World Robotics League®

CHALLENGE 1: ORGANIZER BOT

INSTRUCTIONS BOOKLET

Revision 1.0	Initial Release

http://worldroboticsleague.com/

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1 IMPORTANT NOTES

For World Robotics League®, the constitution and Manifesto which describes the acceptable behavior of help from Parents, Coaches and Mentors is present here.

1.1 INTERPRETING THE DRAWINGS

In addition to the drawings and figures, the challenge field computer model is provided in eASM format which allows you to look at the field in a 3d manner using CAD software. You can look at multiple views, rotate, look at the details and measure any game elements using eASM files. We strongly recommend that you install the free eDrawing and eAsm viewer provided by Dassult/solidworks, from following site:

http://www.solidworks.com/sw/support/edrawings/e2_downloadcheck.htm to view these files.

Figure 1 : An example of how tape is used to mark regions.

1.2 RECREATING THE COMPETITION FIELD

As described in Figure 1, you may use masking tape or electrical tape to mark various regions of the challenge field in case you don't have the official material including field perimeters at hand. Avoid using thick fabric-based tape or tapes that may spill glue since this may alter behavior of the robot. For the Boundary of the competition area, you may either use the official perimeter walls (12 inches high and about 0.25 inch thick) to mark the field or alternately, you may use tape to represent the wall. If you are using tape to represent walls, when recording the video for the competition submission, you MUST record the video at an angle that makes it obvious and establishes beyond any doubt that any part of the robot prohibited from

entering an area does not overlap or encroach in the specified areas during the robot missions. If in the submission video, it is not obvious and difficult to assess whether any part of the robot is entering a prohibited area, the judges will be free to make an assessment based on their best understanding. In such cases, their judgement will be considered final and no appeals will be acceptable.

1.3 COMPETITION SUITABILITY

This challenge is suited for RoboNINJA™ Craftsman Silver skill level ONLY. For explanation of the levels, see the **Levels and Progression** page on the World Robotics League website.

1.4 MODES OF OPERATION OF THE ROBOT

The challenge can be operated in two ways, Remote Controlled (referred to as RC in the rest of the document) and Autonomous. The same challenge can be operated in either fully RC mode or fully autonomous mode and teams are allowed to sequentially attempt both modes of the challenge as part of the competition. If you wish to attempt both the challenges, you may attempt the challenge in the autonomous mode, reset the field and then attempt the RC mode. However, for purposes of submission you MUST submit one single video containing the entire process. In your video submissions, please specify if you are attempting RC mode or Autonomous mode by means of verbally saying the following sentences when starting

- Start the challenge by saying
    - **Attempting Autonomous mode if you are attempting the Autonomous mode**
      or
    - **Skipping Autonomous, going straight to Remote Control Mode, if** you are going to skip Autonomous mode
    - Finally **Starting Remote Control Mode** when you are starting Remote Control Mode.
    - **Ending Run** when you are done with operating the robot.

In RC mode you have a time limit of 90 seconds to attempt the challenge. In autonomous mode, the total time to attempt the challenge is 3 minutes.

1.5 GAME FIELD ELEMENTS

In this challenge, the balls used are simply lawn tennis balls that you may obtain from any sports shop.

2 THE CHALLENGE

In the manufacturing industry, robots are often used for repetitive tasks. One such task is warehouse and factory organization. This challenge is geared towards using a robot for organizing items in a factory setting.

In a typical factory, tools, materials and equipment are stored and organized in various sections. During the work hours, also referred to as shift, workers and robots move the items around to complete various tasks. At the completion of the shift all the tools, material and equipment need to return to respective areas. The intention of returning the items to respective areas is following

1. To ensure that items are available for next shift.
2. To take an inventory in case items are misplaced or missing.

The organization of the items can be a laborious task, and therefore many factories employ robots to organize them. the robots may work in autonomous fashion or RC mode. Autonomous operation of such robots is preferred since the task is performed more accurately and without relying on human resources that are error prone.

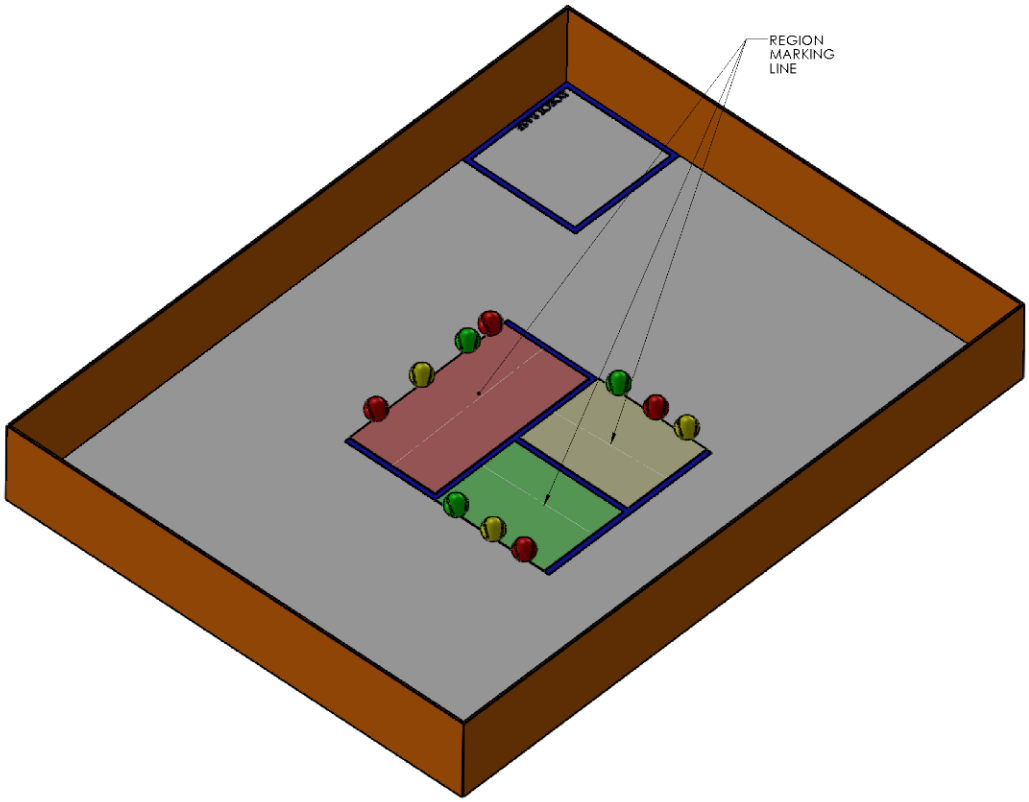

Figure 2: Field perspective view

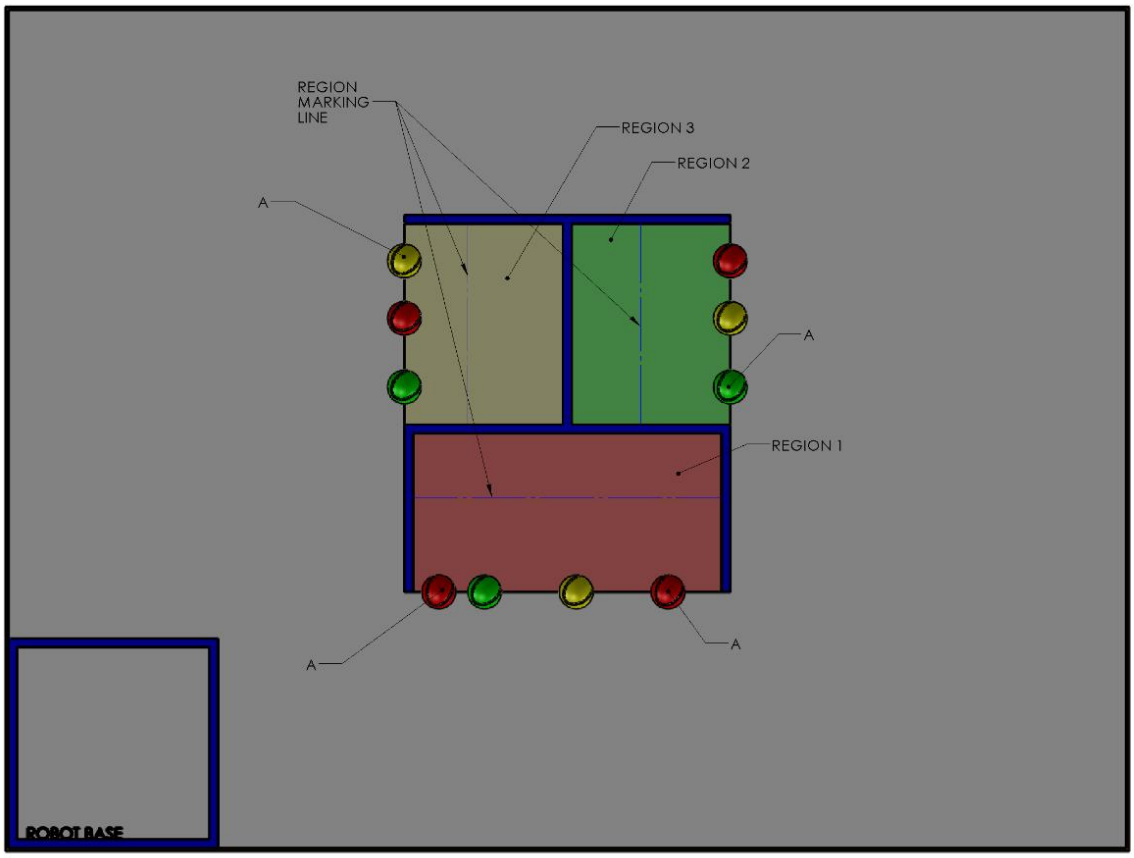

Figure 3 Challenge field details

In this challenge, your job, as the Chief Engineer, in charge of robot automation is to design an autonomous robot that can perform these tasks in an accurate and timely manner.

As described in the Figure **3**, Region 1 Region 2 and Region 3 represent different parts of the factory. Note that each region is defined by wall represented by blue color walls and the region marking line. The Red, Yellow and Green balls represent materials, tools and equipment. At the start of the challenge, the scenario on the field represents the end of a shift where the workers have placed the tools and equipment away from their original locations, which, need to be returned to their assigned locations.

For understanding the rest of the challenge, it will be useful to refer to the drawings when consulting the rest of the challenge document.

Once the Challenge starts, the robot needs to move each item to its respective storage area behind region marking line. The Robot may move the items by pushing, pulling or picking and placing. All these modes moving an item are acceptable. For successful scoring, all the items represented by red balls should be moved to Region 1, all the items represented by the green balls need to be moved to Region 2 and all the yellow balls need to be moved to region3.

NOTE*: You need not paint the regions red, green or yellow. The colors are included for additional clarity. However, if see and advantage and may want to use color sensor, you are allowed to paint the regions in any color of your choice. Alternately, you may use a colored mat in those areas*.

3 CHALLENGE CONDITIONS AND RULES

- All units are specified in inches.
- For marking purposes on the field, you may use tape of any color.
- The square region where the Robot starts the challenge is known as the Base and will be referred to as such in the rest of the document.
- Size of the Robot MUST not exceed 18in x 18in x 18 in. At the beginning of the challenge, the robot must fit in the 18in x 18in area marked as the Base. If you are submitting your challenge via video, the team MUST include a top view of Robot area in their videos before the start of the challenge to confirm that no part of robot exceeds the specified boundary.
- Each challenge may be attempted in Autonomous mode or Remote control mode.
- For the teams competing in Autonomous mode, Robot shall navigate and complete tasks without human intervention. Robot can be modified, realigned and alternate program may be started only when robot is in Robot area before the robot starts the challenge. Once the robot leaves the starting area, any intervention will incur penalties as specified later in the document. If the robot misbehaves and you need to bring it back to the starting area, you may do that. However, as mentioned earlier, penalties will apply. Once the robot starts, the timer for the robot run is running and will not stop when the robot is picked up, modified or reoriented in the Robot base. You may pick up and restart the robot from the base as long as you are still within the time limit of the Autonomous run.
- In RC mode, the robot shall navigate and complete the tasks with the help of a hand held remote-control device such as a gamepad. Unlike the autonomous mode, in the RC mode, the Robot cannot be modified or realigned once the Robot leaves the Robot area.
- When multiple teams are competing at a common venue, each team will be given two opportunities to perform and the maximum of the two runs will be considered as the actual team score. For the submission by video, only one video per team is allowed.
- The Robot may move the items to any of the regions in any order.
- You may use up to 20 motors maximum of any kind on the robot. Any combination of the DC and Servo motors is allowed.

- You may use any number and kind of sensors in this challenge. There is no limit on the type or number of sensors

4 SCORING

Points are scored when Robot moves the ball to specified destination. The points are assigned per follows:

Table 1 Score details (Autonomous as well as Remote controlled)

	Remote Controlled		**Autonomous Mode**	
Region	**Ball marked A**	**Other Balls**	**Ball marked A**	**Other Balls**
1	10	20	20	40
2	10	20	20	40
3	10	20	20	40

- For the move score, the ball must be completely present in the respective region with no part outside of it. Moving a ball in the incorrect region will incur a 2-point penalty.
- For this challenge, if your robot misbehaves during the autonomous portion of the challenge, you may pick up the robot and restart the robot from the base. There is a 5-point penalty for picking up the robot.
- If Robot touches or crosses over any of the walls, it will be considering damaging a factory asset and a penalty of 10 points will be applied.

5 TEAM REGULATIONS

1. A team may contain at most four members.
2. At most two of the team members may be at the field before starting the run; they will be designated as “Robot Drivers”.
3. Everyone else must stand back at least 24 inches from the field.

6 AWARDS

- Highest score Award: 3 awards for the top three scores.
- Repeatability: This awards id given to the challenges attempted at by multiple teams at a common venue. We want to ensure that the skill of the kids is the largest part of the robot run. The robot that produces the highest scores in a consistent manner will get this award.
- Referees choice (flexible criteria): If a design, program or team’s approach is found to be exceptional in any manner; Referees may recognize the team.
- One team may win multiple awards.

7 ROBOT RUN RULES

1. One team can use ONLY one robot during the entire challenge. They must finish with the exact same robot that they started with.
2. If you are submitting video entry:
    a. Your video must describe the team name/number, Season (WRL 2020), Challenge Number and Category (Silver, Challenge 1, RC or Autonomous) on a A4 size paper in the first 5 seconds of the video.
    b. At the start of the video, you must show a top view to ensure that the robot is within the specified size and no part of the robot is extending beyond 18in. Additionally, the height of the Robot shall be confirmed by placing a ruler next to the Robot. It is participants responsibility to submit the evidences for Robot size in a manner that ascertains robot size beyond doubt. Should there be any doubt, referee's decision will be final.
    c. The video must be continuous and must remain unedited through the Robot run duration.
    d. The angle of video recording must ensure beyond any doubt that robot does not interfere with the walls. Should there be any doubt, referee's decision will be final.
3. If a robot misbehaves and needs human intervention, a Robot Driver may intervene. Touching the robot disqualifies the run i.e. score from any previous runs will be discarded unless the game specific rules say otherwise.
4. If a robot or mechanism created by the participating team starts destroying any fragile mechanisms, the referees will stop your mechanism. You may reattempt the challenge if the rules allow and if you are still within the allotted time.
5. The autonomous robot runs can be attempted indefinite number of times within the allotted time frame. For challenges attempted at competition venues, the referee will stop the run if the robot is not finished by the end of the allotted time.
6. For challenges attempted at competition venues, there will be two referees on either side of the field, and their combined decision will be final.
7. There will be 2 rounds for each team. Each team will get 1 run in each round. There will be a 5-minute break between rounds for kids to tweak their programs or robots.
8. Adult help should be limited to non-competitive elements. Adults may help with video recording and time keeping, laying out team details on A4 page as specified in previous sections. We want kids to do the work themselves demonstrably.
9. Referees and Judges may ask the participants to explain their programs and design before the run to ensure that they have done original work by themselves. Each member of the team must be able to answer questions about the program and design. If a team member cannot answer questions satisfactorily, that team will not be eligible for any awards no matter their score.
10. In case of any doubts about any element of the game, the referee's decision will be final.