

**MIDDLE EAST TECHNICAL UNIVERSITY ROBOTIC SOCIETY 18th
INTERNATIONAL METU ROBOTIC DAYS – 2022 RULES OF GARBAGE
COLLECTOR CATEGORY**

- **1.PURPOSE**

- The aim of the competition is that the robot distinguishes the garbage of different colors and transports the appropriate garbage to the appropriate dumpsite. The heights of the 4 different garbage disposal areas where the garbage will be discarded from four different color groups in the competition are different.

- **2.COMPETITION TRACK**

- In the competition track, there are **4** different garbage disposal area and there are **16** garbage which are **4** different colour.
- Track whose size is **180x180 cm²** and height is **30 cm** is made of hardboard.

- On the competition track, there will be a starting area where robots can be located in the desired direction and position. The borderline of the starting area will be indicated by pencil.

- **GARBAGES AND DISCHARGE SITES**

- There are **16** garbages which are **4** green, **4** red, **4** blue and **4** yellow.
- The diameter of garbage is **40±1mm** ,and the height of garbage is **15±1mm**. The garbage is cylinder in shape ,but the bottom of garbage is curved.
- The garbage is produced from filament by using 3D printer.
- There are areas whose sizes are **60x60** cm² in every corner of the track. In addition, these areas are painted in 4 different colours in order that robots can recognize the discharge areas of garbages.

- **DISCHARGE SITES;**

- Yellow area's size is **60x60 cm²** ,and this area's height is ground level.
- Blue area's size is **30x30 cm²** ,and this area's height is **7.5 cm**.
- Green area's size is **30x30 cm²** ,and this area's height is **15 cm**.
- Red area's size is **30x30 cm²** ,and this area's height is **30 cm**.
- Blue, green and red discharge areas are square buckets and these are shown at the bottom of this writing. In addition, the depth of these buckets are 7.5 cm, 15cm and 30 cm respectively.
- The rest of track is white.
- TCS3200 color sensor with 2% output frequency scale read frequency values below listed in the table. However, the following values are example.
- **The material used in the coating of the track is orafol brand vinyl foil. The color codes of the foils on the cataolog ;**
white (matte) : 010 , green(matte) :061 , blue (matte) : 067 , red (matte) : 031 ,
yellow (matte) :021

- During the competition , these values may vary exceedingly depending upon the ambient light. Therefore, we suggest that competitors should not get reference these values and they should only pay attention to change in sensor value.
- **Before the competition, as announced in the event calander, time will be allowed to competitors in order that they can try the track and calibrate the sensors.**

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Photodiode type	Red Area	Blue Area	Green Area	Yellow Area
Red	200-220 Hz	60-80 Hz	70-80 Hz	430-470 Hz
Blue	110-120 Hz	120-140 Hz	140-170 Hz	200-230 Hz
Unfiltered	320-350 Hz	290-360 Hz	250-290 Hz	790-810 Hz
Green	70-90 Hz	70-90 Hz	80-110 Hz	250-260 Hz

3. COMPETITION

- The robots will start the competition from the middle of the competition track and looking in the direction competitor wants.
- Time will start with movement of the robot. The robots are expected to show any movements within 2 minutes. For example, it is enough to take a garbage or point. The robots which show this example have 5 minutes trial time to finish the competition. Otherwise the robots can use second trial. During this time, the expectation from the robots is collecting the cylinders which are on the track and discharging them to their place.
- The robots will earn points from the garbage they collect in the right place; otherwise, it will lose points.
- **Competitors will have 2 rights to compete. The highest score from the three attempts will be considered valid.**
- There is no rule or restriction to how robots collect or discharge the garbage.
- For example, robots; can collect the garbage one by one and discharge them one by one ,or can collect some of garbage and discharge all of them ,or can collect and discharge all of them.

- Robots can discharge yellow cylinders to yellow colored area whose size is **60x60 cm²** .However,robots must discharge the blue , green, red cylinders to buckets in the colored area. It will not given any points to the cylinders which are left out of buckets in the blue, green, and red areas.
- Robots cannot receive any points or penalties if all of the garbage that they left in the yellow painted area on the track is not entered completely in the yellow area. If an entire yellow garbage doesn't enter the field, no points will be awarded. If the garbage of different colors does not enter the yellow field completely, there will be no penalty .
- If the robots are attached to the bucket and / or wall on the track during the competition ,or there is a similar "physical" attachment ,and if the robot remain stationary, the time will not be stopped and the competitors will be given the right to interfere with their robots.
- Competitors will be granted maximum 3 interventions in each trial.
- Once the right to intervene is granted, the competitor may correct the robot with the referee's approval.
- **When the competitor receives the right to intervene,- the approval of the referee - at the midpoint of the track within the area designated by the referees then it can continue to compete.**
- **The referee's approval is required as to how the intervention to the robot will take place as it returns to the race. Competitors who do not follow the referee's instructions are disqualified.**
- **It is strictly forbidden** for the competitors to touch the robots without the referee's consent to intervene. The robot will be disqualified if it is touched without the consent to intervene.
- The robot cannot be removed from the track, any parts added or repaired during the intervention.
- The robots must be independent from the outside. They cannot be connected to any external power source or compressor .

4. SCORING

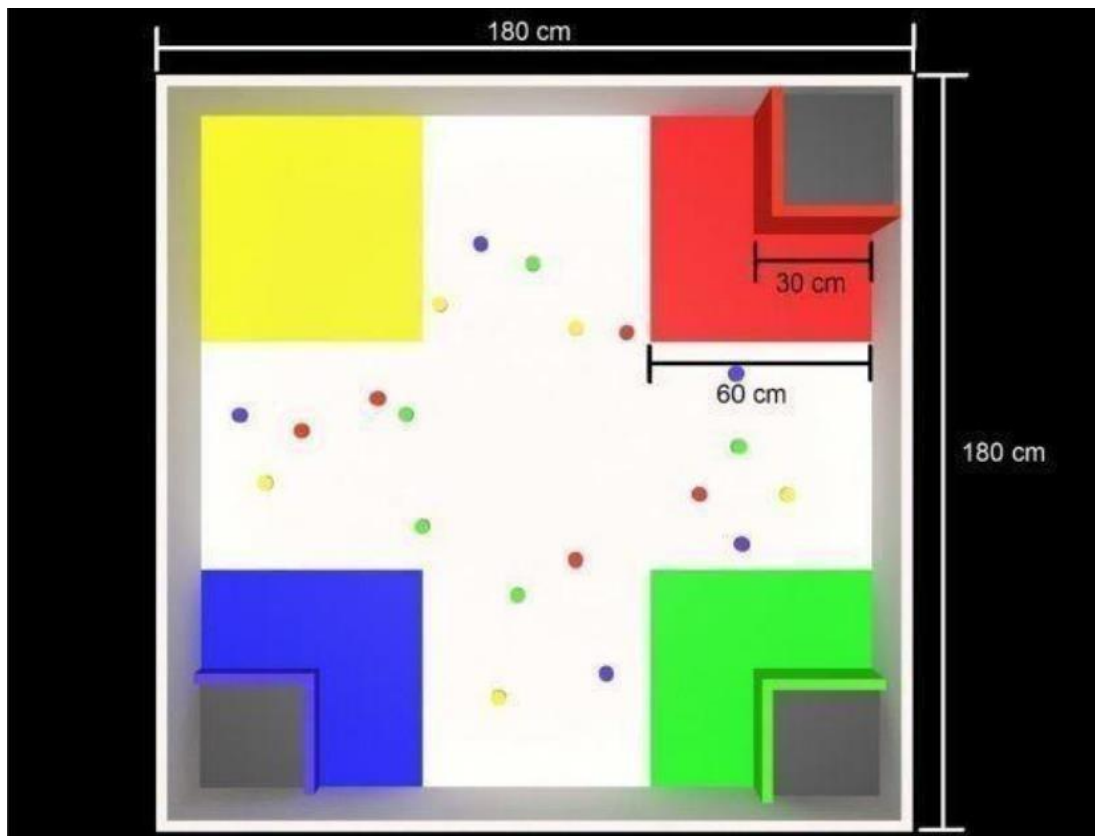
- The robots' scores according to the garbage they collect correctly are as follows; 16 points for each red garbage thrown into the red bucket, 8 points for each green garbage thrown into the green bucket, 4 points for each blue garbage thrown into the blue bucket, 2 points for each yellow garbage thrown into yellow field.
- The penalty points according to the garbage collected by the robots is as follows; - 12 points for each garbage in different colors thrown into the red bucket, -6 points for each garbage in different colors thrown into the green bucket, -4 points for each garbage in different colors thrown into the blue bucket, -2 points for each garbage in different colors thrown into the yellow field.
- The competitor can interfere, if the referee allow him/his, but in this situation, he/she will lose 1 points for every intervention.
- The condition of success in the competition is to complete the competition with positive points. If the robot doesn't have positive points, it will not be graded.
- Regardless of how many points they have collected, the robots that throw the garbage in 4 different colors into 1 bucket will be deemed to pass the right of trial.
- At the end of the competition, competitors are ranked from more points to less points.
- If there are competitors with the same score, Competitor who use the least right of intervention on the track is placed on the top.
- If the number of intervention is same, the time spent on the track is checked. The robot which spent minimum time while competing will be placed in the top row. If the equality is not broken in this case, the number of touching to wall physically is checked to determine who win . If the equality is not broken in this case, the referee will determine the winning robot.
- The competitors can withdraw their robots from competition whenever they want.
- If the robots complete the competition early, these robots cannot take any extra points.
- At the end of competition, no points will be awarded for garbage in robot's chamber.

- During competition, referees will not collect cylinders which are thrown by robots into buckets. Scoring will be made according to the location of cylinders at the end of competition.

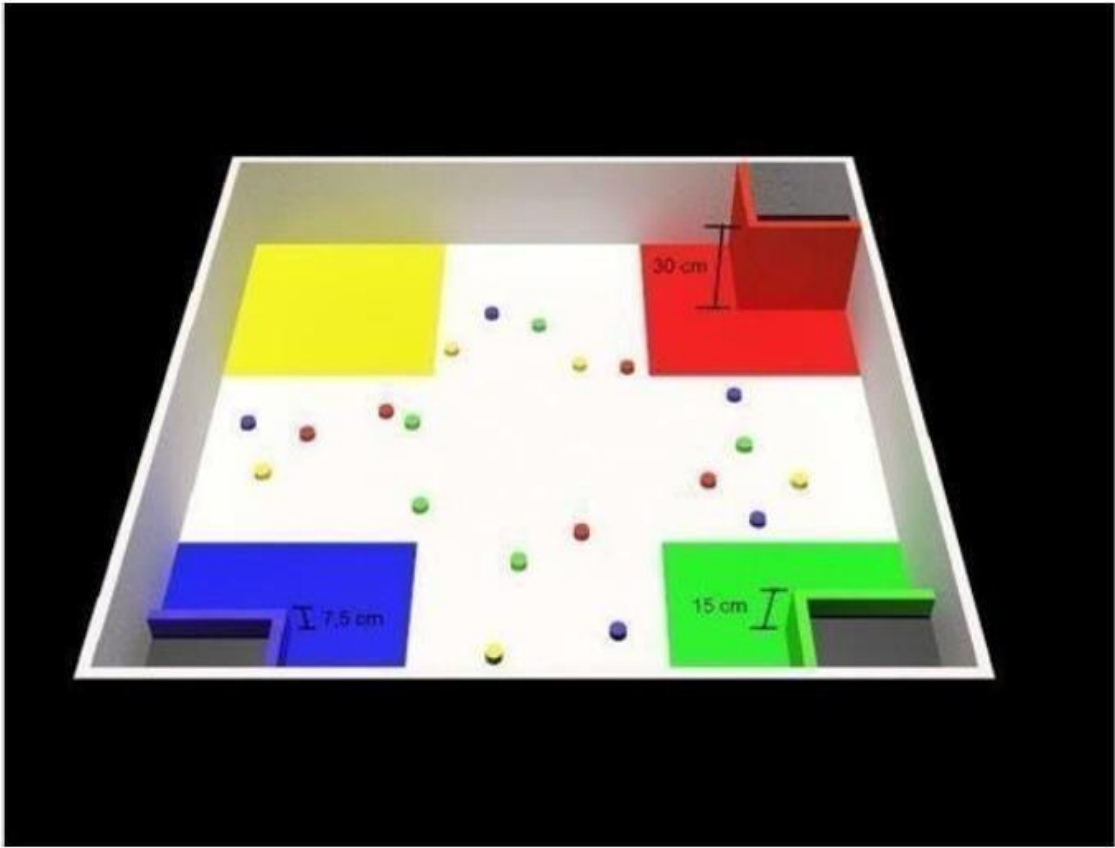
- **5.WEIGHT AND SIZE LIMITATIONS**

- The robots' sizes must be maximum: 30x30 x30cm³ .
- These sizes are for starting of the competition, so after starting, robots' size may vary.
- The weights of robots are not limited.
- 5% tolerance in sizes can be made.
- **METU Robotic Society ,if necessary, can change the rules.**
- **As in the other categories, in the garbage collector category , supracategory rules are valid.**

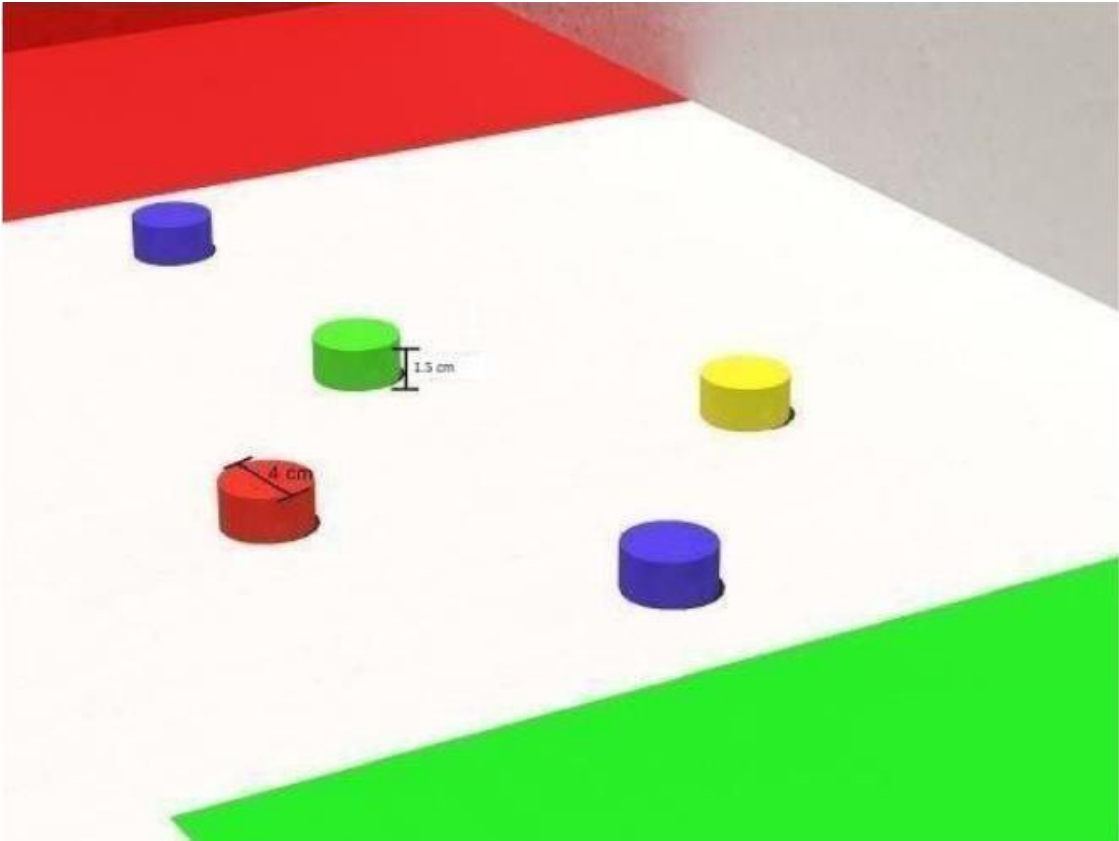
- **6.THE EXAMPLE OF COMPETITION TRACK**



- **TOP VIEW OF THE TRACK**



- THE HEIGHT OF THE BUCKETS



•GARBAGES