NATIONAL ENGINEERING ROBOTICS CONTEST 2026

THEME: LEGO SCHOOL

National Engineering Robotics Contest

A joint venture of NUST and STEM Careers Programme (HEC) Organized

by:

Department of Mechatronics Engineering,

College of Electrical and Mechanical Engineering (CEME),

National University of Sciences and Technology (NUST), Islamabad, Pakistan &

National Centre of Robotics and Automation (NCRA)

CHANGE LOG

The table below will list the pages on which changes have been made to the theme.

Revision Date	

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NOTE:

1. Any correspondence with the NERC officials via e-mail, telephone, or any other means will not be considered as part of the rules (unless uploaded as an FAQ on official NERC website).
2. In all matters of interpreting the rules before and during the Contest and in any issues not covered by these rules, the decisions of the Contest Judging Committee will be considered final.

CONTENTS

1 INTRODUCTION

The National Engineering Robotics Contest (NERC) is a joint project of the National University of Sciences and Technology (NUST) and Science Technology STEM Careers Program HEC to promote research in the field of robotics and its related fields in Pakistan. We, from the Department of Mechatronics Engineering, welcome you all to participate in 22nd National Engineering Robotics Contest (NERC 2026). This competition will provide a common platform for the integration and evaluation of various electromechanical designs, control and path planning algorithms, and agent architectures.

Over the years, NERC has grown increasingly popular among students as well as engineering departments across the country. The Engineering students and students of various schools and colleges from all over Pakistan participate in this competition. Many students participate in this contest in their final years of undergraduate degree and take the contest theme as their Final Year Project, thus becoming part of human resource required in field of robotics and automation. This not only adds value to the competition but also resolves our pledge to bring exciting new challenges every year for the advancement of robotics community at an increasingly wider scale. Robotics is a buzz word at today's technology forefronts. Due to exponential advancements in fields like high performance computing, computer vision, computer networks, material sciences and power electronics, the growth experienced by robotics in past few years is unprecedented. Robotics is the only field which can add precision while replacing the slow manual labor in the contemporary industrial world. Thus, this field faces enormous pressure from industry to produce all-purpose mobile manipulator robots which can perform complex tasks like grab, navigate and place objects at desired locations autonomously. The future of Pakistan relies heavily on advancement in the fields of engineering and science; events of this nature will encourage and motivate students to improve their technical skills in leaps and bounds. The theme of NERC 2026 is Modern Warehouse Logistics. The focus of this year's competition is to develop an autonomous robot capable of automating warehouse package handling and placement operations. In this theme, the robot will start with preloaded packages, and its task is to identify storage locations and accurately place each package in its designated storage zone within the warehouse arena. The team that completes all placements successfully and reaches the parking area first will be declared **"The Winner."**

2 CATEGORIES

There are two categories of the contest:

- Indigenous Robot category
- Modular Robot category.

The purpose of this contest is to develop a sense of problem-solving, project- based learning, team-based learning, technical design and ingenuity among the contestants.

2.1 INDIGENOUS ROBOT CATEGORY

Indigenous category includes robots that are constructed from scratch. Their mechanical structure, controls etc. are designed by the teams themselves. The electronic control modules including all electronic boards and motor drivers (Unless specified otherwise) etc. should be designed and manufactured by the students.

This category is only for university students.

2.2 MODULAR ROBOT CATEGORY

The Modular category has 2 divisions:

I. Lego: Contestants can use Lego or similar kits that use a programable brick/smart brick and sensors that come along with the brick.
II. Ready to Race: Contestants can use Arduino/Logic based ready made kits or create custom kits using Arduino or a similar controller or logic based ICs.

The Modular category is further divided into two subcategories:

2.2.1 Modular School

2.2.1.1 *Lego School*

2.2.1.2 *Ready to Race School*

2.2.2 Modular University

2.2.2.1 Lego University

2.2.2.2 Ready to Race University

*This document describes the theme for **Lego School Category.** This category is for A-level / Intermediate students or below.*

3 CONTEST STRUCTURE

The contest will consist of two stages:

1. Heats/Qualifying Rounds
2. Head to head matches

3.1 QUALIFYING ROUNDS

Each robot will participate in the qualifying rounds (heats). There will be no head-to-head matches in heats. For qualifying rounds following rules will be observed:

3.1.1 There will be NO head-to-head matches. Each team will individually run their robots.

3.1.2 Seeding chart will be based on points scored by teams. If the points of both teams are equal, decision will be made based on time taken by both teams. The team with least time will be placed on higher seed position. If time of both teams is also same, the decision of the higher seed will be based on the shortest distance from the next objective from the current position (as per discretion of judges). If all the above criteria are the same, coin toss by judges will decide higher seed position.

3.1.3 Each team will be provided with maximum of 3 minutes to run their Robot. A timer will be displayed for the audience, however, accurate time through the stopwatch will be recorded by jury.

3.1.4 A team can take as many retries as desired within 3 minutes without any penalty but only the total time taken, and final score will be recorded. (Refer to the section 7.9, **Retry** For further details)

3.1.5 When the team takes a retry the score is reset to zero and the entire arena will be reset.

3.1.6 When the team is ready, and the whistle is blown, time will be started.

3.1.7 If a robot is not able to successfully complete the task in time, then the time when team's flag bearer will call it off (By saying "STOP") will be recorded as the finish time.

3.1.8 Only the **flag bearer** has the right to say **Retry/Stop.** Other members of the group must refrain from saying Retry/Stop other than the flag bearer to avoid confusing the referee, If referee makes a call due to the confusion caused by other team members, the referee's call will be considered final.

3.1.9 Judges reserves the right to give a re-run to any team with zero score with justifiable reason (if required). This clause will only be applicable if the Judges, Jury and Referee agree to the re-run. This clause does not apply to the team's request but to reasons which are justifiable and acceptable to the judging committee.

3.1.10 If the robots complete all tasks successfully and crosses the finish line (scoring maximum point), the stop called by the flag bearer will be of no importance/significance.

3.2 HEAD-TO-HEAD MATCHES

After qualifying rounds, the top 32 teams (with non-zero score) from the qualifying rounds will go on into the final rounds for head-to-head matches. The judges reserve the right to change the number of head-to-head matches. The winners will be decided through a final match. The Runner-up will be decided based on the outcomes of the semifinals. (Subject to award of runner-up category only).

4 CONTEST THEME

NERC 2026 theme focuses on automation in modern warehouse logistics. In this theme, teams are required to build a modular robot capable of transporting and placing pallets within a warehouse environment. The robot must carry a total of 1 preloaded pallet (represented by dominos, See Annex A for reference photos) and accurately deposit them into a defined storage racks located across the arena. The first team to successfully place the pallet in its designated rack slots and reach the parking area will be declared the winner. The Contest Arena, representing a complete warehouse setup and the pallet placement location, is shown in Figure 1. Details are as follows:

1. Laminated wooden sheets (lasani) are used for the construction of the arena. The floor of arena will be of white color as shown in the map (Fig. 1). All the boundary walls and separation walls have a height of 5 inches throughout the arena. The solid line made with black tape of 3cm width (Dotted Line in Fig 1) present on the floor of arena can be used for line tracking. The entire arena is divided into 12x12 inch grids, unless otherwise specified.

2. A single storage unit, S1, is placed inside the arena as shown in Figure 1. The designated opening side of S1 is indicated by a blue line in the arena layout. The remaining visible portion of the storage box is shown in purple.

3. The dimensions of Storage Unit S1 are as follows:

   (a) S1 rack: 7 × 7 × 8 inches (height = 8 inches)

   (b) Supporting base box S1: 7 × 7 × 5 inches (height = 5 inches)

   (c) Total height of S1 assembly (S1+ Supporting box): 13 inches

   (d) S1 contains four slots, each measuring 7 × 3 × 3 inches (depth = 7 inches)

4. The ramp region (R1), shown with gradient fill in Fig. 1, represents the inclined surface

   (a) Ramp height: 5 inches

   (b) Ramp Slope dimensions: 3 × 1 grid cells

5. The ramp and ramp-parking regions include extended features as shown in Fig. 1:

   (a) Ramp slope: Extends 0.6 inches outward on both sides

   (b) Starting Point: The internal usable area of the ramp-parking zone is arranged as a 1 × 2 grid, with each grid measuring 16 × 12 inches

6. The maximum allowed robot dimensions are 12 × 12 inches (L × W).

7. The starting position and orientation of the robots are fixed. The robot must be placed behind the starting line shown in Fig. 1 with red color. The complete robot should be behind the line. The red colored line is only for reference in Fig. 1, it will be a solid black colored line on actual arena.

8. At the start of the match, the robot will be positioned at the starting point as shown on Fig.1, carrying one preloaded parcel.

9. After the start signal, the robot must move forward, cross the checkpoint A and descend the ramp labelled R1 in Fig 1, followed by navigating the arena.

10. Before reaching S1, the robot must cross checkpoint B & C

11. The robot must then reach Storage Unit S1 and place the parcel in it. The opening side of S1 is defined by the blue line marked in the arena. The parcel must be inserted from the designated opening side only.

12. The robot can place the parcel in any of the provided slots.

13. As long as some part of the pallet is within the rack slot, it shall be considered as potted. However, the pallet is to remain within the rack slot till the team either says stop or till the completion of the match. If the pallet drops from the rack slot before the conclusion of the match, the points shall not be awarded. A successful pot shall be considered when no part of the robot is touching the pallet after potting.

14. After successfully placing the parcel, the robot must cross checkpoint D and proceed to the parking area marked in the arena.

15. Crossing the indicated check point is a requirement to score the respective points.

16. The robot must complete all required tasks before entering the parking area. Entering the parking area without completing the task will result in no parking marks.

17. A successful “reach” means all parts of the robot have crossed the parking entrance line, and no part remains on or above the line. (The line shown in red in Fig. 1 is for reference only and will be a solid black line on the actual arena.)

18. Lines are provided on the arena if line following is required, however line following is not mandatory.

19. After the start of the match, no physical contact with the robot is allowed.

20. Each team must bring their own robot.

21. In case of a retry, teams are allowed to reset their robot.

22. Programming or parameter adjustment is allowed only during the setup time of approximately 1 minute and is not permitted once the match has started.

23. Blue arrows, red checkpoints, red starting line, and red ending/parking lines shown in Fig. 1 are for reference only. These markings will not be present on the actual arena. On the physical arena, starting and parking lines will be solid black.

24. The two sides of the arena are mirror images of each other.

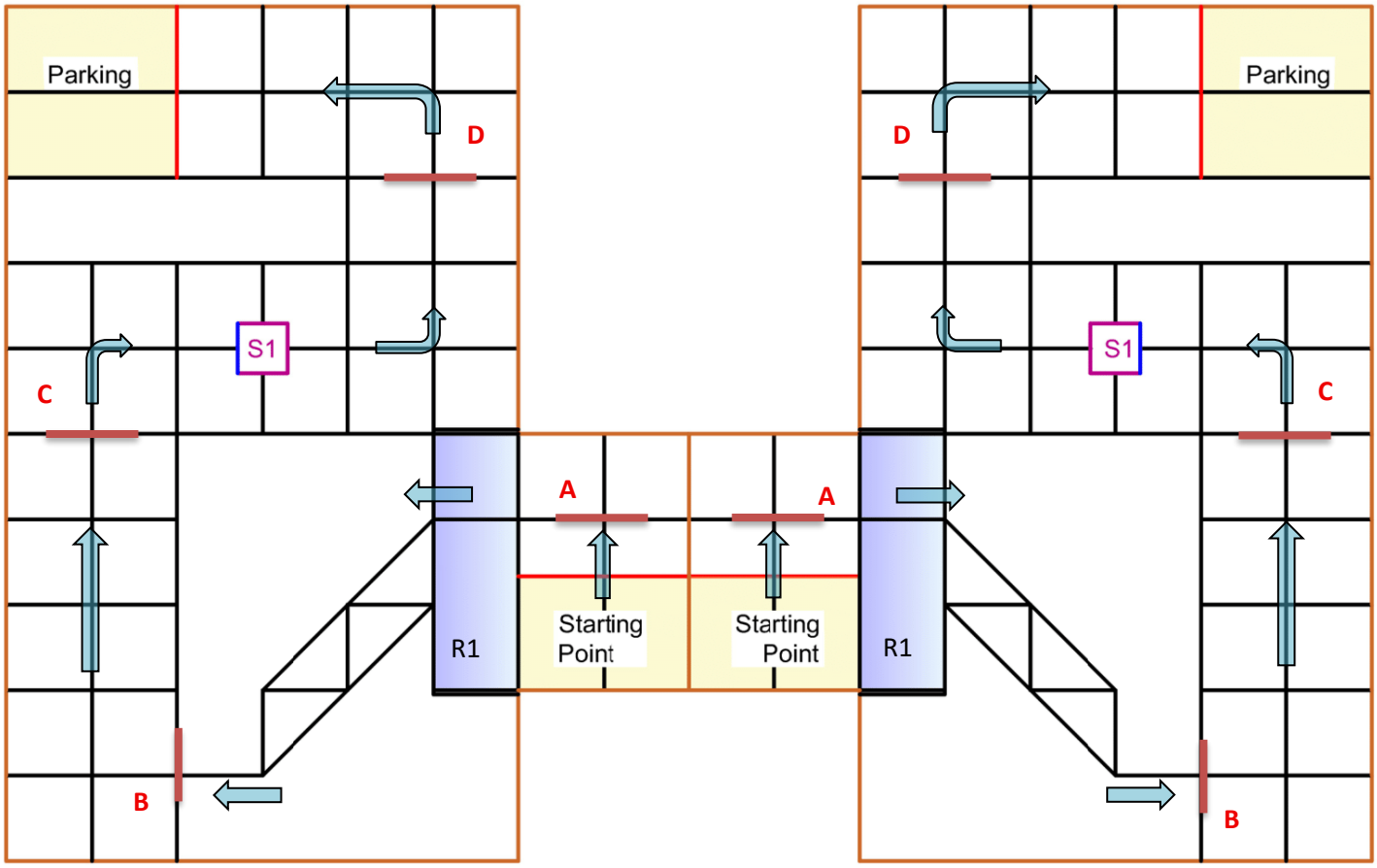


Figure 1: Contest Arena top view

- *Each grid is 12x12 inches.*
- *Both sides are mirrored images; the storage boxes are represented with purple boxes.*
- *Solid Brown lines show the height of 5 inches wall and black lines show the black tape of 3cm width on arena.*
- *Blue arrows, red checkpoints, red starting line, and red ending/parking lines shown are for reference only. These markings will not be present on the actual arena. On the physical arena, starting and parking lines will be solid black.*

4.1 ROBOT OPERATION

The qualifying teams (those which qualify for the final rounds) will compete with each other in a knockout format. In each match two teams will be pitted against each other, running their robots' side by side in the contest arena. Teams will be declared as Team A or Team B based on the coin toss before every match. The winner of coin toss will decide which arena to choose i.e. Left Arena or Right Arena. The left arena will be given a Blue flag while the right arena will be given a Red flag, hence the arena may be referred to as the Red or Blue arena. Once turned on, the robot must be self-controlled without any human intervention. Contestants are NOT allowed to touch their robots. After the blow of a whistle, the robot will have 3 minutes to complete the task.

During a retry, the layout of the arena shall remain SAME and shall be reset , however the point-scoring will restart from zero. The robot may navigate through the arena using any suitable technique. The robot must not displace any item/obstacle in the arena. Displacing any item inside the arena will result in a forced retry or disqualification as per discretion of judges (Judges decision on declaring a displacement will be final). If the participating team sees that their robot has lost track of its location and is facing trouble localizing itself, the team can ask for a retry by raising their flag. During its motion, the robot may touch the walls of the arena without damaging them, but it is not allowed to use any sort of tactile sensor to sense the walls. This will result in forced retry or disqualification (as per discretion of judges).

In case of a tie, the contestant may be required to run a rematch, or the winner may be decided on a coin toss as per the discretion of the judges.

For a particular match, both teams will face the same layout of the arena.

5 POINTS

The point scoring is shown below in Table 1 Point Scoring.

Table 1 Point Scoring

Point Scoring	**Score**
Crossing Checkpoint A*	**10**
Crossing Checkpoint B*	**15**
Crossing Checkpoint C*	**15**
Crossing Checkpoint D*	**15**
Successful potting in S1	**25**
Entering the Parking**	**20**
Total	**100**

* Crossing means that any tire of the robot must have crossed the red marker line at the checkpoints mentioned, as shown in Fig. 1.
**Entering means all the parts of the robots have crossed the parking entrance line and no part is on and above the line.
**The robot must complete all required tasks before entering the parking area. Entering the parking area without completing the task will result in no parking marks.

5.1 DEDUCTION OF POINTS

The deduction of points is shown below in Table 2. Deduction of Points

Table 2. Deduction of Points

Deduction/Penalty	
The robot fits in an area of 12x 12-inch square	No Penalty
Oversize Robot (14x14 inch square)	10 Points
Oversize Robot (exceeding 14 x 14-inch square)	Disqualification
Robots weighs less than 12 kg*	No Penalty
Overweight Robots (Weight between 12 and 14 kg)	10 Points
Overweight Robots (Weight exceeding 14 kg)	Disqualification

Damaging the arena/wall/sites/Tape/Objects	Disqualification

*This is the individual weight of each robot

The penalty handicap shall be applicable in heats and head to head matches.

6 RULES

The following are the rules governing the contest.

6.1 GENERAL

6.1.1 The Contest judges may stop any robot at any time if they feel that it is performing, or is about to perform, any action that is dangerous or hazardous to people or equipment.

6.1.2 Additional information regarding the contest rules and regulations may be found in the Tab of FAQs(https://nerc.ceme.nust.edu.pk) and will be considered as part of the theme and rules. New FAQs are uploaded frequently so keep watching the FAQ corner for new information.

6.1.3 Any correspondence with the NERC officials via e-mail, telephone or any other means will not be considered as part of the rules (unless uploaded as an FAQ on official NERC (website). It is the responsibility of the contest to be familiar with all the rules.

6.1.4 If both the teams have scored same points but are not able to complete the task in allocated time slot decision of the winner will be on judges' discretion who will determine which robot is closer to finish the task first.

6.1.5 If both teams have scored the same points, have the same time and are at the same distance from the finish point, a coin toss will be used to decide the winner.

6.1.6 If any team wants to launch a protest (of any kind), they must do so within 15 minutes after the end of their match. The procedure and payment is outlined in Annex B.

6.1.7 Attempting to damage the game field or performing an act that fails to comply with the spirit of Fair Play will lead to the disqualification of the team.

6.1.8 In all matters of interpreting the rules before and during the Contest and in any issues not covered by these rules, the decisions of the Contest Judging Committee will be final.

6.1.9 Wireless Control of the Robot for operation is not allowed.

6.1.10 Ready-made kits that can be programmed through buttons/ pre-set functions, for example ICHIBOT and similar bots are not allowed in the competition. The team must self-program the controller. Kits with buttons/pre-set function are prohibited even if the team claims that the programming has been done through the controller.

1.1 TEAMS

1.1.1 Each team can comprise of a ***maximum of 6 members***.

1.1.2 If the students from two different Institutions join hands and form a team in collaboration, then the name of the Institution with maximum number of students in such a team would be registered or official consent from both institutions will be required at the time of registration before the contest start date.

1.1.3 A person can't participate in more than two teams

1.2 ROBOT SIZE AND WEIGHT

The robot fits within 12x 12-inch square at the time of measurement. If the area of the robot base is more than 12x 12-inch square but less than 14 X 14- Inch square, then points will be deducted. There is no restriction on the maximum permissible height of the robot. Any robot which does not fit in 14 X 14-Inch square will be disqualified. All robots will be carefully measured. All sensors mounted on the robot will be counted as part of the robot's total dimensions. If contestants want to add a flag, hat or other purely decorative, non-functional items to the robot, they may do so. The decorations may be removed for measurement purposes. The weight of each robot excluding decorations must not exceed 12 kg. Penalties as detailed in 6.1 Deduction of Points will be levied if the robot does not fulfill the size and/or weight criteria.

1.3 ROBOT OPERATION

1.3.1 Any team that damages the arena will be disqualified.

1.3.2 The robot must not use any harmful substances such as oil, petrol etc. in its operation that can damage the arena.

1.3.3 The Robot CANNOT split after the start of the game, only one Robot is allowed to compete at a time.

1.3.4 The robot must not use any destructive or dangerous methods to displace any obstacle or box.

1.4 SENSORS

1.4.1 Robot is not allowed to use tactile sensor of any type for sensing the Walls.

1.5 POWER SUPPLY

1.5.1 The robot must be battery-powered.

1.5.2 The robot must not have any wired connections with its surroundings.

1.5.3 Voltage of the machine's electrical power source must not exceed 48-volt DC. **Power banks may be used.**

1.5.4 Power sources that are considered dangerous or unsuitable by the contest Officials shall not be permitted.

1.6 DURATION OF MATCH

1.6.1 Each match will be of maximum 3 minutes.

1.6.2 Teams will be given around 1 minute for setting up the Robot at the start.

1.6.3 Robot can start at the instant when the start signal is given and a whistle is blown. The Robot should be constructed so that it can be started in minimum possible steps.

1.6.4 Once the robot moves, team members will not be allowed to touch the robot or enter the Contest Arena. If any team member enters, forced retry shall be imposed.

1.6.5 Timing shall start once the start signal is given and the whistle is blown.

1.6.6 Time would be stopped as soon as robot reaches completely into the parking spot. If a robot is not able to successfully complete the task then the time when team will call it off (by the flag bearer saying "STOP") will be recorded as the finish time. The team must leave their robots as it is on their current locations when time stop is called by them. They must NOT pick their robots up till the referee announces the end of the match. The team is not allowed to take a retry after the time has stopped or STOP has been called.

1.6.7 The team which picks the fruit box and then reaches the parking spot first will be declared the winner of the match.

1.6.8 If both teams fail to complete the task, within the time limit, the team scoring more points will be declared the winner of the match.

1.6.9 If both the teams have scored the same points but are not able to complete the task in allocated time slot then winner will be decided on time if both team calls stop at same time, then decision of the winner will be on judges' discretion who will determine which robot is closer to finish the task first. The distance of the robot's current location from the Finish Point (Parking Spot) will be measured.

1.6.10 The Complete robot is required to cross the parking line for the run to terminate.

1.7 RETRY

If the robot is strayed due to some reason, retries are allowed.

1.7.1 There is no limitation on the number of retries and a team can take as many retries within the 3 minutes duration of the match. No Points will be deducted for retries but total score will reset to zero.

1.7.2 Each team would be provided a flag of their respective team. If a team wants to take a retry, the flag bearer must raise the flag and say clearly “retry”. Once the referee announces a retry, the team shall place its robots at their starting location

1.7.3 If a team wants to stop their robot during the match, the flag bearer must raise the flag and say “stop”. The team can then turn off their robot, but they must not move it. The time at which the robot is stopped would be recorded as the final time. The team must not enter the arena until referee has acknowledged the “STOP”.

1.7.4 For each retry, robots must be started again from the start point. Points will reset to zero.

1.7.5 Arena Management team is responsible to reset the arena, any team member is not allowed to interfere or do the resetting of arena themselves. If such an act is done, referee will call retry.

1.7.6 Separate time for individual retries will NOT be recorded or maintained. When a team takes a retry, it is only allowed to restart the robot.

1.7.7 Once the start whistle is blown the team can’t reprogram their robot

1.7.8 If the contestants enter the arena during the match, it will automatically be counted as a retry.

1.7.9 Once the stop has been called by the team or flag bearer or the task has been completed (obtained full marks), retry will not be allowed.

1.7.10 Only the **flag bearer** has the right to say **Retry/Stop.** Other members of the group must refrain from saying Retry/Stop other than the flag bearer to avoid confusing the referee, If referee makes a call due to the confusion caused by other team members, the referee’s call will be considered final.

1.8 DISQUALIFICATION

The following behavior shall be considered for disqualification by the referee and the team could possibly be disqualified:

1.8.1 Attempting to damage the game field.

1.8.2 Performing any act that fails to comply with the spirit of Fair Play

1.9 PROTEST PROCEDURE

The protest procedure is as follows:

1.9.1 The team must launch a protest (submit a complete protest form to the head jury) within 15 minutes after the end of their match.

1.9.2 The team must collect the protest form from the head jury on request or use a hard copy of the form in Annex B.

1.9.3 The team must submit a non-refundable protest fee of Rs. 5000/- along with the protest form.

1.9.4 A complete protest form includes submission of the protest fee.

1.9.5 The head jury will forward the case to the judges.

1.9.6 The judges will decide on the protest's validity and render their decision.

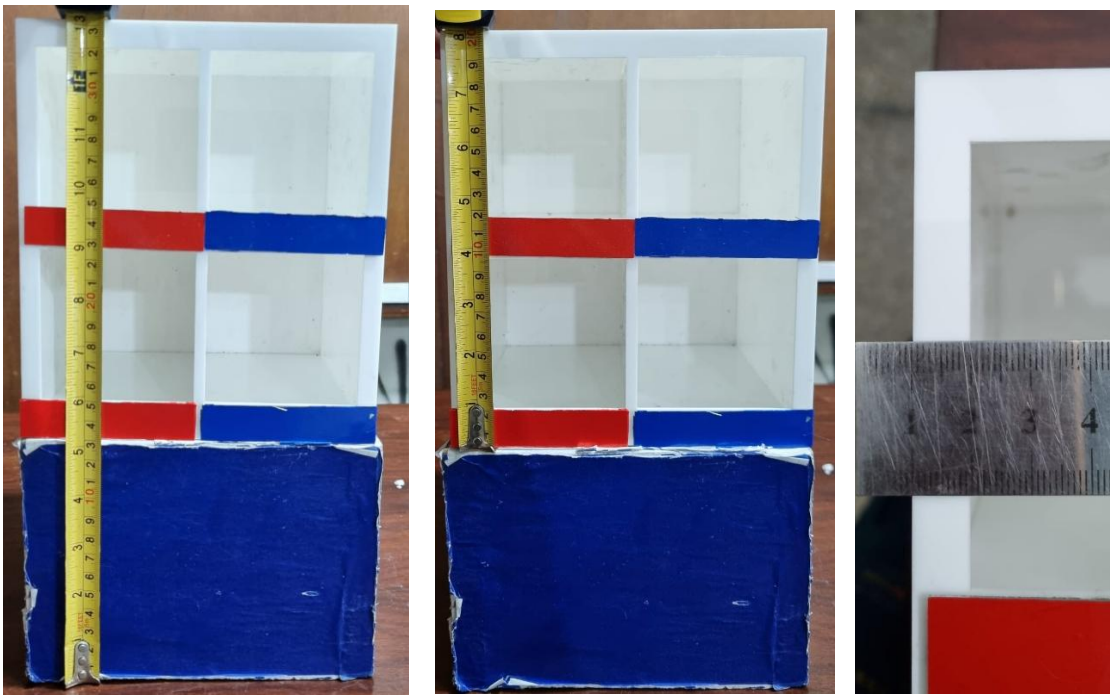
1.9.7 In case of noncompliance of any of points above the protest will not be considered valid.

1.9.8 The judges' decision will be final.

2 TEST RUN

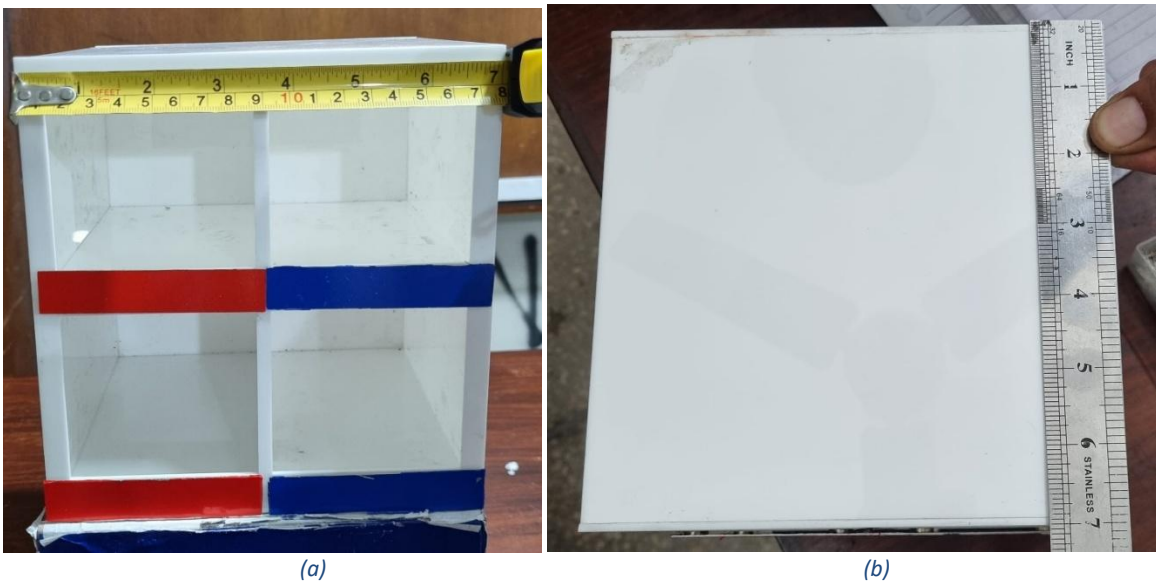
Contestants will be given time for trial run one day before the contest to calibrate their robot/sensors on the actual arena/game field. However, considering the huge numbers of participants, practice time may be limited. Scheduling shall be done by the organizers.

Annex A STORAGE BOX, PARCEL & RAMP DIMENSIONS



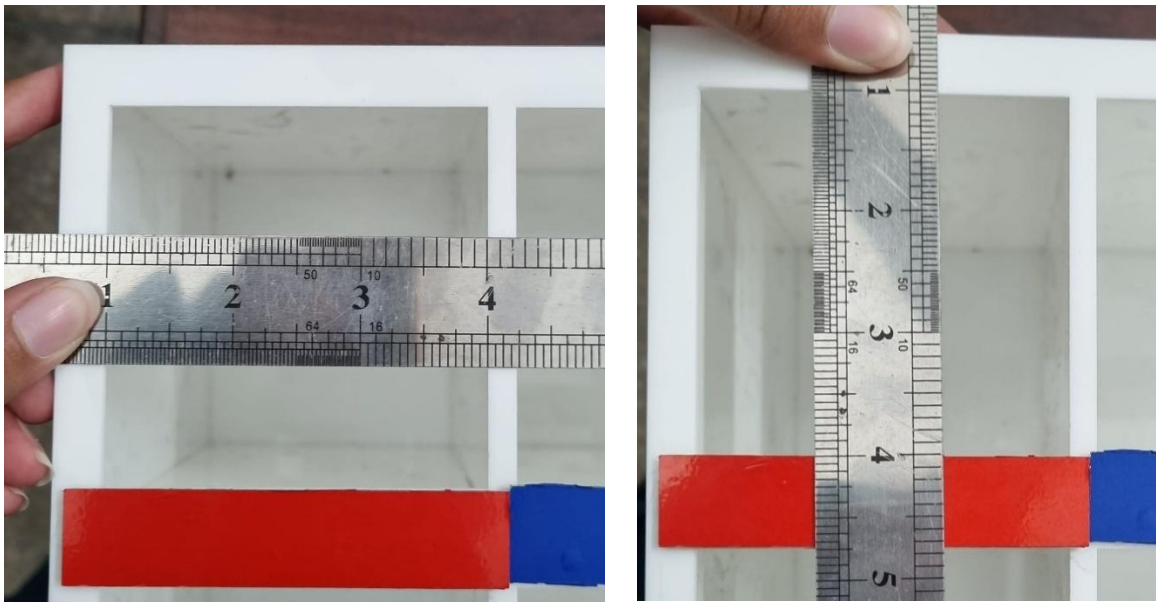
(a) (b) (c)

Figure 1:Storage Box. (a) Height of storage box assembly 13 inches, (b) Height of storage box 8 inches, (c) Distance from the outer boundary of the storage box to the slot opening



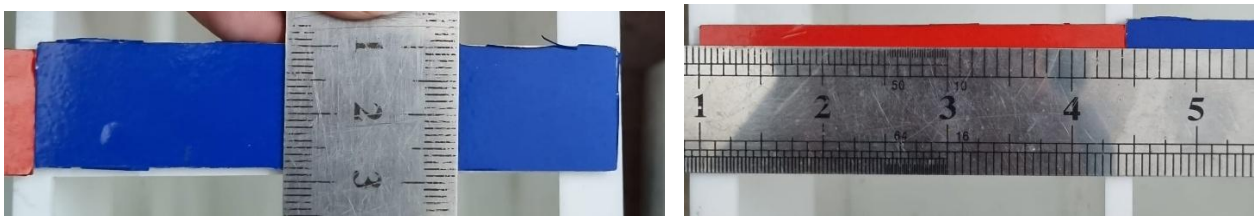
(a) (b)

Figure3: Storage Box. (a) Width of storage box 7 inches, (b) Depth of storage box 7 inches



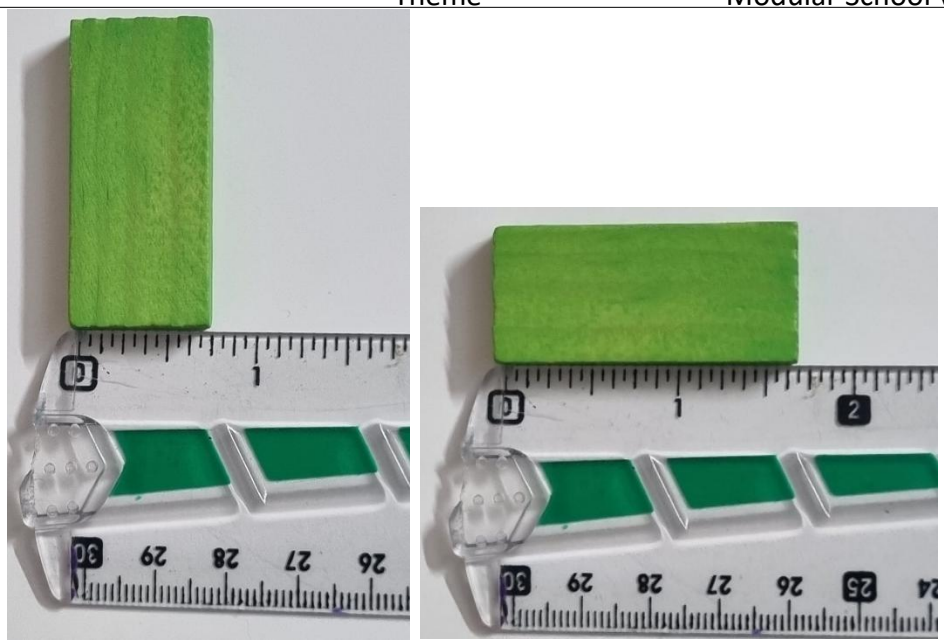
(a) (b)

Figure3: Storage Box. (a) Width of storage box slot 3 inches, (b) Height of storage box slot 3 inches

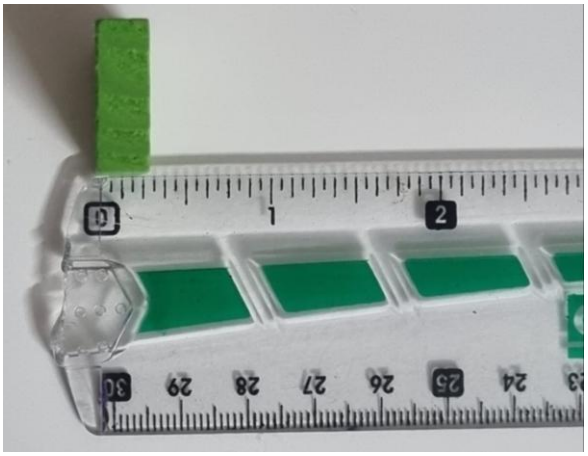


(a) (b)

Figure3: Colored Strip. (a) Width of colored strip 0.75 inches, (b) Length of colored strip 3.5 inches



(a) *(b)*



(c)

Figure 2: Pallet Measurements in inches

Figure 3: Ramp Angle (22 degrees)

Annex B Protest form

Protest Form

Team Name:	
Team ID:	
Team University:	
Team Members:	
Match finish time (to be filled by Head Jury)	
Launch time of Protest (to be filled by the head jury)	
Protest fee Payment (to be filled by head jury)	

Reason of Protest: _____

_____

_____

_____

***By Signing below, I confirm that the decision made by the judges is final and I will not protest it any further.**

_____ _____

Signature of Team Leader Signature of Head Jury

Decision of Judges: _____

_____

_____

_____

_____

Signature of Head Judge