

# Pixelate

## Task:

Circa 2011. Lord Voldemort is keen on killing Harry Potter and destroying Hogwarts. Harry, Hermione and Ron have managed to destroy three horcruxes. However, four still remain.

These four horcruxes are hidden using powerful curses in different places. These places are guarded by Death Eaters and they must be transferred to Azkaban in order to unveil the horcruxes. As Dumbledore said - "Dark magic leaves traces", the location of the horcruxes are hidden below the weapons required to destroy them. Thanks to Dumbledore, you know the locations of the weapons.

The Death Eaters are so powerful that they cannot be destroyed but can only be transferred.

The task now is to unveil the horcruxes by transferring the Death Eaters to Azkaban, identifying the weapons that would destroy these horcruxes and taking them to the respective horcrux for destroying them. Distractions have been set up by Voldemort along the path so that the horcruxes remain safe. He has planted a lot of fake horcruxes along the path.

Now, Harry, Hermione, and Ron seek the help of your amazing Image Processing skills.

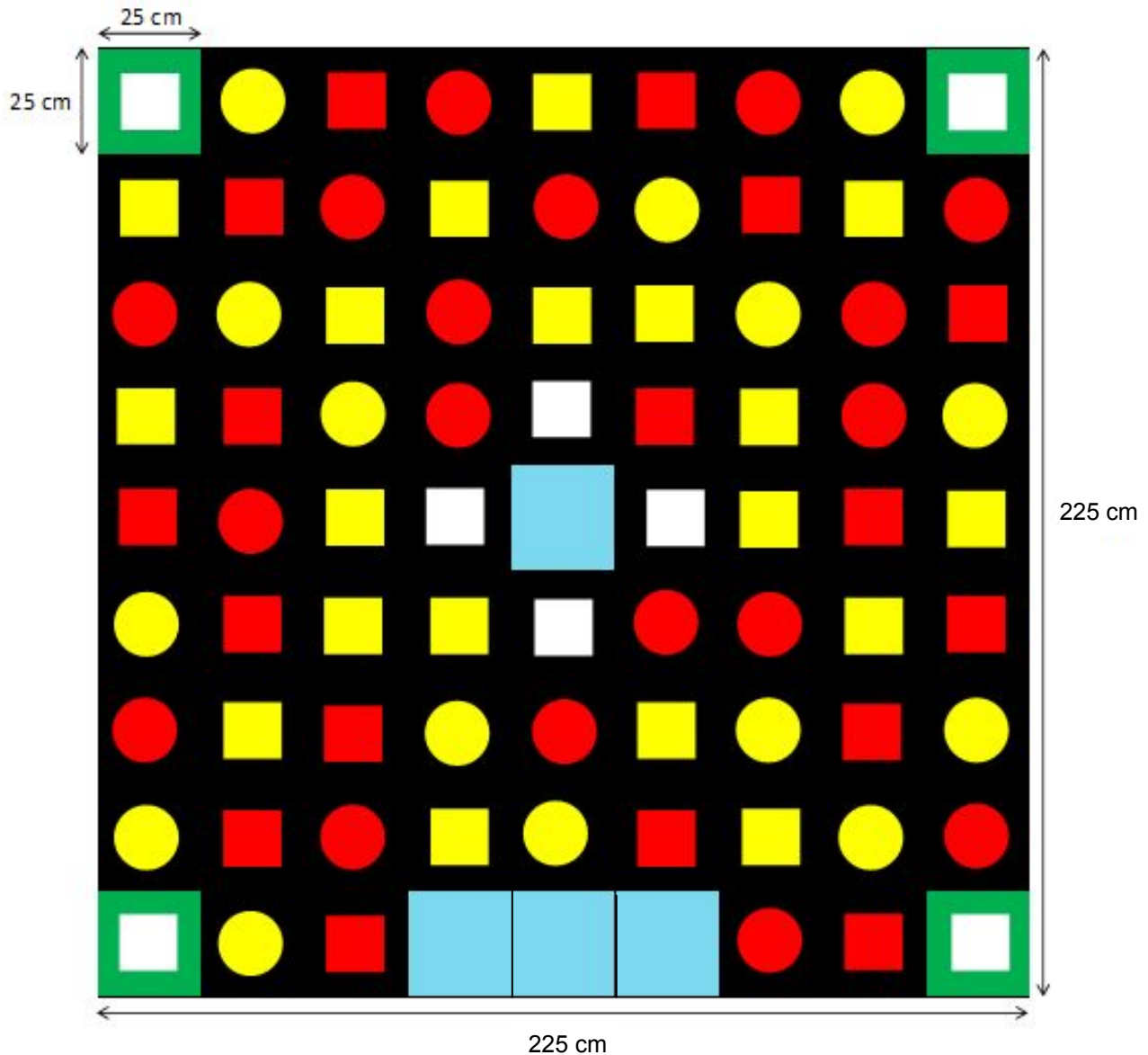
You'll have to make a fully autonomous robot that would be able to do the following:

- Identify locations of the horcruxes and the weapons.
- Unveil the horcruxes by transferring the Death Eaters to Azkaban.
- Grab the weapon and take it to the respective horcrux according to the conditions specified.
- Distract as little as possible, you don't want Hogwarts to be destroyed! Do you?

***It is our choices that show what we truly are, far more than our abilities.***

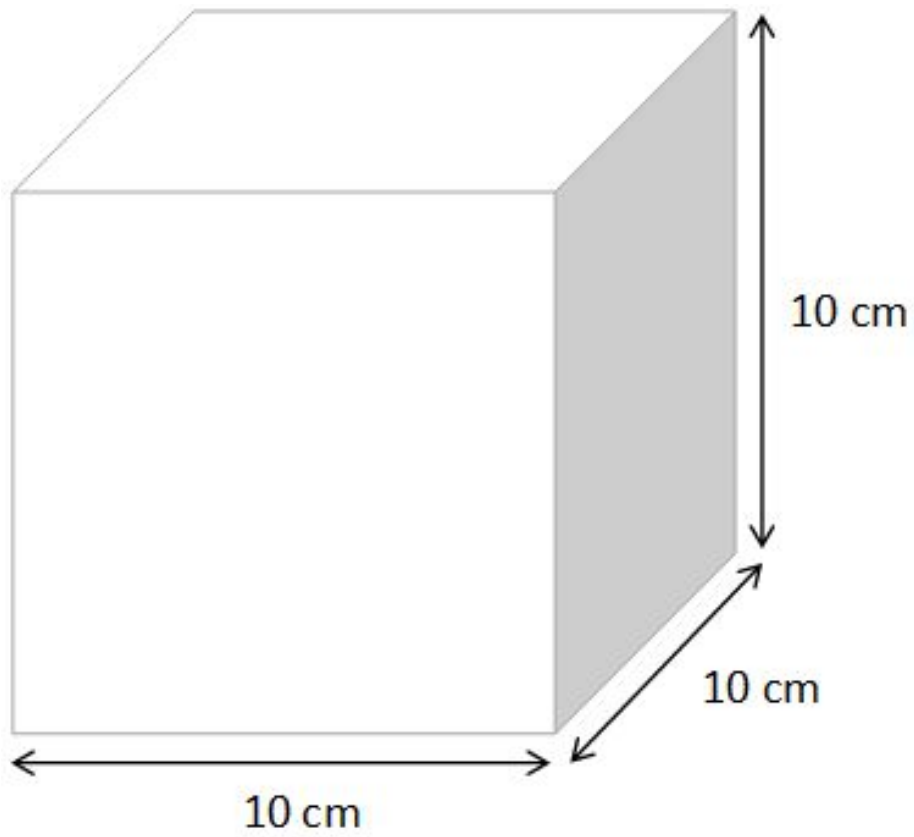
## **Arena:**

- The dimension of the arena will be 225cm x 225cm divided in 9 x 9 grids.
- Each block of the grid is therefore 25cm x 25cm.



**Sample arena**

- Example of Death Eaters and Weapons that will be placed on the arena



## Arena Description:

- The arena contains 9x9 square grids each of which contains one of the following:
  - *Distractions*: They are represented by blocks having some shape and some colour on black tiles.
  - *Azkaban prison*: They are represented by blue tiles. One is present at the bottom (having three cells) and one at the centre (having one cell).
  - *Horcruxes*: They are represented by green tiles with a particular 'shape of some colour' embedded over it. The shape along with the color becomes the identity of the horcrux.
  - *Death Eaters*: They are the white boxes present over the horcruxes to conceal its identity.



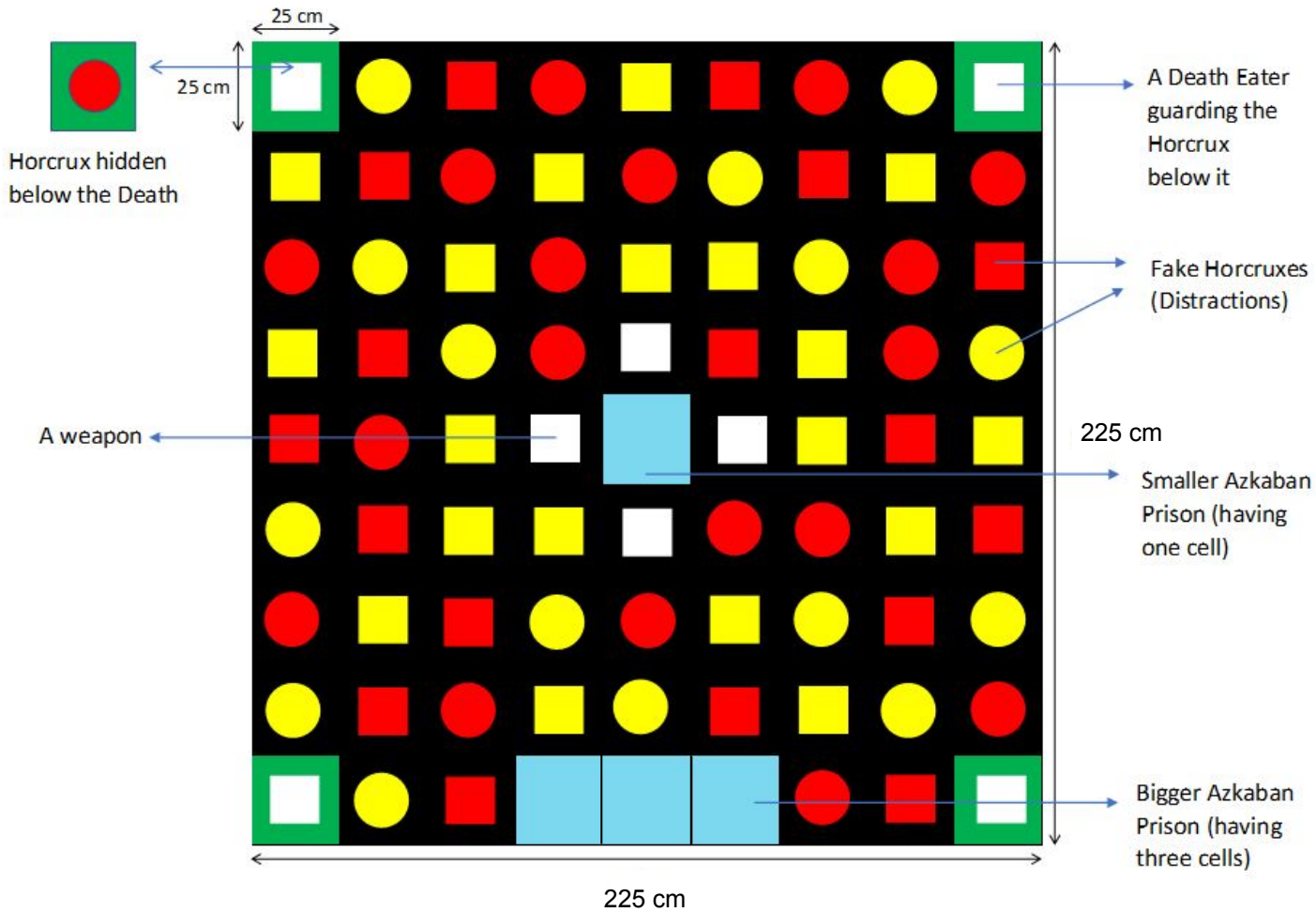
A *Horcrux* with a *Death Eater* guarding its identity.



Identity of *Horcrux* revealed after removing the *Death Eater* present over it.

- *Weapons*: They are represented by white boxes placed over black tiles. The identity of the Horcrux that can be destroyed using a particular weapon is hidden under it.
- The bot has to start from the Azkaban prison (blue cells).
  - Any of the two prison locations (one consisting of a single blue cell and the other consisting of three blue cells) for the Qualifying Round and the bigger one (having three cells) for the Final Round.
- The bot has to end the task at any cell adjacent to the last destroyed Horcrux.
- A video feed from the overhead camera will be provided to the team. The team's computer should autonomously instruct their bot throughout the arena using this feed.





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## Gameplay:

- The problem is divided into two major tasks:
  - Transfer Death Eaters guarding the Horcruxes to Azkaban in order to reveal the Horcruxes underneath.
  - Deliver the weapons present over the arena to their respective Horcruxes following the rules described below.
- The bot has to start from the Azkaban prison (blue cells).
  - Any of the two prison locations (one consisting of a single blue cell and the other consisting of three blue cells) for the Qualifying Round and the bigger one (having three cells) for the Final Round.
- The bot needs to transfer the Death Eaters present guarding the Horcruxes (green background) to the Azkaban prisons. This step unveils the identity of Horcruxes which were earlier concealed by the Death eaters.
  - The bot may choose any path to transfer these four Death Eaters but it should not disturb any of the weapons on its way.
  - There might or might not be a Death eater guarding a Horcrux. Select your targets accordingly.
  - Only one Death eater can be transferred to one Azkaban prison cell . There will be four such prisons cells available in total.
- The bot should blink a Blue LED on the placement of each Death Eater into the Azkaban cell.

- The bot then needs to deliver the weapons to their respective Horcruxes. The location of Horcrux for each weapon is hidden underneath it. The bot has to unveil it by removing the weapon.
  - As Dumbledore said, there are distractions along the path as Voldemort planted a lot of *Fake Horcruxes*.
  - The bot should take a path such that the number of fake Horcruxes along the path is minimum.
    - A Horcrux different than the one for the current weapon is a *Fake Horcrux*.
- The bot should blink a Green LED after picking up each of the weapons and a Red LED after delivering them.
- The task ends after destruction of all the Horcruxes and the bot should be present at any cell adjacent to the last destroyed horcrux. The bot needs to glow a Blue LED for 3 seconds, indicating the end of the tasks.
- The bot should be completely autonomous as Harry, Hermione and Ron are busy in their fight against the dark.

### **Qualifying Round:**

No weapons will be present in the arena. The bot needs to transfer the Death Eaters to the cells of Azkaban.

### **Final Round:**

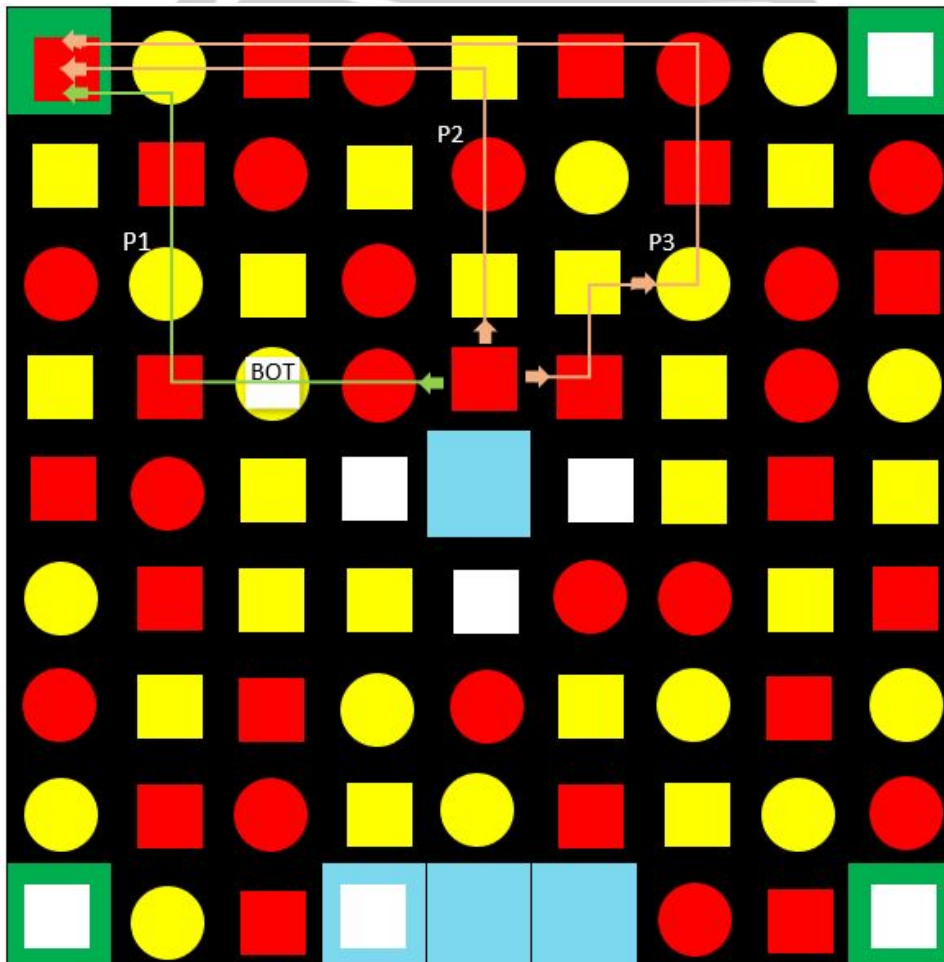
As described above in the Gameplay.

## **Examples:**

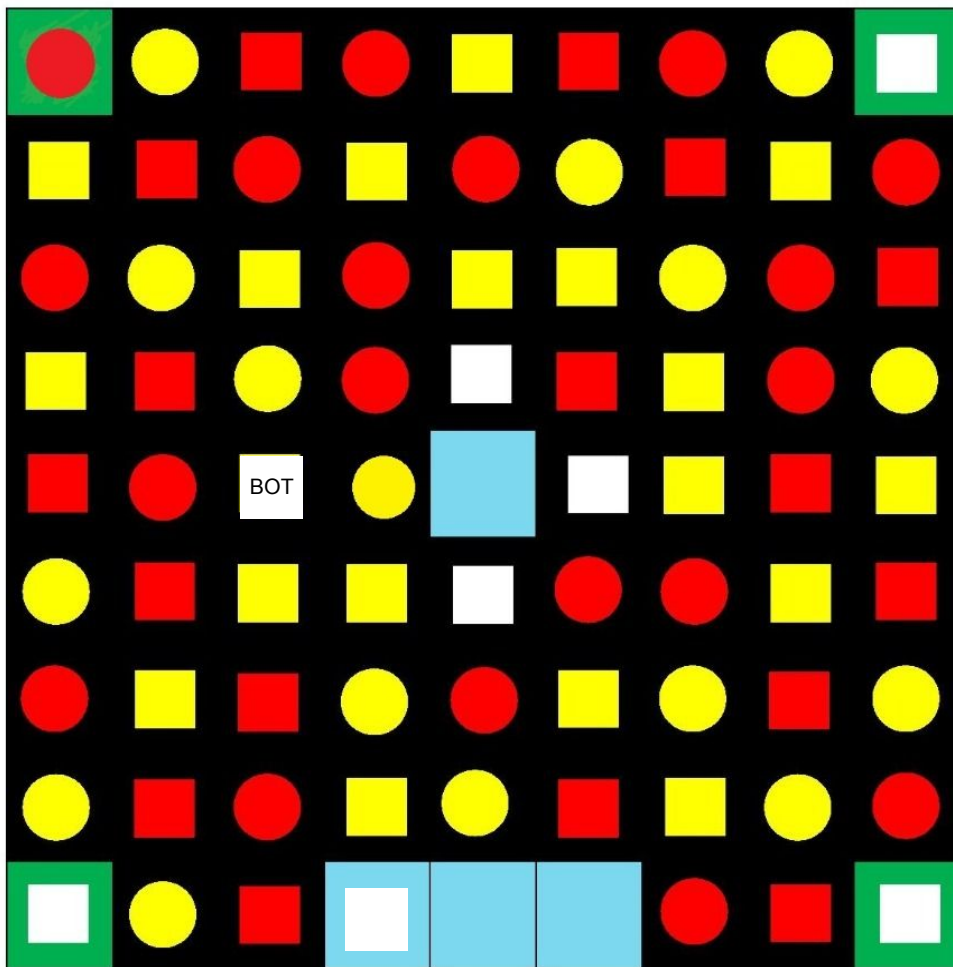
In the following pages a few situations have been shown by means of some examples.



- Here one of the boxes on the green background (Death Eater) has been placed on the blue zone (Azkaban) to get a red square (Horcrux) as destination. Also, one of the boxes on the black background (Weapon) has been removed from its position to reveal a red square. Now this box should be placed on the “red square on green background” and the bot should follow the path on which coloured shapes other than red squares (Fake Horcruxes) are minimum. Here that can be P1 (4 Fake Horcruxes). Path P2 and P3 with 5 and 6 Fake Horcruxes respectively are INVALID.



- Here in this case the colour of the shapes found under the boxes (a Death Eater and a Weapon) are different. So, the bot can't place the box on the black background (Weapon) over the red circle on green background (Horcrux). It has to remove other boxes on green background to find a yellow circle which will be the final position of this weapon.



## Scoring:

### Awards:

- 50 points will be awarded to the teams for placing each box successfully on its prospective destination.
- Points will be awarded to the team on the basis of  $(\text{number of blocks traversed} \times 100) / \text{time required to traverse}$  (the above constant here 100, can be changed during the time of the event).
- 100 points will be awarded to the team on completion of the problem statement successfully.

### Penalties:

- In case the bot moves to any incorrect position, 20 points will be deducted from the total score.
- In case the bot does not follow the expected path, 20 points will be deducted from the total score.

## Event Rules:

- The robot should work purely on image processing-based principles. Each team will be given 20 minutes for calibration and 40 minutes for the final run (this does not include the time for Qualifying round).
- Only two participants are allowed near the arena at all times.
- The participants must bring their own laptops, adapters and batteries.
- The robot should be started by a single click or single command issued by participant.
- Only 3 restarts are allowed in the final round with a penalty of 50 points.
- The final codes must be submitted to the event coordinator.
- The arena would be setup in ambient lighting conditions. A sample picture of the arena would be made available prior to the event.
- It will be the participant's responsibility if there is any data misinterpretation of image of the arena taken by the overhead camera due to obstruction by the body of the robot.

### Note:

- The actual colours on the arena may be slightly different from the ones specified due to ambient light and texture of materials.
- The arrangement of the Fake Horcruxes (distractions) might be different from the one depicted in the sample image during the final event.

## Rules:

### Eligibility:

- All students with a valid identity card of their respective educational institutions are eligible to participate in the event.

### Team Specification:

- A team may consist of maximum of 5 members. Members of a team can be from different educational institutions.

### Robot Specifications and Fabrication:

- The robot should fit within a box of 25cm X 25cm x 25cm.
- The weight of the robot should be less than 2.5 kg. The robot should be capable of moving a  $10*10*10 \text{ cm}^3$  cubic brick (made of Thermocol).
- The Potential Difference between any two points on the robot must not exceed 24V DC.
- Teams are allowed to use readymade microcontroller circuits and gear assemblies. Use of Lego kits is prohibited.

### Camera Specifications:

- The camera will be a C270h model of Logitech. You can find the specifications of the camera here:

<http://www.logitech.com/en-in/product/hd-webcam-c270h>



## General rules:

- Each team can have a maximum of 5 participants.
- Each member should carry a valid Student ID Card.
- Team should report at the arena 30 minutes before the start of the event.
- The robot should, in no way, cause any damage to the arena. Any kind of damage will lead to immediate disqualification.
- Participants should not dismantle their robots before the completion of the whole competition as the devices might need to be verified by the organizers at a later stage to ensure that the participants have not violated any of the rules.
- The organizers reserve the right to change the rules as they deem fit. Change in rules, if any, will be highlighted on the website and notified to the registered participants.
- The decision of the organizers shall be final and binding.

## Certification policy:

- The top three teams will be awarded a certificate of excellence.
- All teams qualifying the first round will be awarded a certificate of participation.
- Disqualified teams will not be considered for any certificates.

## Contacts:

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