2024 MARC -Designer – Space Power Ranger

The MARC (Master AI Robot Cup) – Designer Tournament includes a presentation and a competition. Teams are required to build a robot using the MATRIX Metal Kit and create a project proposal from their R&D process to present to the judges during the oral presentation. The competition is a collaborative event where two teams work together to accomplish a designated task, earning points in the process. Within the given time limit, alliances are required to gather space energy cubes from the playfield and earn points by successfully placing them in the alliance base. Teams have the opportunity to gain additional points by maneuvering their opponents' alliance robots out of the field. The alliance that earns more points in this way accumulates points for the round. The team with the highest score becomes the leading team and gets to choose a partner team to compete in the Alliance Elimination Match.
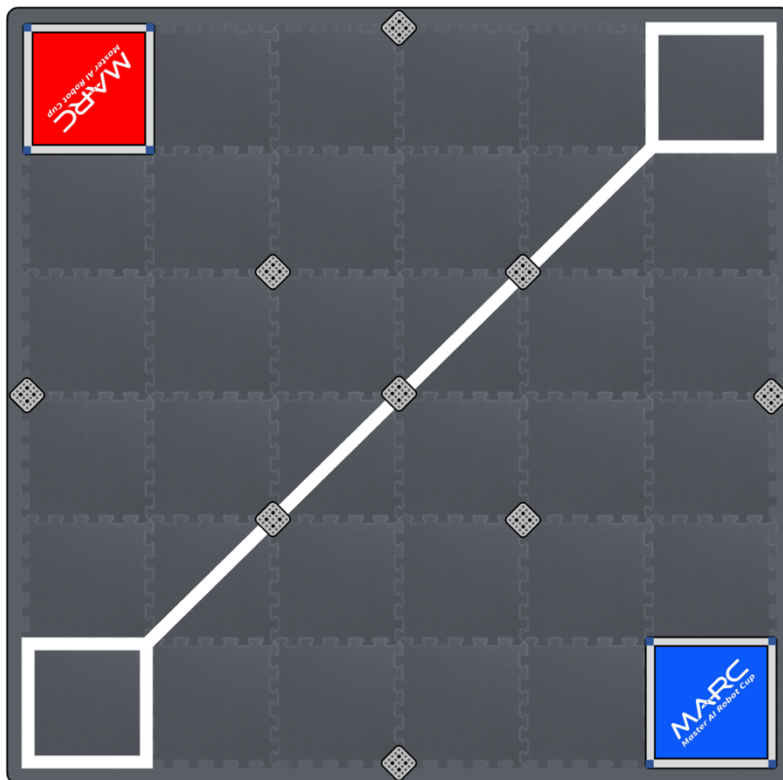

Figure 1. Demo Game Field (without scoring elements)

Eligibility and Programs

Grouping of Levels:

- Group A：Grades 2~7 (Age 7 – 13)

- Group B：Grades8~12(Age14-18)

- Grades 7 to Grades 8 can join A or B
- (Team members may form teams across schools and grades)

Team size:

- 2-4 students who are in the appropriate grade level or corresponding age for the group.

Instructor:

- Must be 18+, limited to 1~2 people, and can teach across schools.

[Presentation format]

A. The total presentation time for each team is 5 minutes, including 1.5 minutes for the team report, and the rest of the time is for evaluation and consultation. The presentation will be evaluated according to the contents of the "Robot Mechanism and Strategy Explanation" and the "Project Proposal".

B. The project proposal includes "Scoring Strategy", "Team Communication" and " Mechanical Design " and is limited to a total of four pages (excluding the cover page and table of contents).

  1. Scoring Strategy: Please describe how the robot plans to score points during the exploring, seizing, and occupying stages in each period. Describe the robot's method for scoring and assessing potential scenarios the robot could encounter in the process along with the team's planned responses.

  2. Team Communication: Describe how your team will be divided up (offensive and defensive responsibilities) within your team for a game.

  3. Mechanical Design: What robot designs have you developed for the robot in relation to the rules and tasks outlined in this competition?

- Attempt to address various aspects such as the chassis framework, arms, grippers, cargo container, counterweights, sensors, and lenses. Visual aids such as pictures and photos can be utilized for presentations.

[Competition Rules]

1. Competition Structure Explanation
    1. This is an alliance competition. The schedule will be established and disclosed by the organizers on the tournament day. After check-in, participating teams will draw lots to determine their team numbers, partners, and opponents for the alliance points competition.
    2. The Alliance system will be divided into two kinds of matches, Qualification Match and Elimination Match.
    3. In both the Qualification Match and Elimination Match, teams will ally with each other to engage in competition. They will contend for tasks involving robot movement and vie for space energy cubes by devising mechanisms for offensive and defensive maneuvers. The robots will be controlled autonomously through programming or remotely via remote control.
    4. The alliance achieving the highest score in a single round of the Qualification Match is declared the winner and is awarded 3 points. In the event of a tie, where both alliances have the same score, each team receives 1 point, while the losing team obtains 0 points. (see section 3 for more details on alliance scoring).
    5. Each team must play at least 4 Alliance Qualification Matches. If a team must participate in more than 4 Alliance Qualification Matches due to the competition system, the team can choose the best 4 matches from the participated matches for the total points.
    6. The team captains will be selected based on the overall alliance point standings, and the team captains will select their teammates to participate in the alliance playoffs. The top 50% of the teams in the alliance points ranking will be eligible to participate in the alliance selection. In case of a tie in total points, rankings will be determined by the total number of scores earned in each alliance qualification matches. If a tie persists, the team with the lower average robot weight will be ranked higher.
    7. The Alliance Elimination Round consists of three matches, the first Alliance to win two matches win the round. In the event of a tie after the three matches, additional matches will be played until one Alliance is the first to win two matches.
    8. If the total number of teams does not reach 24, the two teams with the highest total points in alliance qualification matches will be the Team Captains. They have the privilege of selecting one team from the top 50% of the alliance qualification ranking to advance to the Grand Final.

9. If the total number of teams reaches 24 or more, the four teams with the highest overall points in the alliance qualification matches will assume the role of Alliance Captains for the Alliance Semi-Finals. Each Alliance will consist of three teams, and rotations will be observed during the matches. In each match, the Blue Alliance must determine the robot to compete first and position it on the field unless the Red Alliance decides to go first.

- The priority sequence for alliance captains in selecting allies, based on points ranking, is as follows: 1st round: 1 -> 2 -> 3 -> 4; 2nd round: 4 -> 3 -> 2 -> 1. The matchups are: 1st alliance vs. 4th alliance (with the winning alliance becoming the red alliance in the final), 2nd alliance vs. 3rd alliance (with the winning alliance becoming the blue alliance in the final).

- In the final round, the blue alliance will choose to deploy the robot first and position it. The ultimate round will take place between the two victorious alliances.

2. Competition Rules
   1. The playing field consists of a mat with squares for the Red and Blue Alliances, placed on opposite ends along one of the diagonals of the field (see Figures 1 and 9).
   2. The other white square boxed area at either end of the diagonals of the field is the landing zone, and the two landing zones are connected by a white center field line (see Figure 1).
   3. There are nine mining towers in the field (see Figure 6), which serve as platforms for space energy cubes (see Figure 7) or alliance signaling spheres (see Figure 8).
   4. Field Set Up: All mining towers in the Entry Level Group have energy cubes (refer to Figure 3); the towers on both sides of the Advanced Level Group's alliance base have 1 blue and 1 red alliance signal sphere. The set up is symmetrical, with the referee randomized the position after the bots are placed on the field and are no longer moving (see Figures 4 and 5).
   5. The backs of the two alliance bases will be marked with the corresponding color of the alliance area, and players must operate their joysticks within the alliance area, and may not leave the area during the competition, except if permitted by the competition rules. Two teams will form an alliance, so each alliance will have two robots to compete.
   6. Before the start of the timer, each alliance's robot must not be extended beyond the specified size and must partially touch its own alliance base.
   7. A single match lasts 2 minutes and 30 seconds and is divided into 3 phases: the first 30 seconds is the exploration period, followed by a 2-minute scramble period, and the last 30 seconds of the scramble period is the occupation period.
   8. Competition Format: The Entry Level Group can participate remotely throughout the entire duration, while the Advanced Level Group will engage in autonomous robot mode during the exploration period. At the start of the competition, teams are required to press the green triangle button on the joystick. Once activated with a single touch, the robot cannot be manipulated with the joystick until the ready period beeps. Control over the robot can only resume when the competition period beeps.
   9. The projection of robot in the exploration period may not touch the white center line of the field, the landing zone, the mining tower on the center line, or the energy cube above it, otherwise alliance get penalty.
   10. Teams need to clip energy cube in the field and place it on own alliance base within the time limit, while avoiding being pushed out of the square mats by

their opponents.

11. Each robot can only move one Energy Cube/Alliance Signal Sphere at a time. Alliance get penalty if two Energy Cubes/two Alliance Signal Spheres are in your possession at the same time.

12. Energy Cubes that are complete in the opponent's base cannot be seized again.

13. Each robot has a Reset Card, which allows an existing robot to reenter the field from the nearest landing zone.

14. If the robot is pushed out or falls out of the square mat, the field is incapacitated, and the team has the option of either not moving the robot and putting down the remote control or presenting a reset card and moving the robot to the nearest landing zone by the team itself for re-entry.

15. After a robot is reset in the landing zone, it needs to fully exit the landing zone within the 3-second buffer. The reset protection ends either when the robot is entirely out of the landing zone or at the conclusion of the buffer period. Points will be subtracted if a robot is touched while still under reset protection or if it is pushed out of the arena, unless such action is initiated by the opposing alliance.

16. Reset Cards cannot be used during the Exploration Period and Occupation Period.

17. If an Energy Cube falls out of the field, it will be placed on the nearest Landing Zone box line with the assistance of the Referee, with no pause in time.

18. If the Advanced Level Signal sphere falls out of the square mat, it will be placed back on the nearest empty tower on the field boundary with the assistance of the referee, with no pause in time.

19. When the Cube is entirely within the Base, two scenarios may occur:

A) If your team inadvertently pushes the Cube out of the Base, either alliance can pick it up and utilize it. The displaced mats should be positioned on the nearest landing zone frame line.

B) If the opposing team unintentionally pushes the Cube out of the Base, the referee will return the Cube to the Base.

20. During the scramble period, robots can continue to collect cubes to the base or try to push their opponents out of the field, or they can begin to take over the landing zone.

21. The advanced-level team is prohibited from disrupting the opponent's signal sphere once the scramble period begins. A penalty will be incurred every 5 seconds if this violation persists.

22. If there is no further scoring or point changes, time ends early.

3. Score/Penalty & Game result

[Entry Level Score]

1. Move the space energy cubes to the base and score 100 points for each cube.
2. Robots that fall over or are pushed out of the square mats will result in the opposing alliance receiving 100 points.
3. At the end of the occupation period, when the bell rings, the robots must extend some part of their contact onto the landing zone (indicating landing zone occupancy), earning each robot 100 points.
4. After the occupation period ends, if your team's robots are in both landing zones, you get 100 extra points.
5. Each reset card used is worth 100 points to the opposing alliance.

[Entry level Penalty]

1. Holding more than one of the dice simultaneously will result in a deduction of 100 points. An additional 150 points for each square scored in violation of the rules.
2. A deduction of 100 points will occur if, during the scouting period, the robot is anticipated to come into contact with the Landing zone, center line, or the tower on the center line but does not touch any object in the team's half of the field.
3. If, during the exploration period, a robot is projected to touch the Landing zone, center line, or a tower on the center line while also making contact with an object (like a cube or opponent's robot) in the team's half of the field, 300 points will be deducted.
4. If there is contact with reset-protected opponent robots and the reset robot remains within the field, a deduction of 100 points will be applied.
5. If contact is made with reset-protected opponent robots, leading to their robot falling from the field due to resetting, a deduction of 300 points will be imposed.

[Game result]

1. At the end of the 2:30 period, the team with the highest alliance score wins, or if both teams have the same alliance score, the game is a tie.
2. If time expires and neither team has scored and both teams have lost the ability to move, the game is considered a tie.

3. Playfield and Props Size
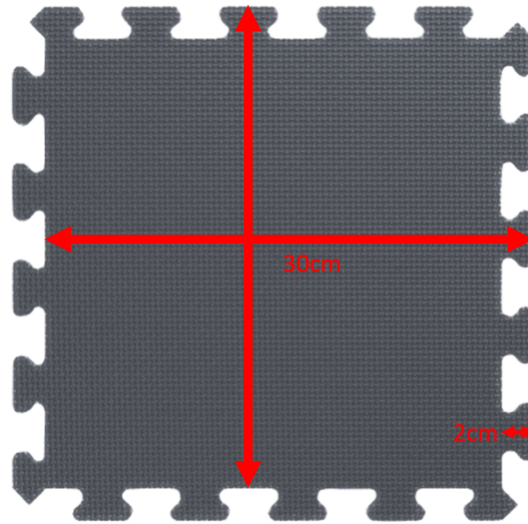
1. Site Configuration:

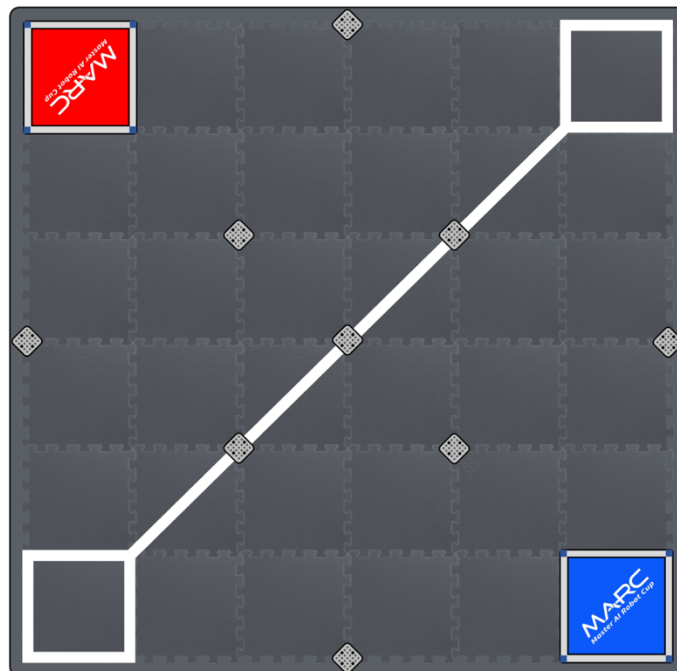Figure 2. Single EVA mat

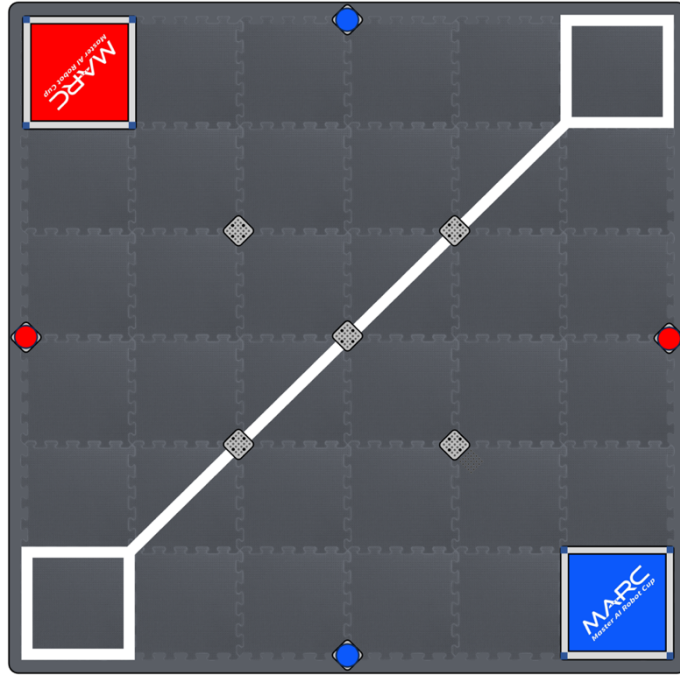Figure 3. Initial Configuration of the Entry Level Group

Figure 4. Initial Configuration of Advanced Level Group Sample1
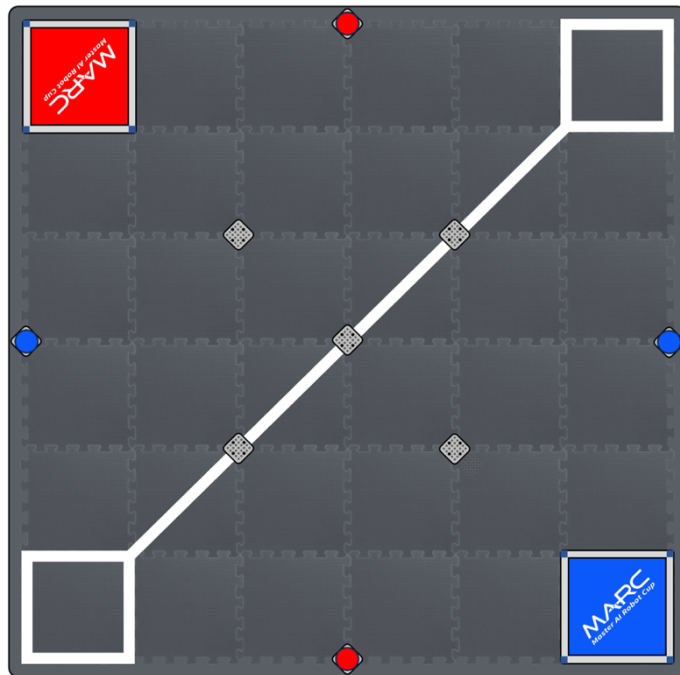

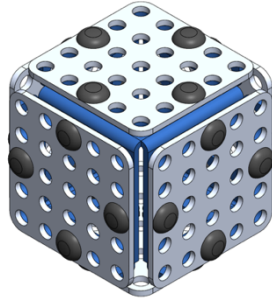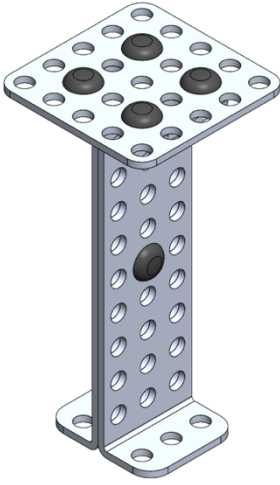Figure 5. Initial Configuration of Advanced Level Group Sample2

Fig. 6. Mining platform, Fig. 7. Space energy cube, Fig. 8. Alliance signaling sphere (red)
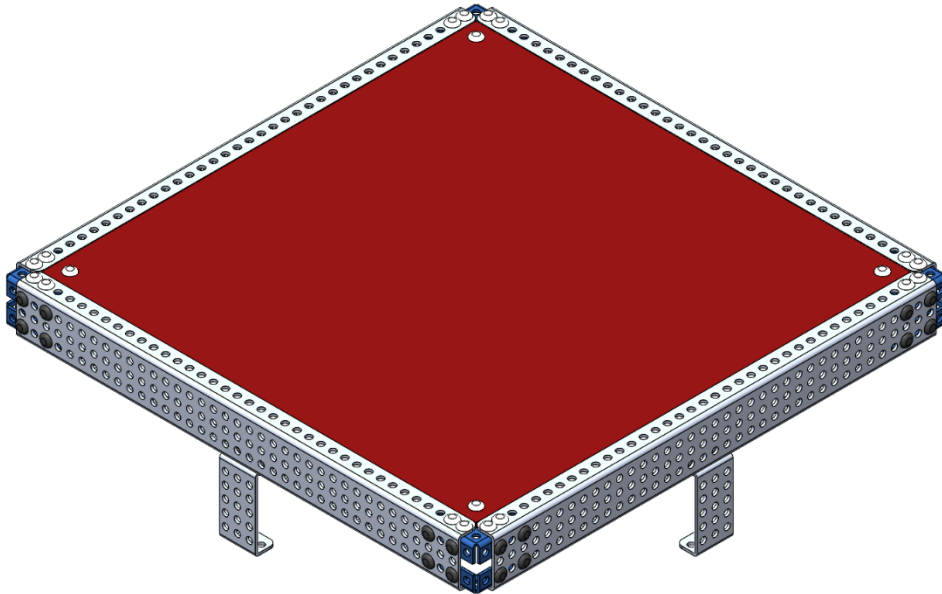

Figure 9. Alliance Base (Red)

2. The playfield measures 188 cm long x 188 cm wide and is made of black EVA mats with a length of 30 cm, a thickness of 3 cm, a density of 50 and an embossed surface, arranged with homogeneous edging strips.

3. Alliance Base: made of MATRIX parts and acrylic panels, 32 cm long and wide, 5 cm high above the field.

4. Landing zone: 32 cm square in length and width, with 3.6 cm wide white ground sticker tape.

5. Center line: connect the two landing zones with 3.6 cm wide white ground tape.

6. Mining tower: made of MATRIX parts, square plane at the top measuring 4.2 x 4.2 cm and 5 cm above the field.

7. Energy cube: made of MATRIX parts, 4.8 x 4.8 x 4.8 cm (5.2 x 5.2 x 5.2 cm with pin bumps).

8. Alliance Signal Sphere: Red and blue LEGO DUPLO props sphere, 5.2cm in diameter.

4. Robot Restrictions

1. Length, Width, Height/Weight: Initial state length 32cm, width 32cm, height unlimited, upper limit 1800g.

2. The controller is limited to one MATRIX Mini V2.4, and the use of the expansion hub/controller is prohibited.

3. All power sources for the robot can only be supplied by one battery pack of 12V or less.

4. Power motors are limited to two MATRIX TT motors/operating voltage is limited to 5V.

5. The servo motor limits the maximum torque to 17 kg-cm (7.4V).

6. The number of sensors and their specifications must comply with the upper limit of the controller.

7. The joystick is limited to one set of MATRIX MJ2.

8. The use of metal parts for the main structure of the chassis and frame is restricted, and the use of one-piece molded frames is not permitted.

9. The rest of the jaws, motor mounts, and housings can be made by 3D printing and laser cutting.

10. The use of water, fire, gas, and the installation of sharp objects (e.g. hammers, razor blades, etc.) are prohibited.

11. Only one robot can be used. Spare robots are not allowed and must be presented in bulk.

12. The Advanced Level Group Image Recognition Lens is not limited to M-Vision

Cam.

5. Team Awards
    1. Winning Alliance: 2 teams (3 teams awarded when the total number of teams reaches 24 or more)
    2. Finalist Alliance: 2 teams (3 teams awarded if total number of teams is 24 or more)
    3. Honorable mention: 6 teams +

6. The Board of Directors reserves the right to amend the Rules and Regulations, and the actual situation will be subject to on-site announcement.