SCHOOLS' ROBOTIC COMPETITION – ROBO CAN - COLLECTOR

1. OBJECTIVE

To design and build an autonomous robot that is able to follow a black path. At the end of the path, it is to collect a "can" weighing **300g** and to return to the starting box before unloading. It must be capable of receiving and transmitting wirelessly the can's position information.

2. JUDGING CRITERIA

The robot which has the **highest number** of collected "cans" within the stipulated time of **4 minutes** is the winner.

3. ENTRY REQUIREMENTS

3.1 The **Robo Can–Collector** is opened for all full-time students from formal MOE primary or secondary schools. Student participants should not exceed the age limit of 18 year-old as of 31-Jan 09.

3.2 Each school could submit up to **three entries**. Each entry shall not be more than four students and must have its own can-collection robot. No robot shall be shared by any entries and no cloning (identical design) is allowed.

3.3 Entry closes two weeks before the competition. The robot must pass inspection at the beginning of the competition. Further details are available from the official web site.

3.4 All robots and the transmitting controller shall be caged at the beginning of the competition and will be returned only at end of the entire competition.

4. RULES AND REQUIREMENTS

4.1 The robot is to be controlled by an on-board programmable microcontroller and powered by 6 AA batteries or its equivalent of 9V (6 x 1.5V). The robot should not exceed 25 cm in length and width.

4.2 The field (Figure 1) is of a rectangular shape with an approximate size of 176 cm by 144 cm, and is constructed using the proprietary Plegofield (www.plegofield.com). There is a black path (on white background) leading to FIVE separate paths, at the end of which a "can" could be pre-loaded on one of these five rocker arms (Figure 2). There is also a starting box measuring 25 cm by 25 cm at one end of the field where the robot would start and finish.

4.3 The robot should be designed to negotiate and follow the black path. Obstacles would be placed randomly by the judges just before competition commences to prevent robot from taking "short cut" to reach the "can". Other fixed obstacles (Figure 3) are placed near the end of each path. At the **first turning of the path**, a transmitting controller will transmit wireless the can's postion to the robot. The robot is to acknowledge the can's position information by **echoing the information**. After the acknowledgement, the transmitting controller is to stop the transmission. The handler is **not allowed to handle** the transmitting controller **after it is on and the program running**. A **penalty of 0.5 points (2 penalties is equivalent to one can collected)** will be given if the controller does not stop transmission after the acknowledgement and when the robot collected the can and return to the starting position.

The transmitting controller is provided by the participant. It will be caged together with the robot at the beginning of the event. A printout of the transmitting program MUST be submitted at the time of caging. (For different teams from the same school, the same transmitting controller could be used. However this must be made known at the time of caging with the team names stated in the printout).

4.4 **One 300g "can", will be placed on the respective rocker.** Upon reaching the end of path, the robot has to collect **the "can"**. Robot should make contact with the rocker arm to dislodge the "can" onto its receptacle. Robot must then carry the "can" (off the ground), and bring it back to the starting box. Upon reaching the finishing position (when any part of the robot body touches the starting box outline) the "can" is unloaded by the handler and robot repositioned within the starting box to start the next run to collect the next "can". Only one "can" is to be collected for each run. Only one handler each is allowed to assist the robot at the starting and finishing position and operate the transmitting controller.

4.5 It is considered an aborted run should the robot drop its "can" on the field in the course of its run. The robot is to start from the starting position and a **"can" will be placed on any rocker arms by the judge. The transmitting controller is to be restart again when the robot is at the first turing of the path.**

4.6 The robot is given **four minutes** to collect as many "can" as possible.

4.7 No adjustment is allowed in the open field during the run. The robot must be brought back to the starting box and restart when being inactive, disabled or out of control in the open field. This will be considered as one aborted run, and the decision to abort the run is at the discretion of the handler.

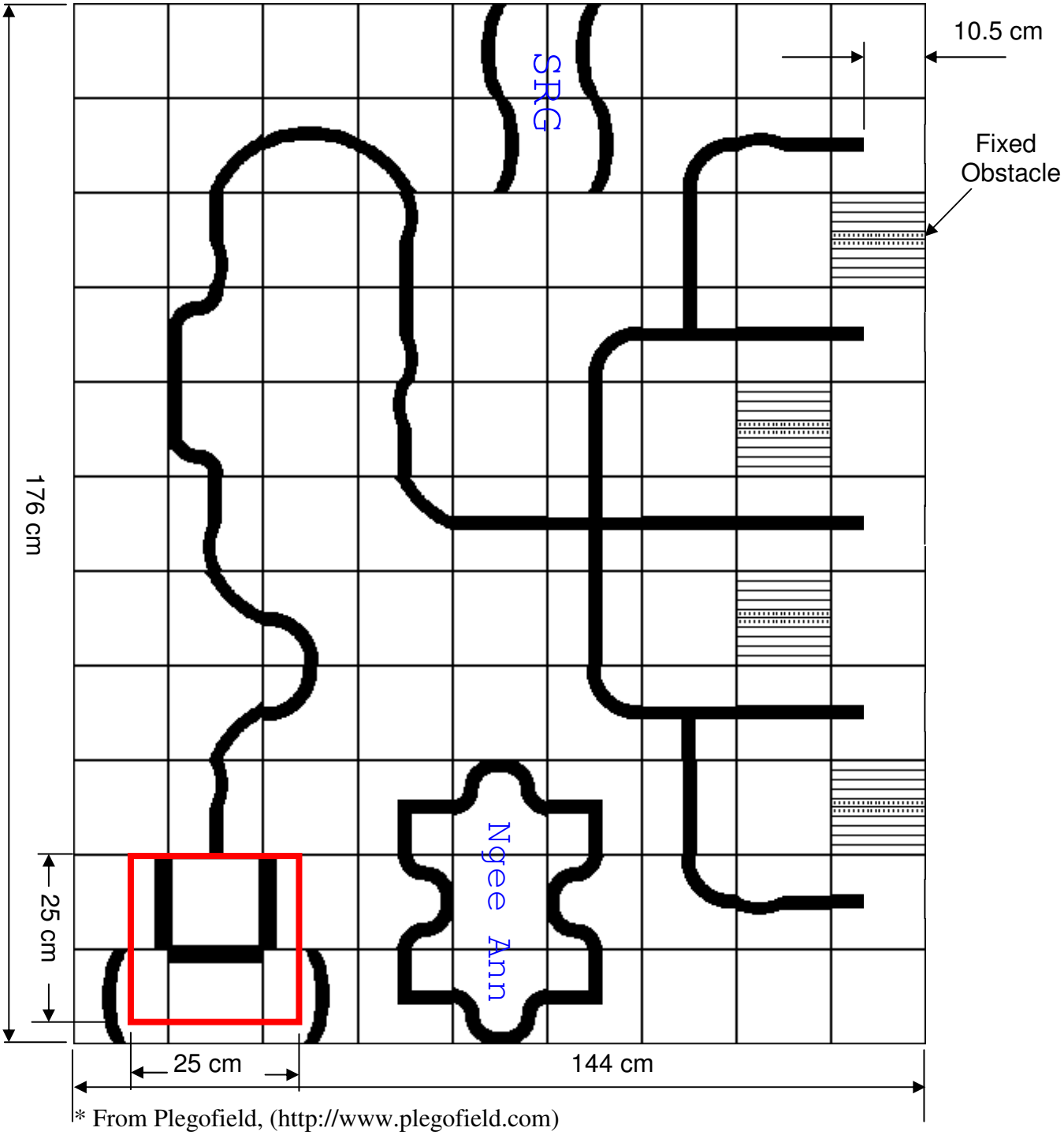
Permission may be granted for 1 recess (10 minutes) and it carries a penalty of 2 minutes on the competition time.

4.7 In the event of a tie, **the robot that collects a "can" in its very first run and with the shortest time will be ranked highest**. If there is still a tie, the robot with the least number of aborted runs during the game will be ranked next. On further tie, the rank will be determined by either the shortest time for a successful collection of a "can" or the furthest distance covered for a non-delivery, of ONE final run.

FAQ (Frequently Asked Questions)

1. Must we use only Lego parts. Can we use parts from other sources?
   There is no restriction on parts used.
2. How many motors are allowed?
   No limits on number of motors used. However, you are limited in the use of maximum 9 V (6 x 1.5V) battery source.
3. How many sensors are allowed?
   No restriction on number of sensors used.
4. Are we allowed to use other microprocessors beside the RCX and other type of sensors supplied with Lego Mindstorm?
   There are no restrictions microprocessor and sensors used.
5. Can my robot collect more than one can at a time?
   No, robot can only collect one can at one time.
6. What brand is the can drink?
   We use Jia Jia Herbal Tea cans.
7. What is filled inside the can to make its weight 200g and 300g?
   Beans or rice.

Figure 1a: The Field*



* From Plegofield, (http://www.plegofield.com)

Figure 1b: The Field

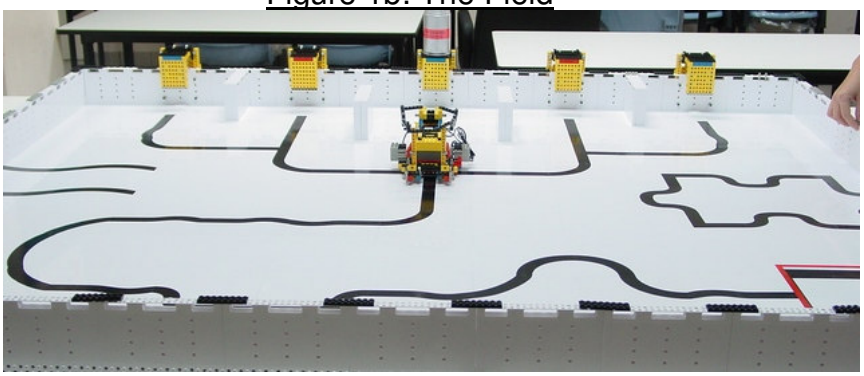
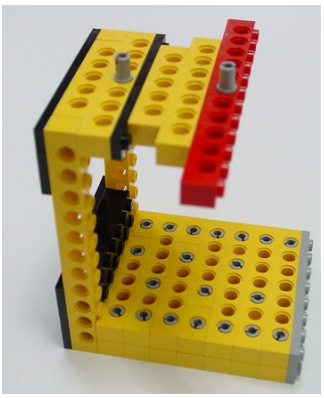
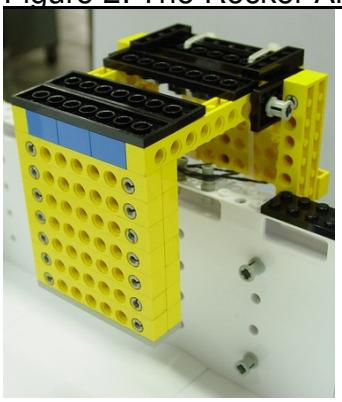


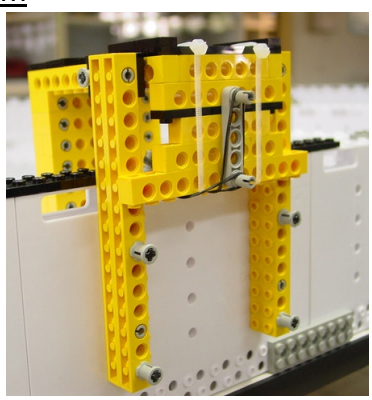
Figure 2: The Rocker Arm



Rocker Arm Construction

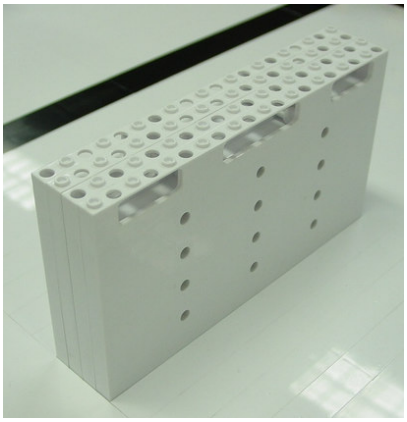


Rocker Arm Front View



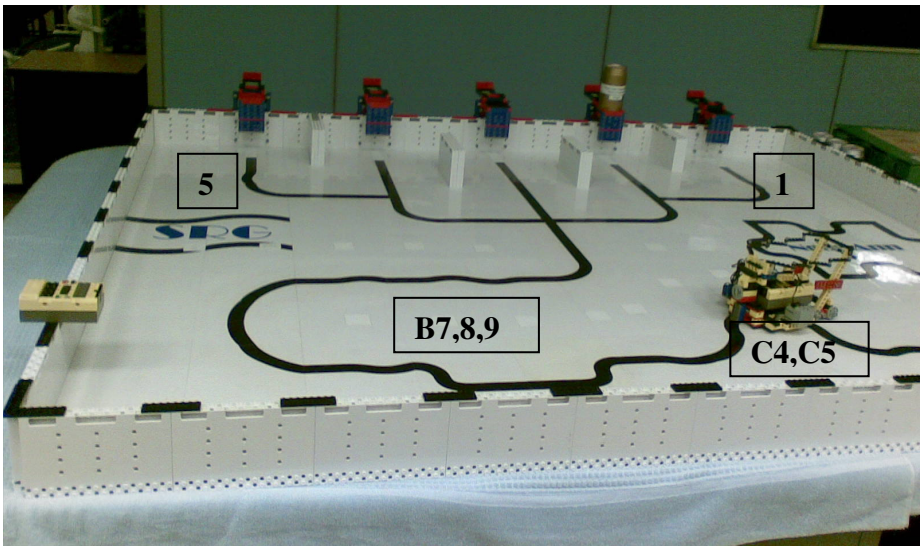
Rocker Arm Back View

Figure 3: Fixed obstacle



8. Will there be a practice run?
   Due to constrain in the venue, we could only set up the track on the actual day. We might consider allowing practice time one to two hours before event commences.
9. Are we allowed to measure the light sensor values so that we can program it on our robot before caging?
   Please do so during practice runs, usually few hours before the event.
10. What does caging mean?
    Only particpating robots need to be caged in a common area before the start of competition.Caged robot will only be released back to the students until the end of the whole competition.
11. Can I take back my robot if I know I have no chance of winning any medal?
    Usually you are not allowed to take back your robot till the end of the competition. However, we understand that some school need to leave early as the bus is waiting etc. In that case, we allow early return of robots provided all the teams from the same school have completed their runs and are out of contention for any medals.
12. Must the entire robot start behind the starting line or can some parts of the robot be in front of the line such as the light sensor?
    The entire robot including sensors, arm etc need to be behind the starting red line.
13. Must the robot follow the line strictly. Can we just program the robot to go straight without following the line.
    Robot must follow the line to reach the "can" as there are obstacle placed randomly everywhere and robot will not be able to take any short-cut .
14. Is flash photography allowed during the runs?.
    Flash is not allowed as flash might effect the light sensors.
15. Are we allowed to wipe the playing field with a dry cloth before starting the run?
    Yes, but please inform the judges first to get his/her permission.
16. Where is the actual position on plegofield is this "first turning of the path" in para 3.3, line 4?
    It is located at grid C4 and C5.

17. Where is the broadcasting controller positioned?
    It is located on top of the wall just next to grid B11
18. What kind of message is sent by the broadcasting controller?
    Participants decide its own message.
19. Which is "can" number 1 and which is "can" number 5?
    "Can" number 1 is at grid I2, while "can" number 5 is at grid I10.
20. Who will be responsible to operate the broadcasting controller? How could you ensure that message is sent at the right time?
    A team member will operate the transmitting controller. The judge or the event organizer will inform the team member the "can position" after the robot start moving away from the "start" position where the handler is not allowed to touch the robot anymore.
    The picture shows the transmitting controller location and the robot location when the can position is made known.



21. What is meant by "echoing the information received 3 times." in para 3.3 line 6?
    Upon receiving the can position message by transmitting controller, your robot's controller must echo some message to acknowledge receipt of the message back to the transmitting controller. Upon the receipt of the acknowledgement the transmitting controller is to stop running the program, otherwise a penalty of 0.5 point will be given. (2 penalties equivalent to one can collected.)