Techfest Office
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AVALANCHE

1.1) Introduction

The apocalypse is drawing nearer. All of humanity is at stake. Global warming has affected the polar regions more than anybody had ever imagined. Sea levels are on the rise and melting icebergs and avalanches have become the order of the day.
One such avalanche is taking place at Techfest 2011. And you are our saviour. Tackle the falling snowballs and separate them according to their colours. But mind the black ones, they are cursed.
Welcome to the image processing robotics section. You will witness here some of the most creatively engineered robots designed to take you right into the future.

2.1) Problem Statement

Build a computer controlled bot which can collect and deposit balls rolling down a ramp with the help of overhead/onboard camera.

3.1) Arena Specifications

The Arena consists of two parts

3.1.1) Ramp

1. It consists of a rectangular ramp of inner dimension 2400 mm x 1000 mm, colored 'green' (the playing surface is green felt mat or carpet). The floor under the carpet is level, flat and hard.
2. At the top end are 5 launching pods from where the ball will be launched.
3. Following this is a 300 mm wide Pin Belt consisting of 6 rows of pins,to obstruct the path of the ball.
4. Then there is 2000 mm of completely unhindered ramp for the ball to roll down.
5. The sides of the ramp are lined with walls 60 mm high.
6. The boundary between the ramp and platform is marked with a 30mm thick white line.

Note : The overhead camera may not be able to detect the pins or the wall.

3.1.2) Collection Platform

1. At the base of the ramp is a flat collection zone of inner dimensions 300 mm x 1200 mm ,colored 'green' (the playing surface is green felt mat or carpet).
2. The platform is at a depth of 180 mm below the ramp.
3. At each end , their is a pocket of dimensions 300 mm x 60mm for collecting balls.
4. At the back end of the platform is a pit in which un-collected balls fall.

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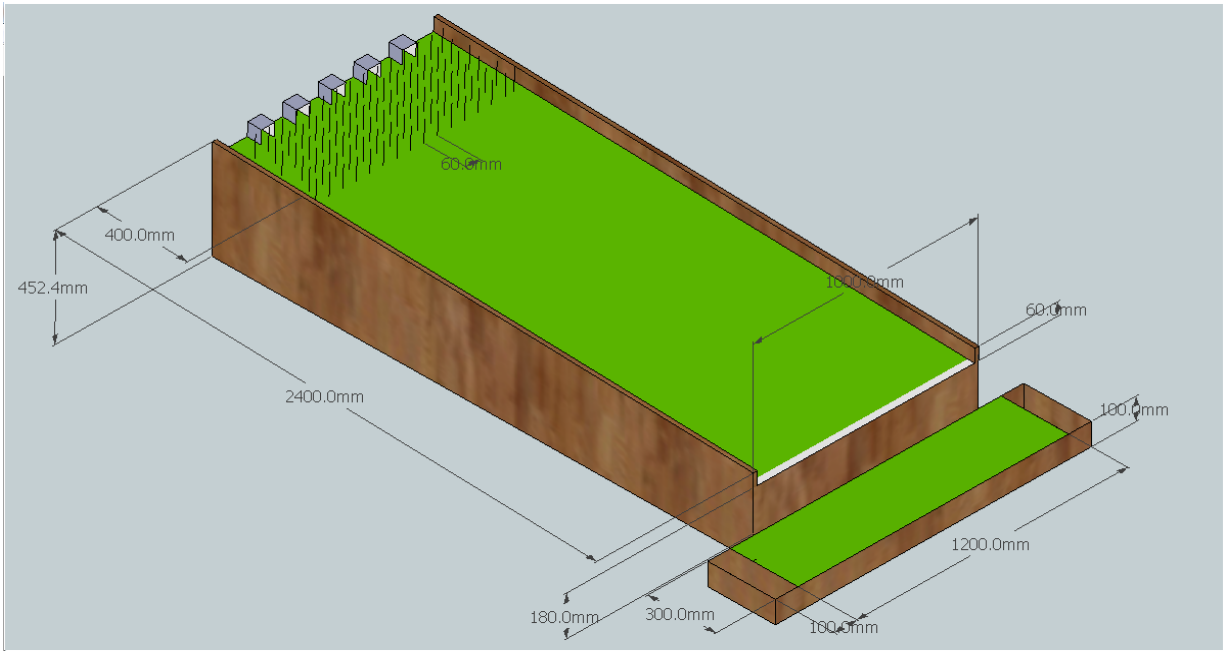

Figure 1: Dimensions

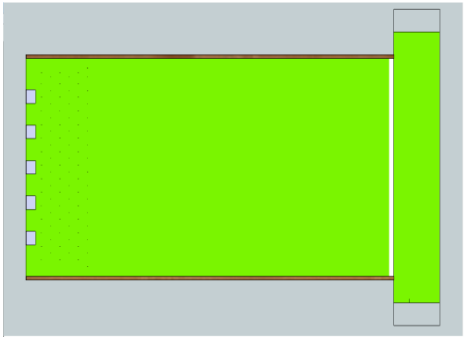

Figure 3: Top view

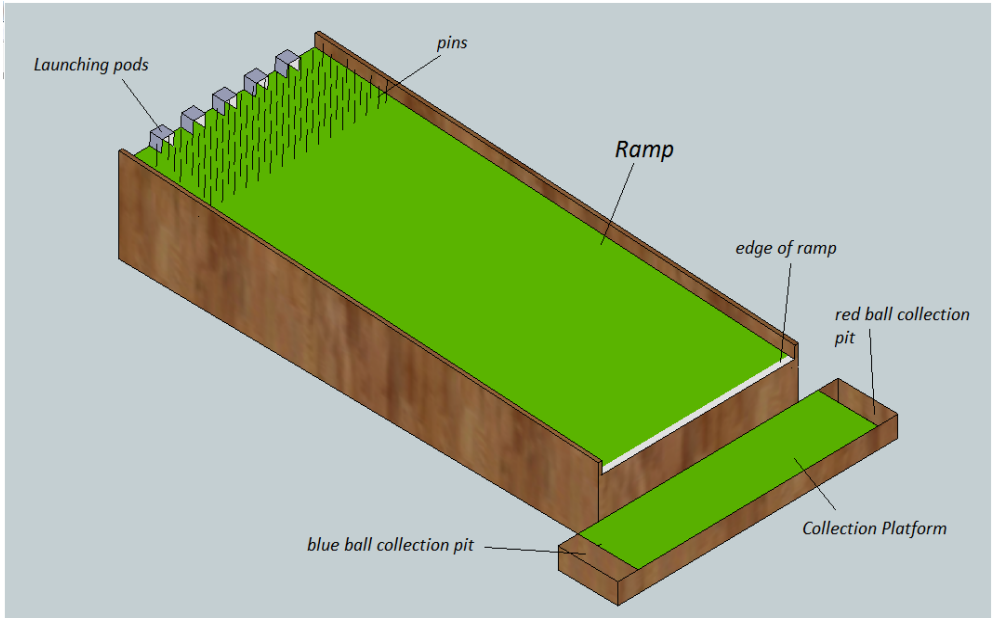

Figure 2: Isometric View

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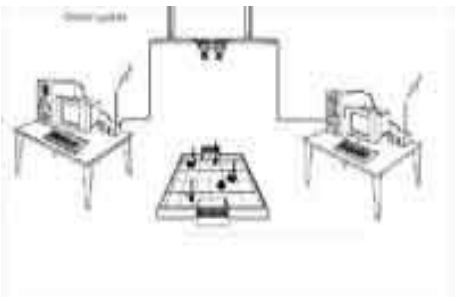
Note : All dimensions are approximate to within a 5% margin of error.

3.1.3) Orientation Tags and Balls
There will be balls of 3 colors : Red , Blue and Black. Ball Specifications will be uploaded soon.

3.2) The competition setup

3.2.1) Overall System

1. There would be one overhead camera above the arena perpendicular to the ramp.
2. Incase of overhead camera,the participants must use the camera provided by the organizers.
3. The details of the camera provided by the organizers will be put up soon.



A monitor (CRT), keyboard, CPU and mouse (USB 2.0) will be provided at the competition venue. Participants can also bring their own CPUs which they can connect to this system. We will provide a computer with Windows 7 as the operating system and Matlab 8.0 (R14) installed in it. Also, all the participants are requested to bring in their codes and any other software if required in virus free pen drives. No CDs would be allowed.

Note :

1. The colors of the arena and balls are subject to change. However, any changes made would be specified in bold on the site. So, you are advised to visit the site regularly for such changes.

2. Teams must come to the tournament prepared to calibrate their robots based on the lighting conditions at the venue. Every effort will be made by organizers to place the fields in a way that the influence by external infrared light is as low as possible.

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4.1) Bot Specifications:

1. Each team is allowed to have only one bot.

2. The bot must fit into a cube of 200 mm x200 mm x 250 mm at all times. It may not expand at any point during it's run beyond these dimensions , even for performing tasks like grabbing etc. Violating this clause would lead to immediate disqualification.

3. The bot has to use an onboard power supply. No external power supply will be allowed. The max potential difference between any two points should not exceed 24 V.

4. Participants are advised to place a colored tag of min. 50 mm x 50 mm (Preferably yellow in color) on top of their machines on a flat surface to help identify the location of the bot during image processing.

5. A bot is allowed to collect more than one ball at a time before depositing.

6. The bot must be fully independent, with powering and motoring mechanisms self contained. However, it can communicate with the computer using either wired or wireless data transfer.

7. The robotic equipment is to be fully autonomous. Human operators are not permitted to enter any information into the equipment during a run. The human operator should not directly control the motion of their robots with a joystick or by keyboard commands under any circumstances.

8. It will be the participant's responsibility if there is any data misinterpretation of the arena image taken by the overhead camera due to obstruction by the body of the bot.

9. The bot cannot be constructed using ready made Lego kits or any ready made mechanism. But you can make use of ready made gear assemblies and ready made wireless modules. Violating this clause will lead to the disqualification of the machine.

10. All the bots have to work on the principle of image processing. Any sort of ambiguity will lead to immediate disqualification. In case of doubt please confirm with the organizers about the validity of your procedure beforehand, via email.

13. The bot can touch the boundary of the ramp freely for any kind of feedback.

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Note: Teams should avoid using any kind of shiny material for robot surfaces. The organizers may exclude robots that do not conform to this clause.

5.1) Gameplay

5.1.1) Pre Game Setup

The participants will get 20 minutes of setup time for calibration and testing prior to the competition and according to a schedule that will be made available at the start of the event. In the setup time, participants can boot their computer and have the program ready for execution.

5.1.2) Game Procedure

This competition is a single run game with only one team playing at a time .The competition will be divided into 2 rounds.

1. While starting, the bot will be placed in the centre of the collection platform.

2. For each team, a random list of numbers corresponding to the numbers on the launching pods will be generated. The pods will be opened by the organisers in that manner.

3. The balls will be launched at fixed time intervals corresponding to the sound of a buzzer. It may happen that more than one ball roll down the ramp simultaneously.

4. The min time interval between rolling of consecutive balls from the launch pods will be 3 secs. A single run will last for max of 2 mins.

5. The bot has to collect balls of different colors in different pits - right pit for red balls and left pit for blue balls

6. The bot must also avoid all contact with black balls.

5.1.3 Rounds

There will be two rounds, elims and finals, with different time intervals between consecutive balls. Black balls will only be present only in round two. More details to be uploaded soon

Advancement from elims to finals:
1. Only the best teams, in terms of points, will be short listed from the first round for the next round.
2. The top 16 teams will proceed to the final round.
3. If there is a tie in terms of points then the tie breaker mechanism stated below would be used.

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5.1.4) Rules

1. While collecting, the bot must at all times stay on the base platform. At no point, can the bot climb up the ramp or extend any of its parts beyond the ramp boundary. The boundary will be marked by a white line.

2. A ball is said to be collected if it is red and is placed in the right pit or if it is blue and is placed in the left pit. A ball will not be called collected if the red one is placed in the left pit or the blue one is placed in the right pit.

3. A ball is said to be lost, if
   a. Bot fails to collect it
   b. It's first contact is with the surface of the platform i.e ball falls directly onto the platform.
   c. If it rolls down the pit at the end of the arena

4. If a ball accidentaly rolls into the left or right pit without any contact with the bot, it will not be counted as collected and will not affect the score in any way. However, it will not be replaced and will be considered as a lost ball.

5. If a ball bounces off the platform back on to the ramp, it will be treated as a lost ball and no points will be awarded for correct collection.

6. A ball will be reset at the end of the regular run incase it gets stuck while rolling down the arena.

7. If a bot is in possession of one or more balls when the time for the run ends and these balls have not been deposited in any pit, then they shall be counted as lost balls.

8. Only one reset chance will be given in case a bot is hit by a ball and requires human assisstance to continue. In this case, the bot will be replaced in the start zone and all balls rolled after the one that hit and it's next, will be replaced.

9. Every bot will be entitled to equal number of red, blue and black balls.

10. Touching a black ball attracts penalty. However, if a bot touches a black ball after it rebounds from the surface of the platform, no penalty will be imposed.

11. A penalty would be levied only once for any number of contacts with a single black ball.

12. The bot can take feedback from the overhead or it's own on-board camera at any point of time during the game. It is advisable to use the overhead camera.

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Note: The actual colors on the arena may be slightly different from the ones specified, due to ambient light and texture of materials. Time slots, prior to the day of competition, would be given to the participants to calibrate their machines to the available light conditions in the arena.

5.1.5) Disqualification

The following cases will attract disqualification :

1. In case a bot violates any of the specification criterions , specifically the following :
   If a bot does not fit in the stipulated dimensions
   If a bot expands beyond the stipulated dimensions during gameplay
   If a bot draws its power from any source which is not on-board
2. If a bot climbs over the ramp or if any portion of the bot crosses the ramp base line
3. If a bot needs to be reset more than once
4. If a bot damages the arena in any way

5.2.1) Scoring and Penalty

1. A correctly collected blue ball is awarded 40 points and a correctly collected red ball is awarded 20 points.
2. No points shall be awarded for collecting a red ball in the left pit or a blue ball in a right pit.
3. No points will be awarded for balls with the bot but not in the pit at the time when the game ends.
4. Contact with the black ball results in a penalty of 50 points.

5.2.2) Ties

Elims:
In case of ties, the one that has the larger number of collected blue balls will be deemed the winner. In case that is also same, there will be a tie-break re-run based on the round format.
Finals:
In case of ties, the one that has avoided the larger number of black balls will be deemed the winner. In case that is also same, the one that has the larger number of collected blue balls will be deemed the winner. Otherwise both will be declared winners.

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5.3) General Rules

Organizers will be not responsible for any minor scratches left by the previous machines on the arena.

1. Any team that is not ready at the time specified will be removed from the competition automatically.
2. The machines would be checked for their safety before the run and would be discarded if found unsafe for other participants and spectators.
3. Participants should not dismantle their robots before the completion of the whole competition as the machines might need to be verified by the judges at a later stage to ensure that the participants have not violated any of the rules.
4. Judges' decision shall be treated as final and binding on all.
5. The organizers reserve the right to change any or all of the above rules as they deem fit. Change in rules, if any, will be highlighted on the website and notified to the registered participants.
6. Teams that intend to use computers provided by the organizers are requested to bring virus free pen drives. CD's won't be allowed. Failure to bring virus free storage device may lead in disqualification of that particular team.

5.4) Team Specification

A team may consist of a maximum of 4 members. Students from different educational institutes can form a team.

5.5) Eligibility

All students with a valid identity card of their respective educational institutes are eligible to participate

5.6) Certificate Policy

1. Certificate of Excellence will be awarded to the top 3 winners.
2. Certificates of Participation will be given to all the teams who reach the final round.
3. Disqualified teams will not be considered for any certificates.