Contest Rule of WER 2021 Brick Educational
Robot Contest "Low Carbon Living"

1 Theme

With the in-depth development of industrialization, the emission of greenhouse gases and carbon dioxide has led to a global rise in temperature and great changes to the climate. Low carbon, environmental protection, energy conservation and emission reduction have become an issue of global concern. The world has fallen into the situation of resource shortage while resource demand is increasing. In recent decades, the world economy has developed rapidly, social conflicts have intensified, land resources for sustainable development have decreased, and the ecological system has been progressively damaged. Household waste, industrial pollution is affecting our lives. In today's rapid economic development, the protection of the natural environment ecology is urgent action.

Low carbon living refers to a green and environmentally friendly lifestyle that reduces the energy consumed in daily work and rest. Its main purpose is to reduce the emission of greenhouse gases and carbon dioxide, thus reducing the pollution to the atmosphere and slowing down ecological deterioration. Low carbon life is to adopt a lifestyle with low energy consumption and emissions as far as possible. Low carbon living is not only a way of life but also an environmental responsibility for sustainable development. Low carbon living is a healthy and green lifestyle, a more fashionable concept of consumption, and a brand-new concept of life quality. Every one of us can start with using public travel, waste utilization, energy conservation and emission reduction. Let's live a low carbon lifestyle, protect the environment and build a beautiful world together.

2 Contest venue and surrounding
2.1 Venue

Figure 2-1 Arena Map

The dimension of the arena map (made of PU or PVC) is 220cm(length) x 120cm(width). The end of the black line (2-3cm in width) marks the position of a task model (model zone). The position and direction of models may vary. There is a base (30cm x 30cm) in the arena to which the robot can leave and return to multiple times.

2.2 Surrounding

The contest surroundings must be cold-light source, low-level lighting and magnetic interference-free. Due to the possible variables, such as: the surface of the arena, variable light levels, etc., It is necessary to develop countermeasures when designing the robot.

3 Task and Score

There are 7 tasks for each round, including pre-set and additional tasks. 4 pre-set tasks with varying difficulty levels (difficult, medium and basic levels); 3 additional tasks will be made public before each specific round of the contest. Contents of pre-set tasks are announced in the rule whereas the position and direction of models, which are variable, are published just before the contest. Additional tasks will be made public just before each round of the contest and contestants should use their initiative to design engineering and programming solutions accordingly. The following pre-set tasks simulate real life scenarios.

3.1 Recycling (60 points)

Difficulty level: ★★★

3.1.1 Recycling task model may be placed in positions 1 to 10 with a fixed direction; red arrow points to the front; the waste blocks are on the top of the model, as shown in Figure 3-1-1.

3.1.2 Finished status 1: The operating is raised to break the waste blocks away from the model, (20 points/each); Finished status 2: Bring the waste blocks to the base successfully, as shown in Figure 3-1-2, (30 points/each).
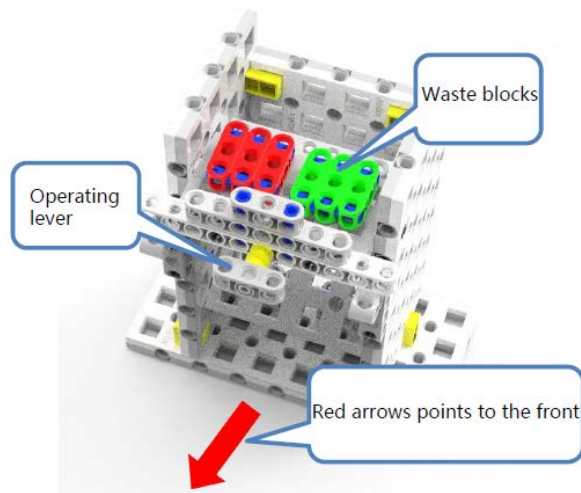
Figure 3-1-1 Recycling Task Model Initial Status

Figure 3-1-2 Recycling Task Model Finished Status

3.2 Sewage Disposal (50 points)

Difficulty Level: ★★★

3.2.1 Sewage Disposal task model may be placed in positions 1 to 10 with fixed direction; red arrow points to the front; the gate is closed and the handle is vertical, as shown in Figure 3-2-1.

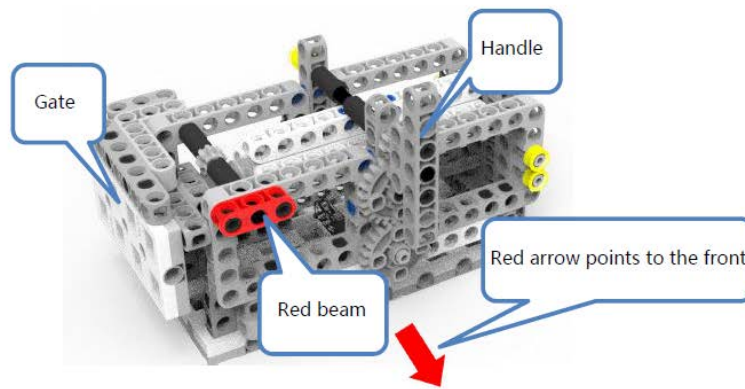**3.2.2** Twist the handle to lift the gate above the red beam, as shown in Figure 3-2-2, (50 points).
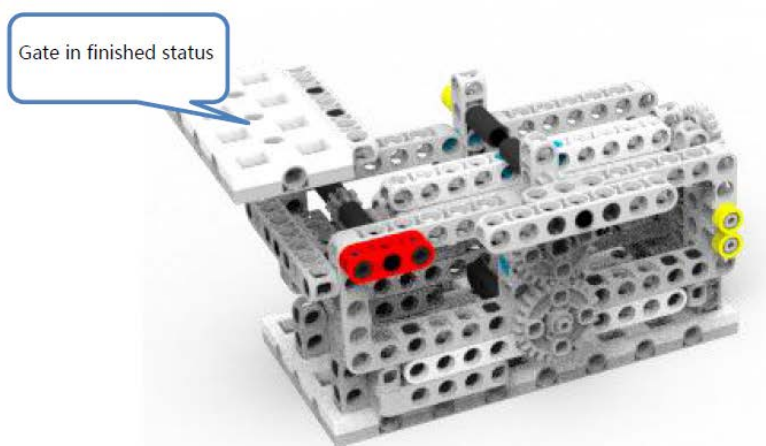
Figure 3-2-1 Sewage Task Model Initial Status

Figure 3-2-2 Sewage Task Model Finished Status

3.3 Waste Sorting (100 points)

Difficulty Level: ★★★★

3.2.1 Waste Sorting task model may be placed in positions 1 to 10 with a fixed direction; red arrow points to the front; there is a handle and a dustbin with a red and green sign in the model; the dustbin lid is closed, as shown in Figure 3-3-1.

3.3.2 Finished status 1: Completely open the dustbin lid by using the handle (40 points). Completely open means that the vertical projection of the dustbin lid can't coincide with the dustbin, as shown in the red box in figure 3-3-2. If the robot didn't open the dustbin lid, no points will be scored.

3.3.3 Finished status 2: By completing "Recycling Task", robot will get waste blocks, put the same colour waste blocks into the corresponding dustbin, as shown in Figure 3-1-2, (30 points/each). No points will be scored, if the waste blocks are not in accordance with the dustbin colour, as shown in Figure 3-3-3
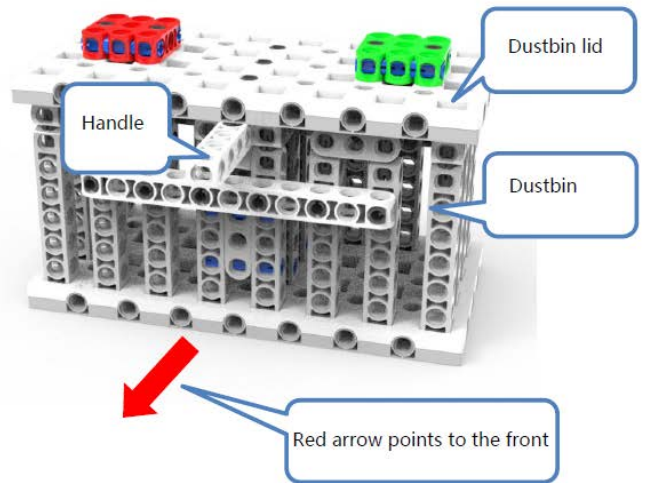

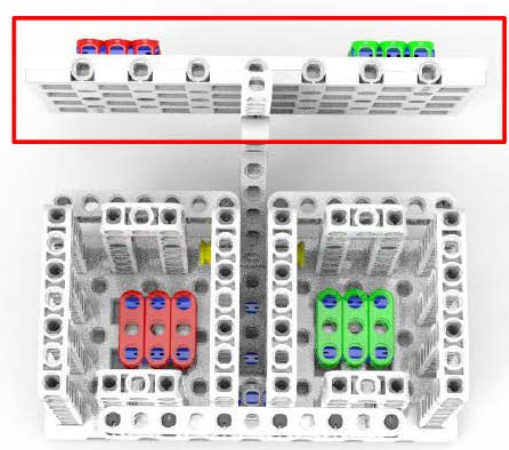Figure 3-3-1 Waste Sorting Task Model Initial Status

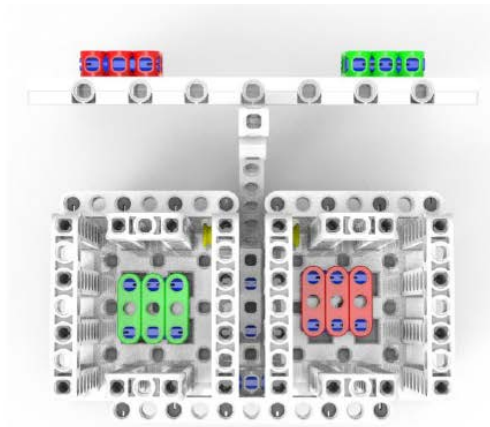Figure 3-3-2 Waste Sorting Task Model Finished Status

Figure 3-3-3 Waste blocks are not in accordance dustbin colour

3.4 Waste Transportation (80 points)

Difficulty Level: ★★★★

3.4.1 Waste Transportation task model may be placed in positions 1 to 10 with fixed direction; red arrow points to the front, as shown in Figure 3-4-1.

3.4.2 Finished Status 1: Pull the transport device out of the temporary storage station, as shown in Figure 3-4-2, (40 points).

3.4.3 Finished Status 2: Pull the transport device out from the temporary storage and bring it back to the base, (80 points).
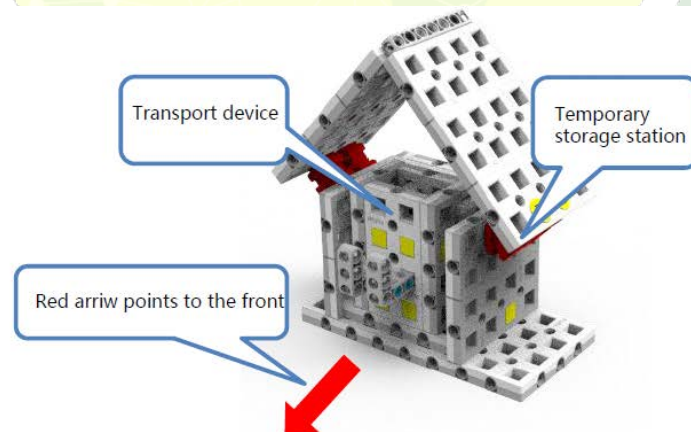

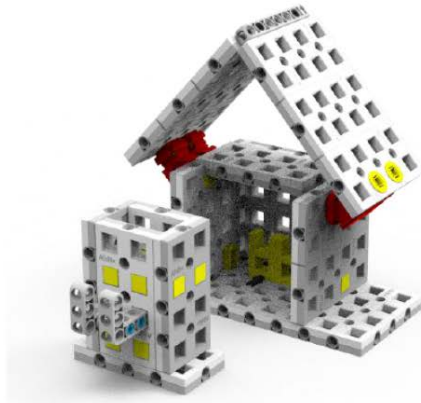Figure 3-4-1 Waste Transportation Task Model Initial Status

Figure 3-4-2 Waste Transportation Task Model Finished Status

3.5 Position and Direction of Task Models

3.5.1 Position of some task models is fixed, but direction may change. The direction of some task models is fixed but position may change. All uncertainties will be released just before each specific round of the contest. Once released, there will not be any changes made during the round in each round.

3.5.2 The direction of Recycling task model and Sewage Disposal task model are fixed, whereas their position may change, from Position 1 to 10. The initial direction of Waste Sorting task model and Waste Transportation task model are fixed, whereas their position may change, from Position 1 to 10.

3.5.3 Additional task models may be placed from Position 1 to 10. There are 3 additional tasks in each round. Task models and instructions will be released just before the start of the contest.

4 Robot Design Regulations

Robot's design and building rules and regulations: All robots must be checked before the contest. In order to guarantee fairness, the judge will randomly check contestants' robots during the contest and request that non-compliant robots are adjusted in line with the regulations. If the robot still doesn't meet the requirement, contestants will be disqualified.

4.1 Dimension: The dimensions of the robot shall not be larger than 30cm x 30cm x 30cm (Length x Width x Height) before leaving the base. However, the structure of robot can automatically extend after leaving the base.

4.2 Controller: The controller shall not be replaced during the single round. Each robot can only use one controller.

4.3 Actuator: Each robot can only use 4 motors in total (Digital servo motor is forbidden).

4.4 Sensor: The sort and number of sensors used by each robot is unlimited.

4.5 Structure: Robots must apply plastic splicing structure; accessories such as ribbons, screws, rivets, glue, or tapes shall not be applied.

4.6 Power: Each robot must have individual battery with a voltage less than 9V. External power supply, boost, step-down or regulated power supply shall not be applied.

5 Contest

5.1 Team

5.1.1 Each team consists of 2-3 students (school age in June 2021) and one of the members shall be the team leader.

5.1.2 Contestants shall respond to all issues in the contest positively and independently. They will respect and interact kindly with teammates, opponents, volunteers, judges and all other people who are in volved in the contest. They will also make their best effort to demonstrate professionalism.

5.2 Rules

5.2.1 WER brick educational robot contest (4+3) is categorized into elementary, middle and high school division.

5.2.2 There will be 2-3 rounds for each contest (no preliminary or semi-final). The time of each round is 180 seconds.

5.2.3 Time will not be extended if the team chooses additional tasks.

5.2.4 After all rounds complete, teams will be ranked by their total score, which is a sum of their score from each round.

5.2.5 It is possible that the organizing committee may alter the rules in terms of registration for practical reasons.

5.3 Procedure

5.3.1 Build robot and program

5.3.1.1 Building and programming can only be conducted in preparation area while debugging can be performed in the arena map.

5.3.1.2 Contestants can enter the preparation area after registration. Judges needs to check the equipment carried by contestants. Built robots can be carried into the preparation area and all equipment must be in accordance with the contest rules and regulations. Contestants are forbidden to carry telecommunication devices unless approved by the organizing committee. After all contestants are seated in the preparation area, judges will notify teams of diagrams of model distribution and additional task rules.

5.3.1.3 Contestants should carry portable calculators, repair tools, replacement and spare parts. Contestants are prohibited to surf the internet or download any programs in the preparation area; contestants are also prohibited to shoot the venue by camera or other devices, or contact trainers or parents by any means.

5.3.1.4 There are 2 hours for debugging and sealing. Contestants can make use of the time to engineer the robot design and program it according to the surroundings.

5.3.1.5 Daily lighting is applied on the arena and contestants can calibrate sensors accordingly. However, the organizing committee cannot guarantee that the on arena lighting is constantly invariable. The lighting may alter in the progress of the contest due to flashlight of camera or camcorder, LED light or other unknown lights, so contestants should find solutions on their own.

5.3.1.6 Contestants must debug and prepare in order and trainers shall intervene by no means. Teams who disobey the rules may be warned or even disqualified. Teams shall put robots in the designated place of the sealing area before the end of the debugging time, afterwards, the arena is in closure.

5.3.2 Preparation before contest time

5.3.2.1 Contestants pick up their own robots and are guided by judges into the contest field. Teams who do not show up in the regulated time will be deemed as waiver.

5.3.2.2 Contestants shall stand near the base after entering the field.

5.3.2.3 Contestants put their robots in the base, of whose parts and shadows must maintain inside the base.

5.3.2.4 The present contestants shall complete the preparation within 2 minutes and give a signal to the judge after completion.

5.3.3 Start-up

5.3.3.1 After the judge confirms the team is ready, they will count down from 3 while contestants can use a hand to slowly approach the robot. When hearing the command "Start", contestant can touch the button or give the sensor a signal to start up the robot.

5.3.3.2 If the team starts up the robot before the command "Start" is given, the operation will be regarded as a mistake and the team will be warned or penalized accordingly (being counted as a restart).

5.3.3.3 Once robot starts up, it will only be controlled by the controller's in-built programs.

Generally speaking, contestants shall not touch robots (Restart is exceptional).

5.3.3.4 Contestants shall not deliberately detach components or drop components on the ground, and such behaviours with a deliberate intent will be judged as a foul. Any unintentionally dropped components shall be cleaned out of the arena instantly by the judge. Robot being scored due to detached components shall be invalid. Detached components indicate at a certain moment there is no connection between robot's built-in components and robot's body.

5.3.3.5 If the carried objects are cast out of the arena accidentally because of the robot's rapid speed or program error, the objects shall not be considered as back to the arena.

5.3.4 Restart

5.3.4.1 If dysfunction occurs or a certain task is not completed in the progress, contestants can take the robot back to the base to restart and a "Restart" will be recorded. The tasks which are completed before "Restart" will be scored accordingly while the carried object during the dysfunction or task failure becomes invalid and will be kept by the judge until the end of the contest. Timing will not be paused during the process.

5.3.4.2 Score: In each round, restart 0 times, the team gains 40 points; Restart once, the team gains 30 points; Restart twice, the team gains 20 points; Restart 3 times, the team gains 10 points; Restart 4 times or above, the team gains zero.

5.3.4.3 Time to Restart is of no limit in each round, but point-gaining will comply with 5.3.4.2.

5.3.4.4 Timing will not be paused or restarted during Restart period.

5.3.5 The robot can go back to the base autonomously.

5.3.5.1 Robot can go back and forth time and again, which will not be counted as a Restart.

5.3.5.2 The criterion of robot autonomously going back to the base is its vertical shadow lying in the base and contestants can touch robots which are already back to the base.

5.3.5.3 After the robot autonomously goes back to the base, contestants can alter or repair robot's structure.

5.3.6 End of judging

5.3.6.1 Each round has 180 seconds.

5.3.6.2 After the team accomplishes some tasks, they shall give a signal to the judge if they decide to give up in the contest, the judge will stop timing and keep the currently used time for a single round; otherwise, the team has to wait till the end of the contest (Judge claps hands).

5.3.6.3 As soon as judge claps hands for the ending of the contest, contestants must power off the robot instantly and leave the robot and all objects on the arena untouched.

5.3.6.4 Judges fill in the scoring sheet and inform contestants of their scores.

5.3.6.5 Contestants clear up the arena and move their robots back to the preparation area.

6 Score

6.1 Score the team based on their task accomplishment at the end of each round. Details are list in the 3rd section.

6.2 The sequence of accomplishing tasks will not influence the score of a single task.

6.3 Some tasks can only be scored after the model is carried back to the base, meanwhile, the following requirements must be matched: 1. The criterion defining robot autonomously going back to the base; 2. The shadow of robot and that of the model are partially or utterly overlapped, or robot contacts the model.

7 Foul and Disqualification

7.1 The score of any team who do not arrive on time will be deducted 10 points for every minute; if the team still does not show up in 2 minutes, they will be disqualified.

7.2 Judge will give a warning to the team for their 1st mis-start, robot should be back to the base area for a Restart and timing will be restarted. The 2nd time mis-start will lead to the team's disqualification.

7.3 Detaching components intentionally is regarded as a foul. The team may be disqualified depending on the seriousness of the situation.

7.4 If the model is damaged by the robot or contestants in the progress (intentionally or not), contestants will be given a warning. The task, no matter completed or not, will not be scored.

7.5 Neither the model nor robot shall be touched out of the base during the process, otherwise, a "Restart" will be recorded.

7.6 Contestants who disobey judge's directions will be disqualified.

7.7 Contestants will be disqualified if they privately contact trainer or parents without a permission of judge.

8 Rank

Each team will be ranked based on their score in total of all rounds, the higher the score is, the higher the ranking will be. If there are teams scored the same, see followings to determine the ranking:

1)The team who used less time for all rounds will be ranked higher;

2)The team who restarts less will be ranked higher;

3)The team who completes more single tasks in all rounds will be ranked higher;

4)The team whose robot is less-weighted will be ranked higher, or the result will be decided by judge.

Appendix Scoring Sheet

WER 2021 Brick Educational Robot Contest (4 +3) Scoring Sheet							Round_	
Arena & Seat		No.		Team		Category		

Tasks		Points	Quantity	Score
Recycling	break the waste block away from the model	20/each		
	break the waste block away from the model and bring it to the base	30/each		
Sewage Disposal	lift the gate above the red beam	50		
Waste Sorting	The gate is opened above the level of the red beam	40		
	put the same colour waste blocks into the corresponding dustbin	30/each		
Waste Transport	pull the transport device out of the temporary storage station	40		
	pull the transport device out from the temporary storage and bring it back to the base	80		
Additional Task 1	details to be confirmed	100		
Additional Task 2	details to be confirmed	100		
Additional Task 3	details to be confirmed	100		
Autonomous Operation	40-(number of restart) *10. The score should be no less than zero			
Total Score				
Time				

Remarks on disqualification: _____

Judge: _____ Scorekeeper: _____

Contestant: _____

Chief Judge: _____ Data Entry By: _____