

ABU
ASIA - PACIFIC ROBOT CONTEST 2024
QUANG NINH - VIET NAM

THEME & RULES

“HARVEST DAY”

Table of Contents

I. THEME.....	3
II. THE IMPORTANCE OF SAFETY	5
III. DOMESTIC CONTESTS AND CONTEST DATES	5
IV. CONTEST RULES	6
1. Terms and Definitions	6
2. Contest Outlines	8
3. Game Procedure	8
4. Violation.....	11
5. Disqualifications	11
6. Teams	12
7. Robot	12
8. Safety.....	13
9. Others	14

Figures and information on contest-related articles (Appendix) will be a separate file.

I. THEME

The significance of efficient cultivation to bring a warm and prosperous life for everyone

1. Terraced fields

For thousands of years, rice has been closely associated with the people of Vietnam. Rice not only provides sustenance but also becomes a beautiful aspect of the cultural and spiritual life of the Vietnamese people. Nowadays, rice serves as both a vital food source and a strategic export commodity for Vietnam.



There is a unique form of cultivation in the traditional agricultural practices of the people living in the highland regions of Vietnam, known as terraced fields.

People will choose slopes, hills, and mountains to create flat terraces for cultivating crops and planting rice. The purpose of implementing terraced fields is to prevent erosion, improve and protect the soil.



The remarkable feature of terraced fields is that during the harvest season from around June to October, the mountain slopes resemble a piece of artistic painting carved into the mountains by the local farmers.



The terraced fields are not only beautiful but also the 'rice granary' of the highland people, utilizing the natural conditions for effective cultivation and providing a warm and prosperous life.

With these significances, in recent years, terraced fields have become a highlight in tourism, attracting many domestic and international tourists. They have become a cultural beauty and a source of pride for the Vietnamese people.



Drawing inspiration from cultivation on terraced fields, the ABU Robocon 2024 contest hosted by Vietnam, has developed robot tasks that depict the stages of rice cultivation. These tasks include sowing, harvesting, and transporting the harvested grains to the warehouse. The underlying message is 'Efficient cultivation brings a warm and prosperous life for everyone'

Illustration photo: Photographer Kim Manh

II. THE IMPORTANCE OF SAFETY

In ABU Robocon, safety is a top priority. Participants shall give safety precedence over everything at all times, from the robot designing and manufacturing stages to taking part in the actual contest. Teams are always required to cooperate fully with the organizer in order to ensure the safety of the Robocon competition for all participants, including team members, spectators, officials and staff, as well as for the surrounding environment.

Members of all teams are required to wear shoes with rubber soles and helmets when participating the game.

III. DOMESTIC CONTESTS AND CONTEST DATES

1. Domestic Contests

All domestic competitions to select the representative teams for the ABU Robocon 2024 Quang Ninh – Vietnam should adhere to the rules laid out in this Rule Booklet. However, it is understood that if (a) material(s) is/are not available, organisers are to employ the best possible replacement(s) available in their country/region.

2. Contest Dates

23/8/2024 (Fri.): Arrival

24/8/2024 (Sat.): Test- run, Rehearsal

25/8/2024 (Sun.): Contest Day

26/8/2024 (Mon.): ABU General Meeting, Producers Workshop, Friendship Exchange Programme.

27/8/2024 (Tue.): Departure.

3. Contest Venue: Quang Ninh Sports Training Center (Ha Long city, Quang Ninh province, Vietnam)

IV. CONTEST RULES

1. Terms and Definitions

Terms	Definitions	Note
Robot 1	<p>The robot that only works in Area 1 and Area 2</p> <p>Robot 1 is either Manual Robot or Automatic Robot.</p> <p>Manual Robot: The robot which is operated by operator via wireless connection.</p> <p>Automatic Robot: The robot which is able to work independently without any help from an operator.</p>	
Robot 2	<p>The robot that works in Area 1, 2, 3</p> <p>Robot 2 must be an Automatic Robot</p>	
Area 1	<p>Area 1 is where the Robots plant Seedlings.</p> <p>Area 1 consists of following:</p> <ul style="list-style-type: none"> - Start Zone is where the two robots start. - Planting Zone is where the robots plant Seedlings. In the Planting Zone, there are twelve (12) planting circles. Only one (1) Seedling must be placed within one (1) planting circle. - Seedling Rack is where 12 Seedlings are placed before the game starts. 	Refer to Figure 1.1
Area 2	<p>Area 2 is where the robots harvest Paddy Rice.</p> <p>Area 2 consists of the following:</p> <ul style="list-style-type: none"> - Harvesting Zone is where the Robots pick up Paddy Rice and Empty Grain. - Water Zone is where robots cannot come in contact with. Robots are able to enter the space above. - Retry Zone for Robot 2 	
Area 3	<p>Area 3 is where Robot 2 stores Paddy Rice.</p> <p>Area 3 consists of the following:</p> <ul style="list-style-type: none"> - Storage Zone is where Paddy Rice and Empty Grain are gathered. - Silo is where Robot 2 brings Paddy Rice for storage. - Silo Zone is where the 5 Silos are fixed. Robot is prohibited from entering the Silo Zone including its space above. When the robot put Paddy Rice into the Silo, only the parts of Robot that bring Paddy Rice are allowed to enter the space above this zone. In this case, Robot is not allowed to touch Silos. Robots can touch the side of the Silo Zone. 	
Seedling	<p>Seedlings are the objects made of PVC pipe. They are placed in the Seedling Rack before the game starts.</p> <p>Each team has 12 Seedlings.</p>	Refer to Appendix
Paddy Rice	<p>Paddy Rice is the balls of team's colour. They are placed in the Harvesting Zone and the Storage Zone before the game starts.</p> <p>Each team has 12 Paddy Rice, in which, 6 Paddy Rice are placed in the Harvesting Zone, the rest of 6 Paddy Rice are placed in the Storage Zone.</p>	Refer to Appendix

Terms	Definitions	Note
Empty Grain	Empty Grain is the ball of purple color. They are placed in the Harvesting Zone and Storage Zone before the game starts. Each team has 6 purple balls in the Harvesting Zone and 10 purple balls in the Storage Zone.	Refer to Appendix
“Mùa Vàng” (Harvest Glory).	‘V Goal’ “Mùa Vàng” (Harvest Glory) is achieved when 3 Silos meeting following conditions. + A Silo is full and contains a minimum of 2 own team color’s Paddy Rice. + The top Paddy Rice is of the team’s colour. The team wins at the moment when Mua Vang is achieved.	
Plant	Is a task in which the Robots pick up the Seedlings from the Seedling Rack, carry and place them onto the designated Planting Circles at the Planting Zone. Each planting circle is allowed to have only one Seedling.	
Harvest	Is a task in which the Robots pick up Paddy Rice/Empty Grain from the Harvest Zone, and carry them to the Storage Zone. The Robots must pick up Paddy Rice/Empty Grain in the following sequence: one (01) Empty Grain, and then one (01) Paddy Rice.	
Store	Is a task in which Robot 2 picks up Paddy Rice located at the Storage Zone, then carries and puts them into the Silo.	

2. Game Outlines

- 2.1 A game between two teams (Red Team and Blue Team) takes place within 3 (three) minutes. Each team has 2 (two) robots, namely Robot 1 and Robot 2.
- 2.3 Before starting the match:
- (a) In Area 1, twelve (12) Seedlings are placed in the Seedling Rack.
 - (b) In Area 2, six (6) Paddy Rice and six (6) Empty Grain are placed in the Harvesting Zone as per attached field layout.
 - (c) In Area 3, six (6) Paddy Rice and ten (10) Empty Grain are placed in the Storage Zone as per attached field layout.
- 2.4 When the game starts, the robots can go to the Seedling Rack in Area 1 to collect the Seedlings and plant them in the Planting Zone.
- 2.5 In Area 2, the robots can collect the Paddy Rice and Empty Grain placed in the Harvesting Zone and transport them to the Storage Zone located in Area 3.
- 2.6 In Area 3, The Robot 2 can collect the Paddy Rice, and store them in the Silos located in the Silo Zone.
- 2.7 The game shall end when the competing team successfully completes the task of “*Mùa Vàng*”.
- 2.8 In case there is no “*Mùa Vàng*” victory, when the 3-minute time is over, the game shall end. The team achieving the highest total score will be the winner. In the case of a tie, the final result will be determined according to Article 3.7.

3. Game Procedure

- 3.1. Set up
- 3.1.1 Before a game, each team has 1 (one) minute to set up and move the robots into the Start Zone. Six (6) Paddy Rice, and ten (10) Empty Grain will be placed at the designated location in Storage Zone by the opponent team by using square frame.
- 3.1.2 Three (3) team members and up to three (3) pit crew members shall be allowed to participate in the set-up.
- 3.1.3 The set-up time will start right after the signal from referees and will end right after one (1) minute.
- 3.1.4 If a team fails to complete its set-up within the given one (1) minute time frame, it may resume set-up after the start of the game by obtaining permission from the referee.
- 3.1.5 The Robots (including the control unit) must fit within a starting zone including its space above.

3.2 Start of the Game

- 3.2.1 When the set-up time is over, referees will signal to start the game.
- 3.2.2 Teams that complete their set-up after the start of the game shall obtain permission from the referee to commence moving their robots.
- 3.3 Team members and pit crew members during the game
 - 3.3.1 Team members are not allowed to be on the field during the game. They must obtain permission from the referees to enter the field. Team members can enter only the space above of the field during the game except during Retry.
 - 3.3.2 Pit crew members have to stand inside the pre-assigned area out of the game field.
 - 3.3.3 Team members are not allowed to touch the robots without the permission of the referee.
- 3.4 Planting Seedlings, harvesting Paddy Rice and Empty Grain, storing Paddy Rice in the Storage Zone and the Silo Zone.
 - 3.4.1 Planting Seedlings
 - (a) Robots perform the task of planting Seedlings in Area 1. For each time, a robot is allowed to collect 1 (one) or multiple Seedlings.
 - (b) Robots plant Seedlings within the Planting Circles in the Planting Area. For each time, a robot is allowed to plant 1 (one) or multiple Seedlings.
 - 3.4.2 Harvesting Paddy Rice and Empty Grain
 - (a) Robots can enter into Area 2 any time.
 - (b) Robots pick up Paddy Rice or Empty Grain from Harvesting Zone, then carry it to the Storage Zone.
 - (c) The number of Paddy Rice and Empty Grain that a robot can harvest in Area 2 should not exceed the number of Seedlings planted in Area 1. Any extra number of Empty Grain and/or Paddy Rice which the robot harvested won't be added to the score and considered as the violation.
 - (d) Robots are allowed to touch the balls without picking them up. However, if a team member wants to pick up any touched ball that has been moved out of its original position, he/she has to return the ball to its original position and retry the robot.
 - (e) Robots have to pick up and carry balls following the order: one (01) Empty Grain and then coming one (01) Paddy Rice.
 - (f) Robot 1 is prohibited from directly transferring Paddy Rice and Empty Grain to Robot 2.
 - (g) Direct transfer: The ball that has left Robot 1 touches Robot 2 without touching the field or the ball on the field.
 - 3.4.3 Storing Paddy Rice in the Silo

- (a) Robot 2 are not allowed to move up to Area 3 when it is carrying Paddy Rice or Empty Grain.
- (b) Robot 2 picks up Paddy Rice from the Storage Zone and stores them in the Silo.
- (c) For each time, the Robot 2 is only allowed to collect a maximum of 02 (two) Paddy Rice.
- (d) If Robot 2 carries Empty Grain out of the Storage Zone, this Robot must be retried. Empty Grain will be returned to the Storage Zone by referee

3.4.4 In case when Robot drops Paddy Rice and Empty Grain (ball) during the task execution:

- (a) If the ball falls outside the field, it will be considered invalid (not retrievable).
- (b) If the ball falls into the opponent's game field, it will be a violation. The team will not be allowed to retrieve it. If the opposing team wants to remove the ball from their side, the team must retry.
- (c) If the ball falls within Area 1 or Area 2 of the own team's game field, the ball can be placed back in the Harvesting Area by team members with a retry.
- (d) If the ball falls within Area 3, outside of the Storage Zone, the ball can be placed back at the white line of square frame position in the Storage Zone by Team members with a retry.

3.5 Score

The score is calculated as follows:

- (a) Robots successfully plant 01 (one) Seedling: 10 points.
- (b) Robots successfully harvest 01 (one) Paddy Rice in the Storage Zone: 10 points.
- (c) Robots successfully harvest 01 (one) Empty Grain in the Storage Zone: 10 points.
- (d) The Robot 2 successfully stores 01 (one) Paddy Rice in a Silo: 30 points.

3.6 End of the game

The game shall end when:

- (a) A team wins the “Mùa Vàng”
- (b) Or the 3 (three) minutes of game time is over.
- (c) One of the teams got disqualified

3.7 Deciding the Winner

A Winning Team is determined as follows:

- 1) The team that achieves absolute victory, the “*Mùa Vàng*”
- 2) The team with a higher total score.

- 3) In case 2 teams have the same scores:
- (a) The team with a higher total score of the stored Paddy Rice in Area 3.
 - (b) The team with a higher total score of the harvested balls.
 - (c) The team with a higher total score of planting in Area 1.
 - (d) The team gains score of planting in advance in Area 1.
 - (e) Determination by The Judge Committee.

3.8 Retry

- 3.8.1 There is no limitation for retry. A retry is considered by the rule with approval from referee. Retry is applied for each robot.
- 3.8.2 In the case that Robot 1 is in Area 1 and Area 2, the robot must retry from Start Zone.
In the case that Robot 2 is in Area 1 and Area 2, the robot must retry from Start Zone. If Robot 2 is in Area 3, the robot must retry from Retry Zone.
- 3.8.3 If Robot 2 needs to retry in the Area 3, team members must take the robot out from the field and bring it to the Retry Zone in Area 2.
- 3.8.5 The items that robots had (Seedlings, Paddy Rice, Empty Grain) must be returned to the designated area by team members when retry. In the case that Paddy Rice and Empty Grain that robot has in Area 3, it must be returned to the designated area in the Storage Zone by team members.

4. Violation

The team who commits the following shall be deemed to be in violation of the rules and subject to a mandatory retry:

- 4.1 The robot uses suction cups on the competition floor.
- 4.2 The robot intrudes the opposing team game fields.
- 4.3 Robot touches the Silo.
- 4.4. Robot has any action of throwing or pushing the ball to opponent team's game field
- 4.5 Any other acts deemed to be an infringement on the rules.

5. Disqualifications

The team shall be disqualified, if they are deemed to have committed the following actions intentionally.

- 5.1 The design and construction of the robot do not comply with the requirements of the competition rules.
- 5.2 Any acts that pose danger to the game field, its surroundings, the robots, and/or people.
- 5.3 Any other act that goes against the spirit of fair play.
- 5.4 Any act of disobedience against a referee's warning.
- 5.5 Any act of controlling Robot 2 apart from during retry.

6. Teams

- 6.1 One (1) representing team from each country or region shall participate in ABU Robocon 2024. As the host country, Vietnam shall be represented by two (2) teams.
- 6.2 A team consists of three (3) team members who are students and one instructor, who all belong to the same university/college/polytechnic.
- 6.3 Besides three (3) team members, three members are allowed to be registered as the pit crew. The members of the pit crew shall also be students from the same university/college/polytechnic as those in.
- 6.2. The pit crew can assist in the work in the pit area, in carrying the robot from the pit area to the game field. They can assist team member during the setting time.

7. Robot

- 7.1 Each team is allowed to bring two (2) Robots.
- 7.2 The robot must not split into parts during the game.
- 7.3 The robot must be constructed by students from the same university/college/polytechnic.
- 7.4 Robot 1 and Robot 2 are not allowed to communicate with each other in any form.
- 7.5 Robot Dimensions

The Robot (including the control unit) must fit within a size of 700mm x 700mm x 700mm at the start of the game. Throughout the game, the maximum dimensions should not exceed 900mm (height) x 900mm (width) x 900mm (depth).

7.6 Robot Weight

- 7.6.1 The total weight of each robot, battery, controller, cables and equipment that the team brings for use in the game must not exceed 25kg.

7.6.2 Any other equipment that the team brings for setup purposes, tools, air containers, and backup batteries (of the same type as that initially installed in the robot) are exempt.

7.7 Power source of the robot

7.7.1 Each team must have their own power source for their robots.

7.7.2 Teams can use only batteries, compressed air, and/or elastic force as power source.

7.7.3 The nominal voltage of any battery used in the robot, controller, and any other devices during the game shall not exceed 24V. When connecting batteries in series, the total voltage must be 24V or less.

7.7.4 Power circuits of Robots should be designed so that any actual voltages in the circuits should be 42V or less. If the power supply system includes multiple isolated circuits, voltage in each system must be 42V or less.

7.7.5 Teams using compressed air must use either a container made for the purpose or a plastic bottle in pristine condition prepared appropriately. Air pressure must not exceed 600 kPa.

7.7.6 Any power source deemed dangerous are prohibited.

8. Safety

The design and build of robots should not pose any kind of danger to any person at the competition scene.

8.1 All robots must have a red emergency “STOP” **button**.

8.2 Robots must be designed and manufactured to ensure the safety of team members, opposing teams, surrounding people and the game field.

8.3 Team members must wear running shoes, helmets, and safety goggles during the games and test runs.

8.4 The following devices are not permitted to be used:

8.4.1 Lead-acid batteries, adhesive-sealed batteries, explosive and high-temperature energy sources, and any items that can damage the game field or hinder the competition.

8.4.2 If lasers are used, they must be of Class 2 or lower. Care must be taken not to damage the eyes of anyone in the venue.

8.5 Team should design fail safe systems.

8.6 When teams have multiple power supply systems, teams must design the circuits and mechanisms not to go out of control or move dangerously no matter which power supply is lost or regardless of the order of turning on the power.

8.7 To avoid starting a fire or smoking by the overload of a motor stall and so on, proper current limiting devices such as a circuit breaker must be installed to power supply circuits. Use wires, connectors, terminals, etc., with a rated current equal to or higher than the assumed maximum current.

9. Others

9.1 Situations not mentioned in this Rule Book shall be subject to the decisions of the Referee and the Organizing Committee.

9.2 The dimensions, weight, etc. of the game field described in this Rule Booklet may have a tolerance of $\pm 5\%$ unless otherwise specified.

9.3 For radio frequency communication, teams can use only Wi-Fi (IEEE 802.11), Zigbee (IEEE 802.15), and Bluetooth for the communications between controller and robot. The organizer will not control the environment of Wi-Fi, Zigbee or Bluetooth.

9.4 All inquiries should be directed to the official website of ABU Robocon 2024 Quang Ninh - Vietnam at <http://www.aburobocon2024.vtv.vn>. The FAQ section will be provided on the website of the contest.

9.5 Any changes to the Competition Rules will be updated on the official website of the ABU Robocon 2024 Organizing Committee at <http://www.aburobocon2024.vtv.vn>.

9.6 Teams must comply with the instructions of the Organizing Committee and the referees to ensure the safety of the robots and/or humans involved.

9.7 Robot transportation

9.7.1 The Organizing Committee will arrange for the transportation of robots for teams participating in the ABU Robocon 2024 Quang Ninh - Vietnam Contest. Details regarding this transportation will be communicated specifically to each team.

9.7.2 For teams participating in the ABU Robocon 2024 Quang Ninh - Vietnam Contest, the robots must be packed in a box with external dimensions of 1000mm (length) x 1600mm (width) x 1400mm (height).

Note: Participating teams must design and manufacture robots that fit within the dimensions of the crate; these dimensions will be bigger than the dimensions of the robots used for the competition.