National Engineering Robotics Contest 2007

Theme and Rules

Objective

We welcome you to the 4th National Engineering Robotics Competition. Robotics is the fastest growing technology of this era. Robots are being used in a staggering number of applications. The goal of this Contest is to build an Autonomous Robot. This robot should be able “To move in a specified arena and pot tennis balls into goal-posts placed at pre-defined points in the arena”. The competition has seen an enormous increase in the number of participants over the years. 54 teams participated in the contest in 2006. This competition provides a common platform to students and gives them opportunity to come forth with genuine engineering design ideas. Participate and be a part of the Engineering Elite!

Robots are extensively used in industrial assembly lines as pick-n-place machines. This year’s competition aims towards mimicking this application of robotics. The task of the contestants is to come up with new and ingenious ideas for robots that should be able to pot tennis balls into goal-posts. A certain set of rules has been set for this competition and contestants must ensure that their Robots do not violate them. The purpose of this competition is to give the contestants a real sense of problem-solving, technical design and ingenuity. There are two categories of the contest; Indigenous robots and Modular/Lego robots. This Contest aims at advancement in the field of Robotics in Pakistan. If you are planning to participate in the National Engineering Robotics Contest read the next few pages very carefully.

1. The Contest Arena

   a. Please review the Floor-plan before continuing.

   b. The Contest Arena is made by joining two Blue Waterproof Floor Mat sheets of size 600 X 183 cm. This kind of floor mat is commonly used in Toyota Hiace Vans.

   c. Fixed Lines are marked on the arena. These Lines can assist the Robot to find its path. The Lines are made from 3 cm wide White Reflector Tape.
d. Five **Goal-posts** are placed on the arena marked 1, 2, 3, 4 & 5. The height of **Low goal-post 1 to 4 is 45 cm** and the height of **High goal-post 5 is 80 cm**. The internal diameter of all goal-post rings is 24 cm whereas external diameter is 28 cm. Review the Floor-plan for detailed dimensions. The position of all goal-posts is fixed. The frame of the goal-post is made of steel and is painted with white emulsion. A red colored net is hanging from the goal rings. The net is woven onto the goal-post ring. The color of the net is NOT fixed. The net could be of any color and hue. The material of net is also not fixed. It may nylon-threaded, cotton-thread or of any material readily available. The goal-posts are placed on the ground. The robot may displace / drop the goal post if it tries to push it, costing it a penalty.

e. Five **Obstacles** are placed on the Arena at fixed positions as shown in Floor-Plan. The obstacles are made from wood and painted with White Emulsion. The obstacles are placed on the ground. The robot may displace / drop the obstacle if it tries to push it costing the team a penalty. Review the Floor-plan for detailed dimensions of the obstacles.

f. The white line from point A to B on the Floor-plan is the **Start Zone.** The contestants will be asked to start from any point on this line. This means that the initial position of the robot will be variable. It is also **MUST** for the robot to enter the arena from point B.

g. Maximum 8 **Tennis Balls** can be loaded in the robot. The diameter of a ball is 6.3±0.3 cm.

2. **Robot Operation**

   Once turned on, the Robot must be self-controlled without any human intervention. Remote-control of any sort (wired or wireless) **CANNOT** be used. Contestants are NOT allowed to touch their Robots or enter the Contest Arena after startup. The Robot must find the goal-post (by virtue of its position or any other sensing technique) and pot the tennis balls into it.

3. **Loading Balls**

   Each team will be provided with 8 tennis balls to load in the robot before the start of the match. The maximum load height of the balls is **25 cm**. The base of the reservoir that contains balls in the robot must not be higher than 25 cm. The height of the top most edge of any ball must not increase load height plus ball diameter i.e. 25+6.3±0.5 cm= 31.3±0.5 cm at start of match.
4. Potting Technique

The Robot must not use any destructive or dangerous methods to pot the balls. The goal-post has adequate weight. However attempting to climb the goal-post can be dangerous and the goal-post may be displaced or break causing damage to the arena. In this case team will be disqualified. The Robot may touch the goal-post for sensing purposes. However if an attempt to touch drops the goal-post, points will be deducted. The robot must not use any harmful substances such as oil, petrol etc. in its operation that can damage the arena. The Robot CANNOT split after the start of the game, only one Robot is allowed to compete at a time. The Robot can have Maximum 2 Potting Outlets. Any kind of support to the outlet / extension with the ground is NOT allowed. Zones 1, 2, 3, 4 & 5 are marked on the floor-plan (not physically). Zone 1 is for Low Goal-post 1; Zone 2 is for Low Goal-post 2 and so on. The complete robot MUST be within the Zone of a particular Goal-post in order to pot balls into it. If any part of a robot is outside the Zone of a particular Goal-post while potting, points will NOT be scored.

5. Potting Rules

A robot can pot maximum 2 balls into a goal-post. More than two balls in a goal-post will not be counted for scoring. At one time a robot can Pot ONLY 1 ball into a Goal-post. In order to pot the second ball into the same goal-post the robot must pot at least one ball into another goal-post first OR completely leave the Zone and then come back.

6. Robot Size and Weight

The Robot must fit within 1200 cm$^2$ i.e. the area of the shadow of the robot if light is projected from top must not increase 1200 cm$^2$. The robot must also fit within a box of 60 X 60 cm i.e. with the area of 1200 cm$^2$ the linear dimension of any side must not increase 60 cm. If the area of the Robot base is more than 1200 cm$^2$ or the dimension of any side increases 60 cm points will be deducted. The maximum height of the robot is 65 cm. The height of the robot CANNOT exceed 65 cm at any time. 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 must also be within the size limit i.e. 1200 cm$^2$ and 60 X 60 cm. The weight of Robot including decorations must not exceed 12 kg. Points will be deducted if the Robot does not fulfill the Size and Weight criteria.
7. Sensors

There is no restriction on the type of sensors that can be used. However, Contestants are not allowed to place any markers, beacons or reflectors in the Contest area to aid in the Robot’s navigation.

8. Power Supply

The Robot must be battery-powered. The Robot must not have any wired connections with its surroundings. Voltage of the machine’s electrical power source must not exceed 48 Volt DC. Power sources that are considered dangerous or unsuitable by the Contest Officials shall not be permitted.

9. Categories

There are two categories of the contest,

a. Indigenous robots
b. Modular/Lego robots

Indigenous robots are the ones that are constructed from scratch. Their mechanical structure, controls etc. are designed and fabricated by the teams itself. Modular/Lego robots are ones in which ready-made kits are used. You can compete in any category. Both categories have separate prizes. There is no difference in the game rules for both the categories.

10. Teams

The Robots can be built by teams of currently registered students from Engineering Institutions, Polytechnic Institutions, Schools etc. Each team can comprise of Maximum 5 members.

11. Duration of Match

a. Each team will be given maximum 4 minutes to complete their task. However, team may be asked to stop the machine earlier if the referees decide that the task cannot be acquired due to mechanical problems or for safety reason.
b. Each team will be given 1 minute for setting up the machine at the start point.
c. Machine can start at the instant when the start signal is given. Machine must be constructed so that it can be started in minimum possible operation(s).
d. Once the machine moves team members will not be allowed to touch the machine or enter in the Contest Arena.
12. Retry

If the Robot is strayed due to some reasons Retry is allowed. Maximum THREE Retries can be awarded by the match referee. Points will be deducted for each Retry. After a "Retry" is called out by a team, they are allowed to pick the machine from the Contest Arena, reset and restart from the Start Zone. This can be done by any of the members of the team. If the team wants to reload balls, they will be provided by the field staff but the number of balls in a robot must not increase. For Retry there would be no "time out" and clock would be running. For each Retry Robots must be started again from the Start Zone. After calling a retry the score will become zero. However each team will be judged on the basis of maximum scores in any individual try (not necessarily the last one).

13. Points

Potting first ball into the Low goal-post 1, 2, 3 & 4 will score 10 points and second ball will score 5 points. Potting first ball into the High goal-post 5 will score 20 points and second ball will score 10 points. Any ball potted after the second ball will carry Zero points in a particular basket. These points will be awarded if the Robot is successful in putting the ball into the goal-post and the ball touches the goal net. The Robot with the Highest Final Score will be the Winner and second highest score will be the Runner-up. The Final Score will be calculated on the basis of total points scored by potting balls minus the points deducted based on the specified criteria.

If two or more teams have same points then decision will be made on the basis of time, i.e. the team scoring maximum in minimum time would be the winner. The time for potting the last ball will be used to take time based judgments. Extreme minor details will be on the discretion of judges.

If the team has committed retries then the best score for any individual try (not necessarily the last one) will be considered for judgment.

**Deduction of Points**

a. Robot goes out of the Contest Arena .......................... 5 points
b. Retry ........................................................................ 5 points
c. Oversize Robot (Size between 1200 and 1500 cm\(^2\)) ... 5 points
d. Oversize Robot (Size exceeding 1500 cm\(^2\)) .................. Disqualified
e. Oversize Robot (Robot does not fit in 60 X 60 cm) .......... Disqualified
f. Oversize Robot (Height exceeding 65 cm before startup) ... Disqualified
g. Overweight Robot (Weight between 12 and 14 kg) ... 5 points
h. Overweight Robot (Weight exceeding 14 kg) .................. Disqualified
i. Displacing / Dropping goal post ................................... 5 points
j. Displacing / Dropping obstacle .................................... 5 points
14. Rules

a. 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.

b. 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.

15. Disqualification

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

a. Attempting to damage the game field.
   b. Performing any act that fails to comply with the spirit of Fair Play.

16. Test Run

Contestants will be given time for trial run a day before the Contest to calibrate their Robot on the actual arena/game field.

Registration- Method & Deadline

Fill the registration form available on our website and send it to us with a non-refundable registration fee of Rs. 500 for each Robot entering into the Contest. Any individual or group can enter more than one Robot, but a registration fee must accompany each entry. The same physical Robot cannot be entered twice even if two entry fees are paid.

Please make your Check/ Draft/ Pay-Order payable to:
Dr. Akhtar Nawaz Malik, Head Mechatronics Department

Our postal address is:
Department of Mechatronics Engineering,
College of E&ME, Peshawar Road, Rawalpindi, Pakistan 46000
Ph: +92 51 927 8044

Please register as soon as possible so that you may be informed about all the updates on the competition via e-mail.
Awards

Prizes are not finalized yet. Details will be published on our website as soon as the prizes are decided.

The following prizes were awarded last year:

>> Winners Rs. 50,000.00
>> 1st Runners-up Rs. 30,000.00
>> 2nd Runners-up Rs. 25,000.00
>> 2 x Best Mechanical Design Award Rs. 15,000.00 each
>> Best Artistic Design Award Rs. 20,000.00
>> Winner NERC 2006 Lego Category Rs. 10,000.00
>> 2 x Participation & Performance Awards Rs. 10,000.00 each
>> Youngest NERC Participant Awards Rs. 3,000.00

The prizes also include:

>> COSIMER PLC software worth 1,000 Euro
>> 2 x COSIMER Robotics and FluidSIM Pneumatics software worth 850 Euro
>> 2 x Software of Fascinating Technologies worth 195 Euro

The Contest

The Contest will be held in the College of Electrical and Mechanical Engineering, National University of Sciences and Technology, Rawalpindi. The date of the competition is not finalized yet however it will be held in June.

Last competition was held on 7th-8th-9th and 10th June 2006.

Contacts

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