Brick Educational Robot Contest-Universal Contest RULE

———Autonomous driving

1. THEME INTRO

For autonomous driving, the automotive industry is currently undergoing a period of transformation. Multiple technological pathways are being explored, product standards are becoming more open, and automobiles are evolving into intelligent mobile terminals. Autonomous driving liberates the driver’ s hands, and cars are no longer just transportation tools; they can become mobile offices, meeting rooms, restaurants, and more, providing people with additional services and convenience. The automotive industry ecosystem is set for a major restructuring. In the future, autonomous vehicles will be best integrated with electric vehicles, with key components undergoing changes. The industry ecosystem will shift toward electrification, intelligence, and connectivity. Companies focused on core technologies such as the "three electrics" (electric motor, battery, and electronic control) and key autonomous driving components will occupy the top of the industrial chain. The ecosystem's structure will also change, and the roles and positions of OEMs, solution providers, and mobility service providers will face a reshuffling.

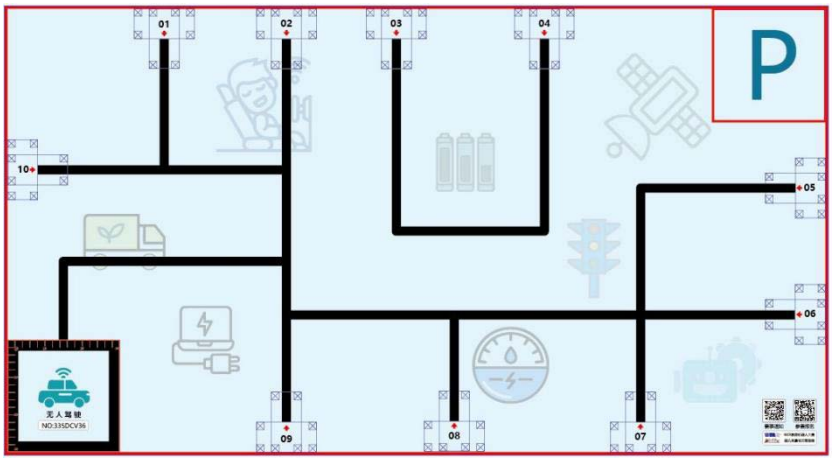
Autonomous driving will also bring about numerous transformations. In terms of mobility, the future will primarily focus on shared transportation, and the integration of autonomous vehicles with shared mobility will be the trend. This will

lead to adjustments and optimization of the traffic structure, with a significant reduction in the number of private vehicles. The insurance industry will also be affected. As autonomous vehicles improve driving safety through sensors and other systems, traffic accident rates will sharply decline, reducing users' demand for insurance. Meanwhile, traditional insurance models will no longer be applicable, and new innovative insurance solutions tailored to autonomous vehicles will emerge. Additionally, the demand for parking spaces will significantly decrease. The rise of autonomous shared mobility will reduce the need for private cars, leading to a lower demand for parking spaces in cities. Parking spaces can also be used more efficiently, freeing up urban space and positively impacting city planning and traffic management.

In conclusion, autonomous driving, as a technology with immense potential, is at the forefront of the era, leading the transformation of future transportation and mobility. Its origins are full of innovation, its development has been spectacular, and its future impact will be both broad and profound. We have every reason to believe that, with continuous technological advancements and improvements, autonomous driving will bring more surprises and convenience to our lives. Let us look forward to the early arrival of this promising future!

2. Contest Arena and Environment

2.1 Arena Setup



The size of the arena map is 120*220cm, and the material is PU cloth. The width of the black guide line is 2cm-3cm. At the end of the black guide line is the location box of the task model (task model placement area), and the position is marked with thin outline. Red arrows as shown in the image below points to the front of each location. The location and direction of the model are randomly assigned prior to the contest date. The site has a base with a size of 30 * 30cm, and the robot can travel in and out of the base location for unlimited times.

2.2 Arena Environment

The environment of arena placement should have cold light source, low illumination and no magnetic field interference. However, there are many uncertain factors in the actual contest environment, such as lines and unevenness on the surface of the field, changes in lighting conditions and so on. Teams should consider various countermeasures when designing robots.

3. Tasks and Scoring

There are 7 tasks in each game, which are composed of two parts: pre-set tasks and on-site tasks. This rule gives a total of 4 preset tasks according to the difficulty level, and 3 live tasks are announced when preparing for the game.

The content of the preset task is published in this rule, but the position and direction of the model can be changed, and the field task and task description are only published in the preparation before the game. The participants should design the robot structure and program according to the field.

In the absence of specific requirements in the rules of the task, the description of the score is only a scheme reference, the contestant can have different solutions, unlimited ideas.

The preset tasks described below are only simulations of real-life scenarios.

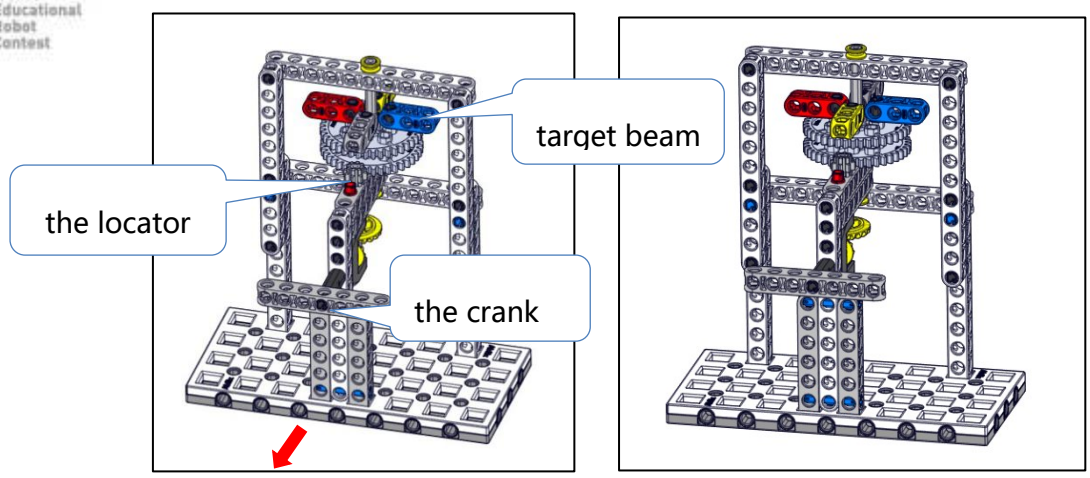
3.1 Departure (20 points) ★

3.1.1The 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 Enable Positioning (50 points) ★★★

3.2.1 The initial position of the positioning model is from 1 to 10. The position is variable, while the direction is fixed. The red arrow indicates the front-facing direction of the model, the crank is in a horizontal state, and the locator must align with the gray target beam, as shown in **Figure 3-2-1.**

3.2.2 The robot needs to rotate the crank to align the locator with any of the red, yellow, or blue target beams. When the alignment is complete, the task is considered finished, and 50 points are awarded, as shown in **Figure 3-2-2.**



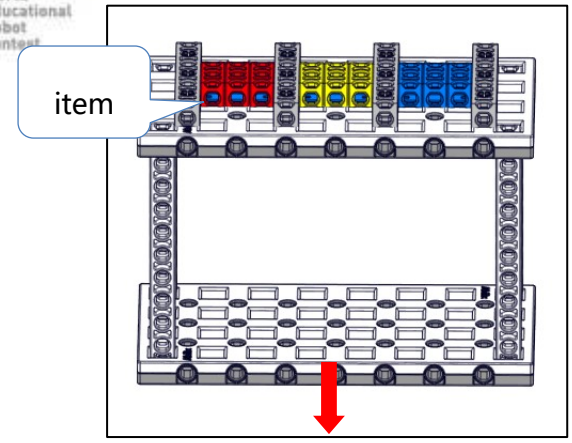
3-2-1 Initial state

3-2-2 Complete state

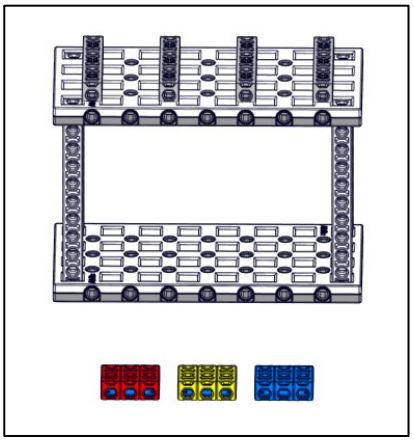
3.3 Point Retrieval (90 points) ★★★

3.3.1 The initial position of the point retrieval model is from 1 to 10, with both position and direction being variable. The red arrow indicates the front direction of the model, and there are three colored items placed above the model: red on the left, yellow in the middle, and blue on the right, as shown in **Figure 3-3-1**.

3.3.2 The robot can push the items to completely detach them from the model, which counts as a completed state, earning 10 points per item. For completing state one, bringing the items back to the base counts as completed state two, earning an additional 10 points per item. If the items brought back to the base are the same color as those in the positioning task after completion, this counts as completed state three, earning an additional 30 points, as shown in **Figure 3-3-2**.



3-3-1 Initial state

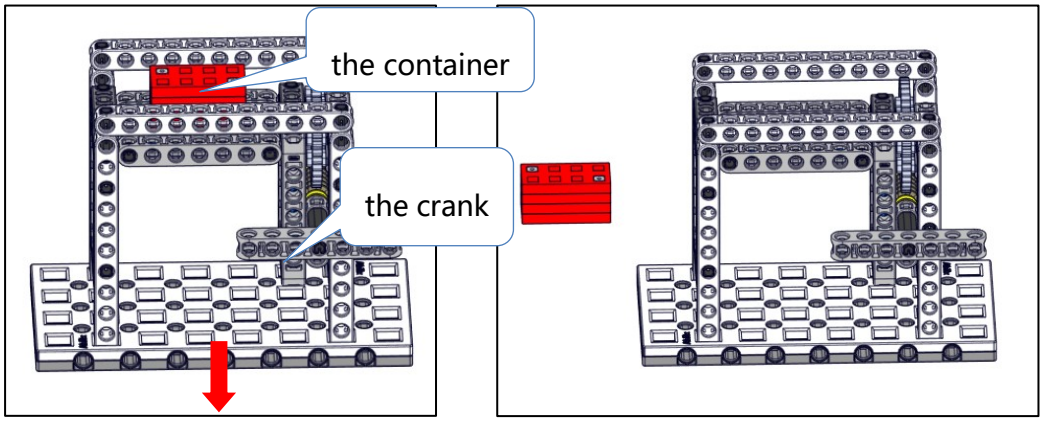


3-3-2 Complete state

3.4 Port Transportation (60 points) ★★★

3.4.1 The initial position of the port transportation model is from 1 to 10. The position is variable, while the direction is fixed. The red container is positioned above the model, and the crank is in a horizontal state, as shown in **Figure 3-4-1**.

3.4.2 The robot needs to rotate the crank to completely detach the red container from the model, which counts as completed state one, earning 30 points. Bringing the container back to the base counts as completed state two, earning an additional 30 points, as shown in **Figure 3-4-2**.



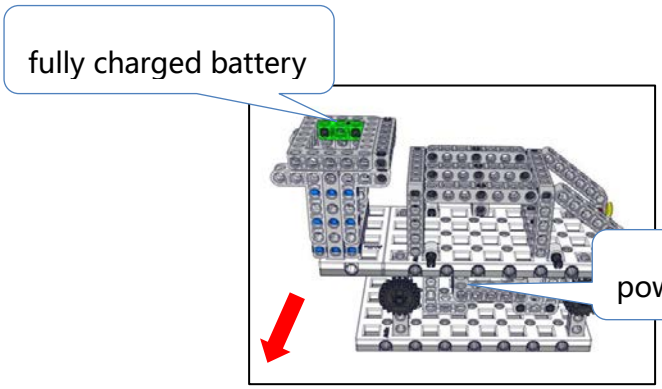
3-4-1 Initial state

3-4-2 Complete state

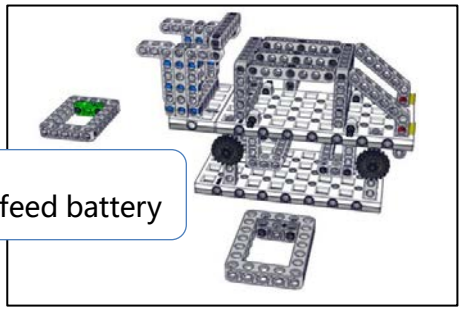
3.5 Quick Battery Swap (160 points) ★★★★

3.5.1 The initial position of the quick battery swap model is from 1 to 10. The position is variable, while the direction is fixed. There is a green fully charged battery at the rear of the car, and a gray power feed battery beneath the car, as shown in **Figure 3-5-1**.

3.5.2 The robot can push the fully charged battery to completely detach it from the model, which counts as completed state one, earning 30 points. Bringing the fully charged battery back to the base counts as completed state two, earning an additional 30 points. The robot can then remove the power feed battery to completely detach it from the model, which counts as completed state three, earning an additional 30 points. Bringing the power feed battery back to the base counts as completed state four, earning an additional 30 points. Finally, placing the fully charged battery onto the bottom of the car counts as completed state five, earning an additional 40 points, as shown in **Figure 3-5-3**.



3-5-1 Initial state



3-5-2 Complete state

3.6 Autonomous Driving (60 points) ★★

3.6.1 Before the end of the competition, if the robot autonomously returns to the

parking area for the last time, it counts as completed state one, earning 30 points. Any drive wheel of the robot within the red line can score points. Only one time per game.

3.6.2 If the robot brings the container from the completed port transportation task to the parking area, it counts as completed state two, earning an additional 30 points. This state is a linked task and cannot be completed independently; if the port transportation task is not completed, then completed state two for this task will not earn points.

In the above task execution process, the position and direction of the task model are some variable and some are constant. The position and orientation of the task model, once published, does not change.

4 Robot

This section provides the principles and requirements for designing and building robots. All robots must pass an inspection before entering the competition. To ensure fair play, judges will randomly check the robots during the game. Robots that do not meet the requirements need to be modified in accordance with the requirements of this rule, if the robot still does not meet the requirements, it will be disqualified.

4.1 Size: Before each departure, the size of the robot shall not be greater than 30*30*30cm (length * width * height); After leaving the base, the robot's mechanism can extend itself.

4.2 Controller: In a single round, the controller cannot be replaced. Only one

controller is allowed per robot.

4.3 Actuator: Each robot is allowed to use a total of no more than 4 motors in the competition (digital steering gear is not allowed).

4.4 Sensors: There is no limit to the type and number of sensors allowed for each robot.

4.5 Structure: The robot must use the splicing structure of plastic material, and must not use cable ties, screws, rivets, glue, tape and other auxiliary connection materials.

4.6 Power supply: Each robot must have its own independent battery, shall not be connected to external power supply, battery voltage shall not be higher than 9V, and shall not use booster, buck, voltage regulator and other circuits.

5 competition

5.1 Participating team

5.1.1 Each team consists of 2-3 students and an instructor. Participants must be students in school.

5.1.2 The participants should have a positive attitude to face and independently and properly deal with various problems encountered in the competition; Self-respect, self-respect, self-discipline, self-improvement; Treat teammates and opponents with kindness; Respect volunteers, referees and all the people who have worked hard for the game, and strive to develop themselves into people with sound personality and healthy psychology.

5.2 Competition system

5.2.1 WER educational robot popularization competition is conducted according to primary school, middle school and high school groups respectively.

5.2.2 There are two rounds of the competition, no preliminary or final. Each race is 180 seconds long. Each game is scored.

5.2.3 If a team chooses a live task, the game will not be extended.

5.2.4 At the end of all matches, the total score of each team will be the sum of the scores of each team, and the teams will be ranked according to the total score.

5.2.5 The competition Organizing committee has the right and the possibility to change the competition system according to the registration and the actual situation of the venue.

5.3 Game process

5.3.1 Building robots and programming

5.3.1.1 Building robots and programming and testing procedures are carried out in the competition area.

5.3.1.2 The student members of the participating team can enter the debugging area after being checked. The referee has the right to inspect the equipment carried by the team, and the equipment used must meet the relevant regulations and requirements of the Organizing Committee. The team members can carry the robots that have been built into the debugging area. The team members shall not bring the communication equipment which is prohibited by the Organizing committee. After all the students are seated in the debugging area, the referee will inform the teams of the score description and the position of the task.

5.3.1.3 Teams should bring their own laptops, repair tools, replacement devices, spare supplies, etc. Participants are not allowed to surf the Internet in the debugging area, use cameras and other equipment to photograph the competition site, and must not contact the instructor or parents in any way.

5.3.1.4 There is 2 hours of preparation time before the competition, and the team can modify the structure of the robot and write programs according to the on-site environment.

5.3.1.5 The field uses daily lighting, and the participants can calibrate the sensors, but the organizing committee does not guarantee that the on-site lighting is absolutely unchanged. As the competition progresses, the lighting situation on the site may change, and the actual impact of these changes and unknown light should be adapted to or overcome by the participants themselves.

5.3.1.6 After entering the competition, the participants must debug and prepare the robot in an orderly and methodical manner, and shall not accept the guidance of the instructor in any way. Teams that do not follow the rules may be warned or disqualified. Before the end of the preparation time, each team should arrange the robot in the designated position in the debugging area, and then seal it.

5.3.2 Pre-competition preparation

5.3.2.1 When preparing to go on the field, the team members receive their own robots and enter the competition area under the lead of the referee. Any team that fails to show up within the time limit will be considered a forfeit.

5.3.2.2 The participating student players shall stand near the base.

5.3.2.3 Team members put their robots into the base. No part of the robot and its forward projection on the ground can exceed the base area.

5.3.2.4 Team members on site should take the time (no more than 2 minutes) to make preparations before the robot starts, check the site, and check whether the model is restored to the initial state. After completing the preparation work, the players should signal to the referee.

5.3.3 Startup

5.3.3.1 When the referee confirms that the team is ready, he will issue the countdown start command "3, 2, 1, Go". At the end of the password, the participant can press the button to activate the robot.

5.3.3.2 Starting the robot before the referee gives the "start" command will be considered a "false start" and will be warned or penalized (count one restart).

5.3.3.3 Once the robot is started, it can only be controlled by its own program. Team members are generally not allowed to touch the robot (except in the case of rebooting). Players must not touch the model during the game, once the model is touched, the task is not scored, regardless

Whether the task is complete and counts as a restart, and the task cannot be completed again.

5.3.3.4 After starting, the robot shall not intentionally separate parts or drop mechanical parts on the field. The separation of parts for the sake of competition is a foul act, and the robot's use of separated parts is invalid. Separate parts means that at some point the parts of the robot no longer maintain any connection with

the main body of the robot. Part separation due to the reasons of the player prevents the player robot from completing the task, which is considered as part of the competition. During the race, stray parts remain in place. Players and umpires clear the field at the end of the game.

5.3.3.5 If the robot throws the items carried by it out of the field due to excessive speed or program error after starting, the items shall not return to the field.

5.3.4 Restart

5.3.4.1 If the robot fails or fails to complete a task during operation, the team members can take the robot back to the corresponding base and restart it. The tasks completed by the robot before restart are valid, but the scoring model carried by the robot is invalid and kept by the referee until the end of this round of competition. The timing does not stop during this process.

5.3.4.2 Robot autonomous operation reward: in the whole process of the competition, 0 restarts, reward 40 points; 1 reboot, reward 30 points; 2 restarts, 20 points; 10 points for 3 restarts; No reward for 4 or more restarts.

5.3.4.3 There is no limit to the number of restarts of the robot in each competition, but the bonus points shall be implemented according to 5.3.4.2.

5.3.4.4 Timing does not stop or restart during restart.

5.3.5 The robot returns to base autonomously

5.3.5.1 The robot can autonomously travel to and from the base several times, regardless of restart.

5.3.5.2 The standard for autonomous return of the robot to the base is that any driving wheel of the robot is within the range of the base, and the team members can contact the robot that has returned to the base.

5.3.5.3 After the robot autonomously returns to the base, the team members can change or repair the structure of the robot.

5.3.6 End of the game

5.3.6.1 The duration of each match is 180 seconds.

5.3.6.2 After completing some tasks, if the team is not ready to continue the game or has completed all tasks, it should signal to the referee, and the referee will stop the time accordingly, record it as a single round time, and end the game; Otherwise, wait for the referee's final whistle.

5.3.6.3 After the referee blows the final whistle, the players shall immediately turn off the power supply of the robot and shall not contact the robot or any object on the field.

5.3.6.4 The referee fills in the score sheet and informs the players of the score.

5.3.6.5 The participants shall restore the venue to the pre-start state and immediately move their robots back to the debugging area.

6 points

6.1 At the end of each game, the score will be calculated according to the completion of the task. The scoring criteria for completion of tasks are set out in section 3.

6.2 The order in which tasks are completed does not affect the score of individual tasks.

6.3 Some tasks need to bring the model back to the base to calculate the score, which must meet the following requirements: (1) The accuracy of the robot's autonomous return to the base; (2) The projection of the robot partially or completely coincides with the projection of the model; Or the robot makes contact with the model.

7 Foul and disqualify

7.1 Teams that fail to show up on time will be penalized 10 points for each minute they arrive late. If the team fails to show up after more than 2 minutes, it will be disqualified.

7.2 The first false start will be warned by the referee, the robot will return to the standby area to start again, and the timing will start again. A second false start will result in disqualification.

7.3 Separating parts for competitive gain is an offence and may result in disqualification depending on the severity of the circumstances.

7.4 A warning will be given if damage to the competition model is caused by a participant or robot, whether intentionally or unintentionally. The field does not score for the task, even if the task has been completed.

7.5 During the competition, the participants shall not touch the competition model outside the base and shall not touch the robot outside the base, otherwise, it will be handled by "restart".

7.6 Failure to follow the referee's instructions will result in disqualification.

7.7 Players who contact their instructor or parents without the permission of the referee will be disqualified.

8 Results Ranking

Each team will be ranked based on their scores in total of both rounds, the higher the score is, the higher the ranking will be. If there are teams which 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 number of completed single tasks (full marks) in all sessions ranked first;

Appendix score sheet

WER 2025 Brick Educational Robot Contest (4+3) Scoring Sheet						___	
No.		Division		Round		Team	

Tasks		Max Pts	#	Score
Departure	The vertical projection is outside the base	20		
Enable Positioning	Locator aligned with any of the red, yellow, or blue target beams	50		
Point Retrieval	Items completely detached from the model	10 /item		
	Items brought back to the base	10 /item		
	Items of the same color	30		
Port Transportation	Red container completely detached from the model	30		
	Red container brought back to the base	30		
Quick Battery Swap	Fully charged battery completely detached from the model	30		
	Fully charged battery brought back to the base	30		
	Power feed battery completely detached from the model	30		
	Power feed battery brought back to the base	30		
	Fully charged battery placed onto the bottom of the car	40		
Autonomous Driving	The point of contact between any drive wheel and the field is within the base	30		
	Container brought to the parking area	30		
Field task	See venue announcement for details	100		
Field task	See venue announcement for details	100		

Field task	See venue announcement for details	100		
Autonomous operation reward	40- (number of restarts) x 10. The value must be greater than or equal to 0			
Total points				
Single round time				

umpire: _ _ _ _ _ _ _ _ _ _ _ _ _ **scorekeeper:** _ _ _ _ _ _ _ _ _ _ _

Team members: Sam Bell _

notes: _