

Brick Educational Robot Contest-Universal Contest—ENERGY REVOLUTION

1. THEME INTRO

WER Contest has adopted the theme of “Energy Revolution” for the year of 2022. The continuous expansion of the global economy, the great development of science and technology and the robust innovation have brought great convenience and amazing lifestyle to our life.

At the same time, more and more people have realized that the energy crisis caused by excessive use and dependence on non-renewable resources is imminent.

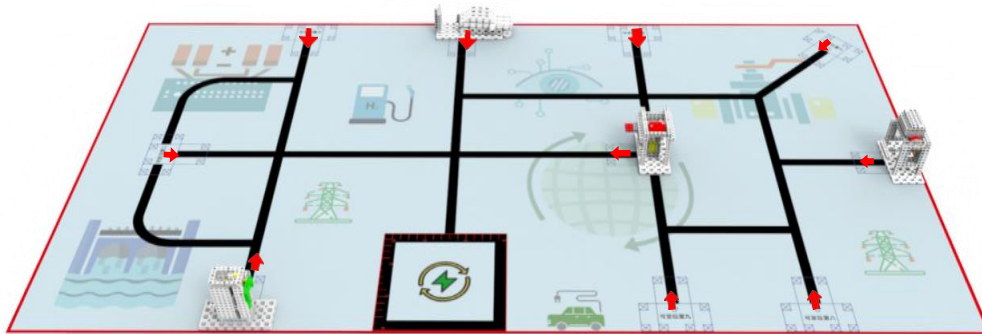
The massive consumption of energy has brought about a sharp increase in carbon dioxide emissions, leading to the deterioration of the global climate, for which mankind has also paid a painful price.

The exploitation and use of traditional energy will be unsustainable in the end. The energy problem will become a complex, changeable, uncertain and severe challenge facing the future. We have to turn our attention to the clean energy recycled such as solar energy, wind energy, biomass energy and hydropower. It was once thought that the utilization of renewable energy was out of reach. Today, with the development and iteration of science and technology, we are bound to master the recycling of clean energy and realize carbon neutralization to zero emission.

This is the common expectation of mankind; It is also a huge change from non-renewable energy to clean energy. It is a great change that has not been seen in a century.

2. Contest Arena and Environment

2.1 Arena Setup



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 Departure (20 points) ★

3.1.1 The robot should depart the base with its vertical projection completely outside of the base area. One successful departure will be enough to score 20 points.

3.2 Wireless Charging Station (50 points) Difficulty: ★★

3.2.1 The wireless charging station model at its initial position can be placed anywhere on the 7 arena map locations. The red arrow shown below in figure 3-2-1 is pointing toward the same direction as the red arrows on the arena map shown in section 2.1. The model can be placed facing right to the red arrow as shown below, or can be placed facing left to the red arrow.

3.2.2 50 points are granted when the robot successfully pushes the electric vehicle into the charging station with the two magnets attached to each other as shown in figure 3-2-2.

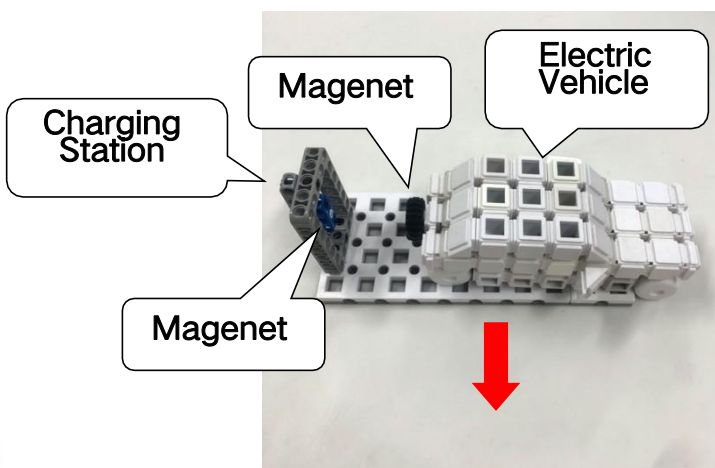


Figure 3-2-1 Initial Position

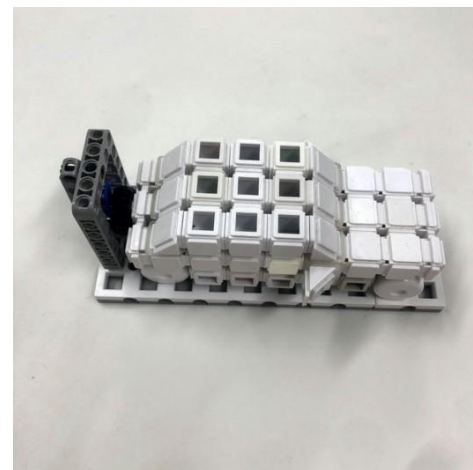


Figure 3-2-2 Finished Position

3.3 High-Density Battery (120 Points) Difficulty: ★★★★★

3.3.1 The high-density battery model at its initial position can be placed at either location 2 or 10 on the arena map. The red arrow shown below in figure 3-3-1 is pointing toward the same direction as the red arrows on the arena map shown in section 2.1. The battery is on the platform. The handle is on the left side of the model, and is shut closed as shown in figure 3-3-1.

3.3.2 30 points are granted when the robot pushes the slab on the left side of the model to drop the battery from the platform to the basket as shown in figure 3-3-2. Additional 40 points are granted when the robot push back the battery to the left side of the model as shown in figure 3-3-3 and then release the battery by pushing down the handle as shown in figure 3-3-4. Last 50 points are granted when the robot brings back the battery to the base.

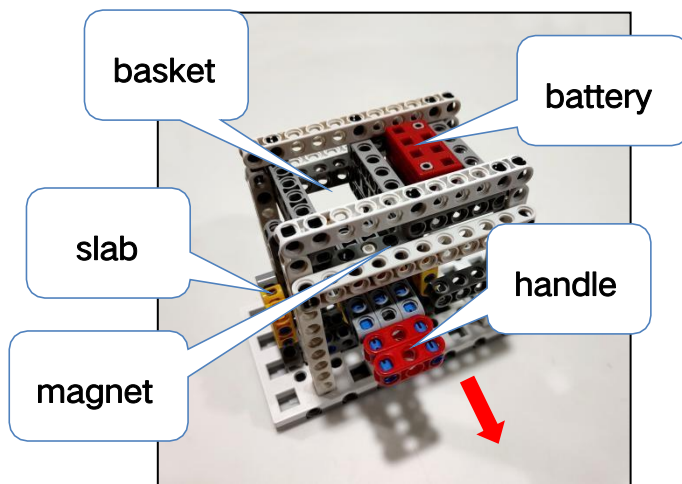


Figure 3-3-1 Initial Position

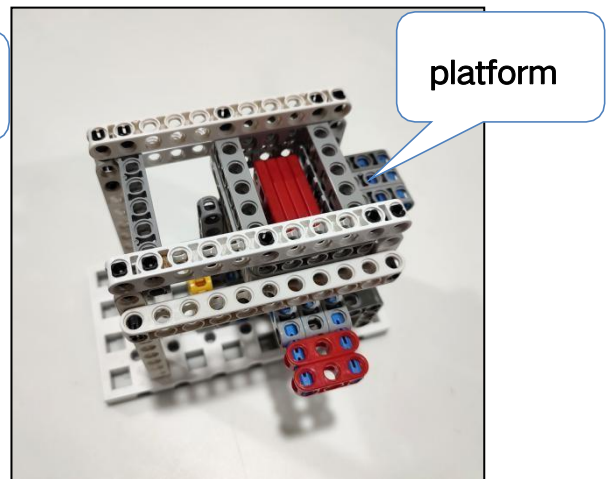


Figure 3-3-2 Position 1

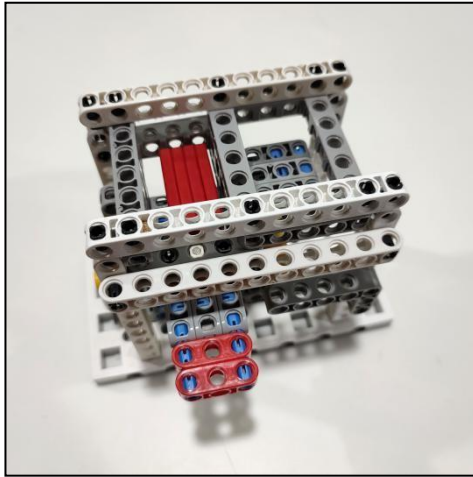


Figure 3-3-2 Position 2

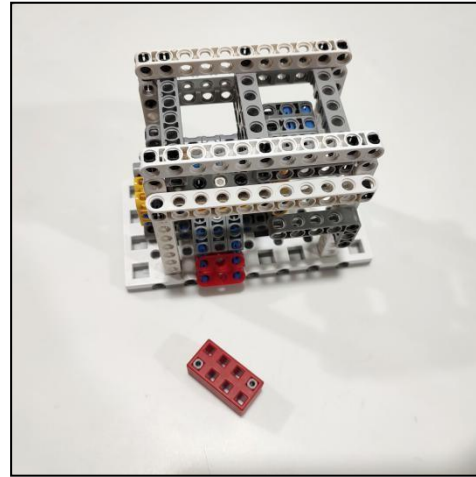


Figure 3-3-4 Finished Position

3.4 Salt Lake Lithium Extraction (60 Points) Difficulty: ★★★

3.4.1 Salt Lake lithium extraction model at its initial position can be placed at either location 1, 3, 4, 5, 6, 7, 8 or 9 on the arena map. The red arrow shown below in figure 3-3-1 is pointing toward the same direction as the red arrows on the arena map shown in section 2.1. Orientation of this model is fixed as shown in figure 3-4-1. Lithium model is placed on the bottom platform and the lever is parallel to the ground.

3.4.2 60 points are granted when the robot turns the lever so the lithium is attached to the magnet on top as shown in figure 3-4-2.

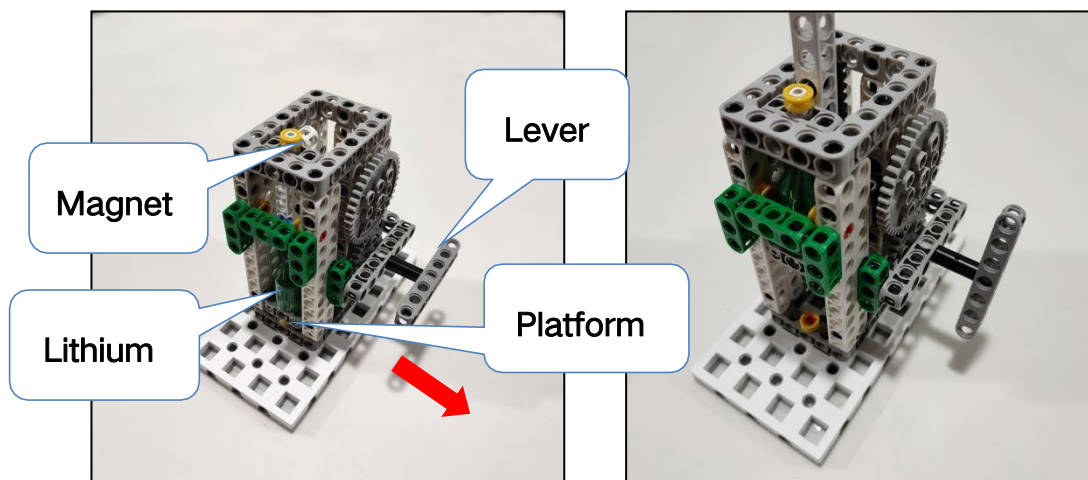


Figure 3-4-1 Initial Position

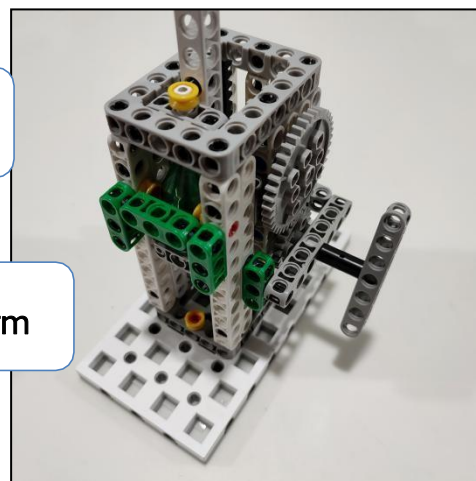


Figure 3-4-2 Finished Position

3.5 Ore Mining (70 Points) Difficulty: ★★★

3.3.1 Mine model at its initial position can be placed anywhere on the 7 arena map locations. The red arrow shown below in figure 3-3-1 is pointing toward the same direction as the red arrow on the arena map shown in section 2.1. The orientation of the mine model is fixed as shown below in figure 3-3-1. The ore is placed horizontally on the mine model with lever parallel to the ground.

3.3.2 30 points are granted when the robot spins the lever to detach the ore from the mine model as shown in figure 3-3-2. Additional 40 points will be given when the robot brings back the ore to the base.

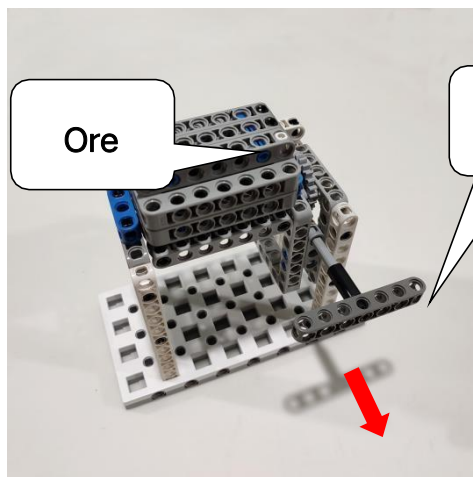


Figure 3-3-1 Initial Position

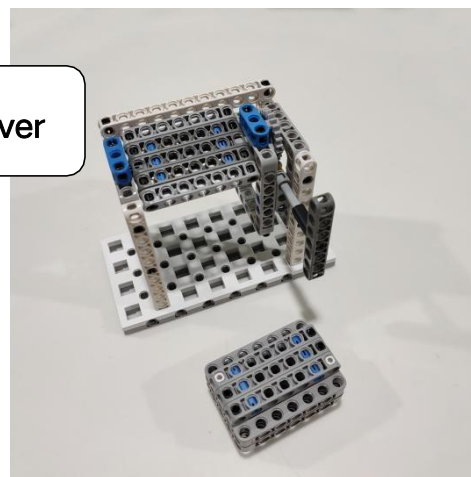


Figure 3-3-2 Finished Position 1

3.6 Return (30 Points) Difficulty: ★★

3.6.1 20 points are granted when the robot completes at least one task and return to the base automatically before time is up.

3.6.2 The return is considered successful when any of the robot's wheel touches the line marking the base area.

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.

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: Type and quantity of sensors used by each robot is unlimited.

4.5 Structure: Robots must only contain plastic parts provided in the kit; 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 1-3 students (enrolled in school) and 1 Coach.

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 personnel who are involved 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) has elementary, middle and high school division.

5.2.2 There will be 2 scoring rounds. The time of each round is 180 seconds. Scores from both rounds are counted towards the final score.

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

5.2.4 After both rounds are completed, 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 response to actual registration and arena environment conditions.

5.3 Procedure

5.3.1 Build robot, program and debug

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 need 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 their designated time will be forfeited.

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 behaviors 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 permission from judge.

8 Ranking

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.

WER 2022 Brick Educational Robot Contest (3+2) Scoring Sheet

No.		Team		Division		Round	
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	Tasks	Pts.	#	Score
Start	The Robot's vertical projection is outside of the base completely	20		
Charging	EV is attached to charging station	50		
Battery	Battery dropped into the basket	30		
	Battery released	40		
	Battery brought back to the base	50		
Lithium	Lithium attached to top magnet	60		
Ore Mining	Ore detached	30		
	Ore brought back to the base	50		
Return	Any one of the robot wheels is inside of the base	30		
On-site #1	TBD	100		
On-site #2	TBD	100		
On-site #3	TBD	100		
Restart Bonus	40-(number of restart) *10. Minimum score = 0			
Total Score				
Time (S)				

Judge: _____ Score Keeper: _____

Contestants: _____

Remarks: _____