposal area, points will be accepted when placing inside the black line. (Points will not be accepted if the block is touching the line.)
- 3) The rock bin is 20 cm x 20 cm and is represented as shown in Figure 5.
- 4) If you move the rock with your foot in succession while walking sideways or in a straight line, the rock must be moved back to its original position.



<Figure 5> Rock and grass treatment plant examples

**5.1.2 Fruit Gathering:** Move fruit blocks into the correct order for the mission.

**5.1.3 Put out the fire:** Place a fire extinguishing cone over the flame cone.

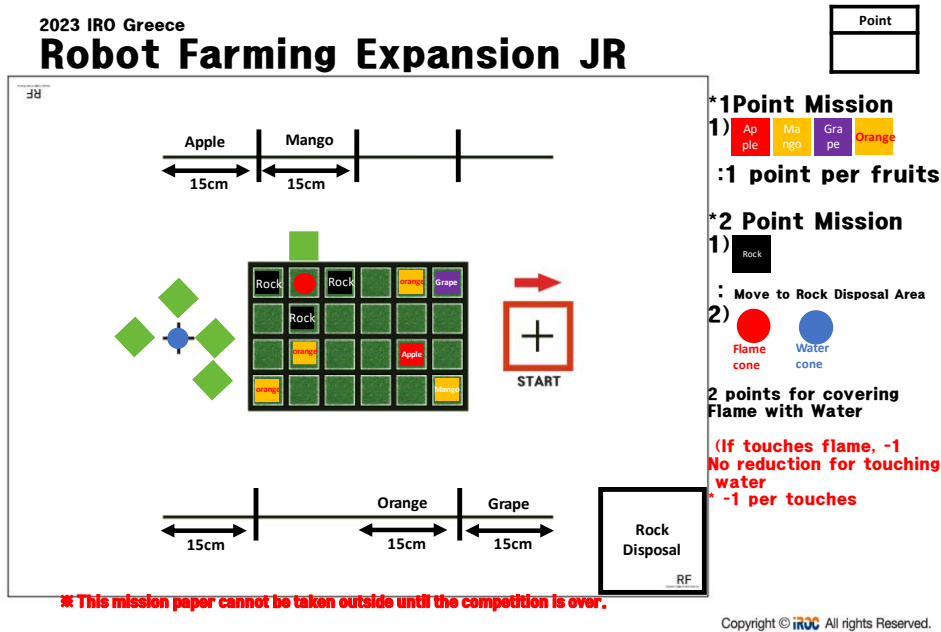
## 5.2 Point

- 1) **Tilling the Field:** 2 points per rock removed
- 2) **Fruit picking:** 1 point for picking 1 fruit that fits the location
- 3) **Putting out fires:** 2 points for covering a flame cone with a fire extinguishing cone

**5.3 Mission Reveal:** The placement of the blocks and the missions to be performed will be revealed on the day of the match via a mission sheet on site prior to the start of the match.

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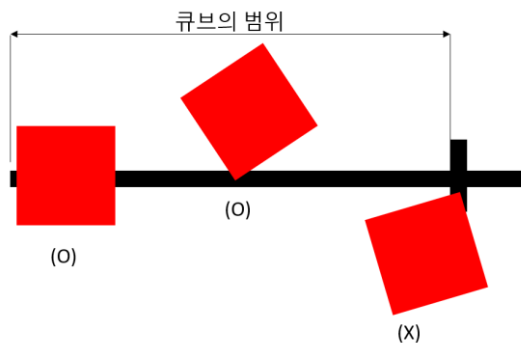
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<Figure 6> Mission paper example

#### 5.4 blocks

- 5.4.1 If a block falls off the playing field, the robot is allowed to move it, including freely transporting it.
- 5.4.2 No part of the robot may touch the flame cone. If it does, it will be penalized 1 point.
- 5.4.3 The flame cone must be completely covered by the fire extinguisher cone for the mission to be scored as successful.
- 5.4.4 If the fruit is not placed correctly, no points are awarded.
- 5.4.5 If the fruit is not centered or positioned on the line as shown in Figure 7, no points are awarded.



<Figure 7> Range of cube success



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**5.5 Start the match:** Follow the referee's signal to start the match.

**5.5.1 False Start:** If the robot is activated before the referee's start signal, a false start is declared and the match is restarted.

**5.5.2 Restart:** A competitor has a total of one opportunity to restart a match per match. A competitor who has two false starts in a match will be disqualified.

**5.6 Time limit:** Total match duration is up to 2 minutes.

## 5.7 Match Officiating

**5.7.1 Called Game:** The match ends when one participant completes all of the missions within the time limit, and the final score and time is recognized.

**5.7.2 Timeover:** If fail to complete the mission within the time limit, your score at the end of the time will count as your record.

**5.7.3 Robot Stoppage:** If a robot stops moving or hovers in a certain space during the match, the referee will issue a 10-count. If the robot does not start up again after the count, the referee will declare a robot stop and the match will end, and the score will be recognized up to the point of the robot stop.

## 5.8 Match disqualification

**5.8.1 Robot Touch:** If a competitor touches a robot during a match without the referee's permission, a robot touch will be declared and the competitor will be disqualified.

**5.8.2 Repairing the robot during the match:** Adding, removing, exchanging, or altering parts of the robot during the match is prohibited, and if a competitor possesses spare parts, tools, batteries, etc. for the purpose of repairing the robot while waiting for the match, the competitor will be disqualified.

**5.8.3 Failure to honor playfield assignment:** Participants caught practicing or competing in a playfield other than their assigned playfield will be disqualified.

**5.9 Rematch:** In the event of an unforeseen event, such as a power outage, a rematch may be held at the discretion of the referee and supervisors.

**5.10 Referee's Rulings:** The referee has the authority to preside over all situations and supervise the participants from the start to the end of the match. Deciding the outcome of a match is the sole authority of the referee and his/her declaration is final.



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## 6. Evaluation

**6.1 Recording items** Mission points and time record

**6.2 Target Mission Recording** After the referee declares the end of the match, the number of missions performed is counted and points are awarded.

**6.3 Time Record** The referee's stopwatch time at the end of the timed mission will be accepted as the record.

**6.4 Final record** Better record among 1<sup>st</sup> and 2<sup>nd</sup> trial will be considered as the final record.

**6.5 Prioritization of records**

### Target Mission Score > Compare Timelines

**6.5.1 Priority on Trial** If tied at the same trial, record of another trial will be compared

**6.5.2 Priority when tied**

- 1) The best record in the 1<sup>st</sup>/ 2<sup>nd</sup> trial will be recognized and counted, but in case of a tie, the participant with the best record in the 1<sup>st</sup> trial will be prioritized.
- 2) If tied, followings will be considered to pick a winner

**Number of succeeded Fruit harvest > Number of succeeded Rock Disposal >  
Number of fire cone extinguishment**