1. Game Events

1.1. Water Polo Under Global Vision (1v1 & 2v2)

1.1.1. The Duration of the Match

1.1.1.1. Periods of Play

The match lasts two equal periods of 5 minutes (excluding time-out). Only one timer can be used for the match, which shall not be changed unless the referee and two teams agree unanimously.

1.1.1.2. Half-time interval

Half-time interval is 5 minutes, which shall not be changed unless the referee and two teams agree unanimously.

1.1.2. Match Process

1.1.2.1. Pre-match Preparation

In order to make sure the robots of each team meet the requirements of the match， all the robots will be checked by the match technical officials before the match. During the match, the robot with any modification must be checked again. The match schedule will be published before the match and debugging time will be provided for each team. Before each round, 10-minute test time will be provided. The teams can save their own program and data with portable hard disk or USB flash disk.

1.1.2.2. Goal Selection

Before the first half, a coin is tossed by the referee and the team that wins the toss decides which goal it will attack in the first half of the match. The other team takes the kick-off to start the match. The team that wins the toss takes the kick-off to start the second half of the match. In the second half of the match, the teams change ends and attack the opposite goals.

1.1.2.3. Kick-off Status

The ball must be placed on the centre point. All the robots must be static in their own penalty area.

1.1.2.4. Kick-off

All robots shall start manually after the referee whistles to begin the match. The robot that starts before the referee’s whistle will be warned once, and it will be taken away from the pool and banned for the match with two warnings.

The kick-off status of water polo 1v1 and 2v2 are shown in figure 2-1 and 2-2.

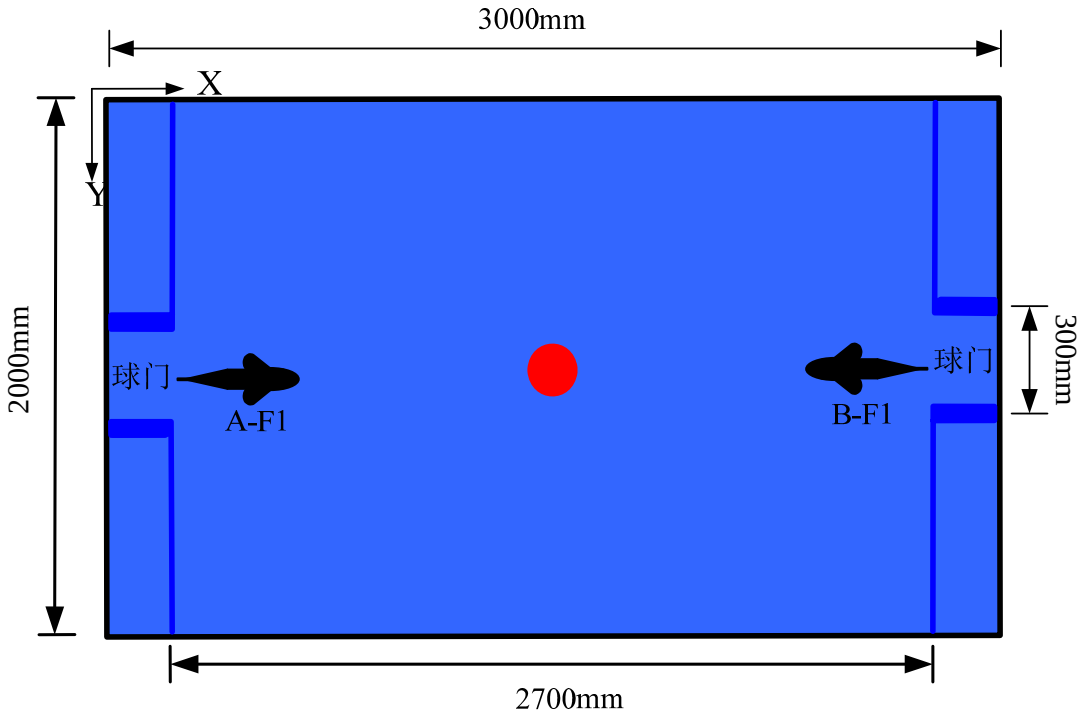

Figure 2-1 Kick-off status of water polo 1v1 under global vision

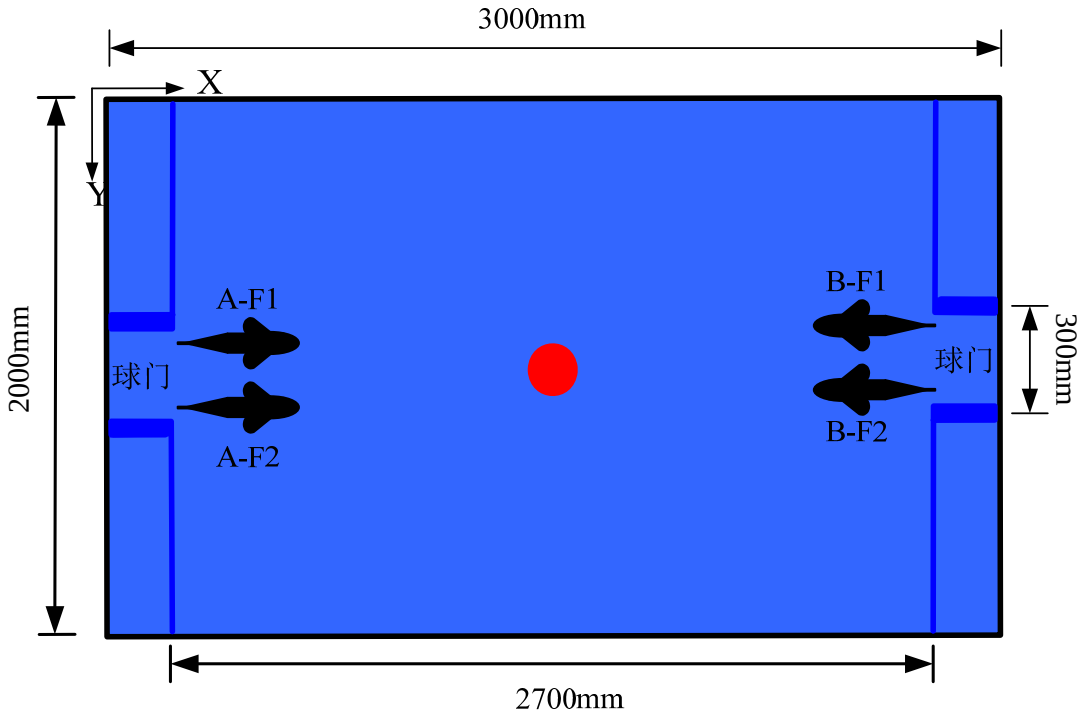

Figure 2-2 Kick-off status of water polo 2v2 under global vision

1.1.2.5. Re-kick-off

Re-kick-off is needed in situations listed below:

1) start the 1st and 2nd half time;

2) after one team goals;

3) when time-out period is over

1.1.2.6. Match Interruption

When a robot is damaged due to collision or any emergence occurs, the referee can whistles to interrupt the match. When the match restarts, all robots must be static in their own penalty field and re-kick-off.

1.1.2.7. Robot Replacement

During the match, any robot that breaks down can be replaced according to the following procedure:

1) team captain goes to the referee and applies for the robot replacement;

2) the referee agrees;

3) the referee puts the new robot at the margin area of the centre line of the pool

The replaced robot must be put at the margin area of the pool, and headed opposite to the attacking direction. There is no limit to the number of times for robot replacement. The replaced robots can be reused for the match. There is no time-out for the replacement during the match.

If the robot failure is caused by the crash with the opponent, the referee can decide whether the match continues or not. During time-out and halftime interval, the robots can be replaced without informing the referee.

1.1.2.8. Foul and Punishment

1) Foul

The team fouls if the following cases happen:

Case 1: When the whole of the water polo enters the penalty area, there are two defending robots in the penalty area.

Case 2: When the whole of the water polo enters the penalty area, the defending robot passes over the goal line.

2) Punishment

For case 1, the referee should take away the robot that enters the penalty area later immediately and keep only one robot in the penalty area. Which robot should be taken away is decided by the referee and 30 seconds later, the robot will be put back to the center line of the pool referring to the rule of robot replacement.

For case 2, the referee should take away the robot immediately and put it at the center line according to the rules of robot replacement.

Note:

The robot enters the penalty area when any part of the robot does.

The water polo enters the penalty area when the whole of the water polo does.

A goal is scored when the whole of the water polo passes over the goal line between the

goalposts.

1.1.2.9. Penalty Kick

Penalty kick is the method for determining the winning team where competition rules require there to be a winning team after a match has been drawn.

When it comes to penalty kick, the water polo is put at the penalty mark of the opponent's field and the robot which takes the penalty kick is put at the penalty area line. The penalty kick includes two rounds. In the first round, there is a robot of the opponent team as the goalkeeper with 3 minutes of time limit. The team goals in shorter time will win the match. If both team fail to goal or goal in the same time, there will be the second round. In the second round, the goalkeeper is removed with 2 minutes of time limit. The team goals in shorter time will win the match.

1.1.3. Scoring Rules

1.1.3.1. Goal Scored

The referee will blow the whistle and signal that the offending team scores a goal when the whole of the ball passes over the goal line between the goalposts, provided that the match is played normally. An own goal will be regarded as the opponent's goal.

1.1.3.2. Points and Ranking

The team with more goals wins the match. If the number of goals by the two team is similar, the match is drawn. According to the result, the team will get:

3 points if the team wins; 1 point if the team draws; 0 point if the team loses.

In the group match, the team ranking will be determined according to the following order:

1) team's points;
2) goal difference;
3) average goals per match;
4) result of the match between the teams.

1.2. Relay Race With Ball Under Global Vision

1.2.1. Game Content

Each team sends two robotic fish to take part in the game. In the initial state, two fish are placed in the center of the wall on each side of the pool as shown in Figure 2-3. When the game starts, the robotic fish A-F1 on side A swims to side B with the ball. After the ball meets the wall of side B, A-F1 stops. Meanwhile A-F2 starts to take the ball back to side A. After the ball meets the wall of side A, A-F2 returns to side B with the ball. After the ball meets the wall of side B, A-F1 restarts to take the ball back to side A. The game is over when the ball meets the wall of side A.

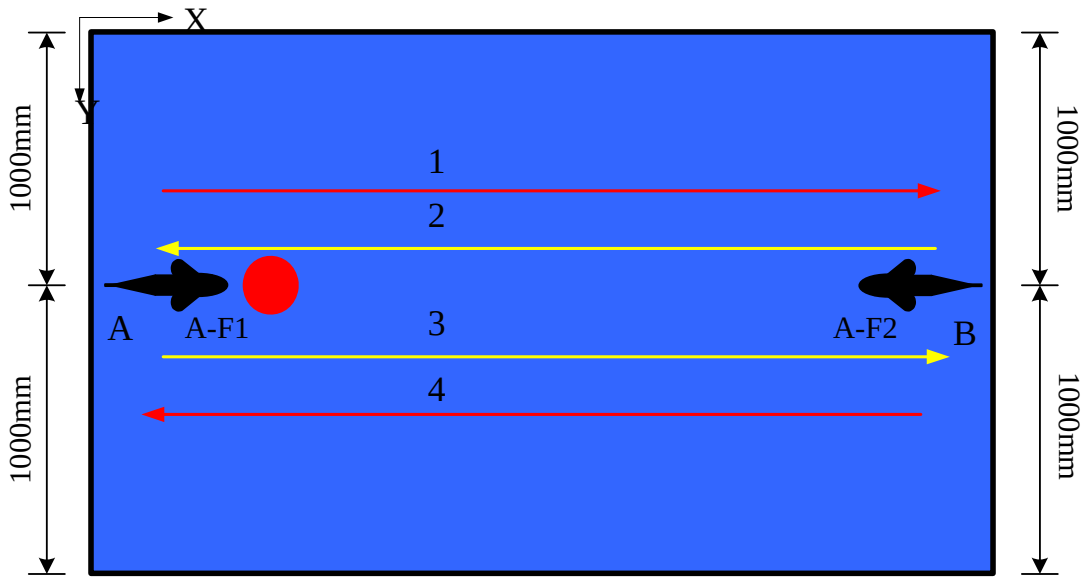

Figure 2-1 Schematic plot of relay race with ball under global vision

1.2.2. Time Limit

The game should be finished within 8 minutes and only can be played once. No timeout is permitted during the game.

1.2.3. Scoring Rules

The score is recorded by the referee according to the following rules：

(1) The robotic fish should be static before the game and can only start after the referee blows the whistle. The robotic fish is not permitted to be controlled manually from remote. Once found, the team will be disqualified.

(2) If the team finishes the game within 8 minutes, the used time will be recorded. When the game is finished, both robotic fish should be static automatically. Otherwise 15 seconds will be added. The team ranking will be ordered by the time length. The fastest team is the champion, and so on.

(3) If the team fails to finish the game within 8 minutes, the completed stages will be counted (4 stages in total) as the score. After A-F1 swims with the ball from side A to side B and the ball meets the wall of side B, stage 1 is completed. After A-F2 swims with the ball from side A to side B and the ball meets the wall of side B, stage 2 is completed. After A-F2 swims with the ball from side A to side B and the ball meets the wall of side B, stage 3 is completed. After A-F1 swims with the ball from side B to side A and the ball meets the wall of side A, stage 4 is completed.

(4) If two or more teams complete the same number of stages within 8 minutes, the teams will be ordered by the time used for stage 1 and the team ranking refers to rule (2).

1.3. Avoiding Barriers With Ball Under Global Vision

1.3.1. Game Content

Each team sends one robotic fish to take part in the game. In the initial state, the robotic fish

and the ball are placed in the center of the wall on each side of the pool, while the barriers are composed of four goals as shown in Figure 2-4. The robotic fish A-F1 starts from the center of the wall on side B, passes the path 1 and path 2 successively and arrives at side A. Then A-F1 passes path 2 and path 1 successively and returns to side B with the ball. The game is over when the ball meets the wall of side B.

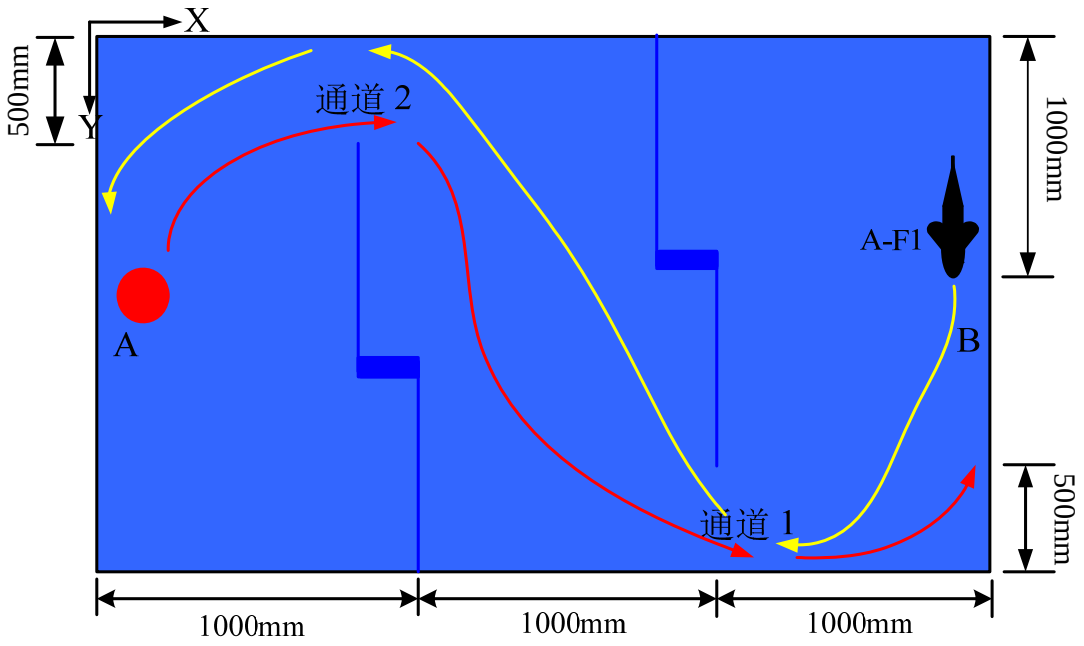

Figure 2-2 Schematic plot of avoiding barriers with ball under global vision

1.3.2. Time Limit

The game should be finished within 8 minutes and only can be played once. No timeout is permitted during the game.

1.3.3. Scoring Rules

The score is recorded by the referee according to the following rules:

(1) The robotic fish should be static before the game and can only start after the referee blows the whistle. The robotic fish is not permitted to be controlled manually from remote. Once found, the team will be disqualified.

(2) If the team finishes the game within 8 minutes, the used time will be recorded. When the game is finished, both robotic fish should be static automatically. Otherwise 15 seconds will be added. The team ranking will be ordered by the time length. The fastest team is the champion, and so on.

(3) If the team fails to finish the game within 8 minutes, the completed stages will be counted (4 stages in total) as the score. After A-F1 swims from side B to side A through path 1 and path 2 successively, stage 1 is completed. After A-F1 passes path 2 with the ball, stage 2 is completed. After A-F1 passes path 1 with the ball, stage 3 is completed. After A-F1 arrives at side B with the ball and the ball meets the wall of side B, stage 4 is completed.

(4) If two or more teams complete the same number of stages within 8 minutes, the teams

will be ordered by the time used for stage 1 and the team ranking refers to rule (2).

1.4. Cycling With Ball Under Global Vision

1.4.1. Game Content

Each team sends one robotic fish to take part in the game. In the initial state, the robotic fish and the ball are placed in the center of the wall on side A of the pool, while the barriers are composed of four goals as shown in Figure 2-5. The robotic fish A-F1 starts from the center of the wall on side A, passes the path 1 and arrives at side B. After the ball meets the wall of side B, A-F1 returns to side A through path 2 with the ball. The game is over when the ball meets the wall of side A.

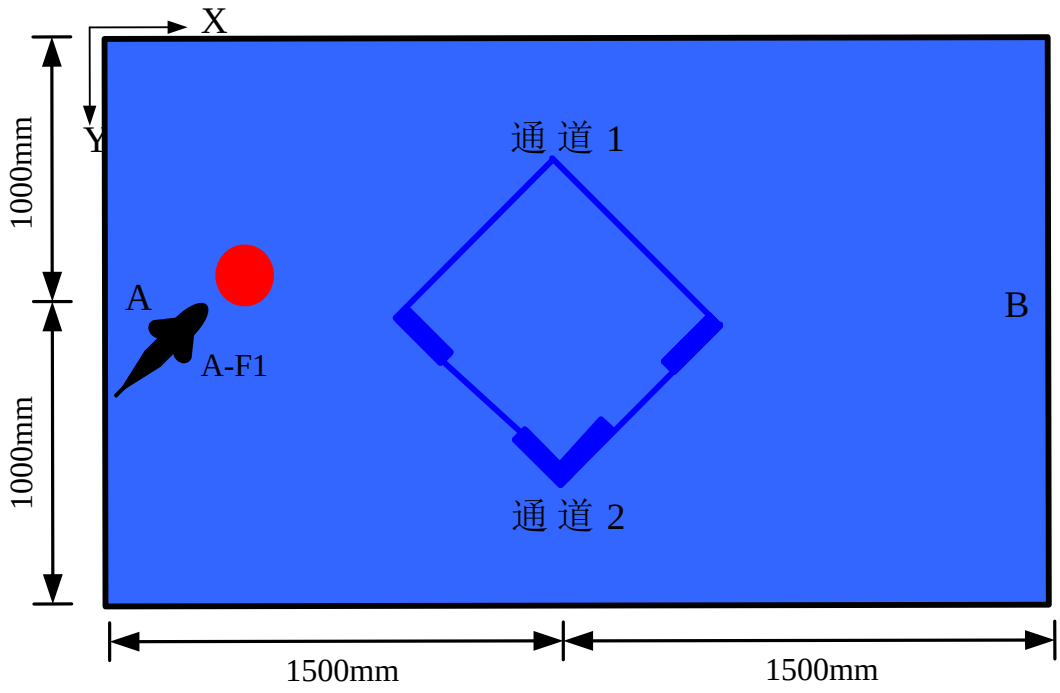

Figure 2-3 Schematic plot of cycling with ball under global vision

1.4.2. Time Limit

The game should be finished within 8 minutes and only can be played once. No timeout is permitted during the game.

1.4.3. Scoring Rules

The score is recorded by the referee according to the following rules:

(1) The robotic fish should be static before the game and can only start after the referee blows the whistle. The robotic fish is not permitted to be controlled manually from remote. Once found, the team will be disqualified.

(2) If the team finishes the game within 8 minutes, the used time will be recorded. When the game is finished, both robotic fish should be static automatically. Otherwise 15 seconds will be added. The team ranking will be ordered by the time length. The fastest team is the champion, and

so on.

(3) If the team fails to finish the game within 8 minutes, the completed stages will be counted (4 stages in total) as the score. After A-F1 passes path 1 with the ball from side A, stage 1 is completed. After A-F1 arrives at side B with the ball meeting the wall of side B, stage 2 is completed. After A-F1 passes path 2 with the ball from side B, stage 3 is completed. After A-F1 arrives at side A with the ball meeting the wall of side B, stage 4 is completed.

(4) If two or more teams complete the same number of stages within 8 minutes, the teams will be ordered by the time used for stage 1 and the team ranking refers to rule (2).

1.5. Ball-passing Relay Under Global Vision

1.5.1. Game Content

Each team sends two robotic fish to take part in the game. In the initial state, two robotic fish are placed on the left side of the pool, upside and downside the midline respectively and the ball is placed before the robotic fish A-F1 as shown in Figure 2-6. When the game starts, the robotic fish A-F1 passes the ball to the upside of the pool through path 1 without crossing it. Then A-F2 passes the ball back to the downside of the pool through path 2 without crossing it. Finally, A-F1 heads the ball into the goal and the game is over.

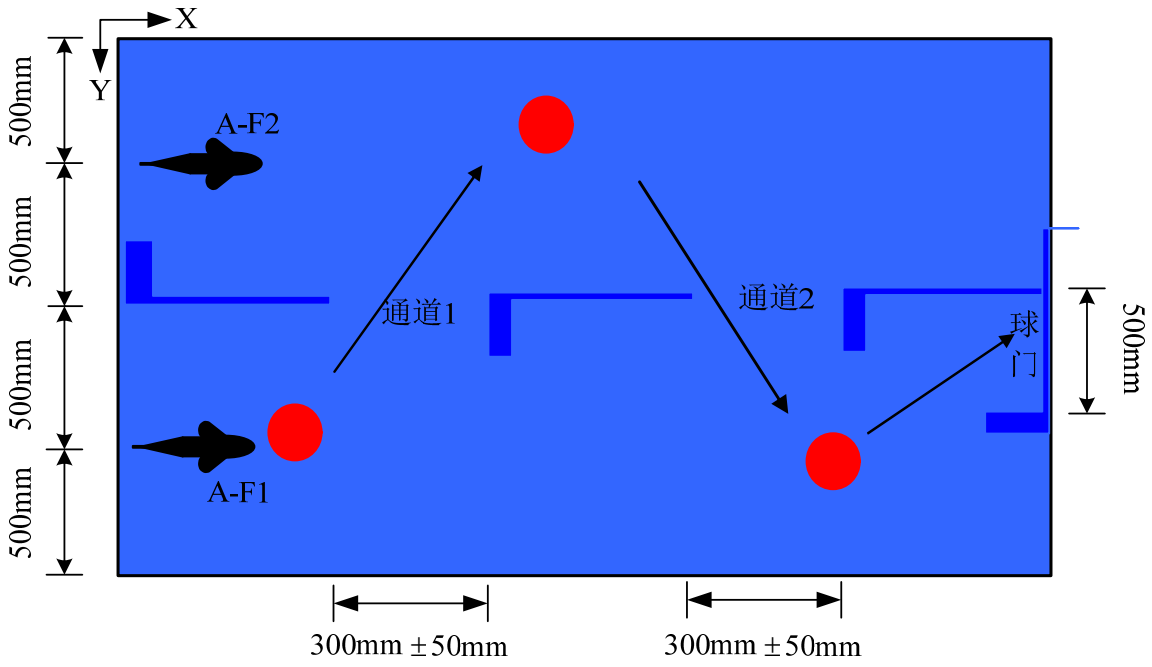

Figure 2-4 Schematic plot of Ball-passing relay under global vision

1.5.2. Time Limit

The game should be finished within 8 minutes and only can be played once. No timeout is permitted during the game.

1.5.3. Scoring Rules

The score is recorded by the referee according to the following rules：

(1) The robotic fish should be static before the game and can only start after the referee blows the whistle. The robotic fish is not permitted to be controlled manually from remote. Once found, the team will be disqualified.

(2) If the team finishes the game within 8 minutes, the used time will be recorded. If A-F1 corsses path 1, 15 seconds will be added. If A-F2 crosses path 2, 15 seconds will be added. When the game is finished, both robotic fish should be static automatically. Otherwise 15 seconds will be added. The team ranking will be ordered by the time length. The fastest team is the champion, and so on.

(3) If the team fails to finish the game within 8 minutes, the completed stages will be counted (3 stages in total) as the score. After A-F1 passes the ball to the upside of the pool through path 1, stage 1 is completed. After A-F2 passes the ball to the downside of the pool through path 2, stage 2 is completed. After A-F1 shoots the ball into the goal, stage 3 is completed.

(4) If two or more teams complete the same number of stages within 8 minutes, the teams will be ordered by the time used for stage 1 and the team ranking refers to rule (2).